Digital Transformation of International E-Commerce: A Bibliometric Analysis

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ABSTRACT:

International e-commerce, driven by digital technologies, has diminished the geographical constraints inherent in traditional trade and opened new avenues for global market expansion. This study aims to conduct a comprehensive and systematic bibliometric review of the scholarly literature on international e-commerce. Adopting an interpretive paradigm, the researcher systematically collected citation data from the Scopus database and preprocessed it following the standard PRISMA protocol. Ultimately, 996 studies were included in the bibliometric analysis using VOSviewer software. The findings indicate that research in this domain predominantly clusters around five key themes: (1) Advanced Digitalization and the Role of Artificial Intelligence, (2) The Digital Economy and Its Socio-Technical Platforms, (3) Innovation, Sustainability, and Entrepreneurial Dynamics, (4) External Shocks and Regional Heterogeneity, and (5) Supply Chain Integration and Crisis Management.

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I. Introduction

E-commerce is expanding globally, primarily in the form known as Cross-Border E-Commerce (CBEC). Unlike traditional domestic or local e-commerce, where sellers and buyers are typically located within the same country or region, CBEC enables commercial actors worldwide to conduct cross-border online transactions, overcoming limitations such as language, culture, time, and distance.The CBEC market value is projected to reach approximately USD 2.25 trillion by 2026, with a compound annual growth rate of 17.4% [1].This significant growth underscores the strategic importance of CBEC in the global economy.To advance knowledge in the CBEC field, studies across various disciplines and regions have examined this phenomenon, employing diverse research methods and theoretical perspectives to analyze and explain CBEC. Despite this expansion, research remains in an early and exploratory stage, lacking a cohesive theoretical framework. Consequently, CBEC requires a systematic and dedicated review to synthesize and integrate the most advanced and up-to-date findings. The objective of systematic reviews is to analyze and evaluate the different approaches and orientations adopted in studies, using extensive bibliometric analysis to uncover the evolutionary aspects of the subject [2]. To address this gap, bibliometric analysis serves as an effective method for examining scientific activity and identifying research trends[3]. Accordingly, the present study applies bibliometric analysis to cluster CBEC research in marketing transformation and, based on a systematic methodology, defines its research objectives in two sections:

A. Performance Objectives:

1. To identify growth or decline trends in studies on augmented reality technology in marketing.
2. To identify the most influential countries in augmented reality technology in marketing.

B. Network Objectives:

1. To identify various collaborative co-authorship patterns in the field of augmented reality.
2. To identify the most effective temporal collaboration patterns.

To provide a clear understanding of the study's structure, the article is organized as follows: Section 2 presents the methods used and specifies the exclusion criteria for the analysis. Section 3 reports the findings and discussions related to the research questions, and the final section concludes with an evaluation and offers recommendations for future research.

II.Research Methodology

Electronic commerce is developing and advancing, with a large number of articles published annually in the field of marketing. The growing volume of literature on this topic highlights the need to examine the evolution of the field and identify the current state of knowledge. This underscores the necessity of employing a systematic approach in the present study. To ensure the quality of the systematic review report, the PRISMA checklist was applied in this research. In the Web of Science search query, the keywords, title, and abstract included terms related to electronic commerce, which are presented in Table 1.

Table 1: Search Query

Keywords in the search query
(("e-commerce" OR "electronic commerce") AND ("digital transformation" OR digitalization OR "digital platform*")) https://www.webofscience.com/wos/woscc/summary/0135e042-f8d1-424f-abc4-b4543477d96a-0195deba0a/b818f5c4-8da4-4401-9dd7-d77553be15d8 0195ddc1c2/relevance/1

This study focused on *electronic commerce* and its related terms. As of the search conducted on January 3, 2026, a total of 1,260 records were initially retrieved from the database. Following this, review articles were excluded, reducing the dataset to approximately 988 publications. Subsequently, only articles published in English were retained. To ensure relevance, all titles, abstracts, and keywords were carefully examined. Only documents explicitly addressing electronic commerce and its synonymous terms were included. Articles from unrelated fields, such as medicine, agriculture, engineering, and architecture, were removed from the dataset. Ultimately, this process resulted in a final set of 945 documents. The full records and references of these documents were downloaded and used as input for bibliometric analysis and scientific mapping with VOSviewer. It is noteworthy that VOSviewer has been freely accessible at (https://www.vosviewer.com) since September 18, 2021

