

Understanding the Resilience of China's Exports: Theoretical Developments, Key Issues and Future Prospects (2016-2026)

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Abstract

Against the backdrop of global supply chain restructuring, rising geopolitical risks and the increasing penetration of digital technologies into international trade, export resilience has emerged as a key metric for assessing the stability, shock-absorbing capacity and structural adaptability of foreign trade. As a major player in global trade, China faces fluctuations in external demand, the reshaping of international rules and a transition in its domestic development model; enhancing export resilience is therefore crucial for maintaining stable trade volumes, optimising trade structure and achieving high-level openness. This paper employs the CiteSpace bibliometric tool, combined with a systematic literature review, to conduct a knowledge map analysis and trace the academic trajectory of research on China's export resilience between 2016 and 2026. The findings reveal that: 1) Research has evolved from a phase of gradual accumulation to one of rapid expansion, with themes shifting from export quality, product upgrading and institutional constraints towards digital technology empowerment, optimised resource allocation, supply chain restructuring and the generation of multidimensional resilience; 2) Research hotspots are concentrated on factor allocation, export product quality, the application of digital technologies and enterprise innovation, with the digital economy, cross-border e-commerce, technological innovation, financing constraints and resource allocation being high-frequency topics; 3) Emerging trends indicate that the impact of spatial agglomeration and cascade effects, sports goods exports and the digital transformation of manufacturing on export resilience warrants continued attention. Overall, research on China's export resilience is shifting from a focus on single-outcome analysis towards a comprehensive research paradigm that takes into account processes, mechanisms and network structures.

Keywords

Export Resilience, Export Quality, Digital Economy, Bibliometrics

1. Introduction

In recent years, the operating environment for international trade has undergone profound changes. In the wake of the global financial crisis, global demand growth has slowed, trade protectionism has intensified, geopolitical conflicts have escalated, and global industrial and supply chains have undergone accelerated restructuring, leading to a significant increase in the uncertainties facing export activities. Against this backdrop, measuring a country's foreign trade competitiveness solely by export volume, growth rates or price advantages is no longer sufficient to explain its stability and ability to adapt in the face of external shocks. For China, which is deeply embedded in the global division of labour, exports are not merely about aggregate expansion; they are also about the ability to withstand shocks, restore growth, optimise structure and reshape competitive advantages in a complex environment. Consequently, "export resilience" has gradually emerged as a key lens through which to observe the high-quality development of China's foreign trade and the security of its open economy (Xu & Liu, 2023; Xie et al., 2025; Wang & Li, 2026).

Conceptually, export resilience in this paper refers to the dynamic capacity of export entities and export systems to withstand external shocks, maintain basic export functions, recover growth, and adaptively restructure products, markets, supply chains and organisational arrangements. It is therefore different from export quality, which mainly describes the value, technological content and market recognition embodied in exported products, and it also differs from export upgrading, which focuses on movement toward higher value-added products, markets or value-chain positions. In this review, export quality and export upgrading are treated as important antecedents and mechanisms through which resilience may be generated, but export resilience itself is defined by stability, recovery and adaptive restructuring under uncertainty.

From the perspective of research evolution, studies on the resilience of China's exports have gradually taken shape against the backdrop of an ever-deepening exploration of "export quality upgrading". In the early stages, academic discourse centred primarily on issues such as the measurement of export product quality, quality ladders, product upgrading, export value-added ratios and the technological complexity of exports, with a focus on analysing the impact of factors such as imports of intermediate goods, the institutional environment, wage fluctuations, industrial agglomeration, anti-dumping measures and factor price distortions on export quality. Relevant studies generally hold that improvements in export product quality represent a significant manifestation of China's foreign trade shifting from quantitative expansion towards qualitative enhancement, and constitute a

key pathway to strengthening international competitive advantage (Yu & Zhang, 2017; Chen & Xu, 2016; Xie & Zhang, 2017; Xu, 2016; Wang, 2016). This implies that although export resilience is a concept that has emerged in recent years, its theoretical foundations have long been gradually established through research on export quality, product upgrading and trade structure.

With the successive emergence of events such as Sino-US trade frictions, the impact of the pandemic, export controls and supply chain scrutiny, academic attention to export issues has begun to shift further from “quality enhancement” towards “resilience building”. Unlike export quality, which focuses on improving outcomes, export resilience places greater emphasis on dynamic capabilities in the face of external shocks—namely, whether the export system can maintain stability and achieve recovery after suffering adverse impacts, and further carry out the reallocation of products, markets and organisational structures. Existing research indicates that digital transformation, brand building, export diversification, trade network optimisation and supply chain adjustments all contribute to enhancing the export resilience of both enterprises and regions (Xu & Liu, 2023). It is evident, therefore, that research on export resilience has gradually shifted from a focus on isolated outcomes to a comprehensive examination of the underlying capabilities, operational mechanisms and network conditions.

Especially following the rapid development of the digital economy, research perspectives on export resilience have been further expanded. New technologies and models such as artificial intelligence, cross-border e-commerce, digital-real economy integration, and digital trade facilitation are profoundly transforming how enterprises engage in international markets. Existing studies have found that digital economic development not only enhances export product quality but also significantly improves corporate and urban export resilience by optimizing resource allocation, facilitating market transformation, strengthening supply chain coordination, and reducing trade costs (Zhou et al., 2022; Li & Zhong, 2025; Chen et al., 2026; Zhang et al., 2025). Meanwhile, the establishment of a unified national market, advancement of market integration, easing of financing constraints, and enhanced technological innovation continue to enrich the dimensions explaining export resilience (Xu & Zhang, 2026; Li et al., 2026). This indicates that export resilience is no longer merely a corporate operational metric but increasingly reflects the comprehensive stability and restructuring capabilities of urban, regional, industrial, and even national open systems.

Based on this, it is necessary to conduct a systematic review of recent research on China’s export resilience. This paper examines relevant studies from 2016 to 2026 and, through a combination of bibliometric analysis and a systematic literature review, explores the evolutionary trajectory, key topics, and future directions of research on China’s export resilience. Compared with existing studies, the marginal contributions of this paper are primarily reflected in three aspects: First, in terms of research perspective, this paper does not confine “export resilience” to the concept itself but incorporates other highly relevant issues such as

export quality, product upgrading, digital technology empowerment, market integration, spatial agglomeration, and supply chain restructuring into the analytical framework. This provides a more comprehensive presentation of the knowledge trajectory of China's export resilience research, evolving from "quality upgrading" to "resilience generation" and further to "system restructuring." Second, methodologically, this paper combines CiteSpace knowledge graph analysis with textual summarization and interpretation, utilizing keyword co-occurrence, cluster analysis, and prominence detection to identify the structural and phased changes in research themes, while also interpreting the graph results in light of specific literature content to address the theoretical limitations of purely quantitative analysis. Third, in terms of content, this paper not only summarizes four core themes—factor allocation, export product quality, digital technology application, and corporate innovation—but also discusses cutting-edge trends such as spatial agglomeration and cascade effects, sports goods export trade, and the digital transformation and upgrading of manufacturing, aiming to reveal the evolutionary direction of China's export resilience research from the corporate level to the urban, industrial, regional, and open economic system levels. Through the above analysis, this paper aims to provide more systematic theoretical support for understanding the high-quality development of China's foreign trade, enhancing export resilience, and promoting the restructuring of an open economic system.

