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Linking Theory And Practice In Humanitarian Supply Chains: A Review Of Challenges, Perceptions And Research Gaps Using SLR And Bibliometric Analysis

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ABSTRACT
This study offers a thorough assessment of humanitarian supply chain management (HSCM) through a systematic literature review (SLR), bibliometric analysis, and latent Dirichlet allocation (LDA) topic modelling. This research looks at 228 peer-reviewed papers from 2006 to 2025, showing the main topics, identifying important areas that need more study, and exploring how theory and practice come together in humanitarian logistics. Five main issues were identified from the analysis: methods for analyzing logistics, managing crises and building trust in supply chains, techniques for managing relief efforts, strategic approaches to humanitarian planning, and the effects of sustainability and local challenges. The report highlights the increasing significance of digital technologies like blockchain, AI, and IoT while also acknowledging their restricted practical implementation due to infrastructural and contextual limitations. It underscores the necessity for enhanced theoretical integration, especially with social and environmental sustainability, and promotes a consolidated research agenda that harmonizes innovation, inclusion, and resilience in humanitarian operations.

Keywords: *Humanitarian Supply Chain Management (HSCM), Sustainability, Digital Technologies (AI, Blockchain, IoT), Disaster Management, Supply Chain Performance.*

1 INTRODUCTION

Humanitarian Supply Chain Management (HSCM) pertains to the strategic planning and coordination of logistics operations designed to provide assistance to communities impacted by emergencies, including natural disasters, armed conflicts, or pandemics (Dubey et al., 2018). The escalating frequency and magnitude of global humanitarian crises spanning the COVID-19 pandemic and natural catastrophes such as Hurricane Dorian and the floods in India and Pakistan highlight the critical necessity for resilient and agile humanitarian supply chains(Kanwal et al., 2023). Humanitarian Supply Chains (HSCs) are pivotal in facilitating the effective allocation of necessities, including food, water, shelter, and medication, to impacted people, frequently under difficult and unpredictable conditions (Thomas & Kopczak, 2007; Van Der Laan et al., 2009).

A standard HSC has three fundamental flows: logistics, information, and finance (Wang et al., 2022). These flows enable the procurement, conveyance, and dissemination of humanitarian assistance, as well as the exchange of information and resources among stakeholders (Chiappetta Jabbour et al., 2019)(Mohan Kumar, Yadav & Sahoo, 2025; Nguyen et al., 2025). Nonetheless, the escalating complexity of humanitarian operations, particularly in disaster-prone and conflict-affected areas, has rendered the efficient coordination of these efforts increasingly challenging.

Sustainability has become a crucial perspective for reassessing HSCM operations. Sustainable humanitarian supply chains (SHSCs), grounded on the triple bottom line framework of people, planet, and profit (Abbas et al., 2022; Salvadó et al., 2018), must concurrently address social, environmental, and economic factors. In humanitarian contexts, social sustainability is particularly important. Prioritizing inclusivity, equity, and the safeguarding of vulnerable populations is essential (Haavisto & Kovács, 2015; Laguna-Salvadó et al., 2019). The consequences of deprivation resulting from delays or lack of access to assistance further highlight the societal ramifications of inadequate HSC performance (Abidi et al., 2014; Damoah, 2022).

From an economic standpoint, humanitarian operations frequently rely on unpredictable donor money, resulting in difficulties in long-term planning and financial viability (Balcik et al., 2016). Cost-effectiveness and the capacity to expand operations during crises continue to be significant issues (Altay et al., 2024; Anjomshoae et al., 2022; Seifert et al., 2018). Notwithstanding the growing academic focus, the notion of sustainability in HSCs is still inadequately examined, and the assessment of its facets especially environmental sustainability remains unclear (Agarwal et al., 2022; Salvadó et al., 2018).

Karuppiah et al. (2021) and Haavisto & Kovács (2015), have examined sustainability in humanitarian missions; however, their analyses were confined to workshops and organizational reports, with scant attention to academic literature. Behl & Pal (2019) have advocated for an extensive academic review about the convergence of sustainability and HSCM.

The importance of digital technologies in HSCs has garnered heightened interest for their potential to improve sustainability and operational efficiency. Disruptive technologies including artificial intelligence (Modgil et al., 2022), blockchain (Chugh, 2023), drones (Edwards et al., 2023), big data analytics (Fosso Wamba, 2022), and IoT (Donyavi Rad et al., 2023) provide novel solutions for enhancing the management of humanitarian operations. These technologies can enhance resource allocation, decrease lead times, and augment traceability, thus fostering sustainability and resilience (Baharmand et al., 2021; Rodríguez-Espíndola et al., 2020).

Notwithstanding the potential of these tools, the incorporation of these technologies in HSCs is still constrained, particularly in low-resource and high-risk environments. Humanitarian organisations frequently have challenges executing Humanitarian Supply Chain Performance Management (HSCPM) systems owing to the absence of standardized metrics, inconsistent data, and coordination obstacles (Agarwal et al., 2019, 2022; Damoah, 2022). Digital change may significantly contribute to overcoming these issues; nevertheless, scholarly comprehension of this shift within the humanitarian sector is yet disjointed (Jeble et al., 2020; Srivastava & Bag, 2025; Wagner & Thakur-Weigold, 2018).

2 LITERATURE REVIEW

The domain of Humanitarian Supply Chain Management (HSCM) has garnered increasing scholarly and practical attention owing to the escalating occurrence and intensity of global crises, such as natural disasters, armed conflicts, pandemics, and climate-related calamities (Dubey et al., 2019, 2024; Imbriale, 2025; Modgil et al., 2022; Yan, 2023). HSCM fundamentally entails the acquisition, delivery, storage, and distribution of relief supplies and services to people affected by crises, frequently amid situations of significant uncertainty and urgency (Gress et al., 2021; Hu et al., 2022; Sentia et al., 2023; Tay, Chen, et al., 2025; Van Wassenhove, 2022). The efficient administration of humanitarian logistics is crucial, as about 73% of humanitarian aid expenditures are allocated to supply chain and logistical operations (Aghsami et al., 2024; Baharmand & Comes, 2019; Falagara Sigala et al., 2020; Mukhopadhyay & Roy, 2016; Negi, 2025).

2.1 Structures and Functions of Humanitarian Supply Chains

Early studies predominantly emphasized the structure and operational efficacy of HSCs, underscoring their logistical intricacies, cost intensity, and necessity for swift reaction. Tavana et al. (2018) highlighted that logistics may constitute as much as 80% of disaster relief expenditures, underlining the significance of meticulously structured supply networks. Dolinskaya et al. (2018), Negi (2025) and Sentia et al. (2025) enhanced this comprehension by delineating the three essential flows in HSCs: logistics, information, and financial flows. These processes collaborate to guarantee the prompt and efficient distribution of assistance from donors to recipients.

Recent literature has recognized the significance of information openness and data accuracy, particularly in the digital era, where social media and mobile platforms affect real-time decision-making (Bag et al., 2023; Rodríguez-Espíndola et al., 2020; R. K. Singh, 2025). Technological integration is revolutionizing communication, reception, and response to information in humanitarian networks.

