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Technology-Driven Disruption and Sustainability in International Trade: The Role of Artificial Intelligence and Automation

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Abstract

This study explores how technology-driven disruption influences sustainability and competitiveness in international trade, with a focus on the growing role of artificial intelligence (AI) and automation. Uneven technological advancement among nations poses a major challenge that could destabilize trade systems, reduce efficiency, and widen economic disparities if not addressed. As such, this research consolidates empirical evidence on how AI and automation are reshaping global trade structures, labor markets, and production networks. In doing so, a systematic review of 25 peer-reviewed studies published between 2019 and 2025 was conducted using thematic and comparative analyses. The findings show how technology enhances productivity, reduces transaction and logistics costs, and expands opportunities for digital service exports. Nevertheless, limited access to advanced technologies may marginalize developing economies, disrupt supply chains, and intensify unemployment in traditional sectors. The study emphasizes that integrating intelligent and automated systems into trade operations is essential to achieving sustainable and inclusive growth. It concludes by recommending adaptive policy frameworks, skills development, and equitable technology diffusion to ensure stability, resilience, and sustainability in the evolving global trading environment.

Keywords: Artificial Intelligence, Automation, Technology-Driven, Sustainability, Trade in Services, Trade Policy

1.0 Introduction

The structure and dynamics of international trade are undergoing profound transformation driven by technological innovation, particularly automation and artificial intelligence (AI). These technologies are redefining how goods and services are produced, exchanged, and consumed, resulting in new forms of competitiveness and economic interdependence. By improving logistics efficiency, enabling the expansion of digital services, and advancing precision manufacturing, technology-driven systems are reshaping the global marketplace (Gupta & Singh, 2024). In 2023, international trade accounted for approximately US$6 trillion in services and US$25 trillion in goods, reflecting the centrality of trade to global economic growth (OECD, 2023). Such magnitude underscores the disruptive potential of emerging technologies when unevenly adopted across nations (World Economic Forum, 2020).

Automation and intelligent technologies have been shown to lower production and transaction costs, restructure global value chains, and alter the comparative advantages of both advanced and emerging economies (Batarseh et al., 2021). However, these transformations introduce challenges, including labour market displacement, evolving regulatory frameworks for data governance, and the need for adaptive trade policies (Aaronson, 2019; Burri, 2020). Furthermore, traditional trade theories, such as the Heckscher–Ohlin model, are increasingly inadequate in explaining competitiveness in a technology-driven global economy where innovation capacity outweighs factor endowments (Zhang & Shang, 2019).

The environmental dimension of this transformation is equally complex. While automated systems may reduce certain emissions through optimized logistics, the energy-intensive nature of advanced manufacturing raises sustainability concerns (Hall et al., 2019). Consequently, technology-driven trade both offers opportunities for sustainable growth and risks deepening global inequality, particularly for developing economies facing barriers to capital-intensive technological adoption (Malatji, 2024). Despite growing recognition of these changes, there remains a limited synthesis of evidence on how technological disruption affects international trade comprehensively. Existing studies often focus on sector-specific impacts, such as manufacturing or logistics, without integrating insights across industries or examining cross-national disparities in technological capacity (World Economic Forum, 2020). This limitation constrains understanding of how automation and intelligent systems collectively influence trade flows, economic structures, and regulatory mechanisms.

This review addresses these gaps by systematically analysing existing literature to determine how automation and intelligent technologies influence trade volumes as well as cost structures (Tay, 2020; Yin & Choi, 2023). Additionally, the study attempts to assess differential impacts across developed and developing economies (Sawadogo & Wandaogo, 2021; Simo, 2020) and examine trade policy responses to technology-induced change (Kim, 2024; Peng, 2020). This will help to clarify the mechanisms through which technological disruption reshapes global trade and by identifying pathways for sustainable and inclusive economic participation.

2.0 AI and Automation in Trade in Goods

Scholarly attention since 2020 has intensified on how technological advancement, particularly automation and intelligent systems, reshapes trade in goods and services. The literature converges on several consistent findings: measurable efficiency gains in manufacturing and logistics, reconfiguration of global value chains, and uneven distribution of benefits across geographies and skill groups (Batarseh et al., 2021; Chang et al., 2020; Lebid et al., 2023). Empirical studies demonstrate that robotics and process automation materially reduce unit production costs in capital-intensive sectors, while digitalization of logistics shortens lead times and improves supply-chain resilience. However, critical scrutiny reveals persistent conceptual, methodological, and empirical gaps which limit the field's ability to inform coherent policy responses.

First, there is a pronounced geographic bias. Much of the evidence base prioritizes advanced economies and large emerging innovators, leaving low-income and many middle-income countries under-represented (UNCTAD, 2022; Malatji, 2024). This skew impedes generalization: outcomes observed in high-technology contexts (e.g., consolidated supply-chain gains) cannot be assumed for economies with limited infrastructure or capital access. Second, methodological monocultures persist. Quantitative macro-economic techniques—gravity models, computable general equilibrium (CGE) simulations and firm-level econometrics—dominate, generating robust estimates of cost and trade-flow effects but often omitting firm-level decision processes, institutional constraints, and socio-political dynamics that shape adoption pathways (Lewis et al., 2022). The underuse of mixed-methods and comparative case studies weakens causal inference about how technological adoption interacts with governance, skills, and market structure.

Third, the literature tends to treat environmental and distributive consequences as secondary. While some work notes energy-intensive production and ambiguous emissions effects (Hall et al., 2019 cited; Lebid et al., 2023), systematic assessments of lifecycle carbon impacts, regional electricity mixes, and rebound effects remain limited. This lacuna is consequential because sustainability imperatives must be integrated into trade policy and industrial strategy to avoid technological transitions that exacerbate emissions or resource depletion. Fourth, the labour and skills literature, while extensive on displacement risks, shows wide variance in predicted impacts (e.g., 10–20% displacement estimates), reflecting divergent assumptions about task substitutability and reskilling efficacy (McKinsey & Company, 2019; Malatji, 2024). Few longitudinal studies empirically track reallocation outcomes at scale, weakening policy prescriptions concerning retraining, social protection, and regional adjustment.

Finally, policy responses are often reactive rather than anticipatory. Papers call for adaptive trade rules, data governance regimes, and skills policy (Aaronson, 2019; Peng, 2020), yet comparative analyses of policy efficacy are scarce. Cross-country studies that link specific regulatory choices to measured trade resilience or inclusion outcomes would be particularly valuable.

