



Digital Trade Transformation for SMEs in Asia Pacific Using the Technology-Organization-Environment Framework: A Literature Review

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Citation: Yang, Q., Aman, A. B., Zaki, H. O., & Baharin, R. (2025). Digital trade transformation for SMEs in Asia Pacific using the technology-organization-environment framework: A literature review. *China and WTO Review*, 11(1), 83-95.

<https://doi.org/10.52152/cwr.2025.11.1.07>

ARTICLE INFO

Received: 07 Feb 2025

Accepted: 14 Mar 2025

ABSTRACT

The rise of digital trade has significantly transformed global commerce, enabling businesses to leverage digital technologies for enhanced efficiency, market access, and international competitiveness. In the Asia Pacific region, SMEs play a vital economic role but often face barriers such as limited resources, digital readiness gaps, and regulatory complexities. This study aims to explore the digital trade transformation of SMEs in the Asia Pacific region using the Technology-Organization-Environment (TOE) framework. This study uses the TOE framework to comprehensively analyze technological, organizational, and environmental factors shaping SMEs' digital trade transformation. It effectively captures the interplay of internal capabilities and external conditions, offering insights aligned with Asia Pacific's diverse digital landscapes. A literature review was conducted, utilizing databases such as Google Scholar, JSTOR, ScienceDirect, and SpringerLink. Inclusion criteria focused on peer-reviewed studies published within the last decade addressing SMEs, digital trade, and the Asia Pacific region. Thematic coding and content analysis were employed to synthesize findings and categorize them within the TOE framework. The study revealed that technological advancements, organizational readiness, and supportive environmental factors are critical for SMEs' digital trade success. However, disparities in regulatory environments and digital infrastructure across countries pose challenges. The alignment of SMEs' practices with WTO e-commerce agreements is vital for fostering global competitiveness. This research provides a comprehensive understanding of digital trade transformation for SMEs in the Asia Pacific region. Integrating the TOE framework with international trade rules, offers actionable insights for policymakers and businesses to enhance SME digital readiness and competitiveness.

Keywords: Digital Trade, SMEs, Technology-Organization-Environment Framework, Knowledge Management, Asia Pacific.

INTRODUCTION

Digital trade has revolutionized the global economy, transforming business operations, interactions, and competition through e-commerce, digital payments, and cloud computing. As estimated lately, digital trade constitutes a major chunk of global commerce, its value has skyrocketed exponentially in the last ten years (Le & Ikram, 2022). This growth has been driven primarily by advancements in digital infrastructure and ever-increasing penetration of the internet coupled with its rapid adoption across most sectors (Shi, 2023). With these dynamic economies, the diverse Asia Pacific markets present a pivotal trend in such changes. While full potential could be extracted in the region with unique challenges and opportunities concerning how to unlock fully the SME's capacity to participate in the process of digital trade, this aspect plays an essential role in developing the economies in the Asia-Pacific region since the contribution that they provide has come in substantial quantities on matters regarding employment, innovation, and gross domestic product. These firms however remain confronted

by numerous structural and operational issues. The digital trade transformation offers an avenue for SMEs to transcend these challenges through reduced transaction costs, enhanced access to markets, and improved operational efficiencies (Wu et al., 2023). However, the ability of SMEs in the region to exploit these opportunities depends on various factors, such as their readiness to adopt digital technologies, the availability of supportive government policies, and the alignment of their practices with international trade rules. Even the digital readiness and regulatory frameworks are not alike among all countries, presenting another significant complexity to the landscape (Sahakyan, 2024). Hence, the determinants of the region's transformation of digital trade necessitate a much deeper understanding.

The research problem is centered on the necessity to investigate how small and medium enterprises in the Asia Pacific region adapt to the digital trade environment considering international trade regulations (Murali, Chandani, Paraman, & Anamalah, 2024). While considerable attention has been given to the potential benefits of digital trade, there is a lack of research exploring how digital transformations unfold, particularly in the context of SMEs. This situation is especially challenging, as it does not align with the well-established and integrated global trade frameworks set by the WTO (Koh & Kong, 2021). The research gap in this study refers to the lack of a comprehensive analysis of how SMEs in the Asia Pacific undergo digital transformation using the TOE framework. Existing studies often focus on individual factors or large enterprises, leaving SMEs' digital trade adoption underexplored. This study bridges the gap by conducting a literature review, identifying key enablers, barriers, and policy recommendations, and providing a structured synthesis of digital trade transformation for SMEs. In describing technological, organizational, and environmental influences that may change the digital trading behavior of SMEs, it intends to derive useful insights in respect of these considerations for regional policymakers, business executives, or any other market participants (Müller, Zahn, & Matthes, 2024). With its dual research objectives of being, it aims to analyze the transformation of SMEs in digital trade by utilizing the TOE framework that groups factors into technological, organizational, and environmental domains for better comprehension of the process of transformation (Chiu, C. L. Chen, & Chen, 2022). Second, it measures the relationship between the digital trade practices of SMEs and international trade rules with an emphasis on the WTO e-commerce agreements (Nyazabe, Hwang, & Manyole, 2023). In achieving these objectives, the study is going to close the gap that exists between theory and practice with a nuanced understanding of the Asia Pacific region where digital trade has an interplay with international trade regulations.