2. Research Methods and Literature Review

2.1. Research Methods

To systematically organize the knowledge structure, evolutionary trajectory, and key issues in research on China's export resilience, this paper employs a combination of bibliometric analysis and systematic literature review. Unlike conventional narrative reviews, bibliometric methods utilize visualization tools to transform relationships among keywords, research themes, and topical clusters into knowledge graphs, thereby providing a clearer overview of the overall landscape and phased developments within a specific research field. The author- and institution-related observations reported later in this paper are therefore presented as narrative findings drawn from the retained literature rather than as independent co-authorship or institutional co-occurrence networks.

This study primarily employs CiteSpace R1 as the bibliometric tool. CiteSpace R1 is a widely used knowledge graph analysis software in social science research, capable of revealing structural relationships and evolutionary patterns among research topics through co-occurrence analysis, clustering analysis, sudden appearance detection, and timeline analysis. Its fundamental principle involves treating information units such as authors, institutions, and keywords in literature as nodes, and constructing a knowledge network based on the co-occurrence frequency or association strength between these nodes.

By clustering and visualizing these networks, research hotspots, research clus-

ters, and cutting-edge directions can be identified more intuitively. This approach is particularly suitable for studies on China's export resilience, as the field did not initially focus solely on "export resilience" but rather evolved gradually through accumulated research on topics such as "export quality" "product quality upgrading" "high-quality exports" "digital economy and exports" and "innovation and exports". Consequently, relying solely on title analysis or empirical generalization may overlook the intrinsic connections between different themes; in contrast, bibliometric methods better reveal the knowledge evolution process from dispersion to aggregation.

In defining the research subject, the "export resilience" discussed in this paper primarily refers to the comprehensive capability of export entities to maintain export stability, achieve recovery growth, and drive structural adjustments when facing external demand fluctuations, changes in trade policies, international market uncertainties, and disruptions in industrial and supply chains. This encompasses both shock resistance and recovery capacities, as well as adaptive restructuring capabilities across products, markets, and organizational structures. It is noteworthy that domestic academic discourse on "export resilience" has emerged predominantly in recent years; prior studies had extensively examined related issues from perspectives such as export product quality, export upgrading, market diversification, trade policy uncertainty, and digital technology empowerment. Therefore, in selecting source materials for this review, we did not rigidly confine our analysis to the term "export resilience" alone but instead incorporated closely related dimensions—including export quality, export upgrading, digital transformation, technological innovation, market integration, and spatial network research—into a unified analytical framework to ensure the comprehensiveness and coherence of the review.

The literature retrieval was conducted in CNKI using the advanced search function, with 1 June 2026 as the final search date. The search field was set to "Subject" and the time span was fixed at 2016-2026. The exact search string was: Subject = ("Export Resilience" OR "Export Quality" OR "Quality of Exported Products" OR "Improvement in the quality of exported products" OR "Export Upgrading" OR "Export Transformation" OR "High-quality exports") AND Subject = ("China" OR "enterprise" OR "city" OR "manufacturing industry" OR "digital economy" OR "technical innovation" OR "financing constraint" OR "the distribution of resources" OR "Cross-Border Electronic Commerce" OR "Spatial Agglomeration" OR "Market Integration"). The Boolean operator OR was used to capture terminological variation within each concept group, while AND was used to ensure that the retrieved records were substantively connected to China-related export research. The database filters were: CNKI full-text records only; source categories limited to Peking University Core Journals, CSSCI, CSCD and AMI; document type limited to academic journal articles; and publication years limited to 2016-2026.

The choice of the 2016-2026 window follows the developmental logic of the

field. Around 2016, research on export product quality and quality upgrading had entered a relatively intensive stage, providing the theoretical foundation for later export-resilience studies. After 2020, trade frictions, the COVID-19 shock, supply-chain restructuring and the rise of the digital economy further pushed the literature from quality improvement toward resilience generation. A unified 2016-2026 observation window therefore captures both the preparatory quality-upgrading literature and the subsequent explicit export-resilience literature.

The systematic literature review component followed a stepwise screening procedure. First, duplicate records, non-journal materials and records without accessible full text were removed. Second, titles, abstracts and keywords were screened to retain papers that addressed export stability, recovery, adaptation, market transformation, product upgrading, digital empowerment, factor allocation, or supply-chain and spatial restructuring in relation to China's export activities. Third, full texts were checked to exclude papers that merely contained the words "export" or "quality" but belonged to unrelated technical fields such as mechanical testing, engineering materials, environmental monitoring or product inspection standards. Fourth, papers that did not use the exact term "export resilience" were retained only when their theoretical argument or empirical design clearly explained one of the three dimensions of resilience used in this paper: shock resistance, growth recovery, or adaptive restructuring. After screening and deduplication, 40 unique core records were retained for knowledge-map interpretation and narrative synthesis.

CiteSpace R1 was then used for keyword-based bibliometric analysis. The time span was set to 2016-2026 with one-year time slices. The node type was set as "keyword" because the purpose of the bibliometric component was to identify topical structures rather than to construct author or institutional collaboration networks. The selection criterion was the g-index with $k = 25$; clustering labels were generated using the log-likelihood ratio (LLR) method; burst detection followed the CiteSpace burst-term procedure; and network simplification used Pathfinder pruning. Keyword co-occurrence, cluster, burst and timeline maps were interpreted together. Cluster quality was evaluated by modularity Q and weighted mean silhouette S , and the CiteSpace output diagnostics reported in the generated maps were used to assess whether the clusters were interpretable. For example, the timeline visualization reported a weighted mean silhouette of 0.8666 and a harmonic mean of Q and S of 0.679, indicating acceptable internal consistency for the topic clusters.

Specifically, based on keyword co-occurrence analysis, "export quality," "product quality," and "export resilience" occupy central positions in the network, indicating that current research remains largely grounded in traditional export quality studies. Keywords such as "digital economy," "technological innovation," "financing constraints," and "export trade" are densely interconnected with these terms, reflecting that digitalization, innovation, and resource allocation have become key areas of expansion in export resilience research.

Based on the clustering results, the map further categorizes the current research into thematic clusters such as “export resilience” “export quality” “product quality” “export” “export trade” “financing constraints” “manufacturing” “quality” and “product transformation”. This indicates that research on China’s export resilience is not conducted in a linear manner but evolves collectively across multiple interwoven thematic domains.

To further examine the phased changes in research hotspots, this study conducted keyword prominence detection on the sample literature, with results presented in **Figure 1**. Keyword prominence primarily indicates a rapid increase in the frequency of a specific keyword during a given period, enabling identification of shifts in research focus across different timeframes. The red segments in the figure represent the duration of keyword prominence, while the prominence intensity reflects the keyword’s level of activity during each phase.