2.2 Social and Economic Aspects of Sustainability in Health and Social care.

The convergence of sustainability and HSCM is garnering heightened academic interest. Although commercial supply chains have historically utilized the triple bottom line (TBL) concept for sustainability, its implementation in humanitarian contexts is comparatively recent and inconsistent (Beamon & Kotleba, 2006; Falagara Sigala et al., 2020; Plesner Volkdal, 2024). Social sustainability is the most frequently discussed pillar, with literature highlighting equitable distribution, community involvement, and the safeguarding of vulnerable populations (Das, 2016; Haavisto & Kovács, 2015; Jeble et al., 2020; John & Ramesh, 2016; Seifert et al., 2018). The costs of deprivation, which represent the societal consequences of postponed or unfulfilled assistance, underscore the necessity for equity and promptness in the provision of aid (Barber & Heaslip, 2013; Butt et al., 2022; Kabra, 2025).

HSCs encounter considerable financial obstacles, chiefly stemming from dependence on erratic donor funding and the elevated operational expenses in rural or conflict-affected areas (Chingono & Mbohwa, 2015; Paciarotti et al., 2021). Researchers have advocated for novel financing strategies, such as impact investments and public-private partnerships, to enhance financial resilience and sustainability (Altay et al., 2024; Cano-Olivos et al., 2022; Indarti et al., 2020; Munyaka et al., 2024).

2.3 Environmental Sustainability and Its Insufficient Representation

Notwithstanding its significance, environmental sustainability is markedly under-represented in the literature concerning HSCs. Limited research has investigated carbon emissions, trash production, or the ecological consequences of humanitarian logistics (K. K. Ganguly et al., 2017; Tatham & Kovács, 2010; Zarei et al., 2019). The increasing demand for the incorporation of climate-resilient and environmentally sustainable activities highlights a substantial research deficiency. The literature advocates for the implementation of green logistics, reusable packaging, and renewable energy sources in humanitarian settings (Bag et al., 2020; Jilani et al., 2018; Regattieri et al., 2018).

2.4 Integration of Technology and Digitalization

Digital technologies are progressively recognized for their capacity to revolutionize humanitarian logistics. Technological advancements including Artificial Intelligence (AI), Blockchain, Big Data Analytics (BDA), Internet of Things (IoT), 3D Printing, and drone technologies are being investigated for their potential to enhance aid delivery (Corsini et al., 2022; Laguna-Salvadó et al., 2019, p. 3; Modgil et al., 2022; T. Singh et al., 2021). Baharmand et al. (2021), Saad et al. (2023) and Tay et al. (2022) demonstrated blockchain's capacity to improve transparency and mitigate fraud in relief distribution.

The literature indicates a sluggish pace of technological adoption in humanitarian supply chains due to financial limitations, inadequate infrastructure, and insufficient technical proficiency within humanitarian organisations (Delmonteil & Rancourt, 2017; Kabra & Ramesh, 2016; Sentia et al., 2025; Yadav & Barve, 2016). Thus, despite significant promise, practical implementation remains constrained.

2.5 Management of Humanitarian Supply Chain Performance (HSCPM)

A burgeoning emphasis is the assessment and administration of performance in HSCs. HSCPM pertains to the establishment of objectives, the delineation of indicators, the oversight of processes, and the assessment of impact (Abidi et al., 2015; Cherkesly & Maizi, 2020; Damoah, 2022; Moshtari & Vanpoucke, 2021). Essential performance metrics encompass lead time effectiveness (LTE) and cost efficiency (CE) (Paciarotti et al., 2021). Even though measuring performance is important, it is difficult to do because of a lack of data, disorganized operations, and different goals among the people involved.

Consequently, digitalization is perceived as a remedy for performance impediments. Research supports the implementation of digital dashboards, real-time monitoring, and automated reporting systems to enhance strategic coordination and transparency (Farzipoor Saen et al., 2024; Fosso Wamba, 2022; K. Ganguly & Rai, 2016; Hong & Jeong, 2019; Krishna & Daniel, 2021; Wagner & Thakur-Weigold, 2018).

2.6 Theoretical Underpinnings of Humanitarian Supply Chain

Humanitarian supply chain management (HSCM) involves many different fields and is complex, but there hasn't been enough strong theory to support it, and what exists is often scattered. An examination of the current literature indicates that only a limited number of studies explicitly utilize theoretical frameworks, often prioritizing operational or empirical aspects instead. Research on Humanitarian Supply Chain Management (HSCM) is progressively advancing; however, its theoretical foundations are still inadequately researched and fragmented. The Resource-Based View (RBV) is a significant theory in this field, highlighting the strategic significance of internal skills and resources for performance and competitive advantage (Ferreira & Ferreira, 2024). In humanitarian contexts, resources including logistical infrastructure, information systems, experienced individuals, and inter-organizational coordination are regarded as essential facilitators of effective relief delivery (Abidi et al., 2014; Dubey et al., 2024)(Pankaj et al., 2023; Yadav et al., 2024a). Research indicates that when humanitarian organisations enhance their collaboration and knowledge-sharing capabilities, their response speed and effectiveness are markedly improved (Jeble et al., 2020).

Institutional theory is another prevalent framework that elucidates how external pressures coercive (from funders and governments), mimetic (from peer organisations), and normative (from professional standards) affect organizational behaviour and decision-making (DiMaggio & Powell, 1983; Moshtari & Vanpoucke, 2021). The growing focus on transparency and sustainability in donor priorities has compelled humanitarian organisations to implement standardized performance metrics and digital technologies, primarily to uphold legitimacy and ensure funding continuity rather than operational benefits (Haavisto & Kovács, 2015; Modgil et al., 2022).

Stakeholder theory is important because humanitarian supply chains involve many different groups like donors, beneficiaries, NGOs, logistical providers, and governments, each with their own needs and goals. This theory posits that efficient coordination and value co-creation among all stakeholders are essential for attaining equity, accountability, and impact in relief operations (Lewin et al., 2018; Wagner & Thakur-Weigold, 2018)(Budshra et al., 2024; Mohan Kumar, Yadav & Sahoo, 2025).

Ultimately, contingency theory has come to serve as a valuable foundation for comprehending why uniform tactics frequently falter in intricate humanitarian contexts. This idea asserts that organizational strategies must correspond with environmental factors, including disaster kind, geography, and resource availability (Ravi Ravindran et al., 2023). Recent research supports context-specific strategies centralized coordination in certain situations and decentralized autonomy in others based on the characteristics of the crisis (Beiki Ashkezari et al., 2024; Moshtari & Vanpoucke, 2021).

Despite these theoretical applications, a significant portion of the HSC literature is largely descriptive or experimentally orientated, exhibiting limited theory development or validation. Consequently, there is a significant demand for enhanced theoretical integration and the formulation of conceptual frameworks that synchronize sustainability, digitalization, and performance management in healthcare supply chains (Behl & Dutta, 2019; Modgil et al., 2022). This study aims to connect theory and practice in humanitarian supply chains by conducting a systematic literature review (SLR) alongside bibliometric analysis. We aim to investigate the problems, stakeholder perspectives, and research deficiencies pertaining to sustainable and digital HSCM. We intend to investigate the subsequent research question:

RQ.1: What is the annual scientific publication trend of research publications in the incorporated domain.