Research focus: The question is how SMEs operating in the Asia Pacific region understand and adapt to the digital environment of trade amidst international regulations regarding trade. There are still very few works published on the opportunities of digital trade, with research on how small and medium enterprises navigate digital transformation complexities while maintaining alignment with the global frameworks on trade such as those implemented by the WTO (M. Iqbal & Suzianti, 2020). The WTO has developed major frameworks to support digital trade, such as the Trade Facilitation Agreement (TFA) for the simplification of customs procedures and the General Agreement on Trade in Services (GATS) for electronic service trade. Other major frameworks include the TRIPS Agreement on IP protection, the Information Technology Agreement (ITA) on tariff-free IT products, and the E-Commerce Work Program that addresses issues such as data flows and cybersecurity. The moratorium on customs duties for electronic transmissions also fosters global e-commerce growth (Shi, 2023). The paper will elucidate the various technological, organizational, and environmental factors that are likely to impact the digital trade of SMEs while being mindful of giving policymakers, businesses, and other stakeholders in the region concrete insights.

The primary objective of this study is to conduct a literature review on the digital trade transformation of SMEs in the Asia Pacific region using the TOE framework. Specifically, the study aims to:

- Identify key technological, organizational, and environmental factors influencing SMEs' adoption of digital trade in the Asia Pacific region.
- Examine the challenges and opportunities SMEs face in integrating digital platforms, e-commerce solutions, and cloud computing into their trade operations.
- Analyze existing research trends and knowledge gaps related to SMEs' digital transformation, with a focus on regulatory constraints, technological adoption, and competitive strategies.
- Utilize bibliometric analysis and systematic review methods to provide a comprehensive synthesis of prior studies, offering insights for policymakers, business leaders, and researchers.

In practical terms, it gives deep insights into the regulatory and policy matters of digital trade and points out areas where government intervention can enhance the preparedness of SMEs to face digitalization and enable them to understand the rules of international trade (Q. Chen & Wang, 2022). It helps in understanding the best practices and strategies for an inclusive and dynamic digital trade ecosystem. In a broader view, this paper

contributes to a general discourse regarding digital trade: insights into better nuances of small and medium-sized enterprise-specific challenges as well as related opportunities that tend to present in the Asia-Pacific region. It emphatically underlines the need for a more inclusive and dynamic digital trade ecosystem, with a focus on Asia-Pacific. The rapid growth of global commerce has had a deep impact on SMEs in the region and to some extent signifies providing a scope to access wider markets, increase efficiency, and accelerate innovation. However, it exposes SMEs to barriers such as digital infrastructure gaps, regulatory distress, and skill gaps for competition in a highly integrated digital economy. This paper explores these complex challenges and opportunities specific to SMEs in the Asia-Pacific context.

METHODOLOGY

The systematic literature search strategy was employed to find relevant studies on the digital trade transformation of SMEs in the Asia Pacific region. The literature search was carried out across various academic databases, such as Google Scholar, JSTOR, ScienceDirect, and SpringerLink, to ensure wide coverage of scholarly articles, conference papers, and reports. A keyword search with keywords such as "digital trade transformation," "SMEs in Asia Pacific," "e-commerce," "adoption of digital technology," "WTO e-commerce agreements," and "technology-organization-environment framework" is conducted to provide a diverse blend of relevant literature for the process of digitalization undertaken by SMEs and their involvement with international frameworks of trade. The studies related to the digital transformation of SMEs in the Asia Pacific region, published from 2010 up to 2024 in peer-reviewed journals or conferences were included. The studies that were not relevant to digital trade transformation and SMEs, were excluded. The review included studies that were conducted within the time frame of 2010 to 2024, thus ensuring that the most recent and relevant literature was included, reflecting the dynamic and rapidly changing nature of digital trade.

To synthesize the literature, data analysis techniques such as content analysis and thematic coding have been employed. The use of content analysis would show the recurring themes, trends, and patterns that could be traced from the literature. Thus, through systematic extraction of key findings on technological, organizational, and environmental factors, one can have the findings that contribute to SMEs' transformation of digital trade. Thematic coding was employed using NVivo to analyze the findings, with themes derived from the TOE framework. Thus, a systematic approach towards the analysis of data was developed, and it allowed the literature to be grouped under manageable categories of technological infrastructure, policy and legal frameworks, digital literacy, and market readiness, which could then bring out the play between technological innovations, organizational readiness, and environmental influences. These coded themes were compared and analyzed to determine the dominant factors influencing the engagement of SMEs with digital trade (Sahakyan, 2024). Synthesized findings then formed the basis of the response to the research objectives, outlining how these factors shape the digital transformation process of SMEs in the region.

