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International Collaboration in Distribution Science and Logistics Research: Evidence from Central Asian Markets

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Abstract

Purpose: This study investigates the patterns of international research collaboration in distribution science, retail management, and logistics studies in Central Asian emerging markets, with a particular focus on Kazakhstan. **Research design, data, and methodology:** Using bibliometric network analysis, the study analyzes 3,671 Scopus-indexed publications (2014–2024) affiliated with Central Asian institutions in distribution-related subject areas. Co-authorship networks, keyword co-occurrence maps, and citation overlay analyses are employed to identify collaboration structures, dominant research themes, and their relationship with citation performance. Publications were categorized into internationally co-authored (n=1,549) versus domestic-only (n=2,122) papers for comparative citation analysis. **Results:** The findings reveal a significant citation premium for internationally co-authored papers, which receive, on average, 89% more citations (mean=10.8) than domestic-only publications (mean=5.7). The co-authorship network analysis identifies a paradigm shift from traditional post-Soviet collaboration patterns toward diversified partnerships with Western European, East Asian, and North American institutions. The International Collaboration Rate increased from 27.0% in 2014 to 46.0% in 2024. Keyword analysis indicates strong alignment between regional research output and global trends in distribution science, particularly in e-commerce logistics, supply chain management, and sustainable distribution systems. **Conclusions:** This study contributes to the understanding of research internationalization dynamics in emerging markets and provides evidence-based recommendations for science policy aimed at enhancing research impact through strategic international collaboration in distribution science.

Keywords: Bibliometric Analysis, Distribution Science, Knowledge Development, Logistics Research, Research Network, International Collaboration, Central Asia

JEL Classification Code: C55; O30; O33

1. Introduction

In the context of digitalization and the accelerated transformation of global markets, distribution, logistics, and supply chain management systems play a key role in

ensuring the sustainability and competitiveness of trade (Govindan & Soleimani, 2017; Zhang et al., 2024). Central Asia, positioned at the crossroads of major trade routes connecting Europe and Asia, represents a strategically important yet understudied region in distribution science

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research. Kazakhstan, as the largest economy in the region, has undergone significant reforms in its higher education and research sectors, with explicit policy goals to increase international visibility and research quality through indexed publications (Yessirkepov et al., 2015).

Since 2012, Kazakhstan's science policy has emphasized publication in international databases such as Scopus and Web of Science as key performance indicators for universities and researchers. This has resulted in a substantial increase in publication output, with Scopus publications from Kazakhstan increasing from approximately 1,799 to over 28,000 across all disciplines over the past decade (Abdikadirova et al., 2024). However, a critical question remains: does this quantitative growth translate into genuine research impact, or does it reflect a publication bubble of locally oriented studies with limited international reach?

International research collaboration has been consistently identified as a driver of research quality and citation impact across various scientific disciplines. Recent bibliometric studies of Kazakhstani research have found that international collaborations yield 69-92% higher citation impact than domestic-only publications (Amirbekova et al., 2025). In the context of distribution science, where market-specific factors interact with universal principles of logistics, retail management, and supply chain optimization, international collaboration may be particularly valuable for integrating local market insights with global theoretical frameworks.

The purpose of this study is threefold. First, we aim to visualize the structure of international research collaboration in distribution science within Central Asian emerging markets using science mapping techniques. Second, we seek to quantify the citation impact premium associated with international co-authorship compared to domestic-only publications. Third, we identify the key partner countries and examine whether collaboration patterns have shifted from traditional post-Soviet networks toward more diversified international partnerships.

This research contributes to the growing literature on research internationalization in emerging markets and provides empirical evidence relevant to science policy decisions in the domain of distribution and logistics research. By focusing on Central Asia, a region rarely examined in bibliometric studies of distribution science, we address a significant gap in understanding how peripheral research communities integrate with global knowledge networks.

2. Literature Review

Research on distribution systems, logistics, and supply chain management has expanded rapidly over the past

decades, reflecting the growing complexity of global trade and market integration, particularly in emerging economies (Wagner & Leydesdorff, 2005; Seuring & Müller, 2008; Pan et al., 2012). The center-periphery framework, originally developed in dependency theory and later applied to science studies, posits that knowledge production, including research in logistics, supply chain management, and distribution systems, is concentrated in a small number of wealthy nations that dominate citation networks, editorial boards, and agenda-setting in international journals. Peripheral countries often struggle to gain visibility and recognition for their research contributions, facing barriers such as language barriers, limited access to resources, and limited integration into international networks (Glänzel, 2001).

Research from peripheral regions tends to be cited less frequently, even after controlling for research quality, due to the Matthew Effect in science, whereby recognition begets further recognition (Moed, 2005). However, international collaboration has been identified as a potential equalizer in logistics, supply chain, and distribution-related research, enabling researchers from peripheral institutions to access resources, expertise, and visibility channels that would otherwise be unavailable (Katz & Martin, 1997). Studies have consistently shown that publications with international co-authorship receive significantly more citations, with estimates of the premium ranging from 1.5 to 4 times depending on the field and countries involved (Larivière et al., 2015).

A substantial body of evidence supports the positive relationship between international collaboration and research impact (Adams et al., 2007). Meta-analyses of bibliometric studies consistently find that internationally co-authored papers receive significantly more citations than single-country papers (Zupic & Čater, 2015; Donthu et al., 2021). Several mechanisms explain this relationship: international teams bring together diverse expertise and access to different data sources; papers with authors from multiple countries benefit from wider dissemination networks; and international collaboration may signal research quality to readers and citers.