RQ.2: What is the pattern of Journal-wise Distribution of Publications.

RQ.3: Which country is the dominating in term of publications of research article in the current domain.

RQ.4: What is the year-wise distribution of themes in Humanitarian Logistics management.

RQ.5: What is the collaboration pattern of the authors from the different countries.

3 RESEARCH METHODOLOGY

This study used a mixed-method research strategy, incorporating a Systematic Literature Review (SLR), bibliometric analysis, and Latent Dirichlet Allocation (LDA) topic modelling to investigate the current status, thematic progression, and research deficiencies in humanitarian supply chain management (HSCM). The methodological framework is founded on the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, which are extensively used to guarantee transparency, replicability, and methodological rigor in evidence synthesis (Anjomshoae et al., 2022; Nawazish et al., 2024)(Nguyen et al., 2025; Yadav et al., 2024b).

The literature search was performed using the Scopus database, owing to its extensive coverage of high-quality, peer-reviewed articles in logistics, operations, and disaster response. The ultimate search query utilized was: (("humanitarian supply chain") AND ("innovation" OR "challenge" OR "perception" OR "disaster management")).

This inquiry was meticulously crafted to encompass literature at the convergence of humanitarian logistics, innovation, stakeholder dynamics, and catastrophe operations. The inquiry produced an initial total of 335 articles. A multi-tiered filtration technique was used to guarantee pertinence. The analysis encompassed only items published in English from 2006 to 2025, emphasizing peer-reviewed journal publications. We excluded articles that were not relevant to the humanitarian supply chain context, such as technical optimization research or commercial logistics studies. After screening titles and abstracts to eliminate duplicates and irrelevant documents, researchers selected 228 papers for comprehensive evaluation and analysis.

In accordance with the PRISMA protocol, metadata including title, author(s), year of publication, nation or area, journal, research methodology, theoretical framework, and principal findings were extracted and documented. Thematic coding was conducted to categories studies into conceptual domains, including Analytical Approaches in Humanitarian Logistics (Maroof et al., 2023; Raghukumar et al., 2016; Yadav & Barve, 2019), Disaster Management and Supply Chain Trust (Beiki Ashkezari et al., 2024; Raghukumar et al., 2016; Resende et al., 2023; Shayganmehr et al., 2024), Humanitarian Operations and Relief Management (Chiappetta Jabbour et al., 2019; K. Ganguly & Rai, 2016; Nain et al., 2024; Resende et al., 2023), Strategic Perspectives in Humanitarian Supply Chains (Aghsami et al., 2024; Cano-Olivos et al., 2022; Munyaka et al., 2024) and Sustainability and Regional Obstacles in Humanitarian Systems (Baraka et al., 2017; Nawazish et al., 2024; Peretti et al., 2015, 2015; Salvadó et al., 2016, 2017; Zarei et al., 2019).

Moher et al. (2009) introduce PRISMA, which stands for Preferred Reporting Items for Systematic Reviews and Meta-Analyses is a framework designed to guide researchers in conducting and reporting systematic reviews and meta-analyses transparently and comprehensively. It is commonly used in various disciplines, particularly in health sciences and social sciences, to ensure clarity and quality in the review process. The process begins with 34 studies from a previous study out of which 4 previous studies are included in review. New studies were identified through database searches, yielding 335 records. After removing 55 ineligible records via automation tools and 13 records for other reasons, 267 records were screened. Of these, 22 were excluded for irrelevance, leaving 245 reports assessed for eligibility. All 19 reports didn't meet the criteria and 226 were included in the final review. Additionally, 20 studies were identified through citation searching, but 10 were not retrieved. The remaining 10 were assessed, but all were excluded as they relied on database-driven searches. Ultimately, the review included a total of 228 studies, combining both previously included and newly identified studies. This structured approach ensures transparency, minimizes bias, and enhances the reproducibility of systematic reviews.

We conducted a bibliometric study using VOSviewer and R's Bibliometrix package (Aria & Cuccurullo, 2017) to gain deeper insights. The investigation examined keyword co-occurrence networks, journal co-citation patterns, author and institutional collaborations, and temporal publishing trends (Fosso

Wamba, 2022). This quantitative analysis of the research landscape identified key contributors, prevailing themes, and emerging research fronts in HSCM (Anjomshoae et al., 2022; Falagara Sigala et al., 2020; Khan et al., 2019; Patil & Madaan, 2024; Tay, Loh, et al., 2025).

Furthermore, Latent Dirichlet Allocation (LDA) topic modelling was employed to reveal concealed thematic structures within the chosen literature. LDA is a generative probabilistic model that detects latent topics in extensive text corpora by analyzing word co-occurrence probabilities (Blei et al., 2003)(Kumar et al., 2024, 2025). This study utilized textual data for LDA modelling, including titles, abstracts, and keywords from 228 selected publications. Python executed the implementation, using topic coherence scores to determine the optimal number of subjects. Each chosen topic was named based on the most relevant terms and example documents, following the methods used in earlier LDA studies related to supply chain and disaster research.

This combined approach, which includes a thorough review of existing literature, analysis of research data, and latent Dirichlet allocation, provides in-depth understanding. It facilitates a detailed examination of theoretical and empirical progress, stakeholder viewpoints, technical innovations, and performance obstacles in the humanitarian supply chain domain. The integrated method facilitates the identification of underexplored subjects and proposes avenues for future interdisciplinary inquiry.