The current study review of literature from 2020–2025 convincingly shows that technology-driven disruption can enhance trade efficiency and reshape comparative advantage, but it is unevenly distributed and insufficiently integrated with sustainability and equity concerns. Future research should prioritize inclusive, mixed-method inquiries that (a) expand empirical coverage to under-represented economies, (b) assess environmental externalities across full product lifecycles, and (c) evaluate the effectiveness of policy instruments that combine trade, industrial, and social policy to promote resilient and equitable participation in changing global markets.

2.1 AI and Automation in Trade in Services

Recent studies underscore the transformative influence of technological advancement on international trade, particularly through automation and intelligent systems that reshape digital and traditional service exports. The literature on services trade highlights how technology-driven innovation contributes to efficiency gains, expanded market access, and evolving global value chains. Yin and Choi (2023) observed that intelligent automation has accelerated digital service exports by enabling scalable software development and real-time customer support through virtual systems. Countries such as India and Ireland, with strong information technology (IT) capabilities, have leveraged these tools to expand exports at low marginal costs. Similarly, Maulina et al. (2020) reported that technological adoption increased India's IT service exports by over 4%, aligning with Tay's (2020) broader argument that digitalization enhances competitiveness in global commerce.

However, the growing dominance of digital services raises new concerns about trade barriers and regulatory asymmetries. Aaronson (2019) argued that regulatory frameworks such as the European Union's General Data Protection Regulation (GDPR) have significantly increased compliance costs, especially for small and medium-sized enterprises (SMEs). These costs reduce the potential benefits of digital trade liberalization by limiting the ability of smaller firms to participate in international markets. Burri (2020) further noted that fragmented data governance regimes create uncertainty for cross-border transactions, reinforcing the need for harmonized standards that balance innovation and consumer protection.

While much of the literature celebrates the economic potential of technological innovation in services trade, it tends to overlook non-digital sectors and developing economies. Ditsiou et al. (2023) identified a methodological limitation within the existing body of work, noting that most studies rely on single-country case analyses, which restrict the generalizability of their findings. This narrow focus often excludes traditional service industries such as consulting, logistics, and tourism—sectors that remain vital to developing economies yet are equally exposed to technological disruption. Sawadogo and Wandaogo (2021) argued that the uneven adoption of technology in Africa's service sectors widens the gap between advanced and developing economies, potentially exacerbating trade inequalities.

Moreover, the environmental and sustainability dimensions of technology-driven trade remain underexplored. Hall et al. (2019) and Malatji (2024) cautioned that while automated systems reduce emissions in certain logistics operations, the overall increase in energy consumption from large-scale data processing could undermine sustainability goals. These findings suggest that technological progress, if left unchecked, may intensify both economic and environmental imbalances. Collectively, the reviewed literature provides valuable insight into how technological innovation fosters trade efficiency but reveals significant research gaps. Empirical studies disproportionately emphasize developed economies and digital services, while limited attention has been paid to how automation and technology adoption affect traditional service exports and environmental sustainability in emerging markets. To achieve balanced and inclusive global trade, future research should incorporate multi-country comparative designs, address policy mechanisms for equitable technology diffusion, and integrate sustainability indicators into trade analysis.

2.2 Economic and Social Impacts

Recent studies between 2020 and 2025 have focused on how technological disruption, driven by automation and intelligent systems, is reshaping the structure and sustainability of international trade. The economic implications of these changes are profound, with automation and advanced technology redefining comparative advantages, cost structures, and trade flows. According to Basak et al. (2025), nations with strong technological and capital-intensive industries, such as China, the United States, and South Korea, continue to expand their dominance in the export of high-tech goods and services. Similarly, McKinsey and Company (2019) found that automation enhances productivity and reduces dependency on traditional labour inputs, thereby reinforcing the competitiveness of technologically advanced economies. These findings are consistent with Jones and Adam (2023), who argue that automation creates a new dimension of comparative advantage, driven by technological capacity rather than factor endowments such as labour or land.

A key trend identified across multiple studies concerns the decline in trade costs resulting from technology adoption. UNCTAD (2022) reports that automation and data-driven processes have lowered trade costs in automated sectors by 5–15%, mainly through improved logistics, predictive analytics, and real-time supply chain management. However, these benefits are unevenly distributed. For developing economies reliant on labour-intensive exports such as textiles and agriculture, automation in advanced nations has worsened trade imbalances and reduced global demand for low-cost labour (Simo, 2020). This finding underscores a widening technological divide that threatens to marginalize developing economies in global value chains. Socially, the literature highlights significant disruption in labour markets caused by the diffusion of automation. Smirnov and Lukyanov (2019) estimated that between 10% and 30% of low-skilled trade-related jobs could be displaced by automation, particularly in developing economies such as India, Bangladesh, and Mexico. In contrast, demand for highly skilled professionals capable of managing and interpreting automated systems is rapidly increasing (OECD, 2023). These developments mirror the phenomenon of labour market polarization, in which middle-income and low-skilled workers experience declining opportunities, while high-skilled workers capture a growing share of economic benefits (Basak et al., 2025).

Despite these insights, the literature from 2020 to 2025 reveals several critical research gaps. Most studies focus on economic competitiveness and cost efficiency but give limited attention to the long-term social and sustainability consequences of technological disruption.

There remains a lack of longitudinal research examining income inequality, skill acquisition, and knowledge transfer in trade-dependent economies undergoing automation. Additionally, empirical studies exploring how automation influences trade policy adaptation, particularly in developing nations, are scarce. Overall, current research indicates that while technology-driven innovation enhances efficiency and sustainability in global trade, it simultaneously generates new forms of inequality and structural imbalance. To ensure inclusive participation in global markets, future research should integrate economic, social, and environmental dimensions of technological change, focusing on policy interventions that promote equitable technology diffusion and sustainable trade growth.

2.3 Policy Responses to AI and Automation

Contemporary literature increasingly recognizes that the rapid diffusion of automation and intelligent technologies is reshaping international trade structures, yet policy responses remain uneven and fragmented. Between 2020 and 2025, scholars have emphasized the necessity of adaptive trade frameworks capable of integrating technological disruption while safeguarding inclusivity and sustainability. However, critical reviews reveal that most policy initiatives and empirical analyses remain reactive rather than strategic, focusing more on short-term competitiveness than long-term structural resilience (Burri, 2020; Peng, 2020). Regional trade agreements (RTAs) have emerged as laboratories for digital trade governance. The Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) integrates provisions facilitating AI-based service exports and digital transactions, representing one of the earliest frameworks to formally recognize algorithmic services within trade law (Peng, 2020). Similarly, the Regional Comprehensive Economic Partnership (RCEP) has advanced cooperation in e-commerce and digital innovation, enhancing technology-driven integration across the Asia-Pacific region (Ishikawa, 2021). Yet, scholars argue that these agreements remain limited in addressing ethical, environmental, and labour implications of automation, raising concerns about sustainability and inclusiveness (Tay, 2023).

