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Exploring the knowledge mapping and research trends of cross-border e-commerce

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Background: Driven by economic globalisation and technological advancements, cross-border e-commerce (CBEC) has witnessed unprecedented growth. This dynamic sector has attracted significant scholarly attention, leading to a proliferation of fragmented research. However, traditional literature reviews often lack the objectivity and depth required for a thorough understanding of the field.

Aim: This study aims to bridge the gap by employing a bibliometric analysis to systematically explore the research landscape of CBEC. The objective is to uncover key trends, knowledge structures and evolutionary pathways within the domain.

Setting: The analysis focuses on 914 CBEC-related publications from 2015 to May 2024, sourced from the Web of Science (WoS) database.

Method: Utilising the CiteSpace tool for visual bibliometric analysis, we extract and elucidate key information regarding publication distribution, authors, research institutions, countries and keywords.

Results: The study shows CBEC research entering maturity with key themes like innovation, China, and logistics. It highlights shifts from competition to integrated digital strategies and from market access to AI and blockchain. Future studies will focus on China's role, consumer perception, and supply chain innovation.

Conclusion: This study offers a comprehensive bibliometric analysis of CBEC, providing a structured framework to understand its evolution.

Contribution: It identifies key trends and emerging research themes, contributing theoretical insights into the interplay between technologies and cross-border trade, while offering practical guidance for industry adaptation.

Keywords: cross-border e-commerce; knowledge mapping; research trends; bibliometric analysis; CiteSpace.

Introduction

In recent years, global economic integration and advancements in e-commerce technology have rapidly made cross-border e-commerce (CBEC) a critical pillar of international trade (UNCTAD 2016). Furthermore, the coronavirus disease 2019 (COVID-19) pandemic has expedited its growth, significantly impacting global trade dynamics (Tolstoy, Melén Hånell & Özbek 2023). The signing of the Regional Comprehensive Economic Partnership (RCEP) in 2020 has reduced uncertainties surrounding CBEC. It has not only integrated relevant resources but also substantially enhanced customs clearance efficiency. According to eMarketer, the global retail e-commerce market almost tripled between 2014 and 2022. By 2023, the global e-commerce market reached $5.8 trillion and is projected to reach $7.9 trillion by 2027 (e-Marketer 2024).

Cross-border e-commerce refers to the transaction of logistics between multiple parties from different customs territories through e-commerce platforms (Ai, Yang & Wang 2016). Depending on the transaction parties, CBEC can be categorised into three models: Business-to-Business (B2B), Business-to-Consumer (B2C) and Consumer-to-Consumer (C2C), facilitating easier access for both consumers and enterprises to the global market. With the advancement of globalisation and information technology, CBEC has rapidly emerged as a vital channel driving international trade (Kim, Dekker & Heij 2017).

A distinctive feature of CBEC is its cross-border online transaction model, which transcends geographical barriers, enabling businesses to explore new markets and innovate operational

models. Simultaneously, it offers consumers a more diverse selection of products, thus fostering global economic diversification. Major e-commerce platforms such as Alibaba and Amazon have developed multinational systems that facilitate the global circulation of goods and services (Wang et al. 2020).

However, the rapid growth of CBEC is accompanied by multiple challenges that add complexity to its development. Scholars have explored a variety of dimensions within this evolving landscape, including market supply and demand, entry strategies, consumer behaviour, customer relationship management, platform collaboration, regulatory frameworks and payment mechanisms (Chen & Yang 2021; Du 2024; Sun et al. 2021; Yuan et al. 2021). For instance, Xiao et al. (2019) identified key situational cues such as online promotions, content marketing, personalised recommendations and social reviews, which significantly influence consumer purchase intentions, especially when brand familiarity is taken into account. Furthermore, the multicultural context of CBEC logistics has introduced significant challenges, especially in last-mile delivery systems, which remain a key area of academic research (Cano, Londoño-Pineda & Rodas 2022; Hsiao, Chen & Liao 2017; Mangiaracina et al. 2019). For example, Ren et al. (2020) proposed a hybrid deep learning model combining advanced techniques within a Seq2Seq framework. This model aims to enhance one-step decision-making in logistics demand forecasting and optimize service capacity allocation in third-party forwarding logistics for CBEC. Blockchain technology has also enhanced payment security and improved transparency in goods delivery, reducing both costs and time associated with cross-border transactions (Liu & Li 2020). Additionally, the policy environment has played a crucial role in fostering CBEC growth. Chen and Yang (2017) emphasised that CBEC serves as an intermediary between government-supported policies and enterprise performance, with institutional and business model innovations acting as key components of this intermediary function.

Despite the rapid growth of CBEC, it remains a complex and risky domain because of challenges such as the lack of cross-national legal enforcement, cultural and language barriers, high information asymmetry and elevated transportation costs (Wang et al. 2015a). These challenges require constant innovation and strategic adjustments from enterprises and governments to remain competitive in the dynamic international trade environment.

Over the past decade, CBEC research has primarily focused on understanding its driving and disruptive factors, highlighting the importance of consumer behaviour, logistics, payment systems, regulatory environments and market entry strategies. However, as globalisation intensifies, the range of influencing factors on CBEC has diversified, resulting in an increasingly fragmented research landscape. The proliferation of research branches has produced a wide array of divergent themes, complicating the task of synthesising the field's development.