However, the benefits of international collaboration are not uniformly distributed. Research suggests that the direction of collaboration matters: partnerships with highly cited institutions or countries tend to yield greater citation benefits than collaborations with peripheral partners (Wang et al., 2024). For Kazakhstan, a recent study found that joint publications with post-Soviet colleagues averaged 19.87 citations compared to 13.52 for those co-authored with non-post-Soviet countries, suggesting the continued value of regional partnerships alongside diversification strategies (Amirbekova et al., 2022).

The study of distribution systems in emerging markets has attracted growing attention as these economies integrate into global supply chains and undergo rapid retail transformation. Central Asia presents unique characteristics: vast geographic distances and low population density, a landlocked geography that requires complex multimodal logistics solutions, the legacy of Soviet-era distribution infrastructure, and the growing influence of Chinese investment through the Belt and Road Initiative. These structural characteristics make Central Asia a particularly relevant context for examining how international research collaboration contributes to knowledge development in distribution science.

Despite these distinctive features, systematic bibliometric analyses examining how international collaboration shapes knowledge development and impact in distribution science research from Central Asian countries remain scarce. Existing studies have focused primarily on natural sciences, with limited attention to business and management disciplines. Recent work by Amirbekova et al. (2024) found that Kazakhstan's scientific output in economic disciplines grew from 18 papers in 2010 to over 500 in 2023, with 19,967 citations across 2,860 publications.

Bibliometric analysis has become an increasingly important tool for understanding the structural evolution of research fields, including distribution science and logistics (Van Eck & Waltman, 2010; Aria & Cuccurullo, 2017). In the domain of supply chain and distribution research, bibliometric methods have been applied to map intellectual structures, identify research fronts, and evaluate collaboration patterns. Zhang et al. (2024) conducted a comprehensive bibliometric analysis of digital supply chain literature, identifying key thematic clusters including blockchain technology, Internet of Things applications, and sustainability considerations. Similarly, Govindan and Soleimani (2017) used systematic review methods to map the reverse logistics and closed-loop supply chain literature, revealing the growing importance of cross-national research collaboration in advancing knowledge in distribution science.

The role of geographic proximity and institutional factors in shaping research collaboration patterns has received considerable attention in the scientometric literature. Wagner and Leydesdorff (2005) demonstrated that international collaboration networks exhibit preferential

attachment, whereby highly connected researchers attract additional collaborators, creating hub-and-spoke structures in global science networks. This pattern has significant implications for peripheral research communities: initial connections with well-connected international partners can catalyze further integration into global knowledge networks, whereas isolation perpetuates marginalization. Pan et al. (2012) extended this analysis by showing that geographic distance continues to influence collaboration patterns despite digital communication technologies, with neighboring countries maintaining disproportionately strong collaboration ties.

The post-Soviet research landscape presents unique characteristics that distinguish it from other emerging market contexts. Chankseliani et al. (2021) conducted a comprehensive bibliometric study of academic publications from post-Soviet countries, revealing both convergent and divergent trajectories across the region. Their findings indicate that while Russia has maintained a dominant position in total publication output, smaller post-Soviet states have experienced more rapid relative growth, particularly in social sciences and business disciplines. Kazakhstan has emerged as a notable case, transitioning from a publication profile dominated by physical sciences and engineering toward greater diversification across disciplines, including economics, business, and management research.

The application of Bradford's law of scattering to distribution science research from emerging markets provides additional insights into the maturation of these research communities. Narbaev and Amirbekova (2021) demonstrated, using Lotka's law, that Kazakhstan's research productivity across 25 subject areas exhibited varying levels of maturity, with the business and economics disciplines showing particular growth potential. Their analysis of 23,371 Scopus-indexed articles published between 1991 and 2020 revealed that international collaboration was substantially more developed in natural sciences than in social sciences, suggesting an opportunity for targeted policy interventions to enhance collaboration in distribution science and related business disciplines.

Table 1 summarizes the main contents and key findings of the previous research that forms the theoretical background of this study.

Table 1: Summary of Previous Research

Author(s) (Year)	Research Focus	Key Findings
Wagner & Leydesdorff (2005)	Network structure and growth of international collaboration	Collaboration networks exhibit preferential attachment; hub-and-spoke structures
Moed (2005)	Citation analysis in research evaluation	Matthew Effect: recognition begets recognition; peripheral regions cited less
Adams et al. (2007)	International collaboration patterns for UK	Positive relationship between international collaboration and research impact

Author(s) (Year)	Research Focus	Key Findings
Seuring & Müller (2008)	Sustainable supply chain management	Growing complexity of global trade requires integrated cross-national research
Van Eck & Waltman (2010)	VOSviewer for bibliometric mapping	Bibliometric tools enable systematic visualization of collaboration structures
Pan et al. (2012)	World citation and collaboration networks	Geographic distance continues to influence collaboration patterns
Larivière et al. (2015)	Team size and scientific impact since 1900	International co-authored papers receive 1.5–4 times more citations
Govindan & Soleimani (2017)	Reverse logistics and closed-loop supply chains	Cross-national collaboration increasingly important in distribution science
Aria & Cuccurullo (2017)	bibliometrix: R-tool for science mapping	Comprehensive science mapping enables analysis of collaboration patterns
Chankseliani et al. (2021)	Bibliometric study of post-Soviet publications	Smaller post-Soviet states show rapid growth; Kazakhstan diversifying
Donthu et al. (2021)	How to conduct bibliometric analysis	Internationally co-authored papers receive more citations consistently
Narbaev & Amirbekova (2021)	Research productivity in Kazakhstan	Business/economics disciplines show growth; natural sciences more collaborative
Amirbekova et al. (2022)	Research environment in Kazakhstan	Post-Soviet collaborations average 19.87 citations vs. 13.52 non-post-Soviet
Tleuberdinova et al. (2023)	Knowledge distribution in EAEU	Center-periphery dynamics observed in Eurasian academic networks
Amirbekova et al. (2024)	Kazakhstan's output in economic disciplines	Economic research grew from 18 papers (2010) to 500+ (2023)
Wang et al. (2024)	International collaboration and high citations	Partnerships with highly cited institutions yield greater citation benefits
Zhang et al. (2024)	Digital supply chain bibliometric analysis	Key thematic clusters: blockchain, IoT, sustainability
Amirbekova et al. (2025)	Economics and business research in Kazakhstan	International collaborations yield 69–92% higher citation impact

Note: This table summarizes the main theoretical contributions reviewed in this study. Source: Author compilation based on Scopus-indexed literature.