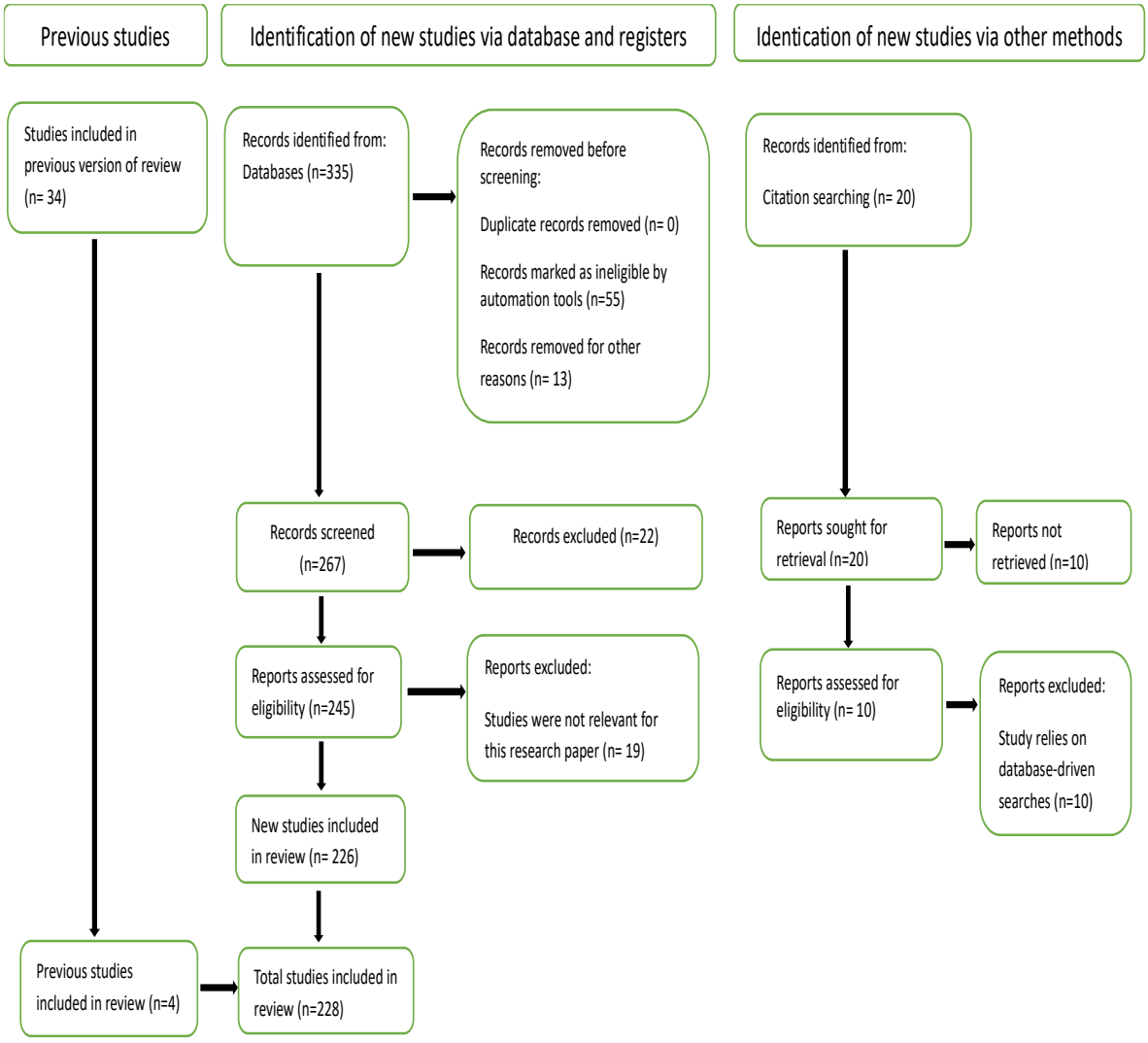

Figure 1. PRISMA Framework

Source: Author's own development

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4 DATA ANALYSIS

4.1 Annual Scientific Production

The publishing trend from 2006 to 2025 indicates a consistent and notable increase in academic interest in humanitarian logistics. Between 2006 and 2014, research production was negligible, averaging less than 5 articles annually. An evident rise commenced in 2015, culminating in a pronounced peak in 2022, which documented the highest quantity of publications, exceeding 35 articles. This increase presumably indicates the worldwide academic reaction to recent significant disruptions, particularly the COVID-19 epidemic. Despite a minor decrease in 2023 and 2025, the overarching trend highlights persistent research vigor, particularly after 2016, signifying the increasing academic and practical significance of humanitarian supply chains and disaster management subjects.

4.2 Journal-wise Distribution of Publications

The distribution of articles across journals highlights the most notable publications in the fields of humanitarian logistics and supply chain management. The Journal of Humanitarian Logistics and Supply Chain Management is prominent with 38 articles, reflecting its specialization and pivotal role in spreading research in the field. The Annals of Operations Research follows with 23 pieces, demonstrating the incorporation of operational research methodologies in humanitarian investigations.

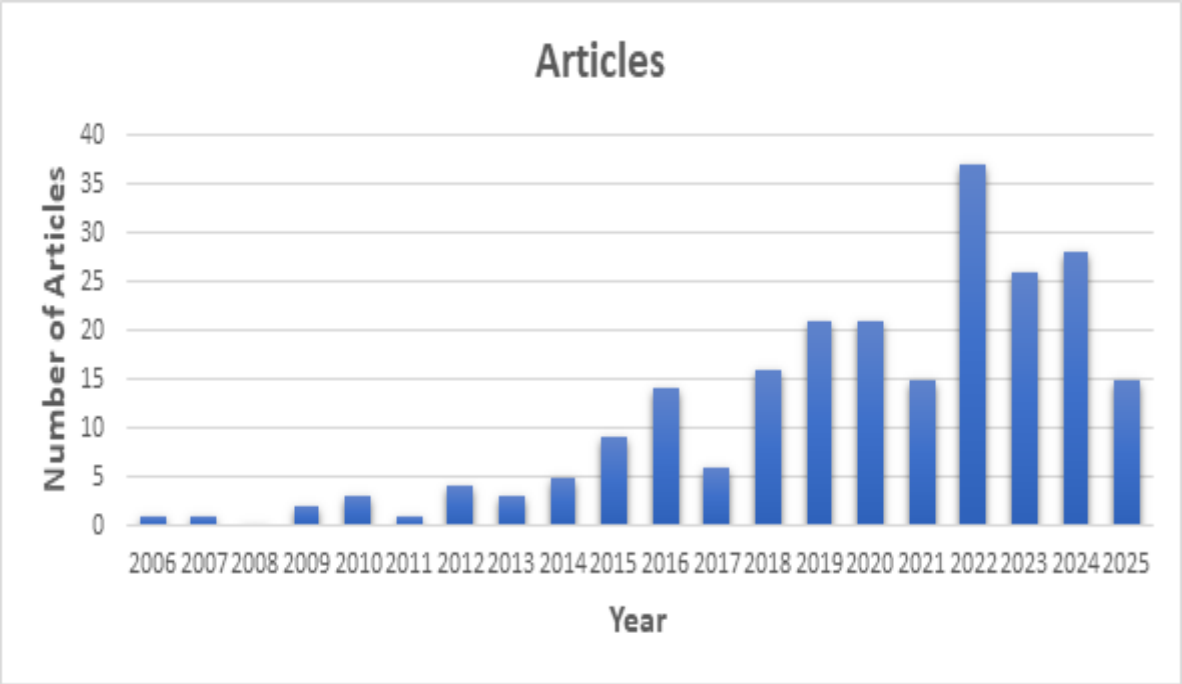

Figure 2: Annual Scientific Production

Source: Author's own development

Additional significant publications are Benchmarking and Springer Proceedings in Business and Economics (8 papers each), as well as Production Planning and Control (7 articles), underscoring multidisciplinary contributions from management, economics, and planning fields. Journals like Sustainability (Switzerland) and Socio-Economic Planning Sciences enhance the debate by highlighting the growing significance of sustainable and socio-economic viewpoints in humanitarian supply chains. This distribution highlights the increasing scholarly interest in specialized and interdisciplinary journals.

4.3 Countries' Scientific Production

The bar graph depicts the frequency distribution of research contributions in humanitarian logistics and supply chain management across ten nations, highlighting significant discrepancies in global academic involvement. The frequency of 126 distinguishes India, indicating its preeminent position in

research output or academic focus within this field. This figure is over twice that of the United Kingdom, which ranks second with 67 contributions, followed by the United States with 47. France and Iran each have 46 publications, but Brazil has 39. The remaining nations, Finland (24), South Africa (21), Italy (19), and Pakistan (19), exhibit somewhat lower levels of engagement. The distribution reveals a distinct geographic disparity, with India positioned as a pivotal center for research in humanitarian logistics and supply chain management.t. This dominance may indicate the nation's significant vulnerability to natural catastrophes, emphasis on disaster management policies, engaged academic institutions, or increasing interest in supply chain resilience. The concentration of research in select countries, notably India, highlights the necessity for expanded international collaboration and more inclusive global participation in tackling humanitarian issues via supply chain innovations.