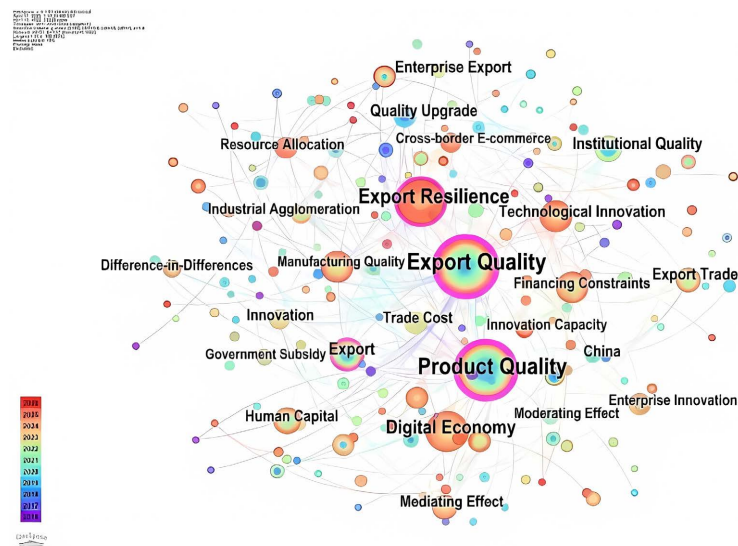


Figure 1. Keyword co-occurrence and clustering analysis map.

As shown in **Figure 2**, keywords such as “product quality” and “quality upgrading” were particularly prominent around 2016-2020. After 2022, terms like “digital economy” and “innovation” gained significant traction, while since 2023, emerging terms including “export resilience”, “digital trade”, “resource allocation”, “technological innovation”, “cross-border e-commerce” and “digitalization” have become dominant. This shift indicates an evolution in research focus—from early analyses of quality improvement toward greater emphasis on resilience analysis, focusing on shock resistance, recovery capabilities, and structural transformation. The timeline further illustrates that core research themes like “export quality” and “product quality” persisted but gradually expanded to encompass new areas such as “export resilience”, “digital economy”, “product transformation”, “manufacturing” and “financing constraints” demonstrating a clear progression from foundational to advanced topics.

Top 25 Keywords with the Strongest Citation Bursts

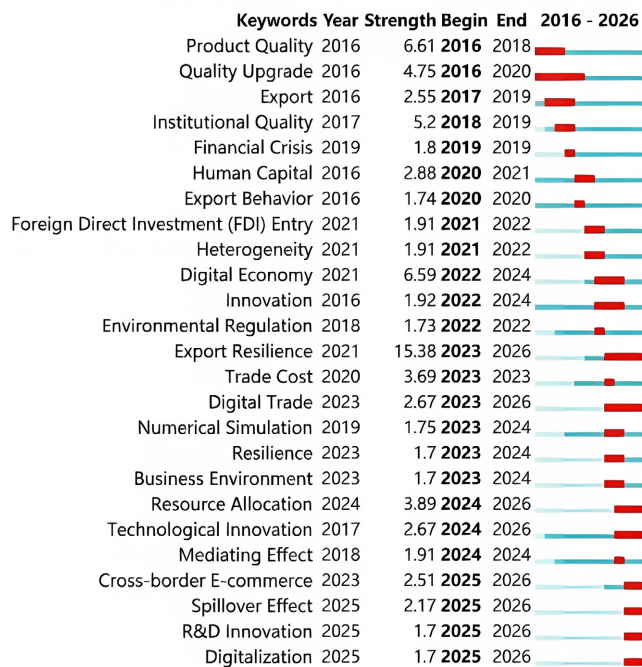


Figure 2. Keyword emergence analysis.

Overall, this study adopts a research methodology comprising “database retrieval - literature screening - knowledge graph identification - text summarization and interpretation”. Knowledge graph analysis provides objective support for identifying topic clusters, hotspot shifts and evolutionary stages in export-resilience research, while text summarization based on bibliographic records and abstracts addresses the limitation of pure graph analysis in achieving sufficient interpretive depth. Since the visualization nodes are keywords, the following discussion of author groups and institutional clusters is positioned as narrative literature observation rather than as a formal co-authorship or institutional network result.

2.2. Literature Characteristics

2.2.1. Narrative Observations on Author Groups

Because the CiteSpace analysis in this paper uses keywords as the main node type rather than author nodes, this subsection does not claim to present an author co-occurrence or collaboration network. Instead, it summarizes the author groups that can be identified through close reading of the retained core records, including their research themes, temporal distribution and contribution to the development of export-resilience research. From this narrative perspective, studies on China’s export resilience have not yet formed a closed research landscape highly dominated by a few authors; rather, they show collaborative participation by researchers from diverse disciplinary backgrounds and the gradual emergence of several relatively stable thematic communities.

The first category comprises a group of foundational researchers whose core

focus was on studies of export product quality upgrading. This group was primarily active around 2016, with their research themes centered on export quality measurement, quality hierarchies, quality upgrading mechanisms, and export markup rates, forming a crucial knowledge base for subsequent studies on export resilience. Representative scholars include Yu Miaojie, Zhang Rui, Xu Ming, Wang Mingyi, and Liu Haiyang. Yu Miaojie and Zhang Rui systematically examined the accurate measurement of China's manufacturing export quality, noting an overall upward trend (Yu & Zhang, 2017). Xu Ming investigated the relationship between labor remuneration, financing constraints, and export product quality, emphasizing the critical role of resource allocation and corporate growth in quality improvement (Xu, 2016). Wang Mingyi addressed export quality upgrading from the perspective of factor price distortions, revealing the differential impacts of labor, capital, and intermediate good price distortions on export quality (Wang, 2016). Liu Haiyang and colleagues, from the perspective of intermediate good imports, demonstrated that high-quality intermediate inputs significantly enhance export product quality (Liu et al., 2017). Although these researchers primarily focused on concepts such as "export quality" or "product quality upgrading," their work essentially explored how export entities can strengthen international competitiveness and adaptability through quality accumulation, thereby establishing the early knowledge foundation for China's export resilience research.

The second category comprises emerging researchers focused on the digital economy, technological innovation, and corporate export resilience. Formed primarily after 2022, this group has shifted its research focus from early-stage quality upgrades to mechanisms of resilience generation, with particular emphasis on the roles of digital technologies, artificial intelligence, cross-border e-commerce, and the integration of digital and real economies. Studies by Xie Qian, Jin Caiqi, and Liu Weigang demonstrate that the convergence of digital and real technologies significantly enhances corporate export resilience by boosting productivity and reducing trade costs (Xie et al., 2025). Chen Zhao, Wei Jiaxin, and Li Xiaohui found that artificial intelligence strengthens export resilience by optimizing resource allocation efficiency and improving product quality (Chen et al., 2026). Wang Chaonan and Li Feng further examined cross-border e-commerce, showing how enterprises can enhance export resilience through product and market transformation strategies (Wang & Li, 2026). A common characteristic of these researchers is their strong responsiveness to real-world shocks, directly addressing the question of "how to maintain and reshape export capabilities under stress conditions," making them one of the most active groups in current export resilience research.

The third category focuses on expanding the research community centered on market integration, urban export resilience, trade networks, and spatial restructuring. This group primarily conducts analyses at meso-or macro-levels, advancing export resilience research from the corporate level to urban, regional, and industrial dimensions. Xu Qinfeng and Zhang Cheng examine urban export resili-

ence through the lens of building a unified national market, identifying market demand expansion and technological innovation as key driving mechanisms (Xu & Zhang, 2026). Li Chun, Shi Enyi, and Liu Caibin analyze corporate export resilience from the perspective of domestic market integration, highlighting the positive roles of institutional cost efficiency, concentration of high-end factors, and market space expansion (Li et al., 2026). Yan Zhijun, Xu Zhilong, and Zhang Jitong explore the complex impacts of manufacturing spatial agglomeration and input-output structures on export resilience (Yan et al., 2026). The significance of this research community lies in elevating export resilience beyond mere corporate performance metrics to a reflection of the stability and structural adaptability of open economic systems.