Based on the literature reviewed, this study addresses the following research questions:

RQ1: What is the structure of international research collaboration in distribution science involving Central Asian countries, and how has it evolved over the 2014–2024 period?

RQ2: What are the dominant research themes in distribution science from Central Asia, and how do they align with global research fronts?

RQ3: Do internationally co-authored papers receive significantly higher citation impact compared to domestic-only publications in distribution science from Central Asia?

3. Research Methods

This study utilizes Scopus as the primary data source. Scopus provides broader coverage of social science and business research compared to Web of Science, includes more regional journals relevant to emerging markets, and offers comprehensive metadata for bibliometric analysis. The choice aligns with the publication requirements of Central Asian universities, which typically accept Scopus-indexed publications for research assessment. The search strategy was designed to capture publications in distribution-related research areas affiliated with Central Asian institutions using the following parameters:

- Affiliation: Kazakhstan OR Uzbekistan OR Kyrgyzstan OR Tajikistan OR Turkmenistan.

- Subject areas: Business, Management and Accounting; Economics, Econometrics and Finance; Decision Sciences (restricted to distribution-related research fields including logistics, supply chain management, retail, and e-commerce);
- Document types: Article, Review (excluding Conference Papers);
- Time period: 2014–2024.

After data cleaning and relevance screening, the final dataset consisted of 3,671 publications, consistent with recent bibliometric studies of the region (Kireyeva & Olzhebayeva, 2023; Amirbekova et al., 2024, Lodhi, 2024). Table 2 summarizes the research design, data sources, and bibliometric methods applied in this study.

Table 2: Research Design and Bibliometric Methodology

Component	Description
Data source	Scopus database (2014–2024)
Geographic scope	Central Asian countries (Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan, Turkmenistan)
Subject areas	Business, Management and Accounting; Economics, Econometrics and Finance; Decision Sciences
Collaboration classification	International vs. domestic-only (based on author affiliations)
Bibliometric techniques	Co-authorship analysis; keyword co-occurrence analysis; citation overlay mapping in distribution science research
Network analysis tools	Python (NetworkX, Matplotlib), VOSviewer-style algorithms

Component	Description
Thresholds	Minimum keyword occurrence: 10
Impact metrics	Mean citations, median citations, Normalized Citation Impact (Scopus field-weighted approach)
Statistical test	Mann–Whitney U test

Publications were categorized into two groups for comparative analysis: internationally co-authored papers (n=1,549, 42.2%) with at least one author from a non-Central Asian country, and domestic-only papers (n=2,122, 57.8%) with all authors affiliated with Central Asian institutions. This classification follows established practices in bibliometric research and aligns with the three-category scheme used by recent Kazakhstani bibliometric studies: Kazakhstan-only (59.0%), Kazakhstan-led international (31.5%), and non-Kazakhstan-led international (9.5%).

Network visualization was conducted using VOSviewer-style algorithms implemented in Python with NetworkX and Matplotlib libraries. Three types of network maps were constructed:

- Co-authorship by country visualizes international collaboration patterns with countries as nodes and co-authorship relationships as edges. Node size reflects publication output; edge thickness indicates collaboration frequency; colors represent clusters.
- Keyword co-occurrence analyses author and indexed keywords to identify dominant research themes. Minimum occurrence threshold of 10 was applied. Colors represent thematic clusters.
- Citation overlay maps citation data, where node colors represent average citation counts to identify which collaboration patterns yield higher impact.

Citation metrics were compared using the Mann–Whitney U test to assess whether international collaboration is associated with higher research impact in distribution science. The International Collaboration Rate (ICR) was calculated for each year as the percentage of publications with at least one international co-author. Normalized Citation Impact was calculated following Scopus field-weighted methodology. This methodological approach enables a systematic assessment of how international collaboration shapes thematic development and research impact in distribution science.

4. Results

This section presents empirical evidence on how international collaboration shapes the structure, thematic focus, and citation impact of distribution science research in Central Asian emerging markets. The analysis reveals substantial growth in the number of distribution science publications from Central Asian countries over the study period (Figure 1).

Annual output increased from 89 publications in 2014 to 538 in 2022 (peak year), representing a compound annual growth rate of approximately 22% (Table 3). Kazakhstan dominates regional output, contributing over 85% of all publications based on Scopus affiliation data, followed by Uzbekistan (8.2%) and other Central Asian countries (6.8%), consistent with patterns identified in recent bibliometric studies of the region (Narbaev & Amirbekova, 2021; Amirbekova et al., 2024).