Review studies have significantly advanced our understanding of CBEC's complexities. For instance, Hazarika and Mousavi (2021) provided a comprehensive overview of the field and outlined future research trajectories, while Liu et al. (2021) addressed macro-level risks inherent in the development of CBEC in China. Chen, Lan and Chang (2023) conducted a thorough review of consumer behaviour research and suggested future research directions. However, despite these valuable contributions, the literature remains fragmented and lacks systematic studies on development trends and keyword integration. Furthermore, existing reviews typically cover fewer than 100 articles, often relying on expert judgement and selective literature inclusion, which limits their ability to provide an objective and comprehensive overview of the field.

To address these gaps, this study adopts a bibliometric approach to analyse 914 publications from the Web of Science (WoS) database, spanning from 2015 to May 2024. Using CiteSpace as a tool for bibliometric analysis, this research systematically explores the development trends, structural patterns and knowledge evolution within CBEC research. The findings will offer scholars and practitioners a comprehensive understanding of the current research framework in CBEC, highlight emerging trends and guide future research directions, thus providing valuable insights for both academic inquiry and practical applications.

This article is organised as follows. In the next section, we describe the methodology, analytic software and data collection procedure used in this study. Then, the main findings from the bibliometric analysis are presented in the 'Results' section. Finally, the contributions and limitations of this study are discussed in the 'Conclusions' section.

Methodology and data

Methodology

Bibliometric analysis is defined as 'the quantitative analysis of publications in a given field' (Mayr & Scharnhorst 2014). By using secondary data, bibliometric analysis examines data acquired from digital databases from a quantitative and objective perspective (Chen 2006). This approach enables the introduction of a systematic, transparent and reproducible review process, thereby enhancing the reliability and quality of the review. Comprehensive bibliometric analysis of a specific topic helps researchers better understand the knowledge base and structure of a particular domain (Shafique 2013). With the advancement of information technology, bibliometric analyses have evolved to generate network visualisations, providing more intuitive insights compared to traditional text-based analysis (Chen 2006). CiteSpace is one of the most popular software tools for analysing co-citation networks in bibliometric research. It has been widely applied across more than 60 fields, including computer science, information science and medicine. In recent years, it has also gained significant traction in the bibliometric analysis of e-commerce literature (Cui et al. 2018; Ding & Yang 2022; He et al. 2022).

In this study, we utilise CiteSpace (version 6.3) to perform co-citation analysis, research collaboration network analysis and clustering analysis. These techniques allow us to generate knowledge graphs of articles, authors, keywords, pivotal points, research frontiers and focal points (Chen 2006), facilitating a clearer interpretation of the data. The co-citation analysis identifies patterns of citation among articles, helping to reveal how research topics are interrelated over time and allowing us to map the intellectual structure of CBEC research. Clustering analysis further categorises articles into themes, helping to identify emerging research trends and provide insight into the development of the field. Research collaboration network analysis highlights collaboration patterns between authors and institutions, underscoring the interdisciplinary nature of CBEC research. This methodology is grounded in knowledge evolution theory, which suggests that research topics evolve over time, with new topics emerging as the intellectual landscape shifts. Furthermore, social network theory helps interpret the relationships between authors and research themes, providing insight into how knowledge spreads and evolves within the CBEC field.

Data

The data for this study were sourced from WoS, one of the most authoritative and widely used databases for academic literature, encompassing over 8800 core journals across more than 100 disciplines worldwide. Web of Science offers comprehensive coverage of global research outputs and serves as the standard citation database for academic research. Given its global reach and authoritative status, WoS was selected as the data source for this study to ensure a representative and high-quality sample of CBEC-related literature.

To capture the most influential studies in the field, we focused on the WoS Core Collection and specifically targeted the SCI-EXPANDED, SSCI and ESCI indices, which include the most impactful journals in scientific and social science disciplines. The timeframe for this analysis was set from 2015 to May 2024, as the first CBEC-related article was published in 2015, and this study aims to analyse the most recent trends in the literature.

We referred to relevant studies (Giuffrida et al. 2017; Hazarika & Mousavi 2021) to determine the search terms. The search query included three CBEC-related keywords: 'cross-border', 'e-commerce' and 'international'. To ensure the reliability of the results, our search terms used only the professional term 'e-commerce' and its abbreviation 'e-commerce'. 'International' was included as a synonym for 'cross-border'. Based on these keywords, we conducted searches using the themes 'cross-border e-commerce' or 'cross-border electronic commerce' or 'CBEC' or 'international electronic commerce' or 'international e-commerce'. After applying these criteria, we retrieved a total of 966 documents, including articles and review articles. The retrieved documents were stored in plain text format, maintaining complete bibliographic information. To ensure data quality, we used CiteSpace to remove duplicates, resulting in a final dataset of 883 articles and 31 reviews, comprising a total of 914 documents. The final dataset includes 38925 references, which were analysed using CiteSpace's visualisation tools to identify trends, collaborations and research evolution.

Ethical considerations

This article followed all ethical standards for research without direct contact with human or animal subjects.

Result and discussion

Distribution of publications

Figure 1 shows the number of articles published each year. The quantity of CBEC-related articles has significantly increased, from 15 articles in 2015 to 205 articles in 2023, reflecting a steadily rising trend in this field. The growth trend can be divided into three phases.

Initial phase (2015–2017)

This phase represents the early stages of research, with a relatively low number of publications per year, growing from 15 articles in 2015 to 30 articles in 2017. This aligns with the initial development and market exploration stages of CBEC, where scholars began to focus on the potential opportunities and challenges it presented.