Overall, the distribution of authors in China's export resilience research exhibits a clear relationship of inheritance and expansion. Early researchers focusing on export quality laid the theoretical and methodological foundations, mid-period scholars specializing in digital economy and technological innovation advanced the expansion of research mechanisms, while recent researchers examining market integration and spatial networks further broadened the research dimensions and perspectives. In other words, although current China export resilience research has not yet formed a highly concentrated core author network, it has established a multi-center structure comprising clusters dedicated to quality research, digitalization research, and spatial structure research.

2.2.2. Narrative Observations on Institutional Clusters

For the same reason, this subsection presents narrative observations on institutional clusters rather than a formal institutional co-occurrence map. The observations are based on the affiliations and research orientations of the retained studies. In general, research on China's export resilience is mainly concentrated in economics schools of comprehensive universities, international trade and economics colleges at finance and economics universities, and research platforms focusing on the digital economy, open economy and regional coordinated development. These institutions differ in research foundations and methodological preferences, but together they form the main body of current research on China's export resilience.

First, comprehensive universities serve as a crucial theoretical foundation in this field. Institutions such as Peking University, Nanjing University, Fudan University, Zhejiang University, and Renmin University of China have accumulated profound expertise over the years in research areas including export quality, global value chains, trade policies, institutional environments, and corporate heterogeneity in trade. Early studies on export product quality measurement, export markup rates, financing constraints, and incomplete contracts predominantly originated from these comprehensive universities and their affiliated research institutions (Yu & Zhang, 2017; Xu, 2016; Yu et al., 2016). The hallmark of these research clusters lies in their emphasis on theoretical foundations, methodological innovation, and long-term academic accumulation, which often constitute the

theoretical basis for China's research on export resilience.

Second, universities specialising in finance and economics, as well as institutions with a focus on international trade and economics, are currently among the most active groups of institutions conducting research into export resilience. Universities such as the University of International Business and Economics, Shanghai University of International Business and Economics, Jiangxi University of Finance and Economics, Shandong University of Finance and Economics, Dongbei University of Finance and Economics, and Guangdong University of Foreign Studies have produced a significant body of research on export quality upgrading, open economies, cross-border e-commerce and digital trade. These institutions typically maintain close ties with China's practical foreign trade sector, and their research topics tend to be more policy- and problem-oriented. For example, scholars at the University of International Business and Economics focus more on the resilience of global value chains, market integration and high-quality export development, whilst those at Guangdong University of Foreign Studies tend to explain export resilience from the perspectives of artificial intelligence, brand building and digital transformation. Meanwhile, Jiangxi University of Finance and Economics and Shandong University of Finance and Economics have built up a body of research on outbound foreign direct investment (OFDI), product transformation, factor price distortions and the upgrading of export quality. A defining characteristic of the cluster of finance and economics universities is their ability to respond swiftly to real-world foreign trade issues, integrating academic research with national opening-up strategies, new forms of foreign trade, and changes in industrial policy.

Third, in recent years, the emerging cluster of institutions formed through platforms such as the Digital Economy Research Platform, the Open Economy Research Center, and regional development research platforms has become a significant driving force in China's export resilience research. These platforms typically focus on studies related to digital transformation, artificial intelligence, supply chain resilience, market integration, and spatial networks, with particular emphasis on the relationships between export resilience, industrial security, supply chain coordination, and the dual-circulation framework. For example, research conducted by institutions like the Digital Economy Research Institute, the Business Development Research Institute, and the Open Economy Research Center has systematically incorporated factors such as digital-real economy integration, cross-border e-commerce, a unified national market, spatial agglomeration, and trade networks into the export resilience analysis framework. This indicates that the cluster of export resilience research institutions is evolving from traditional international trade research units into interdisciplinary and cross-sectoral comprehensive research platforms.

From a macro perspective, the cluster of China export resilience research institutions exhibits three distinctive characteristics. First, the institutional distribution demonstrates pronounced regional concentration, with universities and re-

search platforms in eastern coastal regions and areas with higher openness playing a dominant role—a pattern that aligns closely with China’s foreign trade activities and its open economic development model. Second, there are notable differences in institutional specialization: comprehensive universities focus on theoretical foundations and methodological innovation, finance and economics institutions concentrate on practical issues and policy analysis, while specialized research platforms emphasize cutting-edge topics such as digitalization, networking, and structural transformation. Third, although collaborative networks among institutions are emerging, the overall landscape remains characterized by multiple parallel centers rather than a highly centralized core network. This indicates that China’s export resilience research is still in a rapid growth phase, with significant potential for deeper integration through cross-institutional and interdisciplinary collaboration in the future.

2.2.3. Analysis of Trends in the Growth of the Literature

From the perspective of literature growth trends, research on China’s export resilience has generally shown a clear upward trajectory. However, this growth did not stem directly from the concept of “export resilience” but rather evolved through a process of continuous accumulation in export quality studies before shifting toward focused research on export resilience. By examining existing keyword maps and changes in literature themes, the following trends can be broadly observed.

Around 2016, the most frequently discussed topics in relevant research primarily focused on issues such as “product quality” “quality improvement” “export” and “institutional quality”. This indicates that during this period, the emphasis of China’s academic community in foreign trade research remained on the transition of exports from “quantitative expansion” to “qualitative enhancement”. Extensive studies centered on export quality measurement, quality tiers, improvement in value-added rates, distortion in factor prices, imported intermediate goods, and institutional environments. Although the concept of “export resilience” was not directly introduced at that time, scholars began examining how China’s export competitiveness could be enhanced amid resource constraints and external changes (Chen & Xu, 2016; Xu, 2016; Wang, 2016; Liu et al., 2017).

Between 2018 and 2021, research themes underwent a significant expansion, with keywords such as “human capital” “export behavior” “heterogeneity” “foreign investment entry” and “institutional quality” becoming increasingly prominent. This shift indicates that the research perspective evolved from focusing solely on product and quality issues to encompassing institutional environments, corporate behavior, and structural disparities. Concurrently, amid escalating Sino-US trade tensions, uncertainties in trade policies, and fluctuations in global demand, academic attention turned increasingly toward how exports adapt under uncertain conditions. Although “export resilience” had not yet emerged as the most central buzzword, related research substantially shifted toward examining export stability, market adaptability, and shock resilience. This period can be re-

garded as the incubation and expansion phase of export resilience research.

The real surge in growth began after 2022. Keyword emergence results indicate that “digital economy” and “innovation” gained significant traction during this phase, whilst since 2023, terms such as “export resilience” “digital trade” “resource allocation” “technological innovation” “cross-border e-commerce” and “digitalisation” have emerged as new high-frequency keywords. This suggests that “export resilience” has gradually evolved from a derivative analytical concept into one of the core concepts explaining the stability and high-quality development of China’s foreign trade. Concurrently, the scope of research has expanded from the export performance of individual enterprises to more comprehensive dimensions such as urban export resilience, manufacturing export resilience and regional export resilience. This demonstrates that, alongside quantitative growth in this field, there has been a marked expansion of research boundaries and explanatory frameworks (Xie et al., 2025; Xu & Zhang, 2026; Wang & Li, 2026).