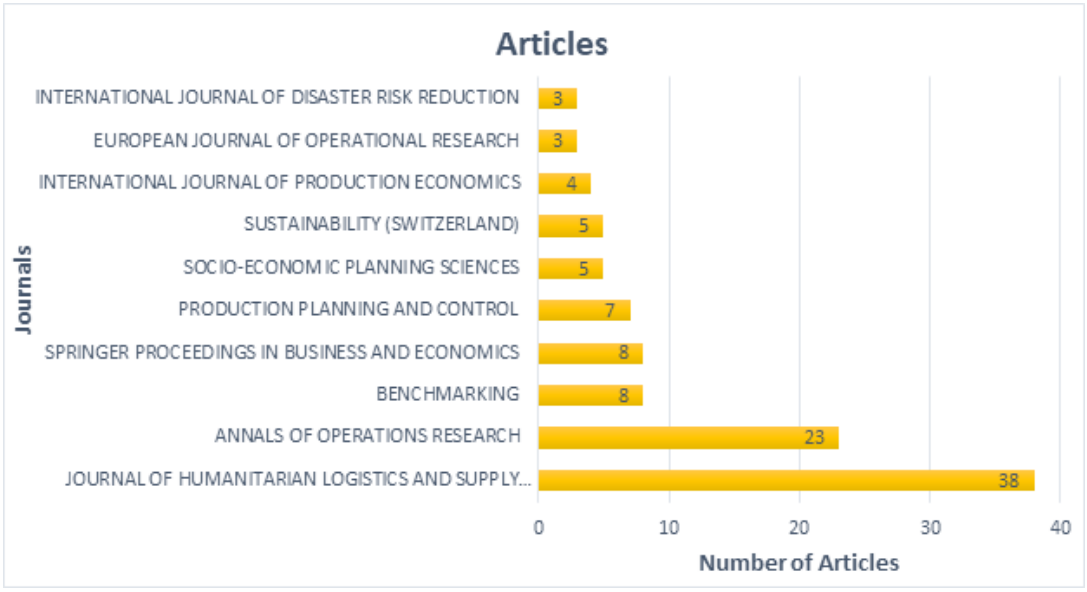

Figure 3: Journal-wise Distribution of Publications

Source: Author's own development

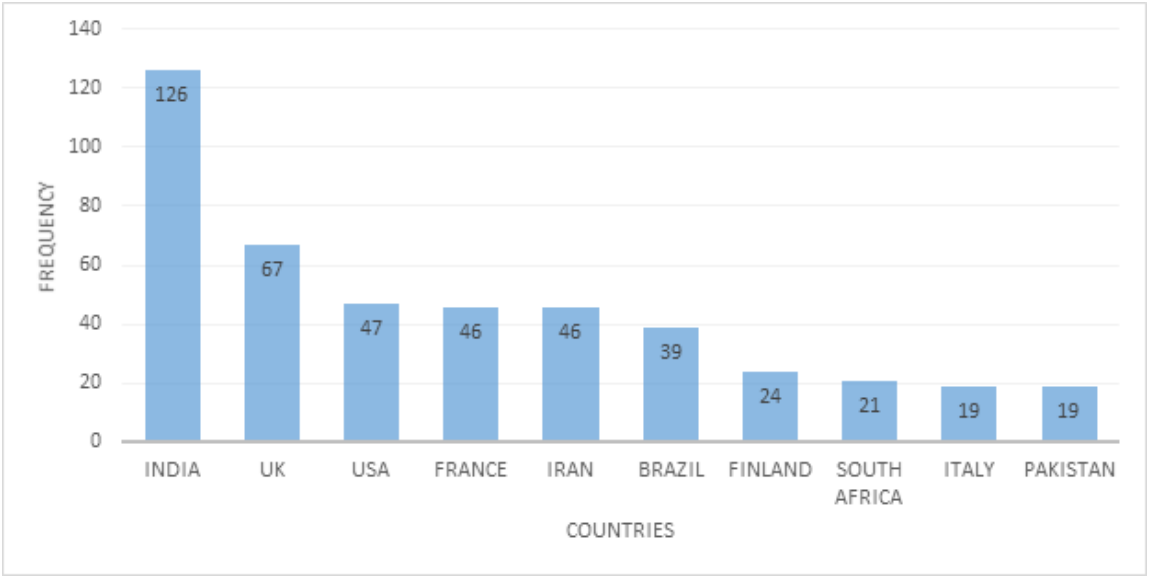

Figure 4: Countries' Scientific Production

Source: Author's own development

4.4 LDA-Derived Themes in Humanitarian Logistics

The application of Latent Dirichlet Allocation (LDA) topic modelling on humanitarian logistics literature revealed five predominant themes:

1. **Analytical Approaches in Humanitarian Logistics:** This theme highlights the use of analytical and interpretive methodologies, such as structural modelling, fuzzy logic, and cost analysis, to optimize humanitarian supply chains. Terms such as "analysis", "fuzzy", and "modelling" signify the quantitative focus of study in this domain.
2. **Disaster Management and Supply Chain Trust:** This theme emphasises the operational dynamics in catastrophe scenarios, particularly regarding supply chain coordination, trust, and information dissemination. The prevalence of phrases such as "trust", "disaster", and "information" signifies a scholarly focus on developing robust and reliable networks amidst uncertainty.
3. **Humanitarian Operations and Relief Management:** This theme emphasises realistic field operations, including logistics coordination, catastrophe response, and relief distribution. Significant buzzwords like "relief", "operations", and "coordination" signify the strategic implementation of humanitarian missions.
4. **Strategic Perspectives in Humanitarian Supply Chains:** This theme examines overarching management and planning techniques, focusing on governance, review studies, and catastrophe preparedness. Common terminology such as "management", "strategic", and "review" indicate a macro-level and policy-focused study trajectory.
5. **Sustainability and Regional Obstacles in Humanitarian Systems:** This theme addresses sustainability issues and region-specific obstacles, particularly in Africa, relating to food, technology, and infrastructure. Terms like "sustainability", "technology", and "Africa" exemplify the increasing scholarly focus on local adaptation and sustainable practices.

These themes collectively illustrate the transdisciplinary essence of humanitarian logistics research, encompassing operational analysis, strategic management, and regional sustainability issues.

4.5 Year-wise Distribution of LDA-Derived Themes (2006–2025)

Research interests in humanitarian logistics have changed over time, as evidenced by the temporal distribution of papers among the five LDA-derived topics. Theme 4: Strategic Perspectives in Humanitarian Supply Chains has constantly garnered scholarly attention, with a significant rise in publications post-2015, culminating in a peak of over 20 documents in 2022. Theme 3: Humanitarian Operations and Relief Management gained traction after 2018, indicating a shift in operational focus. Theme 1: Analytical Methodologies in Humanitarian Logistics Theme 2: Disaster Management and Supply Chain Trust emerged intermittently; however, both experienced significant growth in 2021–2022, corresponding with the global response to COVID-19 and its repercussions. Theme 5: Sustainability and Regional Challenges in Humanitarian Systems has recently emerged, attracting growing academic interest since 2020, which indicates an increased concern for regional inequities and the long-term viability of humanitarian systems. The graph depicts a dynamic evolution in humanitarian logistics research, corresponding with real-world disasters and strategic requirements.