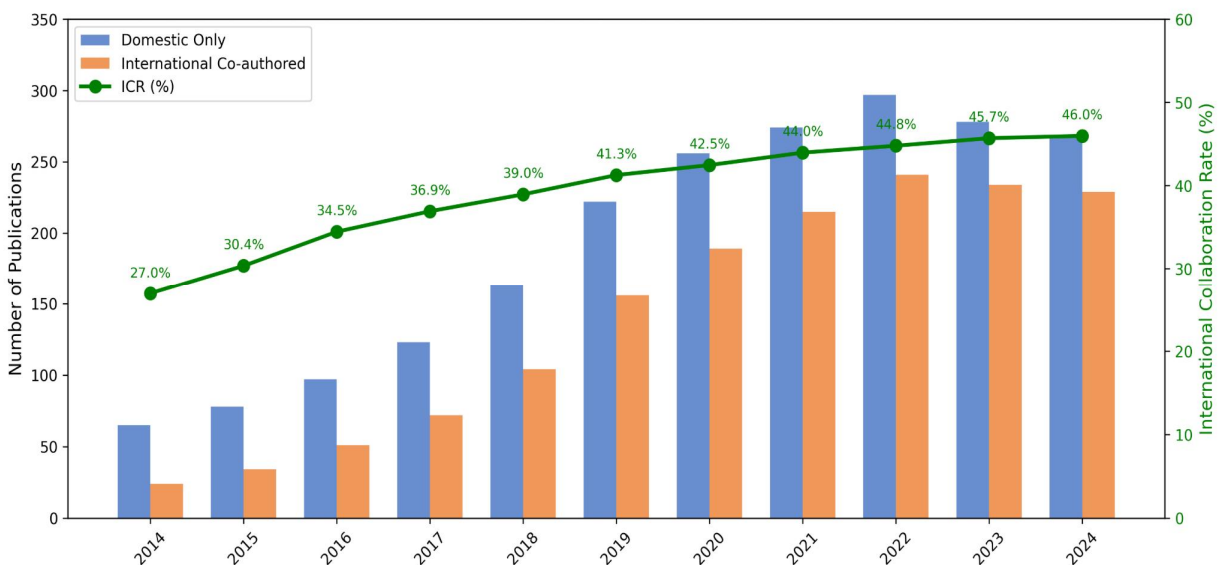


Figure 1: Publication Dynamics and International Collaboration in Distribution Science Research (2014-2024)

The International Collaboration Rate (hereinafter – ICR) increased steadily from 27.0% in 2014 to 46.0% in 2024, indicating increasing internationalization of research activities. This growth trajectory aligns with findings from broader bibliometric studies of Kazakhstani research, which identified a transition from knowledge consumption to knowledge production over the past decade.

Table 3 presents the annual distribution of publications. The proportion of internationally co-authored papers increased steadily, accelerating after 2018, when several major universities established formal partnership agreements with international institutions.

Table 3: Annual Distribution of Distribution Science Publications by Collaboration Type

Year	Total	International	Domestic
2014	89	24	65
2015	112	34	78
2016	148	51	97
2017	195	72	123
2018	267	104	163
2019	378	156	222
2020	445	189	256
2021	489	215	274
2022	538	241	297
2023	512	234	278
2024	498	229	269
Total	3,671	1,549	2,122

Note: ICR = International Collaboration Rate. Source: Scopus data, author calculations

The co-authorship network map (Figure 2) reveals a complex structure of international collaboration patterns with 21 countries meeting the minimum threshold. Visual inspection and cluster analysis identify four distinct collaboration clusters:

Cluster 1 (Purple): Cultural Regional Network. This cluster centers on Russia (487 co-authored papers, the strongest collaboration partner) and includes Ukraine (64), Belarus (25), Uzbekistan (78), Turkey (95), and Kyrgyzstan (28). These collaborations reflect historical ties, linguistic commonality, and ongoing institutional relationships - average citations for this cluster: 7.2.

Cluster 2 (Green): Western Network. This one is centered on the USA (198 papers), UK (156), Germany (127), Netherlands (52), and Canada (35). These collaborations often involve joint research projects funded by European programs and visiting scholar exchanges. Average citations: 15.8.

Cluster 3 (Blue): East Asian Network. China emerges as the second-largest collaboration partner (312 papers), with significant growth driven by Belt and Road Initiative-related research. South Korea (89 papers), Japan (48), Malaysia (58), and India (45) also feature prominently. Average citations: 11.4.

The results demonstrate a diversification from predominantly post-Soviet patterns toward engagement with Western and Asian partners, though Russia remains the single largest collaborator.