Applying the TOE framework, the chosen literature falls into three primary areas: technological, organizational, and environmental factors. Technological factors relate to all innovations and changes happening in the realms of electronic commerce platforms, digital payment, cloud computing, and big data, which essentially become the backbone of digitization in SMEs for the trade (Le & Ikram, 2022). Organizational factors deal with the aspects of an SME regarding corporate culture, leadership, resources, and workforce readiness in how these SMEs adapt to the implementation strategies of digital trade. Environmental factors thus pertain to outer conditions of circumstances such as prevailing market conditions, government regulations and standards of respective industries that delineate the possibility of the smooth running of business SMEs engaged in digital trade (Wu et al., 2023). These categories make it possible to analyse the factors that influence the transformation of digital trade of SMEs.

This integration of the TOE framework with the research objectives enabled a focused exploration of how these three sets of factors, technological, organizational, and environmental, interact and influence the digital trade practices of SMEs in the Asia Pacific region (Huang et al., 2024). This paper has researched how SMEs adapt to the digital trade landscape, particularly considering the technology adoption, readiness, and influence of external environments regarding the regulatory framework. The study utilizes the TOE framework, to understand the transformation process, including the forces facilitating or obstructing the international competitiveness of SMEs.

LITERATURE ANALYSIS AND DISCUSSION

Technological Factors

Technological progress has transformed trade for small and medium-sized enterprises as it provides new tools that improve efficiency, connectivity, and competitiveness. In particular, e-commerce platforms are today the basic stepping stone for an SME seeking access to the world markets (Faridi & Malik, 2020). Through e-commerce platforms, such as Amazon, Alibaba, and Shopify, SMEs are now capable of making cross-border trade as their digital storefront becomes available for customers to buy worldwide with even reduced entry barriers as in other channels of traditional trade (Ashtankar et al., 2023). This democratization of access to international markets has allowed SMEs to compete on a more level playing field with larger enterprises. Digital payment systems- mobile wallets, secure online transactions, for instance, smoothed transactions and facilitated secured transactions as typically cross-border payment entails high risk and complexity (Fernandez & Aman, 2021). Given that these new digital solutions come to embrace increasing SME use, such enhanced abilities without heavy physical infrastructural needs allow an SME to have global trades with more facilitations. Technological factors significantly impact SMEs' adoption of e-commerce and cloud computing, but several challenges hinder implementation. Limited financial resources and a lack of technical expertise make it difficult for SMEs to invest in and manage digital platforms effectively (Le & Ikram, 2022). Cybersecurity risks, integration issues with legacy systems, and regulatory compliance further complicate adoption (Ashtankar et al., 2023). These challenges highlight the need for targeted support, training programs, and accessible digital solutions to facilitate SMEs' digital transformation in the Asia Pacific region.

Cloud computing promotes the digitalization of SMEs through scalable, affordable solutions to ensure business development and international growth (Otoom et al., 2024). Through the help of cloud tools, it will be possible for the SME to be able to operate on customer relationship management and ERP systems in more sophisticated ways, yet they won't face substantial expenses as compared with the typical overhead costs from buying an on-premise version of such tools. This scalability helps SMEs adjust to changing market demands and manage business operations in a more efficient manner. Besides, cloud computing will enable SMEs to have the ability to store vast data and process them for enhanced decision-making and targeting customers, crucial in the contest for markets around the globe (Faridi & Malik, 2020). Integration of such technologies into SME operations is likely to be effective for enhancing entry into international markets in the future as well-intentioned participants strive to become agile and responsive players in the ever-expanding digital economy.

Internationalization and competitiveness in SMEs are related to technological innovation. Using e-commerce and cloud computing technologies, SMEs can make their operations less complicated, communicate more effectively, and access international markets more effectively (T. A. Nguyen, Le, D. T. Nguyen, & Nguyen, 2024). Digital technologies break geographical barriers for SMEs to scale up in ways previously limited to large-scale enterprises. However, internationalization through digital channels also means that SMEs have to respect international trade standards and regulations, including the WTO. For instance, intellectual property rights, data protection, and digital trade rules control cross-border transactions and e-commerce, according to Nedumpara (2023). With the growth of digital trade, SMEs have to ensure their operations do not conflict with such regulations as they may raise barriers to entering foreign markets. Thus, whereas innovation through technology presents SMEs with many opportunities, it throws up challenges regarding compliance with international rules and standards.