Growth phase (2018–2021)

The number of publications began to increase significantly, from 29 articles in 2018 to 161 articles in 2021, with the output in this phase exceeding six times that of the previous phase. This indicates that CBEC gained widespread attention and research interest during these years. The surge can be attributed to changes in the global economic environment, particularly the outbreak of the COVID-19 pandemic. The pandemic not only altered consumer shopping habits, driving more transactions online, but also compelled businesses and governments to reconsider and enhance support and regulation for CBEC platforms.

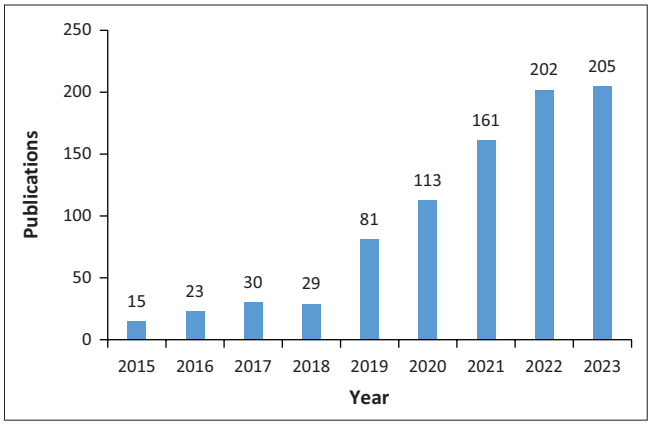

FIGURE 1: Number of publications.

Mature phase (2022–2023)

The number of publications peaked and then stabilised, with 202 articles in 2022 and 205 articles in 2023, suggesting that the field of CBEC had entered a mature stage, with peak research engagement from the academic community.

Analysis on author and cited authors

Table 1 lists the top 10 prolific authors and their primary areas of focus. According to Price's Law, the core authors in the field of CBEC can be identified using the formula $M \approx 0.749\sqrt{NMAX}$ (M representing the number of articles, N representing the highest number of articles published by a single author within the given timeframe). With N being 8, M is approximately 2.12, rounded to 2, indicating that authors with two or more publications are considered core authors in the field. A total of 38 authors met this criterion. The total publications by these core authors account for only 9.96% of the total number of articles, significantly less than the 50% standard of Price's law. This suggests that the CBEC research field is quite fragmented, with a wide distribution of authors and relatively small differences in their publication counts.

Among them, Baozhuang Niu and Shuzhong Ma were the most productive authors during our search period. Both focus primarily on logistics, supply chains and market strategies. Niu et al. (2021) developed models based on accurate disruption predictions, inspired by dual-channel operations in CBEC. This analysis addressed strategic decisions of e-retailers in waiting for channel disruption information within global supply chains. Ma, Chai and Zhang (2018) by addressing issues of information asymmetry and data insufficiency in CBEC, constructed indices for China's CBEC prosperity and risk. The study revealed trends in industry growth, logistics and customs facilitation, and changes in competition and risk, providing guiding insights for cross-border exports.

We analysed the three most cited authors, Ying Wang's work stands out with the highest citation count of 102. Wang et al. (2018) focused on the supply chain service capabilities of CBEC enterprises, offering recommendations for improving the quality of supply chain relationships with e-retailers and other platform users. This indicates a significant research interest in CBEC supply chains. As the second most cited author, Gomez-Herrera, Martens and Turlea (2014) examined the driving factors and barriers of CBEC within the European Union. Their findings revealed that the internet significantly reduced trade costs associated with geographical distance; however, language barriers and emerging online trade costs continued to impede CBEC growth. Notably, English-speaking countries had a distinct advantage in online trade. Furthermore, the third most cited author, Giuffrida et al. (2017), provided a comprehensive review of the logistics supporting CBEC in China, systematically categorising the existing knowledge base. Later, Giuffrida et al. (2020) evaluated various logistics solutions for CBEC to China under conditions of uncertainty, offering critical policy recommendations for the implementation of CBEC logistics in China.

TABLE 1: Top 10 most productive authors.

Author	Publications	Main focuses
Ma, Shuzhong	8	Supply chain; logistics; global market strategies
Niu, Baozhuang	8	Supply chain; logistics; strategy optimisation
Mou, Jian	7	Consumer satisfaction; purchase intention; trust
Jia, Fu	6	Supply chain
Tolstoy, Daniel	6	International entrepreneurship; small and medium enterprises
Mangiaracina, Riccardo	5	Logistics
Wang, Ying	5	Supply chain
Yang, Jianzheng	4	Customer satisfaction; indoor localisation
Tumino, Angela	4	Logistics
Giuffrida, Maria	4	Supply chain; logistics; digital transformation

Analysis on institutions and territories

Table 2 lists the top 10 institutions by the number of publications and their areas of focus. By analysing this table, it is evident that China is the leading country in CBEC research, with six out of the top 10 institutions located there. Zhejiang University ranks first in the field of CBEC with 17 publications, followed by the Ministry of Education & Science of Ukraine (12 publications), Hong Kong Polytechnic University (11 publications) and Zhejiang University of Technology (11 publications), among others, indicating that these institutions have conducted in-depth and authoritative research in CBEC. From the perspective of institution types, 35 universities have published more than five articles each. This suggests that CBEC research is not concentrated in a few universities but is gradually spreading out. Geographically, the research institutions are mainly concentrated in China, the UK and the USA, which correlates with the current development trends in the CBEC field in these countries.

TABLE 2: Top 10 productive institutions.