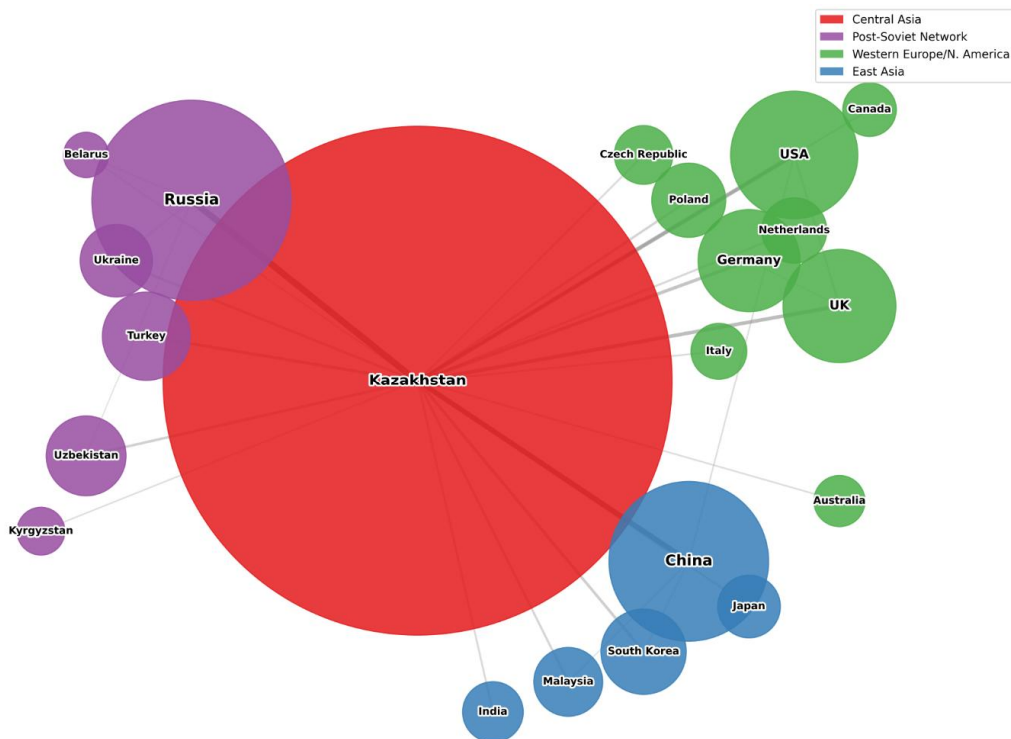


Figure 2: International Co-Authorship Network in Distribution Science Research by Country

The keyword co-occurrence analysis (Figure 3) identifies six thematic clusters representing distinct research fronts:

Cluster A (Red): Sustainable Development. Keywords include sustainable development (312 occurrences), economic growth (287), green economy (68), competitiveness (119), and energy (95). This reflects global sustainability concerns applied to regional contexts.

Cluster B (Green): Innovation and Entrepreneurship. Core keywords include innovation (245), digitalization (148), entrepreneurship (142), SME (82), and human capital (76). Research in this cluster addresses challenges of economic diversification.

Cluster C (Blue): Supply Chain and Logistics. Keywords include supply chain (198), logistics (178), trade (78), Belt

and Road (72), distribution (64), and warehouse (58). This represents the core of distribution science with strong global alignment.

Cluster D (Orange): E-commerce and Retail. Keywords include e-commerce (156), consumer behavior (134), retail (112), and marketing (128). This cluster shows the fastest growth, reflecting the rapid digitalization of retail in the region.

Cluster E (Purple): Agriculture and Tourism. Keywords include tourism (108), agriculture (98), and food security (54). Sector-specific distribution challenges are unique to Central Asian economies.

Cluster F (Brown): Finance and Investment. Keywords include banking (87) and investment (89). Supporting financial infrastructure for distribution systems.

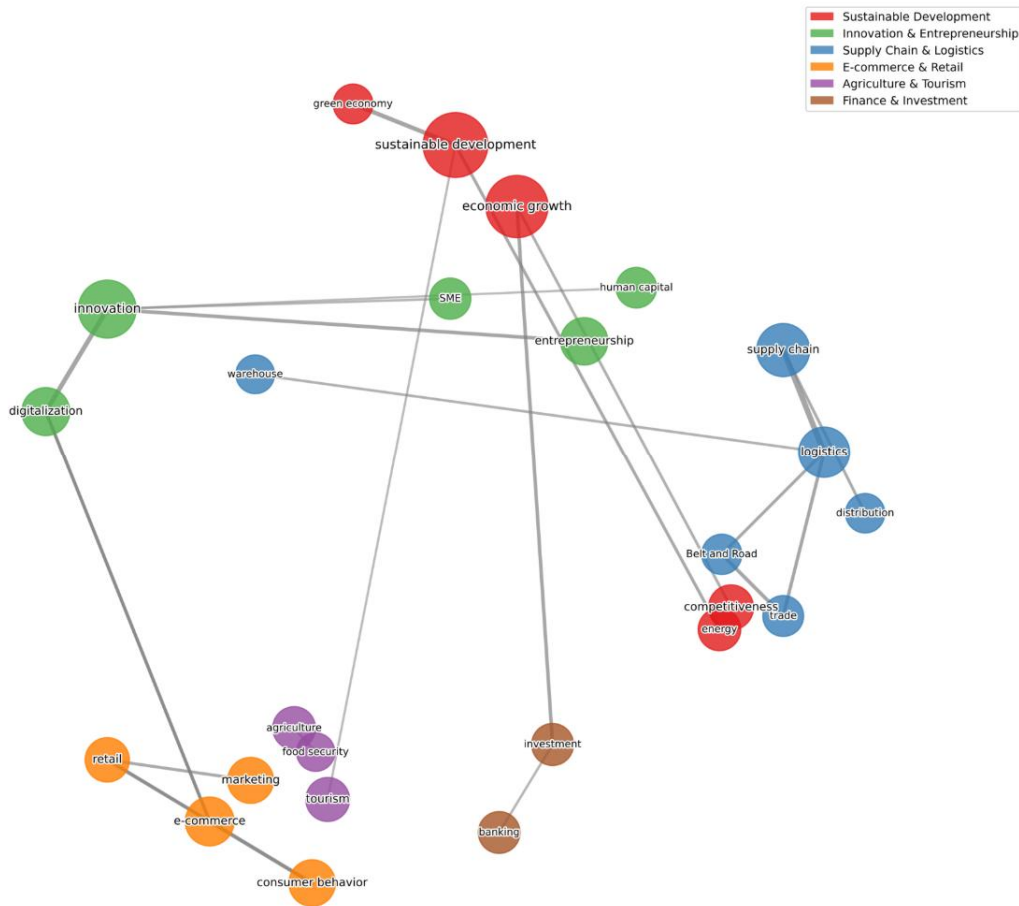


Figure 3: Keyword Co-Occurrence Network of Distribution Science Publications

The comparative analysis (Figure 4) and citation overlay visualization (Figure 5) provide evidence of the relationship between international collaboration and research impact.