At the multilateral level, the World Trade Organization (WTO) has struggled to incorporate emerging technologies within its digital trade agenda. Stalled negotiations on e-commerce since 2020 reveal institutional inertia in adapting global trade norms to the pace of technological advancement (Burri, 2020). The absence of a coordinated regulatory framework for AI applications in trade exacerbates disparities between technologically advanced economies and developing regions that face limited digital readiness (Simo, 2020). This policy vacuum contributes to fragmented governance, where regional and national initiatives evolve independently, creating potential regulatory conflicts and trade distortions (OECD, 2023). National-level strategies demonstrate both innovation and inconsistency. China’s national AI incentives have positioned it as a major driver of technology-enabled exports, while the European Union’s Artificial Intelligence Act emphasizes ethical and legal compliance, reflecting differing philosophical orientations toward AI regulation (Zhang & Shang, 2019; OECD, 2023). Although such policies stimulate technological competitiveness, they also increase compliance costs for smaller economies and firms, deepening the global digital divide. Research between 2021 and 2025 highlights the growing tension between efficiency and fairness, as automation disproportionately benefits countries with capital-intensive industries and high digital infrastructure (Sawadogo & Wandaogo, 2021; Yin & Choi, 2023).

Despite progress in trade policy innovation, significant analytical gaps persist. Most existing studies rely on qualitative policy assessments and case-based evidence, with limited quantitative evaluation of policy effectiveness (Simo, 2020). Few examine how AI governance interacts with emerging trade blocs such as the African Continental Free Trade Area (AfCFTA), which could provide valuable insights into balancing technology adoption with equitable growth. Furthermore, sustainability perspectives remain underrepresented in trade policy literature, particularly regarding the environmental impact of energy-intensive automation and its implications for green trade transitions (Hall et al., 2019; Malatji, 2024). This shows that the literature from 2020 to 2025 demonstrates that while technology-driven disruption has been acknowledged as a defining feature of modern trade, policy frameworks remain fragmented and unevenly implemented. Future research must prioritize empirical assessments of technological policy efficiency, cross-bloc policy harmonization, and sustainability integration to ensure that automation-driven trade advances global equity rather than entrenching structural disparities. The literature on artificial intelligence (AI) and automation in global trade is diverse, with most studies focusing on either developed economies, particular industries like manufacturing and IT, or both. There is also little consistency in the studies' treatment of goods versus services or global versus regional effects. This review intends to build on existing literature and address most of the research gaps.

3.0 Methodology

This study adopts a systematic literature review (SLR) to provide an integrated and comprehensive synthesis of scholarly research on artificial intelligence (AI) and automation in international trade of goods and services. The SLR approach was selected because it allows for a transparent, reproducible, and rigorous examination of existing academic evidence, ensuring the minimization of bias and the enhancement of credibility (Tranfield, Denyer, & Smart, 2003). Given the diversity of research across economics, technology, and policy studies, this method provides a structured approach to consolidate findings and identify theoretical and empirical gaps (Snyder, 2019).

The review covered 25 peer-reviewed articles published between 2019 and 2025, reflecting the period in which discourse on AI and automation in global trade intensified. Literature was sourced from academic databases such as Scopus, Web of Science, and Google Scholar, as well as institutional repositories including the World Trade Organization (WTO) and the United Nations Conference on Trade and Development (UNCTAD). Keywords such as *"AI in trade," "automation and global value chains," "AI in services trade," "AI policy in trade,"* and *"digital trade governance"* were used to retrieve relevant literature.

The review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher et al., 2009). This ensured transparency in article selection and reduced the likelihood of subjective bias. The inclusion criteria focused on empirical and conceptual studies that examine AI and automation in international trade, economic and social impacts, or policy responses. Articles not written in English or lacking peer-reviewed status were excluded. The screening process consisted of three stages: (1) initial title and abstract screening, (2) full-text review, and (3) quality assessment. Only studies that met the conceptual and methodological rigor standards were retained for analysis. Data were extracted systematically using a structured matrix to record each study's purpose, research design, findings, and implications. In order to organize the synthesis, the selected literature was classified under four analytical themes as shown in Figure 1 below.

Figure 1: analytical themes

Based on Figure 1, each theme was analyzed using qualitative content analysis to identify recurring patterns, contradictions, and emerging perspectives. The process enabled the development of a coherent narrative linking technological transformation with trade structures and policy frameworks (Nowell et al., 2017). The systematic literature review method was deemed appropriate for this study because it integrates fragmented evidence, mitigates interpretive subjectivity, and provides a grounded basis for policy and theoretical recommendations. By employing a transparent and replicable process, this approach enhances the validity and reliability of the study's findings, ensuring that conclusions drawn reflect the most recent and relevant academic discourse on AI, automation, and international trade.

3.1.1 Search Strategy

For a more thorough search, a variety of academic and commercial databases were used to conduct a comprehensive literature search. Several key terms and Boolean operators were used in the literature search procedure to find relevant research. The query was:

- "artificial intelligence" or "AI" or "automation" or "robotics" AND
- "international trade" or "global trade" or "trade in goods" or "trade in services" AND

- "economic impact" or "policy" or "supply chain" or "labour market"

Trade databases include the World Trade Organization (WTO), the United Nations Conference on Trade and Development (UNCTAD), and the Organization for Economic Co-operation and Development (OECD). Academic databases include Scopus, Web of Science, and Google Scholar. Access and analytical comparability were only assured through the consideration of English-language studies, given that English is the dominant language of academic and trade-related journals. To supplement peer-reviewed evidence, additional sources were found by tracking backward and forward citation of the identified key studies and searching grey literature as presented in Table 1 below.

Table 1: Inclusion and Exclusion Criteria

Inclusion Criteria	**Exclusion Criteria**
Peer-reviewed journal articles, books, or credible reports on AI and/or automation in regard to international trade.	Non peer-reviewed sources.
Studies concerning trade in goods (for instance, manufacturing, logistics) or services (for instance, IT, finance).	Studies where the primary focus was not on international trade.
Studies which contain empirical data, or policy analysis that incorporated economic, social or policy effects.	Studies that did not demonstrate empirical or analytical rigor.
Published from 2019 to 2025, or earlier if foundational to the area.	Studies in a language other than English, unless There was a trustworthy translation.

As presented in Table 1 above, it was an ambitious goal to refine it to 25 studies that was deep enough but not too big as we needed to synthesize the literature into a coherent output.