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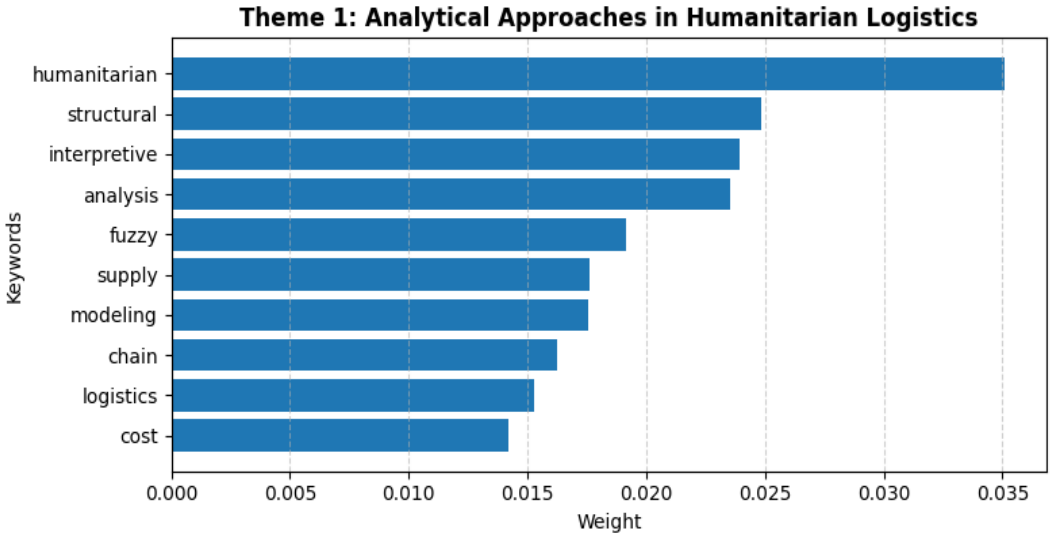

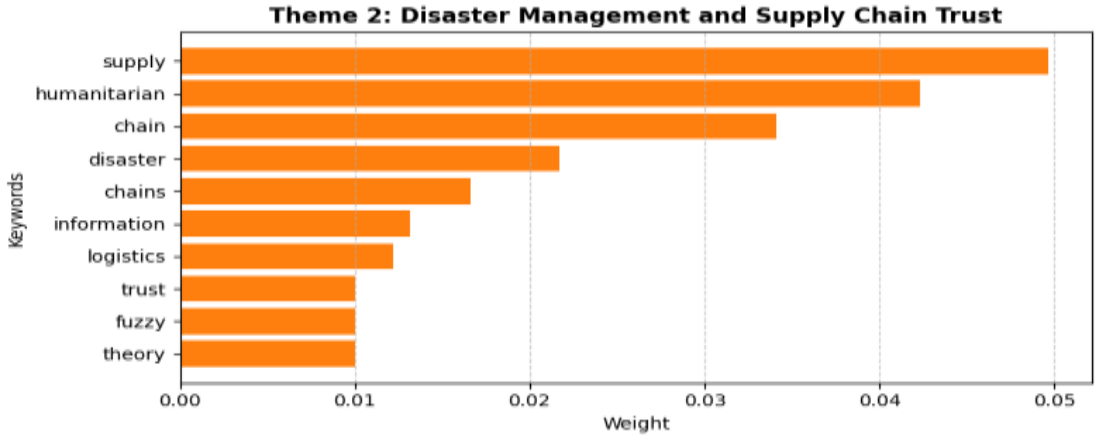

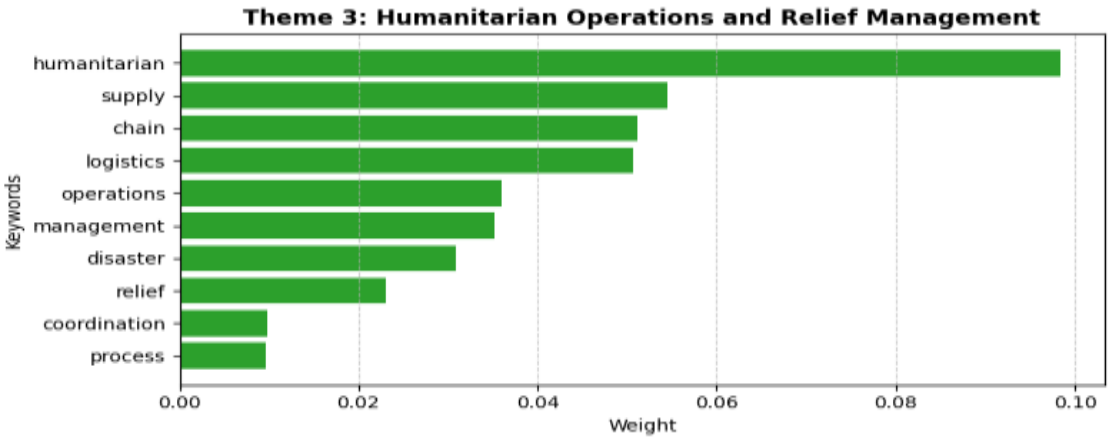

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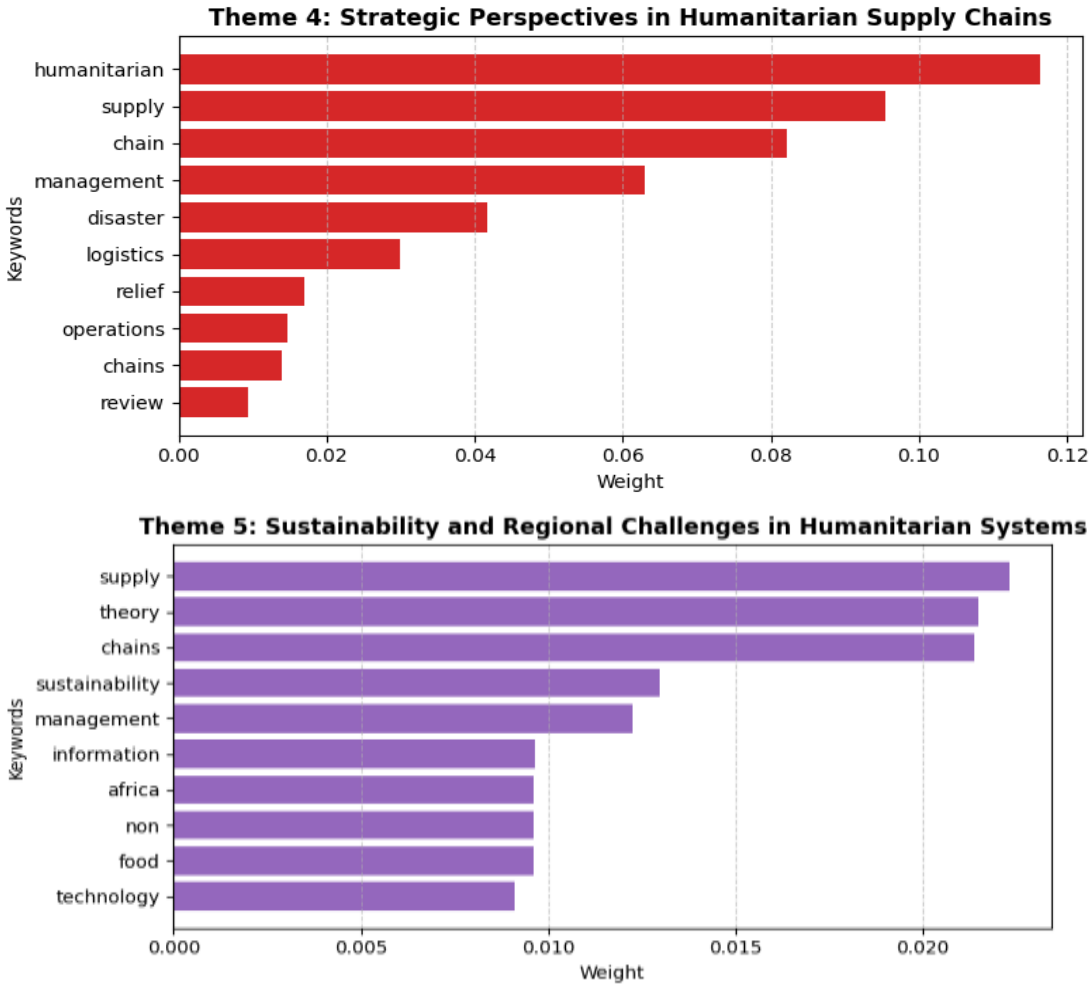