Institution	Publications	Theme
Zhejiang University	17	International trade; internationalisation
Ministry of Education and Science of Ukraine	12	Digital trade; sustainable development
Hong Kong Polytechnic University	11	Supply chain
Zhejiang University of Technology	11	Customer satisfaction
State University System of Florida	9	Supply chain
Polytechnic University of Milan	9	Logistics
Chinese Academy of Sciences	9	Supply chain; customer behaviour
South China University of Technology	9	Supply chain
Xidian University	9	Customer satisfaction
University of London	8	Customer satisfaction; trust; internationalisation

Existing collaborations mainly involve close partnerships among several domestic universities, with occasional international collaborations, such as between Hong Kong Polytechnic University, the University of Adelaide and Xidian University, forming three preliminary cooperation networks. Another emerging centre of institutional collaboration is Zhejiang University, whose network includes Beijing Union University and Alibaba Group. Cross-border e-commerce research is concentrated in higher education and research institutions, and also includes companies like Alibaba Group, indicating growing cooperation between academia and industry. This interdisciplinary and cross-industry collaboration is driven by the dual nature of CBEC, requiring both technological and market support. Overall, the CBEC field still needs to strengthen collaborations between institutions and across countries and regions.

Most of the articles on CBEC are concentrated in Asia, followed by the USA and the EU. China is the most influential country in the CBEC field, with the USA and the UK ranking second and third with 98 and 61 publications, respectively. Of the total 914 articles, 451 are from China, nearly half of the sample size. This finding aligns with the analysis of influential institutions in the CBEC field. However, this result differs from research in e-commerce, which shows the largest contribution from the USA (Mou, Cui & Kurcz 2019). In this context, China performs remarkably well in the CBEC environment. Despite the USA having leading e-commerce platforms such as Amazon and eBay, China has shown strong competitiveness with leading platforms such as AliExpress, SHEIN, TikTok Shop and Temu, demonstrating rapid growth in CBEC. According to the 'State of Mobile 2024' report by data.ai, the four platforms have seen a dramatic increase in global downloads, securing the top four positions in the global shopping app download growth rankings for 2023 (SensorTower 2024). Notably, while the USA ranks second in publication volume, it has the highest centrality. This high centrality indicates a broader research field and more extensive collaborations with other countries, including China and the UK.

In CBEC research, China's unique market position and industry dynamism have attracted widespread attention. One reason is that China has become a significant participant in the global economy and trade. Additionally, China's large population offers an attractive market for businesses. Researchers have extensively analysed the driving forces, challenges, strategies adopted by enterprises, and consumer purchase intentions in China's CBEC development. Specifically, China's internationalisation layout and regional cooperation strategies as the initiator of the 'Belt and Road' initiative have become research hotspots. Meanwhile, the USA, as one of the world's largest economies, also draws considerable research interest because of its mature e-commerce market and technological leadership. These studies focus not only on domestic e-commerce development but also broadly cover cross-border interactions with key economies such as China, the UK and South Korea. Most of this research involves cooperation and competition with China, reflecting a tendency among researchers to optimise CBEC strategies in practice, guide policy formulation, and explore business practices. The EU, as the world's third-largest economy, also garners attention in CBEC development. Researchers primarily investigate the driving factors, existing barriers, and possible solutions for CBEC within the EU at the regional level, providing valuable references for regional policymaking and business strategies. Focusing on a region helps identify the similarities and differences between countries and how they promote or hinder the development of CBEC within the region.

Analysis on keywords

In this section, our overarching objective is to uncover key trends. By filtering irrelevant keywords and merging related ones, we identified the top 15 keywords. Figure 2 illustrates the keyword co-occurrence network. The core high-frequency keyword 'cross-border e-commerce' appeared 305 times. Keywords closely related and frequently co-occurring with 'cross-border e-commerce' include 'innovation', 'China', 'logistics' and 'firms'. For the second most frequent keyword, 'Internet', closely related and frequently co-occurring keywords include 'international trade', 'digital economy' and 'information technology'. Furthermore, keywords centring around 'trust', which has a high centrality, include 'loyalty', 'purchase intention', 'perceptions' and 'social commerce', focusing on important consumer research perspectives. These high-frequency keywords reflect the current research hotspots and the connections between key terms in the CBEC field from 2015 to 2024.

Within the results pertaining to 'keyword bursts', we aim to uncover evolutionary pathways. Keyword bursts refer to a significant increase in the frequency of a specific keyword over a particular period. As shown in Figure 3, the earliest and longest-lasting keyword burst is 'integration'. This highlights the emphasis on integrating digital marketing with corporate performance, big data analysis with risk management and logistics management in CBEC, reflecting the sector's focus on integrated development of key subfields. Early appearing keywords include 'competition', followed

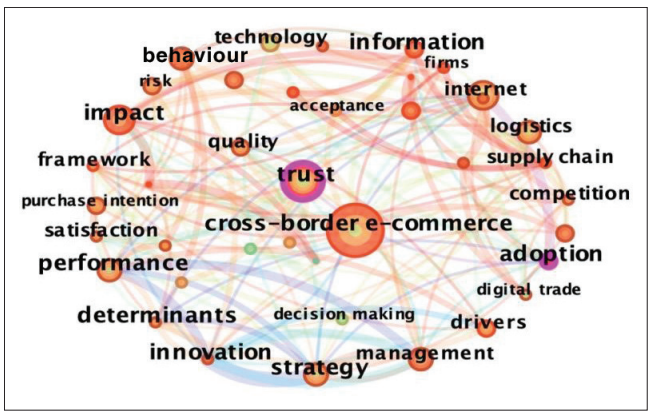

FIGURE 2: Map of keywords.

by the emergence of 'innovation' and 'information technology', indicating that CBEC continues to face and address industry innovation challenges while enhancing operational efficiency and business outcomes through the application of information technology. The emergence of 'word of mouth' and 'social commerce' underscores the critical role of users in market communication and brand building. Based on the prediction of emerging keywords, it is anticipated that 'China', 'perceptions' and 'supply chain' will become focal points of future research, highlighting China's significant role and impact in CBEC; studies on consumer perception differences and risk perceptions, as well as new technologies and digital transformations in supply chains, will further drive the development of the CBEC field. These emerging keywords not only reflect current research hotspots but also provide important references for future academic research.