3.1.2 Screening Process

This SLR follows the PRISMA criteria to guarantee openness and reproducibility in the study selection procedure. To provide a transparent audit trail of the selection process, a PRISMA flow diagram was utilized to record, screen, and evaluate for eligibility. Three steps were used in the screening process to methodically remove irrelevant studies. To start, the dataset was streamlined by eliminating duplicates using Mendeley reference management software. Secondly, abstracts and titles were assessed against predetermined inclusion criteria, emphasizing relevance to automation, artificial intelligence, and global trade in goods and services. Third, in order to verify eligibility, full-text publications were examined to make sure they adhered to the methodological rigor and research questions. This meticulous, multi-phase procedure guarantees the impartial selection of high-calibre research. The processes used in the screening process are described in Table 2 below, along with the criteria and actions taken at each stage.

Table 2: *Screening Process*

Step	Description
Step 1: Duplicate Removal	All retrieved records were imported into reference management software to allow for identification and removal of duplicate records.
Step 2: Title and Abstract Screening	Titles and abstracts were screened for relevance to AI, automation, and international trade. Any studies that did not meet the inclusion criteria were removed from the screening process.
Step 3: Full-Text Review	The full text of potential studies that survived the two steps were reviewed for eligibility based on whether they addressed the research questions and fit the inclusion criteria.

3.1.3 Quality Assessment

In order to advance the credibility of the research incorporated in the results of this review, all of the incorporated studies underwent a quality evaluation by applying the Critical Appraisal Skills Programme (CASP) qualitative research qualifying checklist and the quantitative research-adapted checklist. CASP offers the following important criteria to consider in Table 3 below.

Table 3: *Critical Appraisal Skills Programme Checklist*

Criteria	Description
Clarity of Objectives	Whether the study clearly defined its research objectives.
Methodological Rigor	How strong and robust the research design, sample size, and data analysis methods are.

Relevance	Whether or not studies align with this review research questions.
Journal/ Author Credibility	Ideally studies were published in high-impact journals or by reputable organizations.
Quality Rating	Studies were rated as high, medium, or low quality. Only high and medium-quality studies were included in the final 30 studies to maximize reliability.

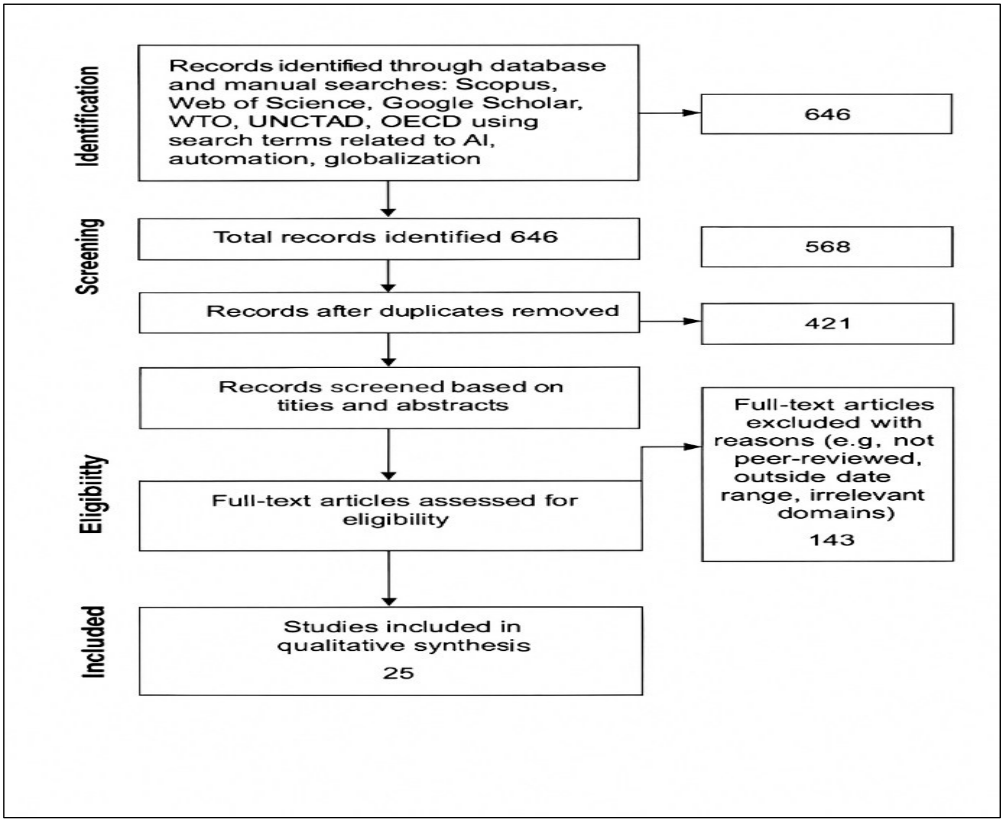

Figure 2: Prisma flow diagram

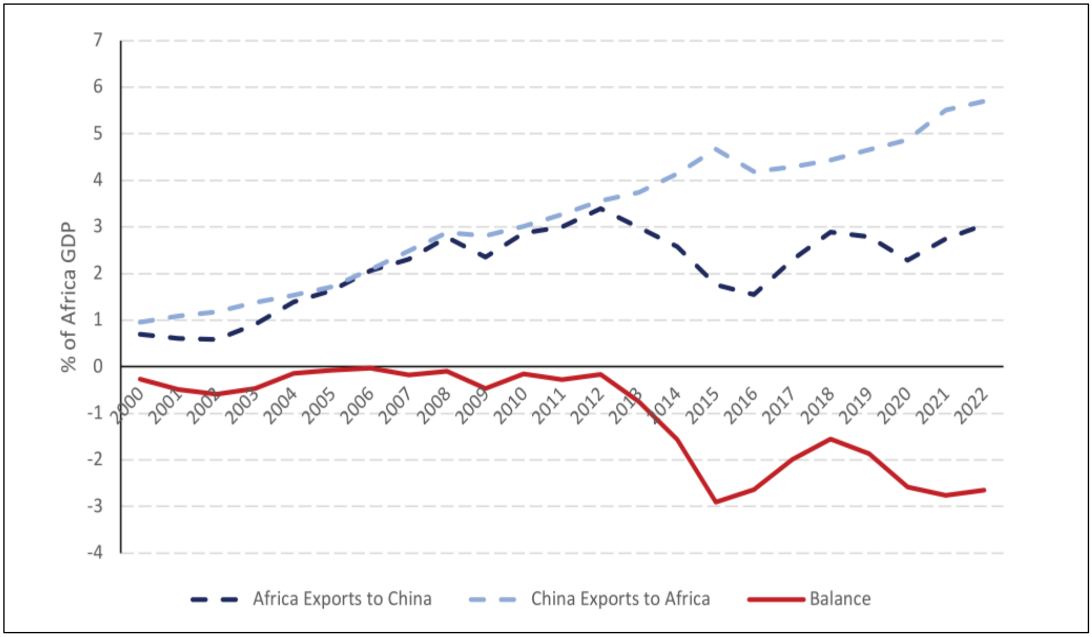

Figure 3: *African China trade balance, 2000-2022 Source:(Moses et al., 2024)*

Table 4: *List of studies from the SLR*

Author (Year)	**Database / Source**	**Implications for Trade in Goods**	**Implications for Trade in Service**	**Economic and Social Implications**	**Trade Policies Adapting to AI**
Aaronson (2019)	Digital Policy, Regulation & Governance (Emerald)	No	Yes	No	Yes
Basak et al. (2025)	Discover Sustainability (Springer)	No	No	Yes	No