Figure 5,6,7,8,9 : Key Themes

Source: Author's own development

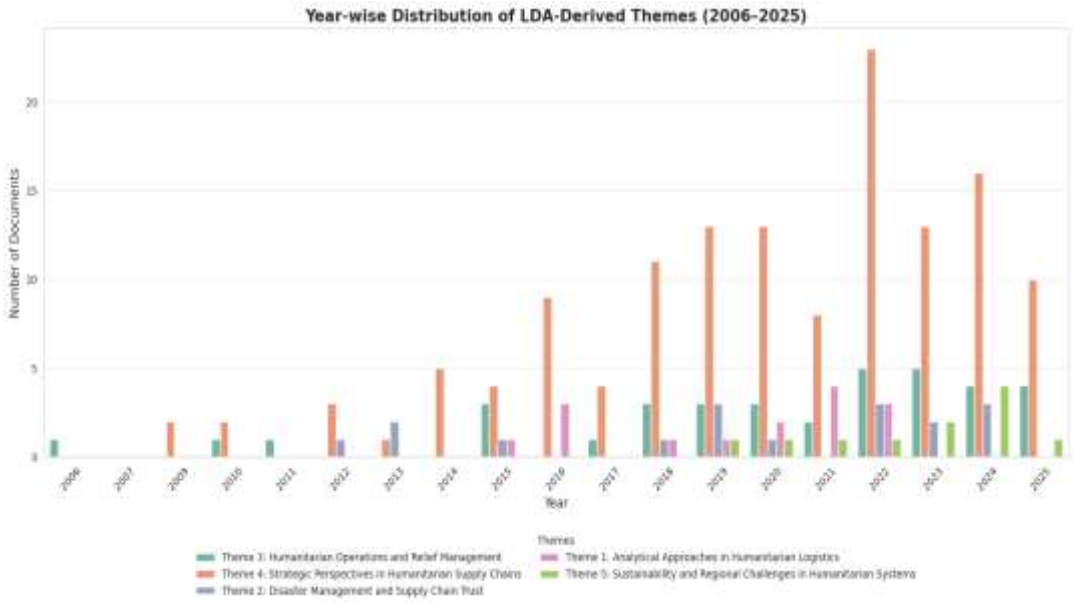

Figure 10: Year-wise Distribution

Source: Author's own development

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4.6 Word Cloud from Author Keywords

The word cloud created using author keywords provides a visual overview of significant research areas in humanitarian logistics literature. The predominant terms include “humanitarian”, “supply”, “chain”, “logistics”, “disaster”, and “management”, which encapsulate the fundamental framework and issues of the field. Moreover, terminology like “relief”, “coordination”, “preparedness”, “performance”, and “technology” signify the operational and strategic aspects examined by researchers. Methodological terms such as “fuzzy”, “structural”, “interpretive”, “modelling”, and “optimization” indicate a robust analytical approach to resolving logistical issues. Moreover, emergent issues such as "sustainability", "blockchain", "innovation", "resilience", and "COVID" indicate expanding themes that address global disruptions and technological progress. The term "landscape" highlights multidisciplinary involvement in crisis response, system optimization, and strategic planning within humanitarian supply chains.

Figure 11: Word Cloud

Source: Author’s own development

4.7 Bibliographic Coupling Among Authors

The bibliographic coupling map organizes humanitarian logistics and supply chain management researchers by common references into color-coded clusters to represent topic coherence. Primary humanitarian logistics and disaster operations researchers are in the red cluster. Maria Besiou, Cyril Foropon, Rameshwar Dubey, Srijit Bag, Mohammad Hossein Zarei, Pravin Kumar, and Ruth Banomyong are notable authors. These authors focus on logistical coordination, disaster relief, and humanitarian supply chain resilience, referencing similar core works. Agnieszka Behli, Liay Ting Try, Adriana Leiras, Gurav Negi, and V. G. Venkatesh support this cluster's focus on humanitarian operational research and performance. The green cluster includes Gaurav Kabra, Akhilesh Barve, A. Ramesh, Jijo John, and Dwijendra K. Yadav. This group may combine humanitarian and commercial logistics perspectives on supply chain strategy and performance. Frameworks, performance indicators, and policy methods may be theirs. The blue clusters focus on more niche or emerging themes. It

includes Uttam Kumar Bera and Amir Aghsami, who study digital transformation, simulation models, and regional humanitarian supply chain management. Their limited but strong relationship indicates a distinct study path. Multidisciplinary connections Tina Comes and Laura Laguna Salvado are in purple. Their bibliographic links reveal numerous groupings, showing their study connects resilience analytics, risk management, and policy implications among field issues. The yellow cluster includes famous people, including Peter Tatham, Ira Haavisto, Gyöngyi Kovács, and Graham Heaslip. The group focuses on sustainability, ethical logistics, and humanitarian applications. Their strong internal cohesiveness and citation methods emphasize practitioner-focused and socially responsible logistics. These clusters provide the discipline's intellectual foundation, each contributing to humanitarian logistics and supply chain research subdomains.