Within the results pertaining to 'keyword clusters', we aim to uncover knowledge structures. We used the LLR algorithm in CiteSpace to cluster the keywords. This algorithm is more suitable for generating high-quality clusters with high intra-class similarity and inter-class dissimilarity. The final results are shown in Figure 4, with Q = 0.7751, S = 0.8882, and Mean (Q, S) = 0.8278 (Q > 0.3; S > 0.7), indicating that the clustering results are highly reliable. The clustering results can be broadly divided into seven categories: '#0 Emerging Markets', '#1 S-O-R Model', '#2 Customer Satisfaction', '#3 Blockchain Technology', '#4 Supply Chain Management', '#5 Digital Transformation' and '#6 Post Adoption Behaviour'.

Keywords	Year	Strength	Begin	End	2015 – 2024
Competition	2015	1.73	2015	2017	
Innovation	2016	3	2016	2018	
Information technology	2017	1.75	2017	2018	
Word of mouth	2018	2.36	2018	2019	
Online shopping	2018	2.28	2018	2020	
Integration	2018	2.14	2018	2021	
Social commerce	2019	1.88	2021	2022	
China	2021	2.14	2022	2024	
Perceptions	2022	1.99	2022	2024	
Supply chains	2023	2.23	2023	2024	

FIGURE 3: Burst keywords detection.

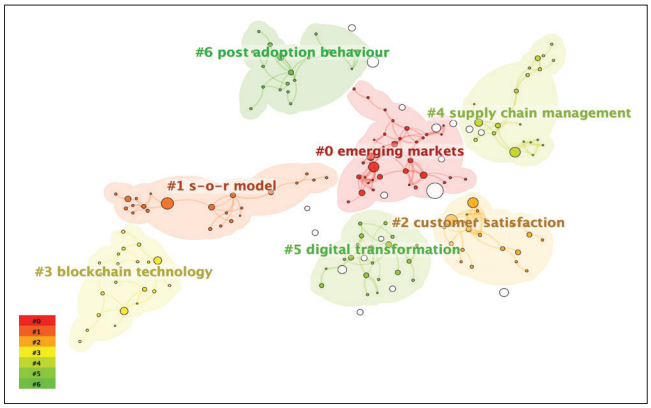

FIGURE 4: Map of keyword clusters.

Cross-border e-commerce research based on consumer perspective

Related clusters include #1 'S-O-R Model', #2 'Customer Satisfaction' and #6 'Post Adoption Behaviour'. Overall, early research keywords mainly focused on basic concepts such as 'customer satisfaction', 'trust' and 'model', then gradually evolved to explore deeper factors such as 'innovation', 'determinants' and 'barriers'. Trust is considered a key factor influencing consumers' purchase intentions. Xiao et al. (2019) pointed out that consumers' perceptions and understanding of a product directly affect their willingness to purchase in CBEC. This indicates that increasing consumer awareness and understanding of products is crucial to enhancing their purchase intentions. Furthermore, Ting and Nam (2016) suggested that the reliability, interactivity, and convenience of a website positively impact consumer behaviour. Zhu, Yan and Ding (2020) found that consumers, influenced by language, geography, culture and religion, exhibit different motivations, desires, interests and needs for certain products. As research deepened, studies on consumer experience shifted to more specific aspects. For example, keywords such as 'price', 'quality', 'communication' and 'customer loyalty' indicate that researchers began to delve into how pricing strategies, product quality and communication affect customer loyalty and, consequently, transaction volume. Wu et al. (2014) emphasised that customer loyalty in CBEC is driven by perceived value and transaction costs. Effective strategies to improve consumer satisfaction include efficient customer service, transparent pricing and flexible return policies, which are crucial for retaining customers and encouraging repeat purchases in the competitive CBEC market.

Notably, the #6 'Post Adoption Behaviour' cluster studies consumer behaviour patterns after adopting CBEC services, such as continued usage and word-of-mouth. This corresponds with the changes in the aforementioned keywords, indicating the increasing importance of service innovation to consumers (Nkwei, Rambe & Simba 2023). Recent keywords such as 'digital platform' and 'ecosystem' reflect the importance of technological innovation and the overall platform ecosystem in CBEC to consumers. For instance, Zhu, Mou and Benyoucef (2019) used a three-stage theory model to explore how product perception affects purchase intention, finding that sustained engagement and contextual involvement of the platform significantly enhance consumer trust and purchase intentions. In real-world examples, TikTok, as a leading global short-video platform, has introduced an innovative growth model for CBEC through its short-video and live-streaming features. The platform's precise algorithms enable product recommendations tailored to users' interests and behaviours, ensuring targeted marketing. Moreover, with TikTok Shop's full-service model, merchants only need to provide products, while the platform manages all operations, including traffic acquisition, significantly simplifying the CBEC process. This service innovation has enabled TikTok's success by creating a dynamic ecosystem that responds to the diverse

motivations, desires and needs of consumers across different cultures and regions.