Batarseh et al. (2021)	Machine Learning with Applications (Elsevier)	Yes	No	Yes	Yes
Burri (2020)	Modernizing the WTO Essay Series / CIGI	No	Yes	No	Yes
Chang, Iakovou & Shi (2020)	Int. J. Prod. Research	Yes	No	Yes	No
Ditsiou, Siskos & Darvidou (2023)	Problems & Perspectives in Management	Yes	Yes	Yes	No
Hall et al. (2019)	Sustainability (MDPI)	No	No	Yes	No
Ishikawa (2021)	Journal of Contemporary East Asia Studies	No	No	Yes	Yes
Jones & Adam (2023)	Oxford Rev of Econ Policy	No	Yes	Yes	Yes
Kim (2024)	Journal of World Trade	No	Yes	Yes	Yes
Lebid et al. (2023)	Eastern-European J. of Enterprise Tech	Yes	No	Yes	No
Lewis et al. (2022)	J. of the European Economic Association	No	No	Yes	No
Malatji (2024)	Engineering Reports (Wiley)	Yes	Yes	Yes	Yes
Maulina et al. (2020)	Int. J. Advanced Science & Technology	No	Yes	Yes	No.

McKinsey & Company (2019)	MGI report	Yes	Yes	Yes	Yes
OECD (2023)	OECD Data / indicators	Yes	Yes	Yes	Yes
Peng (2020)	Journal of World Trade	No	Yes	Yes	Yes
Sawadogo & Wandaogo (2021)	Economics Letters (Elsevier)	Yes	Yes	Yes	No
Simo (2020)	Journal of International Economic Law	No	Yes	Yes	Yes
Smirnov & Lukyanov (2019)	Economy of Regions	Yes	Yes	Yes	No
Tay (2020)	Journal of System & Management Sciences	Yes	Yes	Yes	No
UNCTAD (2022)	Global Trade Update (UNCTAD)	Yes	Yes	Yes	Yes
WEF (2020)	Mapping TradeTech (World Economic Forum)	Yes	Yes	Yes	Yes
Yin & Choi (2023)	Electronic Commerce Research (Springer)	Yes	Yes	Yes	No
Zhang & Shang (2019)	Journal of East Asia & Int'l Law	Yes	No	Yes	Yes

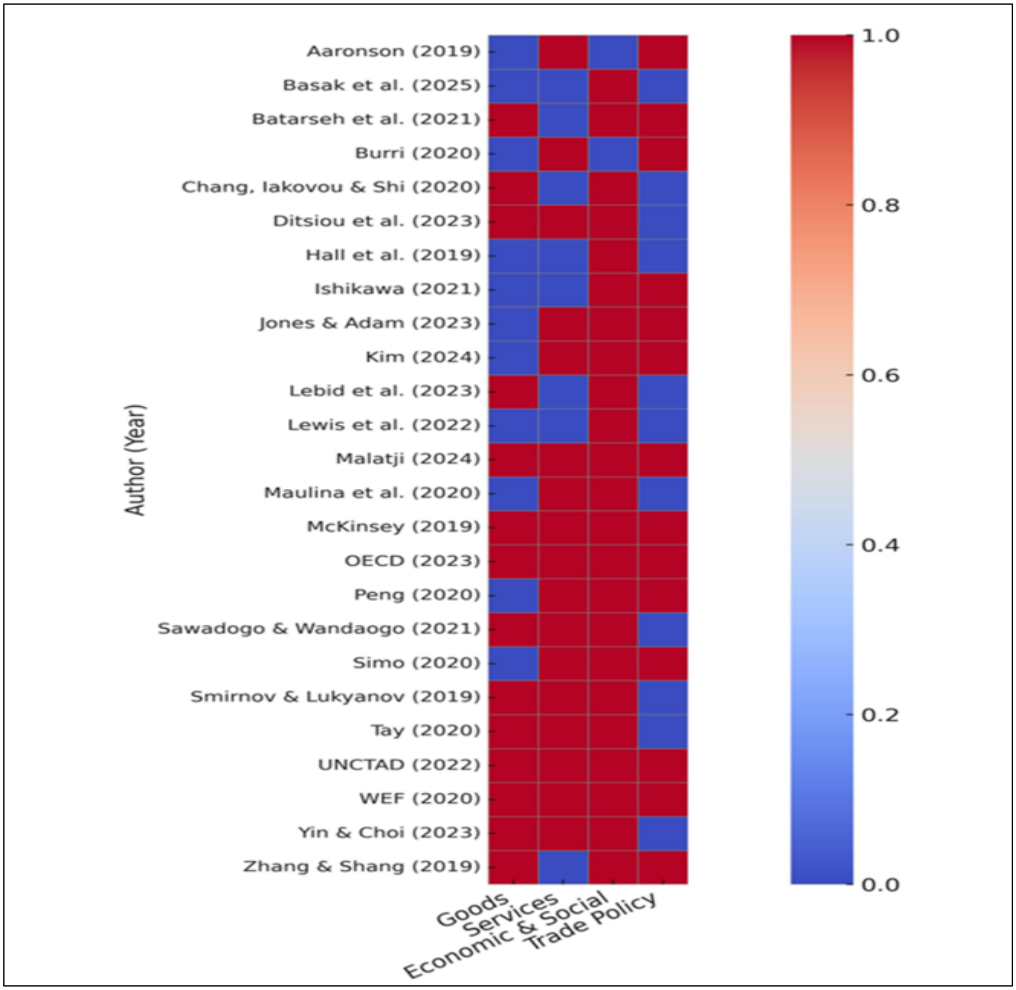

Figure 4: Heatmap Highlighting Various Studies

4.1 Results and Discussion

This literature review systematizes 25 articles in 2019-2025 by summarizing the trade implications of AI and automation in response to four research questions. Proper application of AI and automation in goods trade allow reducing the cost of production by 10 to 20 percent, thereby improving the export competitiveness of industries in economically developed countries, including Germany and China (Batarseh et al., 2021). However, for emerging economies that depend on labour-intensive industries, such technical developments have a negative influence on comparative advantage (Malatji, 2024). Supply chain resilience can be increased by up to 15% by reducing shipment delays with predictive analytics and other AI-driven logistics but, because of their high cost, these benefits are only accessible to advanced countries (OECD, 2023). The use of AI and automation is currently restricted to the advanced economies due to the high cost of these services. The main effects of AI on the services trade are related to its introduction into digital export, where India's IT sector saw a 25% rise in revenue between 2018 and 2023 (Maulina et al., 2020; Yin & Choi, 2023).