From the perspective of growth drivers, this trend is closely linked to real-world shocks. External events such as trade frictions, pandemic impacts, export controls, and the restructuring of global supply chains have significantly heightened academic focus on “how to maintain export stability, achieve export recovery, and implement structural reforms”. Meanwhile, emerging domestic development trends—including the digital economy, artificial intelligence, cross-border e-commerce, and the establishment of a unified national market—have provided new explanatory variables and policy contexts for research on export resilience. Therefore, the growth in China’s export resilience studies is not merely an organic academic expansion but rather a result of the combined effects of accumulating external shocks and ongoing internal transformations.

Overall, the growth trend of research on China’s export resilience exhibits three distinctive characteristics: First, it demonstrates clear phases—initially focusing on export quality, gradually expanding to institutional and behavioral mechanisms in the middle stage, and recently concentrating on resilience and its digital and networked generation mechanisms; Second, it is significantly driven by real-world factors, with major international shocks and domestic transformation policies serving as key contexts for the literature’s growth; Third, it exhibits strong interdisciplinary integration, as multiple fields—including international trade, the digital economy, regional economics, and industrial economics—continuously intersect, collectively elevating export resilience research from a peripheral topic to a core one.

2.2.4. Main Stage Division and Evolution

Based on the changes in literature themes, the evolution of keywords, and shifts in real-world contexts, research on China’s export resilience can be broadly divided into three stages: the initial accumulation phase, the expansion transition phase, and the intensive deepening phase.

The first stage was the initial accumulation phase, roughly corresponding to around 2016. The most prominent feature of this stage was that “export resilience”

had not yet emerged as an independent concept; research primarily focused on issues such as export product quality, quality upgrading, export technological complexity, and high-quality exports. A widely discussed question in academia was how China's exports could transition from low-cost, low-value-added products to high-quality, high-value-added ones. Numerous studies during this period centered on export quality measurement, intermediate goods imports, labor prices, distortions in capital and intermediate goods, institutional environments, and industrial clustering, forming the crucial knowledge foundation for subsequent research on export resilience (Yu & Zhang, 2017; Chen & Xu, 2016; Wang, 2016). Essentially, although this stage mainly addressed "quality," it already laid the theoretical groundwork for understanding export competitiveness, export adaptability, and export adjustment capacity.

The second phase is the expansion transition period, roughly corresponding to 2017-2021. Research during this period exhibited a trend shifting from "quality upgrading" toward "stability and adjustment." Influenced by factors such as Sino-US trade frictions, uncertainties in trade policies, anti-dumping measures, and pandemic impacts, scholars began paying greater attention to the performance of export systems under external shocks. Meanwhile, the proliferation of digital technologies has gradually brought topics such as mobile internet, online search, virtual aggregation, and the digital economy into the scope of export research. The research questions also expanded from "how to improve export quality" to "how to maintain and optimize export capabilities in uncertain environments." It can be said that this phase marked a critical transitional period during which China's research on export resilience evolved from implicit logic to explicit issues (Jin & Shi, 2022; Li & Wang, 2022; Wang & Xie, 2022).

The third phase, spanning from 2022 to the present, represents a concentrated period of deepening research. A hallmark of this stage is the formal recognition of "export resilience" as a central research concept, rapidly gaining traction across corporate, urban, industrial, and regional levels. On one hand, emerging topics such as the digital economy, artificial intelligence, cross-border e-commerce, digital-real economy integration, and digital transformation have been systematically incorporated into export resilience research frameworks. On the other hand, variables including market integration, the development of a unified national market, spatial clustering, supply chain networks, and product diversification have emerged as key factors explaining export resilience (Xie et al., 2025; Chen et al., 2026; Li et al., 2026; Xu & Zhang, 2026; Yan et al., 2026). Compared to the previous two phases, the most significant shift in research is the evolution of export resilience from being viewed merely as short-term risk resistance to being defined as a comprehensive capability encompassing "shock resilience - growth recovery - structural transformation."

From the perspective of overall evolutionary logic, research on China's export resilience has undergone a clearly defined intellectual progression: it began with fundamental studies focusing on export quality issues, then expanded to address

export stability and adaptability under external shocks and technological transformations, ultimately forming a relatively independent research framework for export resilience from the perspectives of digitalization, networking, and structural reshaping. This evolutionary trajectory demonstrates that China's export resilience research is not an abrupt theoretical creation but rather a gradual development shaped by traditional export quality studies, real-world shock pressures, and the expansion of the digital economy. Consequently, this field will continue to deepen along the logic of "quality upgrading - resilience generation - systemic restructuring".

3. Analysis of Hot Topics

After comprehensive analysis of keyword co-occurrence maps, clustering maps, and timeline maps, it can be observed that current research on China's export resilience, although covering multiple dimensions such as the digital economy, trade networks, institutional environments, cross-border e-commerce, brand building, spatial agglomeration, and product transformation, can be summarized into four core themes based on the concentration of research hotspots and literature distribution: factors and export resilience, export quality and resilience, application of digital technologies and resilience, and corporate innovation and resilience. The first two themes form the foundational pillars of export resilience research, while the latter two reflect a clear shift in recent years—from traditional quality improvement analysis to digitalization-and innovation-driven analysis. Overall, these four thematic clusters are not mutually exclusive but collectively constitute the main framework of contemporary China export resilience research.

3.1. Factor Allocation and Export Resilience

Current research consistently identifies factor allocation as a pivotal factor in explaining export resilience. Early studies primarily examined distortions in labor, capital, and intermediate goods prices, along with financing constraints, exploring how these factors influence export quality improvement and corporate export capabilities. As the concept of "export resilience" gained clarity, subsequent research has emphasized that factor allocation efficiency not only determines export competitiveness but also profoundly impacts enterprises "and cities" export stability, recovery capacity, and structural adjustment capabilities under external shocks (Wang, 2016; Xu, 2016). From a traditional factor perspective, distortions in labor, capital, and intermediate goods prices are believed to affect export product quality through mismatch effects, economies of scale, and R&D effects, thereby influencing the sustained competitiveness of exporters. Specifically, labor price distortions suppress export quality improvement in the short term, but their impact may evolve in the medium to long term as experience accumulation and scale effects manifest; capital and intermediate goods price distortions exhibit more complex nonlinear effects (Wang, 2016). Meanwhile, under combined market competition and financing constraints, actual export product quality often falls significantly

below its potential effective quality threshold, indicating that suboptimal resource allocation directly weakens export capabilities (Xu, 2016). Although these studies primarily focus on export quality, they collectively reveal a fundamental truth: the formation of export resilience is highly dependent on rational factor allocation.

In recent years, research on production factors and export resilience has shifted its focus from traditional price distortion analysis to the comprehensive optimization of market integration, factor mobility, and resource allocation efficiency. Domestic market integration enhances corporate export resilience by reducing institutional costs, facilitating the concentration of high-end factors, and expanding market demand—this effect is particularly pronounced in non-high-tech enterprises and regions with lower economic development levels (Li et al., 2026). The establishment of a unified national market strengthens urban export resilience by driving market demand expansion and technological innovation (Xu & Zhang, 2026). These findings indicate that under the new dual-circulation development paradigm, market integration and free factor mobility have emerged as new foundational resources for export resilience.