Blockchain technology-enabled supply chain management

Related clusters include #3 'Blockchain Technology' and #4 'Supply Chain Management'. From the keywords in this category, early research such as 'B2C e-commerce delivery' primarily focused on the basic functions and delivery efficiency of CBEC logistics. Cross-border logistics is the cornerstone of global trade, but factors such as long-distance transportation, incompatible information systems and complex return processes present challenges that reduce transparency and efficiency, affecting customer satisfaction. Wang, Yang and Yin (2015b), based on market survey statistics, constructed a model using structural mechanics equations to comprehensively analyse the main factors affecting cross-border logistics performance in China. The results showed that performance is directly influenced by cross-border payments, electronic customs, legal regulations and technology applications. As research deepened, keywords such as 'supply chain management', 'performance acceptance' and 'integration' began to appear, marking a shift in focus to optimising and integrating the supply chain to improve overall performance. Efficient logistics operations are crucial for shortening delivery times, reducing costs and ensuring customer satisfaction. Ai et al. (2016) studied the impact of logistics performance on the development of CBEC. The study emphasised addressing payment and regulatory issues to enhance logistics efficiency and overall performance. In real-world examples, AliExpress uses a global logistics network with economical express and priority postal services. Through Alibaba's Cainiao Network, it provides efficient solutions such as global warehousing and last-mile delivery, reducing costs and improving speed. The Global Seller Support Program offers localised payments, global marketing tools and cross-border logistics, with secure payments via Alipay. These innovations streamline cross-border transactions and support the growth of global e-commerce.

The introduction of blockchain technology further drove the transformation of supply chain management, especially after 2020, with 'blockchain technology' becoming a significant keyword. Research during this stage focused on how blockchain enhances the transparency, security and efficiency of the supply chain. Liu and Li (2020) proposed a blockchain-based framework to achieve product traceability in supply chain management. As blockchain applications deepened, keywords such as 'international marketing', 'information' and 'coordination' indicated that research not only focused on the technology itself but also extended to its application in global market marketing and improvements in information flow and coordination. For example, Zhou et al. (2023) addressed the issue of blockchain technology adoption within the CBEC sector by developing an evolutionary game model. This model analysed and explored the decision-making behaviours of e-commerce platforms and merchants. Their research aimed to provide deeper insights into the adoption behaviours of blockchain technology, as well as to facilitate the broader application and promotion of blockchain solutions. Yu, Huo and Zhang (2021), based on the resource-based view (RBV) and organisational capability theory, examined the impact of information technology through supply chain integration on international business performance from the perspective of the supply chain upstream and downstream. Recent keywords such as 'dynamic capability' and 'risk' indicate that research is delving into the role of blockchain in enhancing supply chain dynamic adaptability and risk management in complex international environments. Keywords like 'digital transformation market' reflect the expansion of research focus to the overall impact of digital transformation on the market and supply chain. Specifically, Li et al. (2018) explored how entrepreneurs of resource-constrained small and medium enterprises (SMEs) drive digital transformation amid resource scarcity. Their study aimed to enhance the understanding of digital entrepreneurship and digital transformation through an inductive process model. Zhang, Jia and You (2021) introduced the concept of a balanced state, which measures the proximity of a current supply chain's state to its ideal and anti-ideal states. The findings suggested that CBEC supply chains should strive for a balanced approach, rather than solely pursuing high resilience or low vulnerability.

New model exploration based on digital transformation

Related clusters include #0 'Emerging Markets' and #5 'Digital Transformation'. Early research keywords mainly focused on understanding 'barriers', 'determinants', 'innovation' and 'social media' in emerging markets. With the acceleration of globalisation and technological advancements, CBEC has shown not only strong growth momentum in emerging markets but also faces challenges of model homogenisation and a lack of innovation. Digital transformation, through resource reorganisation, dynamic capability enhancement, market challenge response and new model innovation, has become an important means for CBEC to enhance competitiveness and expand emerging markets. Especially through the application of dynamic capabilities and social media to enhance market competitiveness, it is necessary for CBEC enterprises to maintain competitiveness and adapt to market changes (Rambe, Mosweunyane & Dzansi 2019; Vial 2021). Eduardsen et al. (2023), through studying the organisational determinants and performance outcomes of CBEC barriers, found that both domestic and foreign digital infrastructure levels and market internet penetration rates exhibit strong moderating effects on the relationship between CBEC barriers and export performance. In real-world examples, the eMarketer Global Retail E-commerce Forecast reports Southeast Asia's e-commerce market reached $113.9 billion in 2023, growing 18.6%, far exceeding the global average of 8.9% (e-Marketer 2024). This growth is fuelled by a shift to more personalised and interactive social commerce, driven by youth consumption and improving e-commerce infrastructure.

As consumers' familiarity with and expectations for digital services increase, research has gradually shifted its focus. There is now greater emphasis on improving 'service quality' and 'user experience'. This shift highlights the growing importance of digital strategies in predicting consumer decisions. Consequently, enterprises need to optimise their resources and strategic layouts. Research attention has gradually turned to the antecedents of digital transformation, customer behaviour and the impact on SMEs. Li (2020) pointed out that internet platforms 'empower' SMEs by providing technical support on CBEC platforms, enabling them to directly participate in the global knowledge economy and jointly create and deliver knowledge products and technical services. Elia et al. (2021) explored the drivers of digital exports based on the RBV, analysing strategies for leveraging digital technologies to achieve internationalisation in CBEC. Technologies such as artificial intelligence, blockchain and big data provide new pathways for the digital transformation of CBEC. Blockchain technology can be utilised to construct cross-border supply chain systems. Computer vision can be applied for product classification. Machine learning methods can be employed for both product classification and purchase intention analysis and prediction. These technologies enable the automation and intelligence of business processes. They also enhance the operational efficiency and market responsiveness of CBEC (Liu et al. 2020; Wu & Lin 2018; Yuan 2019). The intersection of digital transformation and emerging markets demonstrates the dynamic interaction between technological innovation and market development. Future research should delve into these intersections to promote inclusive and sustainable development in emerging markets.