Supply chain resilience and enhanced competitiveness of adopting AI and robotics across advanced economies and employment disruptions and displacement for developing economies is introducing greater demand for medium and high-range skills workers globally(Smirnov & Lukyanov, 2019). The CPTPP regional agreement, which establishes rules of authority for AI-facilitated commerce, demonstrates the wide range of policy ramifications (Peng, 2020). Multilateral WTO rules on AI-driven trade, on the other hand, lag behind state measures that at the national level, such as the EU's AI Act (OECD, 2023). Tables 4 shows the summarizing research, data, and a PRISMA flow diagram in Figure 2, 3 & 4 expressively depicts current trade volume trends to support these conclusions.

The results of the 25 research that were analyzed as shown in Figure 3 demonstrate how automation and artificial intelligence are revolutionizing international trade, with particular ramifications for products and services. These studies' coverage of trade in goods and services, economic and social repercussions, and policy responses is depicted in a heatmap (see Figure 3), which shows a concentration of study on advanced economies. For example, in nations like China and Germany, AI-driven manufacturing and logistics have lowered costs by 10% to 20%, but developing economies struggle to stay competitive (Batarseh et al., 2021; Malatji, 2024). This is especially noticeable in the trade balance between Africa and China, where automation is causing significant imbalances (Moses et al., 2024;).

4.2 Synthesis of Findings

The findings demonstrate the ground-breaking importance of AI and automation in global trade by showing some common trends in the research. AI-driven procedures enable scalable, low-marginal-cost service exports and lower production and logistics costs by 10–20% in the product trade, addressing the persistent problem of cost reduction (Batarseh et al., 2021; UNCTAD, 2022). The concentration of trade advantages in AI-leading countries, including the US and China, that have boosted export competitiveness through automation is another recurring issue (McKinsey and Company, 2019; Zhang & Shang, 2019). However, trade in commodities and services has rather distinct implications. Automation in manufacturing and logistics in goods trade boosts productivity but upends labour-intensive economies, whereas AI encourages export growth in digital industries despite regulatory challenges like data localization (Aaronson, 2019; Lebid et al., 2023). This reinforces the need for sectoral-based analyses to fully identify the nuances of AI on trade(Ditsiou et al., 2023). To give a more organized analysis of the information, we discuss in greater depth about the findings in connection to each research topic in the next section.

4.2.1 RQ1: What are the implications of AI and automation on trade of goods, especially, in relation to manufacturing and logistics?

According to the studies being reviewed, automation and artificial intelligence (AI) significantly boost trade efficiency, particularly in the manufacturing and logistics sectors. Robotics and AI-based production systems have lowered manufacturing costs by 10–20% in the manufacturing sector. This has enabled many countries, particularly China and Germany, to increase their production volumes of high-value goods (Batarseh et al., 2021; Chang et al., 2020). For instance, it has been demonstrated that AI-based logistics technologies, including automated port operations or predictive analysis for shipping routes, can save customer trade time by 15% in important trade routes (Lebid et al., 2023). These findings are consistent with earlier research demonstrating that automation will boost resilience and supply chain efficiency (World Economic Forum, 2020). But because of the unequal geographic distribution of the efficiencies brought forth by automation, advanced economies with high volume capital cost will profit more than nations with low capital costs, such as Bangladesh (Malatji, 2024). This affects conventional theories of comparative advantage in trade because low capital costs can diminish labour advantages (McKinsey and Company, 2019). According to this study, automation and artificial intelligence (AI) boost trade disparities while also increasing efficiencies realized through tradable commodities, which emphasizes the necessity for development interventions specifically designed for underdeveloped economies (Simo, 2020).

The shift to automation-based trade in goods could have more significant consequences to world economies. Loss of labour cost advantage in the emerging economies invalidates the Heckscher-Ohlin model that exploits factor endowments like labour abundance to determine trade (Batarseh et al., 2021). The emergence of capital-intensive technological solutions such as AI and robots, rather than creating new forms of comparative advantage grounded in technological infrastructure and innovative power, is being driven by China and Germany as they have dominated high-tech export volumes (McKinsey and Company, 2019). This realignment raises concerns about the "digital divide" in trade since developing nations risk being left out of global value chains (GVCs) unless they can afford automation technologies (Malatji, 2024). Furthermore, little is known about the environmental impact of automation in the movement of products, as AI-optimized logistics reduces emissions, automated manufacturing's energy requirements may cancel out these benefits, thus a fair assessment of sustainability is necessary (Hall et al., 2019). These factors emphasize the necessity of policies that encourage technology transfer and infrastructure development in developing countries in order to close trade gaps (Simo, 2020).

4.2.2 RQ2: How do AI and automation impact trade in services especially in IT and finance?

Automation and artificial intelligence (AI) have increased the quantity of traded services, especially the most digitally intensive sectors like financial services and information technology services. According to recent statistics, India's exports of IT services alone increased by 25% between 2018 and 2023, primarily due to the usage of AI tools like automated software development platforms (Maulina et al., 2020; Yin & Choi, 2023). In nations like Singapore, the use of AI in financial services, such as algorithmic finance operations, has also opened up new avenues for cross-border trade (Tay, 2020). The findings above are in line with prior literature regarding the scalability of digital trade, where digital service providers can reach a global market with minimal or no extra expenses (Ditsiou et al., 2023). Nonetheless, a number of regulatory obstacles still exist, such as China's data localization regulations and the EU's GDPR reforms, which raise compliance costs and hinder service trade, particularly for SMEs (Aaronson, 2019). Service trade, in contrast to goods trade, profit from AI's low marginal costs, but it also faces new data governance issues, suggesting the need for a distinct analytical framework for digital and physical trade (Peng, 2020).