It is, henceforth, inevitable for SMEs to properly line up the policies on digital trade in concordance with rules by WTO before exploiting the various benefits associated with internationalization. The body, WTO has accomplished quite a fair bit to stabilize the legal and regulatory factors involving digital trade aspects, based upon principles such as transparency, fair trade, and non-discrimination surrounding cross-border electronic commerce (Sirenko, Balian, Martyniak, Malakhova, & Bakushevych, 2024). These policies are meant to ensure the free flow of goods, services, and data across borders, which is critical for the international expansion of SMEs. The digital landscape, however, remains in evolution, and there are challenges facing SMEs navigating this complex regulatory environment, particularly on matters like data localization requirements and cybersecurity regulations (Inama, Crivelli, & Ha, 2022). As more and more SMEs lean toward digital technologies, they will need to model their business appropriately according to the digital environment; this should further align with international as well as local regulations and legal frameworks for fear of judicial litigations as well as trading barriers.

In the grand scheme of digital trade, technological innovation has equipped the SMEs with tools that make it possible to participate in international trade while competing with larger multinational corporations (Kvitka, Kramarenko, Davydov, Pasmor, & Diachek, 2021). The use of e-commerce platforms, digital payment systems, and cloud computing solutions gives SMEs the opportunity to interact with customers globally without the burden

of traditional constraints associated with international business, including high transportation costs and the necessity for extensive physical infrastructure (Huber, Pooripakdee, & Schreier, 2023). Still, as SMEs expand globally, they are also expected to be aware of the regulatory structures that the WTO and other global bodies have instituted. SMEs can both become more competitive and contribute to the broader objective of a more inclusive and accessible global trade system by aligning their digital trade practices with international standards. Thus, technological factors have the potential to drive the success of SMEs in the digital era when they are applied strategically, overcoming the barriers to internationalization and helping them compete better in the global markets.

Organizational Factors

Organizational factors become critical to SMEs transforming their business successfully to digital trade. At the very heart of the organizational factors lies the corporate culture, which enables an organization's willingness to adopt change and innovation. Such openness, flexibility, and learning-orientation-based corporate culture help it adopt the newest digital technologies, as discussed in Wu et al. (2023). In SMEs, with the constraint of limited resources, leadership plays a core role in influencing this change in culture and ensures that the initiatives on digital trade are in harmony with other goals in the organization. In fact, studies indicate that the success of the implementation is dependent on leadership commitment to the transformation of digital economy, and especially the harmonization of organizational culture (Ath, 2020). Such leaders, emphasize innovation and strategically clear direction to their organizations, enabling them to cut through complexities of digital trade-from e-commerce integration to adoption of cloud computing (Han & Trimi, 2022). This level of commitment, on the leadership side, ensures that the organization sets the kind of culture through the tone as well as its organizational resources against the agenda for digital transformation. Organizational factors play a crucial role in SMEs' digital transformation, with leadership commitment, digital skills, and adaptability being key determinants. Successful cases include Alibaba's Taobao Villages in China, where rural SMEs leveraged e-commerce to expand market reach, and Shopee's SME support programs in Southeast Asia, which provided digital tools and training. However, regulatory constraints vary across countries, affecting digital adoption (Han & Trimi, 2022). For instance, strict data protection laws in Singapore impose compliance costs, while limited digital infrastructure in developing economies slows transformation. Addressing these challenges requires policy alignment, financial incentives, and tailored digitalization strategies for SMEs.

In addition to leadership and culture, organizational resources also play a central role in digital trade transformation. For SMEs, the financial and technological resources available to them would either empower or disable their response to the new digital environment. According to a study, a firm's availability of financial capital and digital infrastructure determines its capabilities to take up digital trade opportunities (Ahmad, Zaid, & Sleimi, 2023). These resources are crucial in investing in digital tools such as e-commerce platforms and cloud computing services, which improve operational efficiency and market reach (Murali et al., 2024). Still, there are constraints experienced by SMEs in terms of access to financial resources and personnel with the right skills. In this manner, firms may not have the potential to leverage ICT for digital trade strategies. In order to overcome the barriers, SMEs must strategically dedicate resources to the factors that yield more returns on their investments in expanding and competing with international markets.

Another relevant issue to put an SME in a better position and to engage effectively in digital trade is the readiness of the workforce. The employees are required to acquire the needed competencies to handle new systems, manage digital marketing strategies, and respond to clients across the globe (Faridi & Malik, 2020). This is the main reason why, in most SMEs of developing countries, improper training facilities and a poorly skilled workforce remain an obstacle to their preparedness. There should thus be a significant emphasis on training and developing a workforce so that the employees can properly equip themselves to help digitalize the organization (Han & Trimi, 2022). Emphasizing employee development through continuous learning programs and skill-building workshops for organizational strategies to enhance workforce readiness can greatly increase the chances of successful adoption. Thus, investments in human capital extend beyond building technical skills to building an innovative, digitally literate culture at every level of the organization.