Overall, the initial exploratory stage research themes mainly focused on constructing basic concepts and frameworks. Subsequent research shifted towards specific strategies, applications and technological innovation and integration. Current research themes further deepen, focusing more on market segmentation, personalised services and continuous improvement of customer experience. Research is expanding towards how to achieve business process automation and intelligence through advanced technologies such as big data, artificial intelligence and the Internet of Things to improve overall operational efficiency and market responsiveness. In addition, consumer satisfaction has always been a popular research topic for CBEC purchase intentions. Research on post-adoption behaviour investigates the patterns of continued usage and satisfaction that users exhibit after adopting new technologies or services. This area of study is essential for companies aiming to design effective retention strategies. Insights gained from this research help in improving customer loyalty and satisfaction, thereby contributing to more informed decision-making in user experience management.

Analysis on references

Table 3 lists the top 10 most-cited references and their details. Valarezo et al. (2018) is the most frequently cited because of its innovative approach and comprehensive analysis of the driving factors and barriers of CBEC. This study identifies various factors affecting CBEC, such as gender, education level and computer and internet skills, providing specific policy recommendations for governments. Recommendations include enhancing public digital skills, increasing online trust and utilising online information evaluation. These insights offer valuable theoretical and practical guidance, significantly advancing research and practice in the field of CBEC.

From the perspective of research questions, studies on CBEC can be broadly categorised into four areas: consumer behaviour, logistics and supply chain management, payment systems and market entry strategies. Among the top 10 most-cited studies, four focus on the logistics aspect of CBEC, with three employing modelling methods. This highlights the critical role of logistics in CBEC and reveals key conclusions on optimising logistics strategies, reducing costs, improving efficiency and enhancing consumer satisfaction. Overall, highly cited literature primarily addresses crucial aspects of CBEC, including how to improve efficiency through technological and service innovations, understand and promote online consumer behaviour, and optimise cross-border transaction processes through strategies and technologies. These studies not only deepen academic understanding of CBEC but also provide valuable guidance for industry practice, particularly in improving operational efficiency and consumer satisfaction.

Conclusion

In recent years, CBEC has experienced robust growth; however, current research remains largely fragmented and lacks systematic integration. This study utilises the WoS database and CiteSpace software for visual data analysis to systematically explore and summarise the knowledge structure, development trends and evolution pathways within this field. This approach aids scholars and practitioners in constructing a rigorous knowledge framework and predicting future developments. The results indicate that CBEC research has undergone significant growth, with a surge in 2019 and a stabilisation over the past two years. However, the field lacks a prominent group of influential authors, suggesting weak collaboration and dispersed efforts. Most research hotspots and collaboration networks are concentrated in China, highlighting limited international collaboration and regional disparities that warrant further investigation. Key trends analysis identifies 'cross-border e-commerce' as the central theme, with keywords such as 'innovation', 'China' and 'logistics'. Evolutionary pathways have moved from competitive dynamics towards integrated strategies in digital marketing and logistics, with future studies expected to emphasise China's role, consumer perception and supply chain innovation. The knowledge structure of the study categorises seven clusters into three main focal areas: consumer-centric research, blockchain technology-enabled supply chain management and new models based on digital transformation. Consumer satisfaction has consistently been a key topic and will likely remain a focus of deeper research in the future. Furthermore, future research should address the

TABLE 3: Top 10 most cited references.

Study	Research question	Method	Theory	Findings
Valarezo et al. (2018)	The determinants of the individual's decision to perform cross-border e-commerce	Survey	The discrete choice model, logistic regression techniques	Gender, education, digital skills and foreign nationality significantly affect CBEC adoption. Customer reviews and foreign nationality also positively influence adoption.
Kim et al. (2017)	Distance effects on CBEC and the importance of express delivery	Experimental design, mathematical modelling	Gravity model	Express delivery can mitigate the perceived geographical distance in e-commerce, and the high efficiency of express services positively impacts e-loyalty.
Giuffrida et al. (2017)	Outline directions for future research to encourage CBEC development	Literature review	A systematic methodology	The existing literature on CBEC logistics support is summarised, and key directions for future research are pointed out, such as distribution network design and logistics outsourcing strategies.
Qi et al. (2020)	Examining a foreign firm deploying CBEC as an entry mode to the Chinese market	Case study	Transaction cost theory	CBEC reduces uncertainties and opportunistic behaviours, enhancing trust, allowing foreign firms to minimise investments in physical shops, staffing, logistics and warehousing.
Ma et al. (2018)	Conducting on the current status and the trends of the industry as well as the magnitude of risk in CBEC	Mathematical modelling	None	CBEC has a relatively stable situation for logistics facilitation but a drastic fluctuation in customs facilitation.
Hsiao et al. (2017)	Offering a logistics service design for CBEC using Kansei engineering with text-mining-based online content analysis	Experimental design	Kansei engineering, partial least squares model, text mining techniques	User-generated online content analysis complements conventional surveys in capturing customer-centric design elements for Kansei design.
Wang et al. (2020)	How CBEC firms can generate supply chain service capabilities through supply chain relationship quality	Case study	Service dominant logic theory	Three critical supply chain resources—information, logistics and finance—intertwine to shape service capabilities that enhance supply chain relationships.
Zhu et al. (2019)	The impact of product cognition on purchase intention in CBEC	Mathematical modelling	Three-stage theoretical model, hierarchy-of-effects model, commitment-involvement theory	Platform persistence and situational involvement exert significant influence on enhancing consumer trust and purchase intention.
Liu and Li (2020)	Offering a blockchain-based CBEC supply chain management framework	Experimental design, mathematical modelling	Multi-chain structure model, data management model, block structure model	The framework, models and methods can successfully deal with key recover problem, and protect against clone attack, counterfeit tag attack and counterfeit product attack.
Gomez-Herrera et al. (2014)	The patterns and determinants of cross-border online trade in goods reveal comparison of online and offline trade costs	Survey, mathematical modelling	Standard gravity model	Compared to offline trade, online cross-border trade has lower costs related to geographical distance, but higher costs related to language barriers. Institutional factors significantly influence cross-border trade.