Furthermore, human capital and labor mobility have increasingly become crucial complements to this issue. On one hand, the accumulation of human capital enables enterprises to enhance their technological absorption and innovation capabilities, thereby improving product quality and export stability; on the other hand, the integration of labor markets and improvements in skill structures also strengthen export resilience by optimizing the allocation of regional factors. Overall, current research on factors and export resilience has evolved from early discussions focused solely on price distortions to comprehensive examinations encompassing capital, markets, labor, institutions, and resource allocation efficiency.

3.2. The Quality and Resilience of Export Products

In the study of China's export resilience, the quality of export products is one of the most fundamental issues. From the perspective of knowledge sources, many current researches on export resilience are essentially built upon earlier studies on the quality upgrading of export products. The quality of export products not only affects a company's price-quality competitiveness in the international market but also influences its ability to cope with trade frictions, demand fluctuations, and market reallocation. Therefore, the relationship between "export product quality and resilience" constitutes one of the most persistent research hotspots in current studies.

Regarding the measurement and evolution of export product quality, previous studies have conducted systematic explorations at an early stage. From a measurement perspective, the quality of China's manufacturing exports can be assessed from both supply-side and demand-side dimensions. Relevant research indicates that the quality of China's manufacturing exports generally shows an upward trend over a certain period; however, this improvement is not a simple average

enhancement but is accompanied by significant industry differentiation and hierarchical disparities (Yu & Zhang, 2017). Studies from a quality ladder perspective also reveal that the quality index of China's manufacturing exports still has room for improvement overall, though the length of the quality ladder and upgrading potential vary markedly across industries (Chen & Xu, 2016). This demonstrates that export quality upgrading manifests not only as an overall improvement but also as differences in quality structure and upgrading pathways across industries.

Regarding the influencing mechanisms, factors such as imports of intermediate goods, institutional environments, agglomeration of producer services, vertical spillovers from foreign investment, minimum wage systems, and environmental regulations have all been demonstrated to impact the upgrading of export quality. Specifically, imports of high-quality intermediate goods can enhance corporate export product quality by optimizing input structures and improving production efficiency—a effect particularly pronounced among sustained importers and high-tech products (Liu et al., 2017). Improvements in institutional environments and human capital boost firms' technological absorption capabilities and production organization efficiency, thereby elevating export product quality (Li & Wang, 2022). Similarly, the clustering of producer services facilitates quality upgrades in manufacturing exports through knowledge spillovers, specialized division of labor, and optimized resource allocation (Zeng & Han, 2022). These findings collectively indicate that export quality is not determined solely by productivity factors but is shaped by a combination of technological advancement, institutional frameworks, service quality, openness, and resource allocation.

Further analysis reveals that the relationship between export quality and export resilience manifests primarily in three aspects. First, high-quality products typically possess higher added value, stronger market stickiness, and more stable customer relationships, making them better resilient to external shocks. Second, quality improvement reflects continuous accumulation of enterprises in technology, branding, and product portfolio—this very accumulation serves as a source of export resilience. Third, enhanced export quality enables enterprises to elevate their position in destination markets, product portfolios, and value chain divisions, thereby expanding their capacity for market transformation and structural adjustments. Consequently, in current research on China's export resilience, export product quality constitutes both a fundamental research subject and a critical variable for explaining resilience disparities.

3.3. The Application of Digital Technology and Resilience

Based on the emergence of keyword results and the growth in recent literature, the application of digital technologies has become one of the most active research hotspots in current studies on China's export resilience. In particular, keywords such as “digital economy,” “digitalization” “cross-border e-commerce” “artificial intelligence” and “digital-real integration” have gained rapid prominence in recent years, indicating that digital technologies are profoundly reshaping the mech-

anisms underlying export resilience.

Most studies initially examine the role of digital technology from the perspective of export quality. Digital initiatives such as internet search and corporate digital transformation can enhance export product quality by reducing information costs, improving productivity, facilitating technology access, fostering technological innovation, alleviating financing constraints, and accumulating human capital (Jin & Shi, 2022; Li & Zhong, 2025). This demonstrates that digital technology does not merely alter how enterprises acquire information; rather, it drives export quality upgrades by optimizing resource allocation and innovation capabilities. Since improved export product quality strengthens enterprises' international competitiveness and market adaptability, the positive impact of digital technology on export quality also lays a crucial foundation for building export resilience.

In more direct studies on export resilience, the role of digital technologies becomes particularly evident. Firstly, the integration of digital and physical technologies enhances enterprises' ability to maintain export stability and recover from external shocks by improving productivity, reducing trade costs, and strengthening supply chain coordination (Xie et al., 2025). Secondly, artificial intelligence not only directly boosts export resilience but also indirectly contributes by optimizing resource allocation efficiency and enhancing product quality (Chen et al., 2026). Thirdly, cross-border e-commerce leverages platform channels, information matching, and market connectivity to facilitate product and market transitions, thereby strengthening export resilience (Wang & Li, 2026). Additionally, the establishment of comprehensive pilot zones for cross-border e-commerce enhances urban-level export resilience through advanced trade digitization (Zhang et al., 2025). Thus, digital technologies have evolved beyond being mere tools for improving foreign trade efficiency; they now serve as critical mechanisms enabling businesses and cities to withstand external shocks, restore export growth, and achieve structural adjustments.

From a mechanistic perspective, the role of digital technology in enhancing export resilience is primarily manifested in four aspects: first, improving enterprises' responsiveness to international market fluctuations by reducing search and transaction costs; second, enhancing supply chain stability through platform-based and data-driven collaboration; third, strengthening resilience against shocks by promoting product, market, and channel diversification; and fourth, bolstering long-term competitive advantages by driving quality upgrades and innovation in export products. Consequently, research on the application of digital technology and export resilience has become the most dynamic and cutting-edge area in current China export resilience literature.

3.4. Corporate Innovation and Resilience

Corporate innovation represents another core focus in current research on China's export resilience. Existing literature indicates that whether through technological innovation, product innovation, organizational innovation, or institutional inno-

vation, these approaches enhance export resilience by boosting productivity, optimizing resource allocation, driving quality upgrades, and expanding market boundaries. Particularly against the backdrop of intensifying external shocks, innovation is no longer merely a means to enhance corporate competitiveness but is increasingly recognized as a critical capability for maintaining export stability and achieving structural transformation.

On one hand, technological innovation and R&D investment have been proven to enhance resilience by improving product quality, enhancing market adaptability, and optimizing export structures. Existing research indicates that the stronger an enterprise's R&D innovation capacity, the better it can sustain export growth through product upgrades and market reorientation in response to fluctuations in external demand and policy shocks (Xie et al., 2026; You et al., 2025). On the other hand, corporate innovation extends beyond internal R&D activities to include capability development through interactions with foreign capital, institutional environments, and external regulations. Based on this, current literature on enterprise innovation and resilience can be broadly categorized into two main directions: foreign capital-driven innovation and institutionally driven innovation.

3.4.1. Enterprise Innovation Driven by Foreign Capital

The flow of foreign capital and open factors has long been regarded as a key driver for upgrading the quality of China's exports. Early studies indicated that foreign investment primarily enhances the export product quality of domestic enterprises through backward vertical spillover effects rather than mere horizontal spillovers within the same industry (Xu & Peng, 2016). Building on this, recent research further demonstrates that OFDI, overseas market integration, and access to international innovation resources not only help firms improve their export product quality but also strengthen their export resilience in challenging environments. The underlying logic lies in the fact that foreign capital and global resources facilitate technological absorption, R&D collaboration, and intermediate good upgrades, thereby enhancing firms' market reallocation capabilities and long-term adaptability (Jing & Li, 2016; Liu & Wang, 2026).