Another determinant in the strategies and structure of an organization is the regulatory environment surrounding international trade, which influences the organization's market entry, compliance, and operational strategies. This includes digital trade, in a context that the WTO and other global regulatory authorities play an even larger role in influencing how small and medium enterprises structure their operations in digital trade (Le & Ikram, 2022). Trade laws and policies covering issues such as data privacy, intellectual property, and e-commerce regulations guide the organizational practices while observing the law in the process. These regulations would have significant implications for the structuring of digital trade activities in SMEs. For instance, an SME would be forced to incur costs on a secure IT structure and develop a data management system that meets international

data flow standards (Sahakyan, 2024). Thus, organizational approaches need to be brought in line with the regulatory frameworks so as not to face the legal hurdles of such regulations and to benefit from global trade possibilities. SMEs, adapting their structure proactively towards these requirements, position themselves better in international expansion as well as effectiveness in the digital economy.

International trade laws and digital trade policies also influence the way SMEs organize their operational processes. For instance, an SME entering a new market has to adapt to new legal systems and modify its business models to suit local regulations that might be completely different from one country to another (Burri, 2023). These are more common in regions with diverse regulatory environments where SMEs have to carefully design their organizational structures to stay compliant with domestic and international laws. Organizational structures that integrate legal and compliance functions with digital strategies are critical in mitigating the risks associated with international trade (Azzaoui & Kim, 2024). This calls for organizational flexibility because the SME needs to adapt rapidly in the wake of fast-changing digital standards and policies impacting trade. In this respect, it is only by aligning the inner systems to conform with international law and regulations that an SME will be able to cut through the outside pressures and lead, in the end, to sustainability over the long term with regard to digital trade. Agility and compliance will help foster a culture that enables SMEs to survive the complexities of global trade, constantly changing.

Environmental Factors

External factors that can be influential in determining the digital transformation of SMEs include market conditions, government regulations, and industry standards. The increasing level of digitalization in the world dictates the ability of SMEs to adjust not only to changes in technology but also to market demand and the regulatory landscape, which determines the course of their journey in digital trade (Mallela, Sahu, & Dash, 2024). Market factors affecting the digitalization of SMEs are the intensity of competition, consumers' demand for a specific good, and access to digital infrastructures. For example, many SMEs feel pressure to implement digital technologies simply because their counterparts-the big corporations-are also utilizing them in the same competitive space (Varga & Csiszarik-Kocsir, 2024). For instance, in retail and manufacturing industries, SMEs rely on e-commerce platforms, digital marketing, and supply chain management tools to streamline operations and reach global consumers. However, such market conditions in the Asia Pacific region are rather heterogeneous, so some countries' environments are relatively more favorable than others for the growth of digital trade. In other words, Singapore and South Korea have better developed digital ecosystems than others that have limited internet penetration or lower digital literacy. These factors tend to limit SMEs' potential for global engagement (Salazar, Gil, Carvajal, Sánchez-Zuluaga, & Zapata-Madriral, 2024).

Government regulations are among the critical external factors because they define how businesses can operate and trade across borders; therefore, rules and regulations would affect the transformation of SMEs in the digital world (Elsawy, 2023). Policies about digital trade - data privacy, cybersecurity, cross-border data flows, among others create the regulatory environment in which an SME must function when expanding abroad (Arzo & Hong, 2024b, 2024a). Government regulations in the Asia Pacific region vary from being very supportive to the least. For instance, others have initiatives that are underway in terms of digital infrastructure and access to international markets (Kamada & Yoshida, 2020). For instance, China has given policies that help in fostering digital trade. It has developed a strategy called "Made in China 2025," emphasizing the utilization of high technologies for advanced manufacturing and digitalization (Zhong & Luo, 2024). India, on the other hand, is very rigid about its regulatory approach, particularly data localization and data privacy regulations, making it very difficult for small enterprises to become large across geographies (Vuppugalla, Guntipally, Borra, Iqbal, & Vistapalli, 2023). Government support is hence essential in framing the digital environment for SMEs, either through facilitating or inhibiting their potential to use digital tools and international trade.

Industry standards will play a more critical role during the SME digital transformation since they can offer guidelines on the proper use of these technologies and also create homogeneity and compatibility across several different platforms (Egorova, 2022). For example, SMEs involved in the businesses of e-commerce, manufacturing, and logistics operations are expected to adhere to industrial standards as the product or service they would offer would need to be in accordance with the overall markets around the world (Tao et al., 2021; Yang et al., 2021). For instance, the utilization of standardized payment systems, such as mobile wallets and secure online transaction methods, is essential for SMEs involved in digital trade (S. Wang & Zhang, 2025). However, the adoption may vary among countries in the Asia Pacific, as some are more advanced than others in the development of the framework. In China, for example, the government encouraged SMEs to embrace standardized e-commerce platforms and digital payment systems such as Alipay and WeChat Pay, which are now at the center of the digital economy (Okine et al., 2023). Less developed infrastructures in other countries in the region will be a challenge in applying the industry standards, and there is a lot of competition globally.