Note: Please see the full reference list of the article, Cui, Y., Shi, Y., Gu, M. & Li, J., 2025, 'Exploring the knowledge mapping and research trends of cross-border e-commerce', *South African Journal of Economic and Management Sciences* 28(1), a5909. https://doi.org/10.4102/sajems.v28i1.5909, for more information.

CBEC, cross-border e-commerce.

integration of supply chains with blockchain and artificial intelligence in emerging markets. It further illustrates a shift in focus from foundational market access and trade regulation studies to emerging topics. The cited references predominantly focus on supply chain aspects, and the related journals exhibit high overall quality, reflecting the interdisciplinary nature of CBEC research.

Academic contributions

This study integrates bibliometric citation analysis with network maps and visual techniques based on CiteSpace, providing a comprehensive overview of the knowledge structure, development trends, and deep-seated patterns of evolution in the field of CBEC. This article reveals publication trends in CBEC, identifies key research institutions and prolific authors, and offers insights into research collaboration networks. It delineates core nodes of academic influence and provides direction for future research. Through visual analysis of international cooperation networks, this article highlights the collaboration patterns among research institutions across different countries and regions, offering new perspectives on global academic cooperation. In addition, this study evaluates the academic value of cited references, guiding scholars in selecting appropriate academic resources for reading and publication. Furthermore, through keyword co-occurrence and clustering analysis, this study identifies research hotspots in the CBEC domain and highlights key areas for future investigation, including post-adoption consumer behaviour, emerging trends in digital transformation within new markets, and the integration of cutting-edge technologies such as blockchain and artificial intelligence in supply chains. These insights offer valuable directions for advancing academic research.

Practical contributions

This study provides a comprehensive analysis of CBEC, offering practical insights for industry professionals. The findings highlight key implications for business strategy, technological innovation and sustainable development. Firstly, consumer behaviour analysis is crucial for developing personalised marketing strategies. Professionals should leverage data-driven insights to tailor their offerings based on evolving market trends and regional preferences, ensuring more effective market penetration. Understanding local consumer behaviour is essential for optimising product offerings and marketing approaches in diverse international markets. Secondly, technological innovations, particularly blockchain and artificial intelligence, are pivotal in optimising supply chain and logistics systems. Blockchain improves transaction security and traceability, while AI enhances

demand forecasting and inventory management. These technologies enable companies to achieve greater operational efficiency, improve responsiveness and reduce costs, especially in emerging markets. Furthermore, professionals should focus on developing robust market entry strategies that address cultural differences and local consumer preferences. Tailoring marketing campaigns and product offerings to specific regions will be essential for success in the global marketplace. Collaboration between academia and industry is also essential. By working together, researchers and practitioners can tackle challenges such as logistics inefficiencies and regulatory barriers, driving innovation and policy advocacy to support the growth of CBEC. This partnership can also help translate academic insights into practical applications that address real-world issues in digital trade. Lastly, the study emphasises the importance of sustainability. As global e-commerce expands, industry players must focus on environmentally responsible practices, data protection and ethical consumerism. Adopting sustainable supply chain practices and ensuring data privacy will not only align with consumer expectations but also contribute to long-term success. In summary, this study provides actionable insights for CBEC professionals, emphasising the importance of data-driven strategies, technological adoption, international cooperation and sustainability for navigating the challenges and opportunities in the global digital economy.

Limitations and further research

This study primarily employs bibliometric methods for literature analysis, which has certain limitations. Firstly, data collection is mainly reliant on the WoS database, overlooking other core databases and conference articles relevant to this field (e.g., WHICEB, ICEB). Future research should delve into articles related to CBEC themes from core international conferences or databases. Secondly, the reliance on English literature may introduce biases in understanding. To gain a more comprehensive understanding of the CBEC field, future research should incorporate more diverse data sources and consider literature in other languages. Given that the results show higher productivity in China compared to the United States, we aim to extend our research using the Chinese academic database CNKI for a deeper analysis of additional studies.

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Competing interests

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Authors' contributions

Y.C. was responsible for conceptualisation and methodology. Y.S. was responsible for formal analysis and original draft. M.G. was responsible for visualisation and review editing. J.L. was responsible for software and review.

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Data availability

The authors confirm that the data supporting the findings of this study are available within the article.

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