III.. Results and Discussion

A. Publication Trends

From the publication of the first article in 1998 until 2026, approximately 945 CBEC articles have been published according to a Web of Science search. This figure reflects an irregular publication pattern. However, since 2020, the number of publications has increased exponentially, indicating

a significant acceleration in CBEC research output. Based on this publication surge and cumulative percentage analysis, nearly 50% of the articles were published in the past three years; consequently, the study period (1998–2026) can be categorized into four intervals according to the pace of publication development.

***Phase One*: Formation and Initial Stagnation (1998–2015)** was characterized by a slow and fluctuating publication pace. This low publication rate resulted in only 10 articles being published during this period. Research centers primarily focused on classical e-commerce, ICT infrastructures, websites, and electronic payments. Given this focus, the scholarly literature at the time still lacked a deep conceptual linkage between e-commerce and digital transformation, and most studies were descriptive and technology-oriented in nature.

***Phase Two*: Conceptual Awakening (2016–2019)** saw the publication of only 60 articles overall. During this period, initial attention focused on the role of emerging technologies in redesigning online business models. **As a result,** this phase can be considered a transitional stage from traditional e-commerce to a digital transformation approach. **Furthermore,** estimates from 2018 indicate that approximately 70% of online shoppers had placed at least one order through CBEC platforms [4], **highlighting the rapid adoption of cross-border e-commerce. In addition,** market reports show that by 2020, the number of global CBEC consumers continued to grow steadily

***Phase Three*: Period of Leap and Consolidation (2020–2022)** witnessed a sharp increase in publications, with a total of 400 articles released during this period. **This surge coincided with** the COVID-19 pandemic, which triggered an explosion in the use of digital platforms and accelerated the growth of Cross-Border E-Commerce (CBEC). **Consequently,** research during this phase emphasized platformization, digital resilience, digital supply chains, and the impacts of external shocks, particularly the pandemic**. As a result,** digital transformation shifted from being merely a competitive advantage to a strategic necessity in e-commerce. **Moreover,** with the continued growth of CBEC and its emergence as a key driver in the e-commerce sector, it is projected that CBEC's share of total e-commerce will rise from 15% in 2016 to 22% in 2022 [5].

Phase Four: Period of Maturity and Thematic Diversification (2023–2025) witnessed the highest volume of publications, with 435 articles covering a wide range of topics, including artificial intelligence and big data, multi-sided platforms, sustainability and ESG, and emerging markets. **During this phase,** the focus shifted from mere technology adoption to governance,

regulation, and outcomes. **Consequently,** the literature of this period reflects the theoretical maturity of the field and a move toward macro-level, interdisciplinary, and policy-oriented analyses (**Figure** 1).

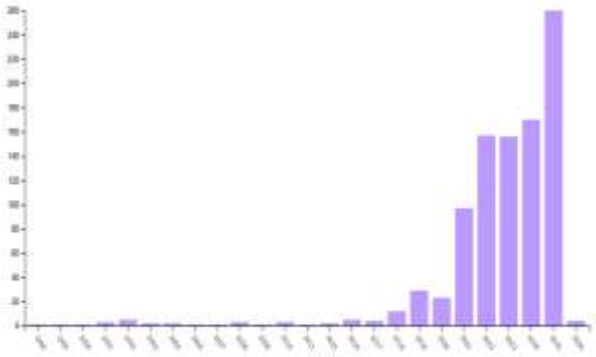

Figure 1. Pareto chart of electronic commerce publication trends for the years 1996–2023

A. Identifying the most influential countries in electronic commerce

Bibliometric findings indicate that knowledge production in the field of cross-border electronic commerce (CBEC) is highly geographically concentrated and uneven. China accounts for the largest share of scientific publications by a significant margin, reflecting its central role in both practical and research developments in CBEC. This geographic concentration underscores China's prominence and pivotal position in shaping CBEC research, resulting in the majority of existing theoretical frameworks and empirical evidence being influenced by China's institutional and market context.