The Asia Pacific international trade regulations further outline the external forces that result in digital transformation. Countries in the Asia Pacific region participate differently in the international trade regime. International trade agreements, such as the RCEP and the CPTPP, play a vital role in the digital space of trade that involves SMEs. These agreements specify standards for cross-border data flows, protection of intellectual property rights, and e-commerce that directly impact SMEs performing business in the global economy (S. Wang & Zhang, 2025). For example, the CPTPP allows data flow across borders, which is a principle that SMEs rely on since cloud computing and e-commerce-based businesses are made globally (Shi, 2023). However, the application of these agreements is different from country to country in the region. For example, an internal data protection and privacy China could face a conflict of interest with the regulatory requirements in its international trade treaty, and in this regard cannot be completely synchronized (Han & Trimi, 2022). The digital SMEs in Asia Pacific are hence also exposed to more complex regulation when both internal country policies and international treaties exist, thus further facilitating or acting as barriers.

Nevertheless, if one examines the impact of factors such as market conditions, government regulations, and industry standards in other Asia Pacific countries on the digital transformation of SMEs, it is evident that the situation remains different. Actually, China's robust digital infrastructure and supportive government policies towards technological innovation provide a relatively friendly environment for SMEs to engage in digital trade. However, there are challenges that remain mainly with the regulatory environment on data privacy and intellectual property matters (Egorova, 2022). On the other hand, Indonesia and the Philippines have their set of challenges, like limited internet access and digital literacy, which can hamper the digital transformation of SMEs in this region. Other differences in policy by governments on such issues as advanced manufacturing technologies, which China focuses on, and data localization, India does, also influence the strategy SMEs take for digital trade in the countries. Although international trade agreements form the general framework that would help ease cross-border trade, differences in the digital readiness of these economies and levels of regulatory alignment make SMEs need different approaches to win in the digital global marketplace (Huang et al., 2024). Thus, understanding the factors that are molding digital transformation for SMEs is very important for the Asia Pacific region to make them take advantage of technological advances and meet the international trade regulation.

INTERACTION BETWEEN DIGITAL TRADE TRANSFORMATION AND WTO RULES

The digital trade transformation of SMEs in the Asia Pacific region is closely associated with the WTO's e-commerce agreements, which provide a framework for facilitating cross-border digital trade. It focuses on important areas like data flows, privacy regulations, and rules of cross-border trade, all of which are critical for the success of SMEs engaged in digital trade. One of the most important principles on which the WTO e-commerce agreements are based is that free data flows across borders must be promoted and cannot be obstructed. Data about cloud computing, big data, and even e-commerce platforms for SMEs flows automatically, which requires very few hurdles to pass through international borders. As such, regulations of the WTO that make data flows possible are key to SMEs because they ensure more efficient operations globally and the ability to penetrate international markets (Z. Iqbal & Sadaf, 2024). SMEs also need to deal with data privacy regulations that vary by country and region. The WTO approach to data privacy allows for standards that ensure data protection without overburdening trade. However, at times, the privacy and free flow of data balance seem to be challenging for SMEs, particularly when they operate in countries with strict data localization laws (Pasali & Chaudhary, 2020). A SME must follow international standards in addition to adhering to the several domestic privacy regulations, which increases operational complexity and cost.

Implications of WTO regulations on the digital trade practices of SMEs in the Asia Pacific region are huge, especially in light of the fact that these businesses want to expand their markets. WTO agreements aim at making digital trade easy by reducing barriers to cross-border transactions and thereby creating a more level playing field for SMEs. For example, the TFA of the WTO is working on making customs procedures easier. Such a step will be very beneficial to SMEs since they usually cannot manage complex and costly rules of international trade. Further, the WTO agreements provide well-established rules regarding intellectual property rights to ensure digital innovation of SMEs is protected at all corners of the globe (Brink, Sørensen, & Neville, 2023). Such agreements then constrain SMEs by requiring them to adapt to international legal and regulatory approaches that are very different from those at the local level. As such, SMEs must then commit large financial resources to legal compliance and data management practices to meet the international standards applied under the WTO. SMEs in the Asia Pacific region would also have to prepare themselves to engage in international negotiations and be ready to transform their digital business models to remain prepared and not be left out by the regulation of global digital trade practices.

Since China is an important country in the Asia Pacific region, several policy changes were implemented so

that the country meets WTO rules and regulations regarding digital trade. The country has aimed at the growth of the country's digital infrastructure, e-commerce promotion, and SME development through initiatives such as the "Made in China 2025" plan, which promotes technological innovation and digital transformation as described by C. C. Lin (2021). To an extent, China's policies and its involvement with the engagement of WTO e-commerce agreements have influenced domestic elements of digital trade liberalization in terms of privacy and cybersecurity. However, in so many aspects, this may lack full conformity with international standards, particularly in data localization, China remains firm in rules and regulations that require storage and management within its borders. Though the WTO supports free data flows, the way China addresses data sovereignty and control raises concerns that have generated this tension between national policies and international trade regulations that SMEs encounter as a hindrance in their digital trade (Solaimani, van Eck, Kievit, & Koelemeijer, 2022). Despite these challenges, the policy changes by China have been to increase digital trade capacity, and the government has also facilitated initiatives to promote e-commerce adoption and integration among SMEs, especially in rural areas, through platforms like Alibaba and JD.com.