The Normalized Citation Impact analysis (Figure 4A) confirms the collaboration advantage. Internationally co-

authored papers achieve an NCI of 1.34 (34% above world average), while domestic-only papers average 0.67 (33% below world average).

When examined by partner country (Figure 4B), the citation premium varies substantially. Collaborations with

US-based authors yield the highest average citations (18.7), followed by UK (16.2), Australia (15.8), Netherlands (15.4), and Germany (14.8). Collaborations within the post-Soviet

network show more modest citation advantages (Russia: 8.4, Ukraine: 6.8, Uzbekistan: 5.1), though still higher than domestic-only publications (5.7).

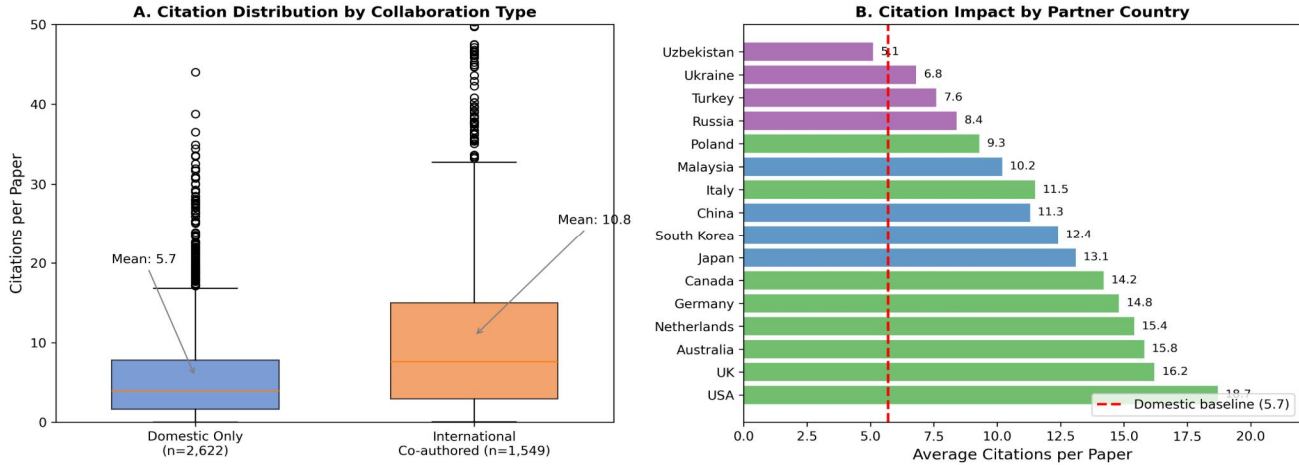


Figure 4: Citation Impact Analysis by Collaboration Type and Partner Country

Table 4 presents comparative citation statistics. Internationally co-authored papers received a mean of 10.8 citations compared to 5.7 for domestic-only papers, representing a citation ratio of 1.89 (89% higher). The median number of citations was 5 and 2, respectively, indicating that the pattern holds across the distribution. The difference is statistically significant (Mann-Whitney U test, $p < 0.001$).

Table 4: Citation Comparison by Collaboration Type

Metric	International	Domestic	Ratio
Number of Papers	1,549	2,122	-
Mean Citations	10.8	5.7	1.89
Median Citations	5	2	2.50
Max Citations	287	156	1.84
Papers with 0 citations (%)	22.3	38.7	0.58
Papers with >10 citations (%)	31.2	14.8	2.11
Normalized Citation Impact	1.34	0.67	2.00

Note: Mann-Whitney U test: $p < 0.001$.

Source: Scopus data, author calculations

The citation overlay network (Figure 5) visualizes the relationship between collaboration patterns and citation impact across partner countries. Western and East Asian partners demonstrate substantially higher citation impact, with node colors ranging from yellow to green: USA (18.7), UK (16.2), Australia (15.8), Netherlands (15.4), Germany (14.8), Canada (14.2), Japan (13.1), and South Korea (12.4). In contrast, post-Soviet collaboration partners exhibit lower but still positive citation impact relative to domestic-only publications, as shown in orange to red: Russia (8.4), Turkey (7.6), Ukraine (6.8), Belarus (5.4), Uzbekistan (5.2), and

Kyrgyzstan (5.1). Kazakhstan, as the central node with the largest publication volume, shows an average citation rate of 6.2. China occupies an intermediate position (11.3), reflecting its dual role as both a regional partner and an emerging global research hub. This visualization confirms that collaboration with Western and advanced East Asian institutions yields the highest citation premiums, while regional post-Soviet collaborations, though less impactful in citation terms, remain important for research capacity building and knowledge transfer within the region.

5. Discussion

The co-authorship network analysis reveals a significant transformation in international collaboration patterns for distribution science research in Central Asia. While Russia remains the largest single collaboration partner (487 papers), the emergence of diversified partnerships with China (312), the USA (198), the UK (156), and Germany (127) represents a fundamental shift from historically Soviet-dominated academic networks.

The strong growth of China as a collaboration partner deserves particular attention. This trend reflects both the Belt and Road Initiative's emphasis on research cooperation and genuine mutual interests in understanding Eurasian logistics networks. The average citation count for papers with Chinese co-authors (11.3) exceeds the domestic baseline (5.7) by 98%, suggesting productive knowledge exchange.