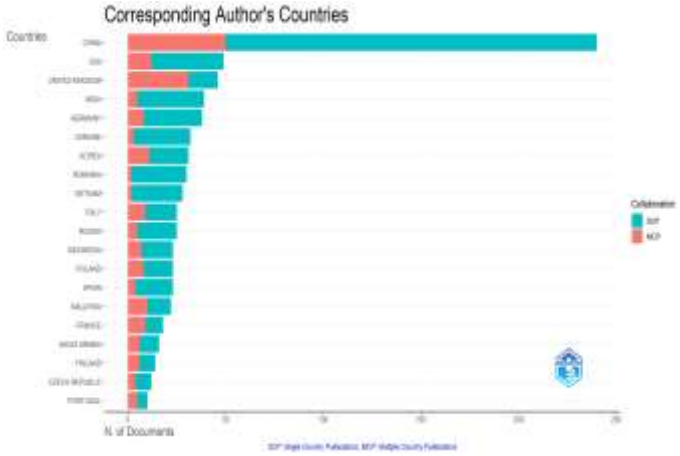

Figure 2. Collaboration Network of Authors from Different Countries in the Field electronic commerce

In contrast, developed Western countries such as the United States and the United Kingdom, although still playing a significant role in the production of theory and research methodology, continue to lag behind China in terms of the volume of empirical studies. The moderate participation of European countries is primarily focused on regulations, logistics, and consumer trust, reflecting the region's regulatory-oriented approach to CBEC. Moreover, comparing the participation of European countries with the limited yet growing presence of emerging economies indicates that both groups play distinct roles in the development of CBEC while highlighting existing research gaps (**Figure** 2).

B. Identification of Different Co-authorship Interaction Patterns in the Field of Electronic Commerce

The Country Collaboration Map illustrates the global network of international interactions, highlighting the United States and China as two central hubs. These central hubs, through their extensive connections to other countries, demonstrate their pivotal role in shaping the global collaboration network. The darker blue of these two countries indicates a high volume of participation and their central position within the network; China, with widespread connections to Asian countries (such as Japan, South Korea, and India), Oceania (Australia), and even parts of Europe and Africa, primarily reflects economic, infrastructural, and scientific collaborations (such as the Belt and Road Initiative), whereas the United States exhibits stronger connections to North America, Western Europe, and traditional Asian allies. This pattern also reveals geographical inequalities, as developing countries in Africa and Latin America often appear in lighter colors with fewer connections, indicating their relative marginalization in global collaboration flows. At the same time, comparing peripheral countries with regional clusters emphasizes the importance of network analysis in understanding contemporary geopolitical and scientific dynamics, with regional clusters (such as Europe) demonstrating stronger internal collaborations and underscoring strategic competition and bipolarization between the two major powers (**Figure** 3).

Figure 3. Co-authorship Pattern of Countries in the Field electronic commerce

C. *Identification of the Most Influential Co-occurrence Patterns in the Field of Electronic Commerce*

The VOS viewer tool is particularly valuable for this study, as its analytical capabilities enable the identification of relationships among keywords and the elucidation of the structure of research topics relevant to the field under investigation. These analyses assist in determining the main research clusters associated with the assessment of trends and key topics in the domain of electronic commerce. In the following section, these clusters and their corresponding key terms are presented (**Figure 4)**:

The first cluster (green) identified through the analysis conducted using VOS viewer comprises a set of keywords related to advanced digitalization and artificial intelligence**.** This cluster emphasizes the pivotal role of emerging digital technologies in sustainable entrepreneurial transformation and green innovation, where artificial intelligence, machine learning, the Internet of Things, and big data analytics serve as key tools for process optimization, environmental impact reduction, and the creation of intelligent and sustainable business models. Advanced digitalization thus becomes a driving force for sustainable innovation in addressing global challenges. Furthermore, the integration of technologies such as Industry 4.0, artificial intelligence, blockchain, and the circular economy is highlighted as a facilitator of environmental sustainability and efficiency [6].