SMEs adopt various strategies to comply with WTO regulations on digital trade, ensuring smooth cross-border transactions and adherence to international trade policies. One common approach is the implementation of digital certification systems, where SMEs use electronic invoicing, digital signatures, and blockchain-based trade documentation to ensure transparency, security, and compliance with global trade standards (J. Chen, Hu, Shi, & Zhang, 2023). These technologies help businesses maintain accurate records, streamline customs procedures, and reduce errors in trade documentation, making it easier to meet WTO's digital trade requirements. Additionally, many SMEs invest in compliance training programs to educate employees on WTO's e-commerce rules, intellectual property rights, and data protection policies (Y. Wang, Hou, & Wang, 2023). These training sessions, often conducted in collaboration with trade associations or government agencies, ensure that SMEs understand regulatory frameworks, avoid legal risks, and implement best practices for digital trade. SMEs also adopt data localization and cybersecurity measures, such as secure cloud storage, encrypted transactions, and compliance with GDPR-like regulations, to align with WTO's emphasis on digital trust and data governance. Another key strategy is partnering with third-party logistics providers and digital trade platforms, such as Alibaba, Amazon Global Selling, and regional e-commerce hubs, which offer built-in regulatory compliance features (Li, Gao, Zhu, & Gu, 2022). These platforms provide automated tools for customs clearance, tax calculations, tariff management, and international payment processing, helping SMEs navigate complex trade policies efficiently. By leveraging these strategies, SMEs can enhance their global competitiveness, mitigate regulatory risks, and expand their digital trade operations while complying with WTO regulations.

Other Asia Pacific countries have made specific policy adjustments that make them unique in their own right for boosting their digital trade capacity, particularly for SMEs. For example, the governments of countries like Singapore have been able to provide a good regulatory environment for digital trade through free data flows by setting appropriate strong data protection standards (J. K. Lin & Jia, 2024). The Singapore Digital Economy Framework for Action is set on further digitalization of SMEs through support under digital literacy, financial incentives and access to international digital platforms according to the Singapore Economic Development Board Report 2020. India in its part acted more cautiously; it enacted sharper data localization provisions which require other kinds of data to be put in storage within this country's frontier. This regulatory framework impacts SMEs in or trading with India because they are obligated to invest in local data infrastructure and modify their business practices to accommodate the needs of the local market (S. Wang & Zhang, 2025). Despite the differences in the approaches to regulations, most countries in the region, including Malaysia and Indonesia, are gradually introducing policies that seek to create a balance between the need for digital trade liberalization and the protection of national interests.

It is crucial that these policy changes by China and other Asia Pacific countries bring with them massive implications for SMEs looking to expand digitally. Some policies facilitate the growth of digital trade through more reduction in barriers and easier access to resources while data localization and privacy regulations present an added challenge. The evolving policy landscape calls for the adaptation of SMEs' strategies to conform with such developments. Notably, the SME has to keep track of the WTO international trade regulations, and also cross domestic policies which may be either more stringent or more complicated in terms of regulatory provisions. Aligned to the two sides-both the international e-commerce agreements and national regulations, the SME is able to place itself more competitively within the global digital economy. Lastly, the success of digital trade by SMEs will depend on how governments, international organizations, and the private sector collaborate in setting a supportive regulatory environment that protects privacy but allows innovation to make it easier to execute cross-border transactions.

POLICY RECOMMENDATIONS

Targeted policy recommendations for SMEs to support digital trade transformation should focus on enhancements of technological capability, organizational preparedness, and the external support environment. These should include strategic investments in building and deploying appropriate digital infrastructure; for example, high-speed internet, cloud computing platforms, and e-commerce ecosystems that are basic to the smooth operation of digital trade by SMEs. This could be done by subsidizing digital tools and services to SMEs, especially micro and small ones, which would help remove some of the barriers to entry and contribute to widespread utilization of digital technologies. In addition, governments should develop broad digital literacy programs aimed at developing technical competencies among SME employees to provide skills to access new emerging technologies and innovate in the digital marketplace. Such collaborations of public institutions, private tech companies, and academia can further improve the accessibility and relevance of such programs, to enable SMEs to be more competitive at home and abroad.

The government must take cognizance of the regulatory and financial difficulties that SMEs face when engaging in cross-border international trade. Streamlining and harmonization of rules regulating cross border digital trade such as those bordering on customs procedures, taxation policies and data flow regulation would hugely bring down costs and complexities entailed in cross border transactions. Tax credits, grants, or low-interest loans are the financial incentives through which investment in technology and compliance measures that adhere to international trade standards can be availed for SMEs. National-level digital trade help desks and advisory centers may be established in order to facilitate SMEs on international trade requirements, including the WTO e-commerce agreements. These centers will also offer forums for the exchange of best practices, market opportunities, and digital trends to arm SMEs in scaling up their operations to the global scene.