3.4.2. Innovation-Driven Enterprises: Innovation Driven by Institutional Frameworks

Unlike foreign investment-driven approaches, institutional innovation places greater emphasis on how the external regulatory environment shapes innovation and export resilience. Existing research demonstrates that institutional arrangements—including contract enforcement efficiency, improved institutional frameworks, trade facilitation measures, the depth of free trade agreements, and the development of a unified market—not only enhance export quality by reducing transaction costs and stabilizing expectations but also strengthen export resilience by boosting corporate innovation incentives and alleviating external constraints (Cao, 2022; Bi et al., 2025; Cheng & Wang, 2025). In this context, corporate innovation does not occur in isolation but emerges within broader institutional con-

texts. Consequently, current research on enterprise innovation and export resilience is progressively shifting from a focus on “internal corporate innovation” to an integrated analytical framework encompassing “institutional environment-corporate innovation-export resilience”.

Overall, research on corporate innovation and resilience has become a pivotal link connecting export quality, digital technology, and the institutional environment. Whether driven by foreign investment or institutional factors, all these approaches ultimately address the same core question: how enterprises can enhance their export stability, adaptability, and restructuring capabilities through sustained innovation.

4. Emerging Research Fronts

After examining keyword burst charts, timeline maps and recent changes in literature themes, this section identifies the emerging fronts of China’s export-resilience research. The purpose here is not to list future recommendations, but to clarify the newest problem domains that have begun to differentiate from the earlier core themes of export quality, factor allocation, digital technology and corporate innovation. Around 2024-2026, keywords such as resource allocation, technological innovation, cross-border e-commerce, spillover effects and digitalization remained highly active, suggesting that the field is moving from general factor analysis toward more context-specific and system-oriented inquiry. The three most visible fronts are spatial agglomeration and cascade effects, sports-goods export trade and sports-economy development, and the digital transformation and upgrading of manufacturing.

4.1. The Spatial Agglomeration and Cascade Effects of Export Resilience

Spatial factors have emerged as a crucial frontier in export resilience research. Early studies typically viewed industrial agglomeration as a key factor in enhancing export quality and competitiveness. The literature generally agrees that industrial agglomeration facilitates knowledge spillovers, division of labor synergy, specialized support systems, and economies of scale, thereby driving product quality upgrades and export expansion (He, 2017; Mo & Ou, 2016; Zeng & Han, 2022). Under this framework, spatial agglomeration is increasingly recognized as a positive source of regional competitive advantage.

However, as the restructuring of global value chains and the spread of supply chain risks become increasingly prominent, spatial agglomeration does not necessarily enhance resilience; it may even undermine export stability through network transmission mechanisms. Research examining multi-regional and multi-industry input-output linkages between two countries indicates that manufacturing spatial agglomeration can intensify upstream-downstream dependencies and deepen global value chain integration, triggering long whip effects and cascade effects that exacerbate export volatility and weaken export resilience (Yan et al.,

2026). This finding calls for re-evaluating the traditional linear logic that “agglomeration improves efficiency”: within highly interconnected industrial networks, localized shocks can rapidly propagate across broader regions via supply chains and input-output relationships, rendering agglomerated areas—once characterized by scale advantages—more vulnerable to disruptions.

Building on this foundation, the cutting-edge significance of spatial agglomeration research manifests primarily in two aspects. First, it shifts export resilience studies from the individual firm level to the regional network level. Export resilience no longer merely refers to a single firm’s ability to withstand risks; rather, it increasingly reflects a region’s overall resilience against shocks through industrial linkages, logistics organization, factor mobility, and market coordination. Second, it shifts the research focus from “whether agglomeration occurs” to “how to achieve more resilient agglomeration.”

The more pressing issue for the future is not merely to discuss whether agglomeration has positive effects, but rather to further analyze which types of agglomeration are more conducive to cushioning shocks, preventing risk diffusion, and establishing a more robust regional export system amid supply chain restructuring. Therefore, spatial agglomeration and cascade effects have emerged as cutting-edge topics not only because they address the real risks associated with the current global industrial chain restructuring, but also because they introduce stronger perspectives of network analysis and spatial governance into research on China’s export resilience. Future studies could further integrate urban clusters, port systems, industrial belt coordination, and the development of a unified domestic market to explore the mechanisms underlying regional export resilience and its spatial disparities.

4.2. The Export Trade of Sports Products and the Development of the Sports Economy

Research on export resilience from a sector-specific perspective is gaining increasing momentum, with the sporting goods manufacturing industry serving as a particularly representative frontier area. Unlike traditional manufacturing analyses, the sporting goods sector integrates manufacturing, consumption, branding, and cultural dimensions. Its export performance not only influences foreign trade volume but also exhibits strong correlations with sports industry development, health consumption upgrades, and the cultivation of a sports economy. Consequently, studies on the export resilience of sporting goods are emerging as a crucial gateway linking sector-specific export dynamics with the new consumption economy.

Currently, a representative study is the analysis by Zhao Wei and Xu Xiaowen on how the digital economy enhances the export resilience of the sports goods manufacturing industry. The study found that the digital economy significantly improves the export resilience of this sector, with this effect mediated by industrial structure upgrading and exhibiting notable spatial spillover effects (Zhao & Xu,

2024). This conclusion indicates that the sports goods industry is not merely an ordinary segment within general manufacturing but rather an export sector highly sensitive to digital technologies, consumption trends, and regional linkages. Particularly against the backdrop of initiatives such as “Building a Sports Powerhouse,” “Healthy China,” the “Silver Economy,” and the upgrading of leisure consumption, the issue of export resilience in sports goods has growing implications for broader industrial development.

From a broader perspective, there may be three interconnections between sports goods exports and the development of the sports economy. First, enhanced export resilience helps stabilize the sports goods industry chain and brand chain, thereby supporting the long-term growth of the sports economy. Second, improvements in sports consumption, nationwide fitness initiatives, and the expansion of the health industry in turn provide stronger domestic demand support for sports goods companies, enhancing their resilience against external shocks. Third, the rise of digital platforms, cross-border e-commerce, and brand communication facilitates the establishment of a synergistic mechanism linking “exports-brands-consumption-industry ecosystem” within the sports goods sector, fostering deeper integration between research on export resilience and industrial economics studies.

This direction represents a cutting-edge approach because it addresses a long-standing limitation in export resilience research: the excessive reliance on general manufacturing samples and insufficient analysis of variations across specific sub-sectors. Compared to heavy chemical industries or general consumer goods, the sporting goods industry exhibits more distinctive characteristics in terms of brand dependence, consumer experience, platform dissemination, and scenario innovation. This implies that its export resilience may depend more on digital marketing, brand premium, platform channels, and consumer recognition rather than solely on traditional cost advantages. Future efforts to integrate sporting goods exports with the sports economy, health industry, platform trade, and cultural dissemination will help develop a more refined and industry-relevant analytical framework for China’s export resilience research.