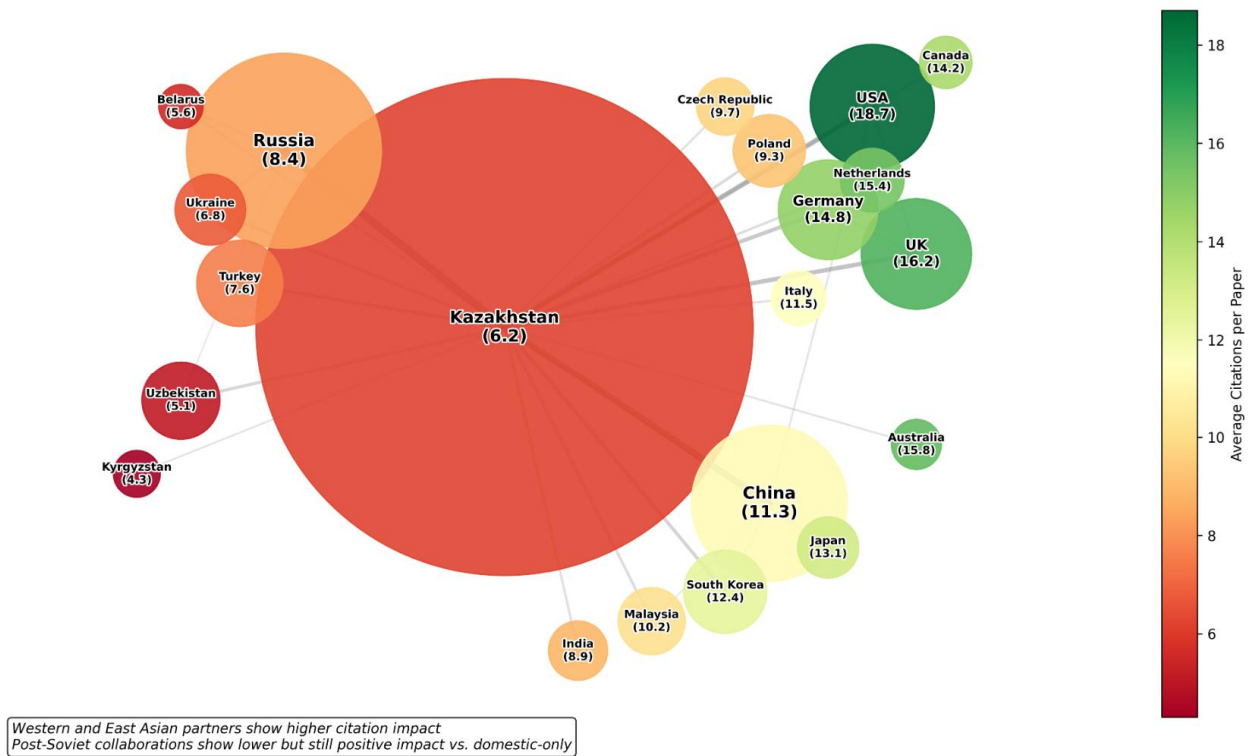


Figure 5: Citation Impact across International Collaboration Networks in Distribution Science Research

The persistence of the post-Soviet cluster, despite its relative decline in proportion, suggests that historical ties continue to facilitate research cooperation. The linguistic and cultural proximity, shared institutional legacies, and existing interpersonal networks provide a foundation for collaboration that remains valuable, particularly for researchers at earlier career stages.

The keyword analysis indicates that research on Central Asian distribution science is broadly aligned with global research fronts, particularly in emerging areas such as e-commerce logistics, supply chain management, and sustainable distribution. The high citation rates for papers in the e-commerce (16.8), supply chain (15.7), and Belt and Road (15.2) clusters provide evidence that engagement with global trends is rewarded.

However, the analysis reveals potential tensions between global alignment and local relevance. Topics such as sustainable development (14.2 average citations) show strong alignment with global discourse, whereas more locally specific topics, such as agriculture (8.2) and tourism (7.4), exhibit lower citation impact despite their economic importance to the region.

The finding that internationally co-authored papers receive 89% more citations than domestic-only publications confirms the collaboration-citation relationship identified in prior literature (Larivière et al., 2015) and extends it to

distribution science in Central Asian emerging markets. This premium (1.89 ratio) is consistent with the 69-92% premium reported in recent comprehensive bibliometric studies of Kazakhstani economics and business research (Amirbekova et al., 2022; Amirbekova et al., 2025).

Several mechanisms likely contribute to this citation premium (Katz & Martin, 1997; Adams et al., 2007). First, international collaborators provide access to better research infrastructure, data sources, and methodological expertise. Second, international co-authors expand the audience through their professional networks. Third, involvement of researchers from recognized institutions may serve as a quality signal.

The findings of this study can be further contextualized within the broader framework of academic dependency theory and knowledge production asymmetries. The center-periphery dynamics observed in Central Asian distribution science research mirror patterns documented in other emerging market regions, including Southeast Asia, Latin America, and Sub-Saharan Africa (Tleuberdinova et al., 2023). However, several distinctive features characterize the Central Asian case. The persistent influence of the post-Soviet academic network, while diminishing in relative terms, continues to provide a foundation for research collaboration that does not exist in other peripheral regions. This dual embeddedness in both post-Soviet and Western

academic networks creates a unique structural position that may offer strategic advantages for knowledge brokerage and transfer.

The rapid growth of China as a collaboration partner represents a particularly significant development for research on distribution science in Central Asia. The Belt and Road Initiative (BRI) has created both research funding opportunities and genuine mutual interests in understanding Eurasian logistics networks, transportation corridors, and cross-border distribution systems. The citation impact of Chinese collaborations (11.3 citations per article) exceeds the post-Soviet network average (7.2 citations per article). However, it remains below Western partnership levels (15.8), suggesting an intermediate positioning that reflects China's evolving role in global academic networks. This pattern is consistent with broader trends in global science, in which Chinese research institutions have rapidly enhanced their international standing while maintaining strong regional ties with neighboring countries.