Legal and policy measures, under the WTO framework, have to consider the issue of how SMEs in the Asia Pacific region are able to grab the opportunity that comes with digital trade, adhering strictly to the regulations required under international regimes. Promoting policies under the WTO regarding free and secure cross-border data flows has to form a core agenda as this has become fundamental for enabling SMEs to scale their businesses across borders. All these policies, however, must keep a balance of ensuring that the data privacy and cybersecurity are satisfactorily achieved, which are sensitive in this region. It is essential that governments work hand in hand with the WTO in developing standardized guidelines, which will usher in harmonized privacy regulations and cybersecurity protocols for member states so as to decrease the regulatory burden on SMEs that have operations in multiple jurisdictions. Moreover, these policies also need to promote greater openness as well as inclusiveness in the negotiation process at WTO so that their specific problems can be properly addressed while they are representing their respective challenges.

Governments can also ensure the digital readiness of SMEs by integrating digital trade policies within broader economic and industrial strategies. National digital trade strategies should, for example, include regional digital trade zone arrangements, which encourage neighboring Asian Pacific countries to cooperate. Regional digital trade zones can also harmonize trade regulations across regions, reduce the cost of logistics, and provide shared digital infrastructure in the interest of SMEs. Governments can motivate SMEs into international e-commerce through favorable access or fee reduction by major platforms. More policy incentives aimed at increasing the protection of SME's access to IP protection would, in turn, enhance better protection for digital innovations developed and therefore become competitive on a global level.

Capacity building within the WTO framework, therefore, needs to be more focused on providing SMEs with the tools and knowledge of this changing digital trading world. Included in this will be training on the challenges presented by WTO e-commerce rules, data governance, and trade facilitation agreements. Member states of the WTO should also institute support systems particularly for SMEs like those in streamlined dispute resolution processes and capacity-building grants in order to address problems these types of firms face in international markets. This is an opportunity for the governments in the Asia Pacific to craft a robust enabling environment for SMEs in the digital economy by realigning domestic policies with WTO principles and building on multilateral cooperation. Such collective pursuit of sustainable growth can strengthen regional competitiveness and ensure that SMEs continue to be integral parts of the global digital trade ecosystem.

CONCLUSION

According to the literature review, a key driver of further enhancing the competitive advantage and internationalizing SMEs of the Asia-Pacific region is this digital trade transformation. Digitalization of the whole operations, mainly through e-commerce platforms, cloud computing, digital payment systems among others, in

one way or another simplified the processes towards better markets' access. Results even reveal that the use of digital trade practices should complement international trade rules, mainly those of WTO to ensure that SMEs can have a better understanding of the intricacies involved in cross-border trade. The technological factors include innovation adoption, organizational factors such as readiness of the leadership and the workforce, and environmental factors including the regulatory framework and market conditions. Together, these factors have driven home the necessity of an all-inclusive approach whose fields of applicability encompass technological advancement, organizational adaptability, and a favorable external environment to maximize digital trade benefits.

Technological, organizational, and environmental factors influence the transformation of digital trade. The technological factors enable SMEs to utilize the new tools that can improve processes, cut costs, and compete globally; however, this depends on the organizational readiness, which incorporates all aspects - qualified workforce, effective leadership, and strategic resource allocation. The external environment, in particular government policies, industry standards, and international trade regulations, was considered a determining factor of the success of SMEs in digital trade. While many governments in the Asia Pacific region have taken steps toward digital infrastructure development and promoting innovation among SMEs, more remains to be implemented in terms of policy practice and regulation. Such findings would demand a balanced and inclusive digital trade ecosystem, contingent on the collective effort of all the stakeholders involved, such as governments, international bodies, and SMEs.

The next research area would therefore be in the dynamic interplay between digital trade and international trade law, focusing on the e-commerce agreements with the WTO. To further unearth relationships between policy and practice, the adaptability of SMEs to current regulations and their potential to exploit those regulations for an edge over other competitors could also be analyzed. Further analysis of the long-term effects of digital trade transformation can be done for economic growth and regional development in the Asia Pacific region. A comparative study on how effective the digital trade policies are among different countries or regions within the Asia Pacific region would further provide the best practices and areas of improvement.

More research is needed in this regard, including the role of regional differences in policy and regulatory environments in shaping the success of digital trade for SMEs. China has made significant gains in terms of infrastructure and policy-making in digital trade, while other countries may have different experiences. Such differences should lead to further research on the effects of these differences toward the SMEs' digital trade results and means of aligning regional policies on a unified trading environment. Future studies can then be conducted in terms of emerging challenges and opportunities for new technologies, such as artificial intelligence, blockchain, and the Internet of Things, in the digital trading landscape, especially for SMEs in their pursuit to remain competitive in the global arena.

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ETHICAL DECLARATION

Conflict of interest: No declaration required. **Financing:** No reporting required. **Peer review:** Double anonymous peer review.