4.3. The Impact of Digital Transformation and Upgrading in the Manufacturing Sector on Resilience

If research on spatial agglomeration and sports goods exports represents an expansion of the research framework for export resilience, then the digital transformation and upgrading of manufacturing signifies the most promising frontier in this field. In recent years, keywords such as “digital economy,” “digitalization,” “technological innovation,” and “cross-border e-commerce” have remained prominent, indicating that digital transformation has become one of the key factors explaining variations in export resilience. Unlike early studies that primarily examined how digital technologies enhance export quality or volume, current research places greater emphasis on how digital transformation improves exporters’ adaptability, collaborative capabilities, and recovery capacity under shock conditions.

Existing literature has confirmed this trend across multiple dimensions. Firstly, the integration of digital and physical technologies enhances enterprises' capacity to maintain export stability and recover from external shocks by improving productivity and reducing trade costs (Xie et al., 2025). Secondly, artificial intelligence strengthens export resilience by optimizing resource allocation efficiency and enhancing product quality, demonstrating that intelligent technologies not only influence production processes but also impact export stability through resource allocation and quality upgrades (Chen et al., 2026). Thirdly, digital transformation improves supply chain innovation quality, collaboration efficiency, and stability, thereby strengthening supply chain support capabilities for export activities and further enhancing export resilience (Guo et al., 2025). This indicates that the impact of digital transformation on export resilience has expanded beyond mere "reduction in information costs" to encompass a comprehensive mechanism involving "productivity improvement - resource optimization - quality enhancement - supply chain coordination - structural restructuring."

It is noteworthy that the digital transformation and upgrading of the manufacturing sector has emerged as a frontier not only due to the rapid growth in related research, but also because it represents a fundamental shift in the research paradigm for export resilience. Traditional foreign trade studies primarily focused on cost advantages, product upgrades, and market size, whereas digital transformation has prompted researchers to reconsider how enterprises can leverage data, platforms, algorithms, and smart manufacturing systems to enhance their capabilities in perception, prediction, and reorganization. Against the backdrop of frequent external shocks and accelerating market changes, this rapid response capability enabled by digital systems has become a key driver of export resilience.

As an emerging front, manufacturing digital transformation is analytically significant because it connects export resilience with production-system modernization. Foundational digitalization, platform-based collaboration, intelligent manufacturing and AI integration may influence resilience through different channels, including faster demand sensing, more flexible production organization, better supply-chain coordination and more efficient resource allocation. The value of this front therefore lies in revealing how digital systems reshape exporters' abilities to perceive shocks, predict market changes and reorganize supply-chain relationships, rather than merely showing that digitalization improves export performance.

Overall, research on the digital transformation and upgrading of the manufacturing sector is elevating the issue of export resilience from a mere matter of foreign trade performance to a question concerning the modernization of manufacturing and the restructuring of an open economic system. This not only positions it as one of the most policy-relevant cutting-edge directions today but also suggests that future research on China's export resilience is likely to continue advancing along the path of "digitalization-intelligentization-networkization".

5. Future Research Directions and Implications for China

5.1. Discussion on Future Research Directions

Having separated the emerging research fronts in Section 4, this section focuses on the cross-cutting agenda that should guide future studies. Although existing research has formed an analytical framework around export quality, factor allocation, digital technology and corporate innovation, the field still needs greater conceptual precision, stronger causal identification and a more systematic connection between micro exporters and macro export systems.

First, future research should further standardize the concept and measurement of export resilience. Current studies variously treat resilience as export continuity, post-shock recovery, quality upgrading, global value-chain resilience or industrial-chain security. These perspectives are useful, but inconsistent definitions may lead to incomparable indicators and fragmented conclusions. A more coherent framework should distinguish shock resistance, growth recovery and adaptive restructuring, and should specify how these dimensions are measured at the enterprise, city, industry and national levels.

Second, future studies should deepen mechanism identification instead of only testing whether a factor has a positive or negative effect. Export quality, market integration, digital transformation and innovation may all improve resilience, but their effects may operate through different channels such as productivity improvement, market diversification, financing relief, product upgrading, supply-chain coordination or expectation stabilization. Clarifying these pathways will help explain why the same policy or technology produces heterogeneous results across firms and regions.

Third, future research should incorporate digital governance and platform rules into the analysis. The existing literature has demonstrated the importance of the digital economy, artificial intelligence and cross-border e-commerce, but more attention is needed to platform dependence, cross-border data flows, algorithmic distribution, digital trade barriers and compliance with changing international rules. This will move digitalization research beyond a simple technology variable toward a broader framework of technology, rules, platforms and governance.

Fourth, future studies should strengthen system-level identification. Export resilience is increasingly shaped by connections among enterprises, industrial-chain nodes, port and logistics systems, regional markets and global value chains. Spatial econometrics, input-output analysis, complex network methods and event-study designs can be used to examine how local shocks spread through supply chains, how regional coordination absorbs risks and how domestic market integration provides endogenous support for export stability.

Fifth, future research should place more emphasis on industry heterogeneity and dynamic tracking. The resilience mechanisms of sports goods, agricultural products, high-tech manufacturing and platform-based consumer goods are unlikely to be identical. In addition, resilience changes before, during and after external shocks. Long-cycle panel data, event studies, dynamic network analysis and

multi-level models can therefore provide a more precise understanding of resilience formation and adjustment over time.

Overall, future research on China's export resilience should proceed along the path of conceptual unification, mechanism deepening, digital-governance expansion, network analysis and scenario refinement. Only by advancing simultaneously in theoretical framework, research object and methodological tools can export-resilience research develop into a systematic paradigm with strong explanatory and policy value.

5.2. Research and Practical Implications on China's Export Resilience

From a practical perspective, research on export resilience has direct policy value for China's high-level opening-up and the construction of a trading powerhouse. The key implication is that export resilience should not be treated as a temporary response to external shocks, but as a long-term capability embedded in market institutions, industrial organization, technological systems and enterprise strategies.

First, a super-large domestic market and a unified national market should be treated as the strategic base of export resilience. Reducing institutional barriers, improving cross-regional factor mobility and strengthening domestic circulation can help exporters cushion external demand shocks and create more stable expectations for investment, innovation and market diversification.

Second, digital transformation should be promoted as a capacity-building process rather than as a purely technical upgrade. Policies should support enterprises in data infrastructure, intelligent manufacturing, cross-border e-commerce services, supply-chain collaboration and platform governance, so that digital tools can improve exporters' ability to sense market changes, coordinate resources and recover from disruptions.

Third, export quality upgrading and resilience building should be advanced together. Quality improvement strengthens market stickiness, brand recognition and value-chain position, while resilience ensures that enterprises can continue investing in quality and innovation under uncertainty. Policy support should therefore connect quality standards, brand cultivation, R&D incentives and risk-management mechanisms.

Fourth, rules-based openness and institutional development remain essential. Stable expectations, trade facilitation, effective contract enforcement, high-standard free trade agreements and transparent digital trade rules can all reduce transaction costs and strengthen exporters' confidence in long-term market participation.

Fifth, policy attention should shift from the resilience of individual exporters to the resilience of industrial chains, regional systems and trade networks. Coordinated governance of ports, logistics, industrial clusters, supply-chain nodes and domestic markets can reduce the risk that localized shocks will spread into systemic export disruption.

Overall, the most important practical insight is that future foreign-trade com-

petition will not only depend on who exports more, but on who can maintain, recover and restructure exports more effectively under uncertainty. Enhancing China's export resilience therefore requires the joint advancement of market integration, digital capability, quality upgrading, institutional openness and system-level risk governance.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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