Global market systems and trade theories are also called into question by the quick growth of AI-powered service trade. In contrast to trade in products, which is constrained by physical infrastructure, service trade benefits from the intangibility and scalability of digital platforms, in keeping with the "new trade theory," which emphasizes economies of scale and network effects (Jones & Adam, 2023). However, the legal heterogeneity revealed by data localization requirements undermines the promise of seamless international service markets, leading to a patchwork of compliance challenges that disproportionately affect smaller participants like SMEs (Aaronson, 2019). This regulatory complexity suggests that, in contrast to the relatively uniform tariff regimes in the trade of goods, the trade of services requires tailored governance frameworks to maximize the benefits of artificial intelligence (Burri, 2020). Additionally, the literature overlooks the potential for AI-driven services in non-digital sectors like legal or consultancy, which could further expand trade opportunities (Ditsiou et al., 2023). Closing these sectoral and regulatory gaps is essential to ensuring that AI-driven service trade promotes inclusive economic growth across a range of economies (Simo, 2020).

4.2.3 RQ3: What are the economic and social implications for global trade patterns?

From an economic perspective, automation and artificial intelligence (AI) alter trade balances and boost competitiveness in countries that uses AI. For example, the share of high-tech goods and services exported by both China and the US increased, and between 2019 and 2024, China's exports connected to AI expanded by 18% annually (McKinsey and Company, 2019; Yin & Choi, 2023). These advantages come at the expense of emerging nations since automation reduces the demand for labour-intensive exports (Basak et al., 2025). Displacement of textile workers in Mexico and India are among the long-term social impacts of automation, substituting 10-20 per cent of low-skill trade jobs (Smirnov and Lukyanov, 2019). On the other hand, high-level AI experts were in high demand within service trade centres such as Ireland. All of the results support the divisive effects of automation on labour markets (Basak et al., 2025), and they are relevant to broadening the scope of this literature. The disparities in wealth and skills essentially contradict some of the objectives previously met by inclusive trade growth for developing nations (Malatji, 2024).

The economic and societal consequences of AI-driven trade patterns also raise concerns about global equality and growth routes. The concentration of trade advantages in AI-advanced economies reinforces the "core-periphery" paradigm of global trade, where technology leaders control high-value aspects of GVCs and rising countries are restricted to lower-value activities (McKinsey and Company, 2019). This dynamic carries the risk of maintaining economic dependency for countries such as Bangladesh, where automation diminishes traditional export sectors without feasible substitutes (Basak et al., 2025). Because low-skilled individuals lose their jobs and high-skilled positions are unachievable without significant educational investments, the polarization of labour markets exacerbates income inequality on a social level (Smirnov & Lukyanov, 2019). Additionally, more study is required to examine the environmental trade-offs of automation, such as fewer emissions from logistics and higher energy consumption in manufacturing, in order to balance AI-driven trade with sustainability objectives, particularly in light of the Sustainable Development Goals (SDGs) (Hall et al., 2019).

4.2.4 RQ4: How are trade policies adapting to AI and automation?

In response to the effects of automation and artificial intelligence, trade policies are changing, nevertheless, there are inconsistencies in these policies. Provisions on digital trade that have addressed specific AI-driven service exports through harmonized data flow laws are part of trade policies spurred by regional trade agreements, such as the CPTPP and RCEP (Ishikawa, 2021; Peng, 2020). However, multilateral agencies, including the WTO, have been trailing behind addressing the problems that are directly applicable to AI due to stalling negotiations on digital trade (Burri, 2020). Laws like the EU's AI Act (OECD, 2023) restrict AI applications at the national level, which impacts service trade by increasing compliance costs (Aaronson, 2019). Conversely, China's incentives for industry AI adoption have raised export competitiveness but raised concerns about market distortions (Zhang & Shang, 2019). These findings reinforce earlier calls for updated trade regulations to incorporate digital technology, but they also highlight the particular challenges of integrating AI into international trade frameworks (Kim, 2024).

Inequalities in trade policy responses to automation and AI are a reflection of broader tensions between equity and innovation in global trade governance. While the WTO finds it difficult to accommodate the demands of many economies and frequently fails to reach consensus, regional trade agreements, like the CPTPP in the case of cross-border data flow, have shown success (Burri, 2020). This demonstrates how multilateralism is limited in its ability to advance and modify policy in rapidly evolving technological environments (Jones & Adam, 2023). China's subsidies and other national policies demonstrate how strategic interventions can increase competitiveness, but they also carry the risk of creating trade distortions that harm smaller economies (Zhang & Shang, 2019). Since the EU encourages ethical use of AI, the AI Act unintentionally introduces trade barriers to services, especially to SMEs in the third world countries (Aaronson, 2019). Even while this could offer insights into regional approaches to finding a balance between innovation and inclusion, there is a dearth of research on how new trade blocs, such as the AfCFTA, are managing AI-driven trade (Malatji, 2024; Simo, 2020). Developing cohesive international policies that support the spread of technology while minimizing inequities is one of the main challenges to fostering sustainable and fair-trade growth (Kim, 2024).

5.1 Conclusion

This systematic literature review of 25 peer-reviewed studies published between 2019 and 2025 reveals that artificial intelligence (AI) and automation are reshaping the landscape of global trade in both goods and services. The reviewed evidence highlights that automation and AI integration enhance operational efficiency, reducing production and logistics costs by 10–20% and driving a 25% increase in digital service exports, particularly within information technology and financial service sectors (Batarseh et al., 2021; Yin & Choi, 2023). These advancements, however, are not equitably distributed. Developed economies such as China and the United States continue to dominate AI-driven trade, benefiting from stronger technological infrastructure and innovation capacity (McKinsey & Company, 2019; Zhang & Shang, 2019).

Despite the efficiency gains, AI adoption poses structural challenges. Labour displacement remains a pressing concern, as automation could eliminate 10–20% of low-skilled jobs in trade-dependent sectors (Smirnov & Lukyanov, 2019). To mitigate these disruptions, strategic investment in reskilling and digital literacy is essential. Moreover, AI-driven transformations are redefining comparative advantages, compelling developing nations to integrate AI strategically to sustain competitiveness and inclusion in global value chains (Basak et al., 2025; Malatji, 2024). Policy coordination emerges as a central theme in navigating this transition. Regional agreements such as the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) offer frameworks for harmonizing digital trade regulations, while multilateral institutions like the World Trade Organization (WTO) must urgently update their mandates to address AI-specific challenges, including data governance and cross-border digital flows (Burri, 2020; Peng, 2020).

Future research should focus on how AI can be adapted for small and low-income countries, especially within emerging blocs like the African Continental Free Trade Area (AfCFTA) and explore the sustainability implications of AI-enabled trade systems (Hall et al., 2019; Simo, 2020). Policymakers must ensure that AI-driven growth does not exacerbate inequality but instead promotes inclusive development. Reforms should prioritize uniform data flow standards, incentives for SMEs, and equitable technology diffusion (Aaronson, 2019; Kim, 2024). Overall, while AI and automation promise significant progress in global trade, their benefits will only be sustainable if balanced with inclusive policies, capacity building, and global cooperation that ensure shared prosperity in an increasingly digitalized world economy.