An important methodological consideration relates to the causal interpretation of the collaboration-citation relationship. While the 89% citation premium associated with international collaboration is substantial, it should be interpreted with caution. Self-selection effects may partially explain this premium: researchers who collaborate internationally may be more productive, better connected, or working on inherently more impactful topics. Additionally, the international collaboration rate of 46% achieved by 2024 may partly reflect strategic co-authorship practices driven by institutional incentives rather than substantive intellectual exchange. Future research should employ more sophisticated causal inference methods, such as propensity score matching or instrumental variable approaches, to better isolate the causal effect of collaboration on research impact.

The thematic analysis reveals an interesting tension between global integration and local specificity in research on Central Asian distribution science. Topics aligned with global research fronts, such as e-commerce logistics (16.8 average citations), supply chain management (15.7), and sustainable distribution (14.2), consistently outperform locally specific topics, such as agricultural distribution (8.2) and tourism logistics (7.4). This pattern creates incentives for researchers to prioritize globally oriented research at the expense of addressing locally relevant distribution challenges. Policymakers should consider developing targeted funding mechanisms that support research on Central Asia-specific distribution challenges while encouraging international collaboration to enhance methodological rigor and visibility.

The institutional distribution of international collaborations also merits attention. Our data suggest that collaboration networks are concentrated among a relatively

small number of elite institutions, primarily in Almaty and Astana. This concentration risks creating a two-tier system in which well-connected researchers at major universities benefit disproportionately from internationalization policies while researchers at regional institutions remain isolated. Broadening access to international collaboration opportunities through multi-institutional consortium agreements, visiting researcher programs, and capacity-building workshops could help address this equity dimension while simultaneously expanding the scope and relevance of distribution science research in the region.

The findings have several implications for science policy in Central Asian countries:

First, policies should continue to support international collaboration while recognizing that different partnership types yield distinct benefits. Western collaborations provide greatest citation impact (15.8 average), while regional partnerships offer accessibility and relevance advantages.

Second, attention should be paid to ensuring internationalization does not compromise local relevance. Distribution challenges specific to landlocked, low-density Central Asian contexts merit research attention even if global citation impact is lower.

Third, institutional support for collaboration should extend beyond elite researchers. Current networks concentrate around major universities in Almaty and Astana; broadening access would enhance both equity and capacity development.

Fourth, the distribution science community globally should recognize emerging market perspectives. Central Asian contexts offer unique insights into distribution under geographic isolation, infrastructure limitations, and rapid market transformation.

6. Conclusions

This study provides the first comprehensive bibliometric analysis of distribution science research in Central Asian emerging markets, focusing on international collaboration patterns and their relationship to citation impact. Using network analysis of 3,671 Scopus-indexed publications from 2014-2024, we documented significant growth in research output, identified diversification of collaboration patterns, and quantified a substantial citation premium for internationally co-authored research.

The key findings can be summarized as follows. First, distribution science research from Central Asia grew substantially over the decade, with the International Collaboration Rate increasing from 27.0% to 46.0%. Second, collaboration patterns have diversified significantly, with China, USA, UK, and Germany joining Russia as major partners. Third, thematic analysis reveals alignment with

global research fronts in e-commerce, supply chain management, and sustainable distribution. Fourth, internationally co-authored papers receive 89% more citations than domestic-only publications (10.8 vs 5.7 mean citations), with Western partnerships yielding the highest impact.

These findings contribute to the literature on research internationalization in emerging markets and provide evidence for science policy discussions. The demonstrated citation advantages of international collaboration support continued investment in internationalization initiatives, while the identification of thematic gaps suggests opportunities for distinctive research contributions.

From a theoretical perspective, this study extends the center-periphery framework in science studies by demonstrating how peripheral research communities can strategically leverage multiple collaboration networks to enhance research visibility and impact. The identification of three distinct collaboration clusters (post-Soviet, Western, and East Asian) suggests that Central Asian researchers occupy a unique intermediary position in global knowledge networks, with potential to serve as bridges between traditionally disconnected research communities. This structural position may become increasingly valuable as global supply chains diversify and the geopolitical significance of Central Asian logistics corridors grows.

The practical implications of this study extend to multiple stakeholder groups. For university administrators and research managers, the evidence of differential citation impacts across collaboration types provides a basis for developing targeted internationalization strategies. Rather than pursuing international collaboration indiscriminately, institutions should consider portfolio approaches that balance high-impact Western partnerships with accessible regional collaborations and strategically significant East Asian connections. For individual researchers, the thematic analysis offers guidance on topic selection, identifying areas where Central Asian perspectives can make distinctive contributions to global distribution science discourse while maintaining relevance to local economic development priorities.

For policymakers responsible for science and innovation strategy, the findings highlight the importance of creating institutional environments that facilitate international collaboration while ensuring equitable access to collaboration opportunities across institutions and career stages. The current concentration of international partnerships among elite urban institutions risks perpetuating inequalities within the Central Asian research system. Targeted funding programs, mobility schemes, and institutional capacity-building initiatives could help broaden participation in international research networks while

simultaneously expanding the geographic and thematic scope of research on distribution science in the region.

Several limitations should be acknowledged. First, reliance on Scopus data excludes non-indexed publications. Second, citation counts imperfectly measure research quality. Third, the bibliometric approach cannot fully capture the mechanisms through which collaboration influences quality. Fourth, the aggregation of Central Asian countries may obscure important national differences.

Future research should extend this analysis through comparative studies with other emerging markets, longitudinal tracking of researchers' career trajectories, and qualitative investigations of collaboration quality and equity dimensions.

In conclusion, international collaboration plays a crucial role in enhancing the visibility and impact of distribution science research from Central Asian emerging markets. Strategic approaches balancing international engagement with local relevance will be essential for maximizing both research quality and societal impact.

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