The second cluster (red) identified through the analysis conducted using VOS viewer comprises a set of keywords related to **digital economy and social platforms**. This cluster highlights that platforms are crucial not only for user experience—such as website design, electronic service

quality, accessibility, ease of use, and usefulness—but also for marketing communications, including online advertising, personalized recommendations, and website policies [7].

The third cluster (blue) identified through the analysis conducted using VOS viewer comprises a set of keywords related to **innovation, sustainability, and entrepreneurship.** This cluster emphasizes the significance of entrepreneurship as a tool for addressing environmental and social challenges through innovative approaches and directs recent research trends toward green business models and sustainable transformation. Green business and sustainable transformation, as a strategic approach, guide traditional business models toward the integration of environmental, social, and economic principles, positioning green innovation as a driver of sustainable growth. In this context, the practical implementation of these models through supply chain redesign, circular models, and low-carbon technologies not only mitigates negative environmental impacts but also generates long-term competitive advantages [8].

The fourth cluster (purple) identified through the analysis conducted using VOS viewer comprises a set of keywords related to **external shocks and regional differences.** The conceptual focus of this cluster emphasizes economic resilience against external shocks and diversification as strategies to achieve long-term sustainability, highlighting that investment in innovation and resilient infrastructures is critical for reducing the vulnerability of different regions. External shocks—such as economic crises, pandemics, or climate change—combined with regional heterogeneity, affect resilience and the performance of sustainable entrepreneurship and green businesses; regions with stronger infrastructures and better access to resources are more capable of absorbing these shocks and transforming them into opportunities for green innovation [9].

The fifth cluster (yellow) identified through the analysis conducted using VOS viewer comprises a set of keywords related to **supply chain linkage and crisis management.** The conceptual focus of this cluster indicates that recent studies increasingly conceptualize the supply chain not merely as an operational mechanism but as a strategic component in responding to crises. Accordingly, this cluster emphasizes the necessity of strengthening supply chain linkages as both preventive and reactive strategies in crisis management, thereby directing research trends toward the examination of resilient and sustainable models within entrepreneurship. Within this framework, the integration of Industry 4.0 technologies and integrated supply chain approaches plays a pivotal role in mitigating the impacts of global crises—such as pandemics and geopolitical disruptions—and contributes to the long-term sustainability of businesses [10].

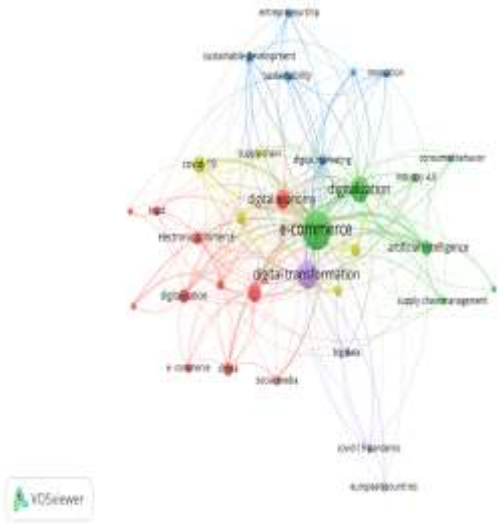

Figure 4. Co-occurrence output map in the field of electronic commerce

IV. CONCLUSION

Overall, the results of the bibliometric analysis indicate that the literature on innovation, sustainability and entrepreneurship is moving toward an integrated and multidimensional paradigm—one that positions advanced digital technologies (particularly artificial intelligence and digitalization), resilience to external shocks, crisis management through resilient supply chains, and sensitivity to regional differences as central elements. This conceptual convergence suggests that the identified developments are not merely fragmented trends but rather reflect a structural shift in the orientation of the field. Accordingly, the transition toward digitally driven, resilient, and context-sensitive sustainable entrepreneurship is emphasized; a transition that, through the integration of advanced technologies, adaptive policies to address regional inequalities, and the strengthening of resilient supply chains, not only manages global challenges such as climate change and crises but also creates opportunities for green innovation and inclusive growth in the future of sustainable entrepreneurship.

Despite these meaningful findings, the results of the present study should be interpreted in light of certain methodological limitations. The primary limitation concerns the reliance on a specific database, as databases such as Web of Science are continuously updated, leading to changes over time in the number of publications and citations.

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