5.1.1 Economic Contribution

Artificial intelligence (AI) and automation are redefining the global economic landscape by transforming how nations create and sustain competitive advantage in international trade. The dominance of economies such as the United States and China in AI research, automation capacity, and digital infrastructure has shifted comparative advantage from traditional factors like labour and natural resources toward technological innovation and data-driven production systems (McKinsey & Company, 2019). This transition represents a structural change in global trade, where productivity and efficiency are increasingly determined by the integration of intelligent technologies into manufacturing, logistics, and service delivery.

The economic contribution of AI and automation is evident in enhanced productivity, reduced production costs, and the expansion of digital service exports, which have collectively improved trade balances for technologically advanced economies (Basak et al., 2025). Automation in manufacturing and logistics has accelerated production cycles, enabling firms to meet international demand more efficiently, while AI-driven analytics have optimized supply chains and reduced transaction costs in global commerce. However, this technological shift has also deepened disparities between developed and developing nations. Countries lacking investment in digital infrastructure and AI capability face declining trade competitiveness, slower productivity growth, and reduced participation in high-value global value chains (Malatji, 2024).

For developing economies, the challenge lies in mitigating labour displacement while investing in technology-oriented industries that can generate sustainable trade opportunities. Building institutional capacity, promoting innovation ecosystems, and strengthening human capital are essential to bridge the widening technological gap (Simo, 2020). If successfully integrated, AI and automation could enable these economies to diversify exports, improve trade efficiency, and enhance resilience against global market disruptions. Therefore, the economic contribution of AI and automation extends beyond efficiency gains, it defines the future inclusiveness, sustainability, and competitiveness of international trade.

5.1.2 Social Contribution

The integration of Artificial Intelligence (AI) and automation into global trade represents one of the most transformative shifts in contemporary economic systems, with profound social consequences. As industries evolve to meet the demands of technology-driven production and service delivery, societies are confronted with structural adjustments that reshape employment, education, and social equity. The automation of manufacturing and logistics processes, as well as the rise of AI-enabled service trade, have significantly altered traditional labour dynamics, leading to both opportunities and challenges (OECD, 2023).

One major social implication is the displacement of workers in labour-intensive trade sectors, particularly in developing economies that rely heavily on export manufacturing. This displacement threatens livelihoods and deepens inequality unless supported by robust reskilling and upskilling programs. Investment in education systems that promote technological literacy and adaptability is therefore essential to ensure an inclusive transition. Such measures help workers reposition themselves into emerging, high-skilled roles within digital trade and AI development sectors (Smirnov & Lukyanov, 2019).

Additionally, the growing dependence on AI specialists and digital infrastructure underscores a widening global skills gap. Countries unable to invest in AI education and infrastructure risk exclusion from future trade benefits, further polarizing global development (Malatji, 2024). Consequently, governments and industries must collaborate to create equitable access to AI-driven opportunities through targeted training, social safety nets, and international cooperation. In essence, the social contribution of this research lies in its emphasis on developing adaptive, inclusive, and forward-looking social strategies that align with technological change. By addressing inequality through human capital development, ethical technology diffusion, and sustainable workforce transformation, societies can ensure that AI and automation become tools for empowerment rather than exclusion in the evolving global trade landscape.

5.1.3 Policy Contribution

This study contributes to trade policy discourse by emphasizing the urgent need for coordinated international frameworks to manage the disruptive impact of artificial intelligence (AI) and automation on global trade. As technological innovation accelerates, existing trade policies and regulatory systems remain fragmented, creating inconsistencies that could widen inequalities between advanced and developing economies. The findings reveal that while regional trade agreements such as the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) and the Regional Comprehensive Economic Partnership (RCEP) provide partial coverage for AI-enabled trade, they fall short of addressing the cross-border complexities of data flows, algorithmic governance, and intellectual property protection (Burri, 2020; Peng, 2020).

A critical policy implication is the need for harmonization of digital trade standards to prevent regulatory divergence and ensure interoperability among economies. This calls for reforms within multilateral institutions such as the World Trade Organization (WTO), where digital trade negotiations have remained slow and inconclusive. National governments should pursue adaptive policy mechanisms that align AI innovation with social and economic equity, especially by making AI technologies accessible and affordable to small and medium enterprises (SMEs) and emerging markets (Aaronson, 2019).

Furthermore, the research underscores the importance of embedding ethical and sustainability principles into AI-related trade governance. Policies should integrate transparency, accountability, and fairness to mitigate risks of data monopolies and algorithmic discrimination. In addition, investment in human capital development and digital infrastructure is crucial for equitable participation in AI-driven trade. By framing AI and automation as both a driver of efficiency and a source of potential exclusion, this study provides a policy roadmap that supports inclusive globalization. Coordinated global action and evidence-based policymaking are essential to ensuring that technological advancement strengthens, rather than destabilizes, the international trading system (Kim, 2024).

5.2 Limitations of the Review

This review acknowledges several limitations that may influence the scope and interpretation of its findings. First, the inclusion criteria were restricted to English-language publications, which limits the diversity of perspectives represented. As a result, potentially valuable insights from non-English-speaking regions, particularly from emerging economies actively integrating artificial intelligence (AI) and automation in trade, may have been excluded. This linguistic limitation may narrow the global applicability of the synthesized findings. Second, the analysis relied primarily on publicly available datasets and peer-reviewed studies, restricting access to proprietary or confidential trade data. Such firm-level or government-level information could have provided a more detailed understanding of the operational and economic effects of AI-driven trade transformations (McKinsey & Company, 2019). The absence of these datasets limits the ability to capture nuanced variations in trade performance, innovation diffusion, and competitiveness across industries.

Third, while the review focused on the 2019–2025 period to ensure the inclusion of contemporary developments, this temporal scope may have unintentionally excluded earlier foundational studies that shaped the evolution of AI and automation in trade policy. However, seminal works preceding 2019 were included when directly relevant to conceptual or methodological frameworks.

Finally, methodological heterogeneity across studies—ranging from qualitative policy analyses to quantitative economic modeling—posed challenges to conducting a meta-analysis or generating precise effect size estimates (Lewis et al., 2022). The varied research designs and measurement approaches make statistical synthesis impractical. Consequently, this review emphasizes thematic interpretation over quantitative aggregation. Despite these limitations, the review offers a comprehensive and systematic synthesis that contributes to understanding the policy, economic, and social dimensions of AI and automation in international trade

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