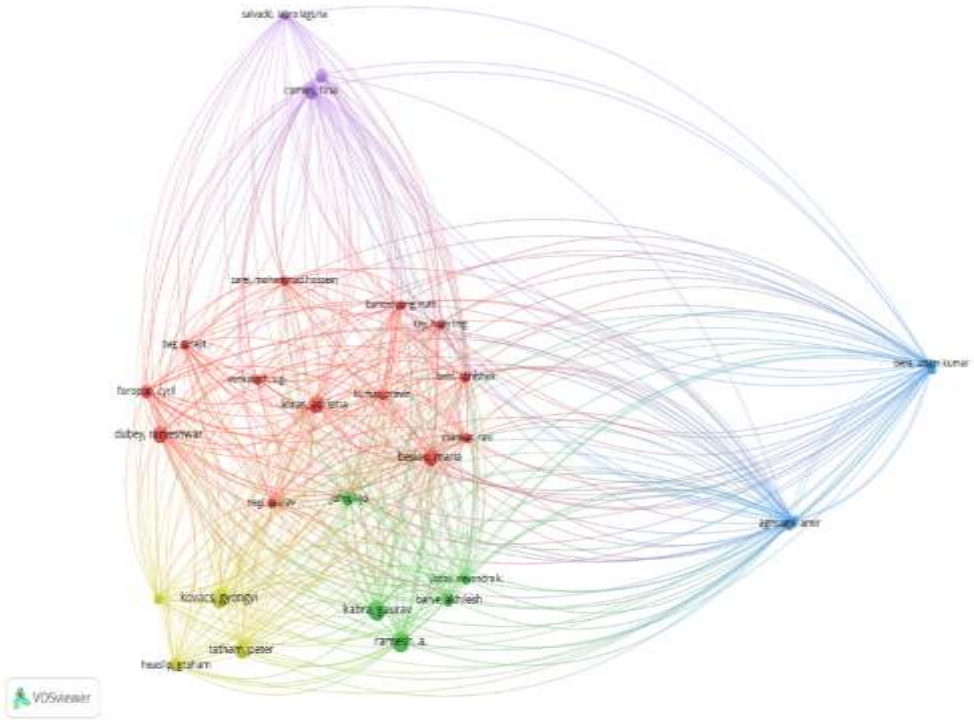

Figure 12: Bibliographic Coupling Among Authors

Source: Author's own development

4.8 Co-Occurrence Network of Author Keywords

VOSviewer generated a co-occurrence network of author keywords in humanitarian logistics and supply chain management. It illustrates the frequency with which terms co-occur in publications, highlighting important research topics and their interconnections. The predominant keywords include "humanitarian supply chain", "humanitarian logistics", and "disaster management", signifying their frequent usage and co-occurrence with numerous other terms. Central concepts are associated with thematic clusters. The blue cluster encompasses keywords such as "disaster relief operations", "relief operations", "literature review", and "performance measurement" pertaining to operations and performance evaluation. The red cluster underscores catastrophe response logistics and coordination via "humanitarian operations", "disaster relief", and "logistics". The green cluster encompasses "disaster response", "humanitarian", "COVID-19", and "swift trust", signifying a focus on emergency response, trust development, and pandemic research. The yellow cluster includes "collaboration", "information sharing", and "disasters", signifying coordination and communication within humanitarian supply chains. The purple cluster connects "blockchain", "systematic literature review", and "multi-objective optimization", indicating novel technologies and methodologies. This map illustrates the primary study

topics, themes, and trends within humanitarian logistics literature.

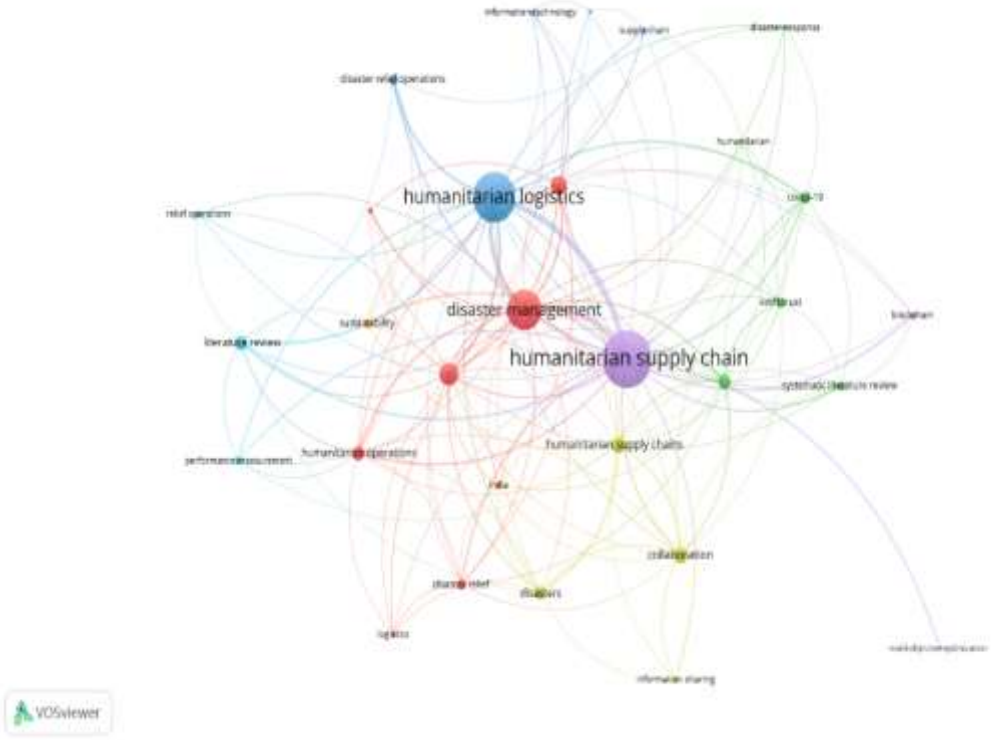

Figure 13: *Co-Occurrence Network of Author Keywords*

Source: *Author's own development*

5 DISCUSSION

The study of humanitarian supply chain management (HSCM) over the last twenty years shows that it is a growing field that changes in response to global events like natural disasters, wars, pandemics, and climate issues. This growth is clear from the large rise in research published since 2015, with 2022 being the year with the most publications. This rise in research is linked to major global problems, especially the COVID-19 pandemic, which created unique challenges for humanitarian logistics and increased interest in the topic. The maturation is evident in the substantial increase in scholarly production from 2015 onwards, with 2022 representing the peak volume of publications. This increase corresponds with significant global disruptions, notably the COVID-19 pandemic, which prompted unparalleled challenges for humanitarian logistics and, as a result, intensified research interest in the field. The bibliometric analysis of the study indicates that humanitarian logistics is increasingly attracting academic interest and is progressing towards more interdisciplinary, solution-oriented, and technology-enhanced methodologies.

This study's significant contribution is the identification of five predominant themes in humanitarian supply chain literature via Latent Dirichlet Allocation (LDA). Each subject signifies a unique study emphasis while jointly highlighting the intricacy and interrelation of HSC systems. The initial theme of analytical techniques in humanitarian logistics underscores the academic community's significant dependence on optimization, simulation, and decision-support systems to improve efficiency in volatile contexts. This stream is predominantly characterized by models that utilize fuzzy logic, interpretive structural modelling, and cost-benefit analysis. These methods are especially pertinent due to the significant uncertainty in disaster zones, where prompt judgements frequently determine life or death outcomes. Nevertheless, numerous analytical models remain theoretical and are infrequently implemented or evaluated in actual humanitarian emergencies, indicating a disparity between academic

modelling and practical applications.

The second theme Centres on catastrophe management and trust in supply chains. The literature underscores the necessity of establishing trust and guaranteeing transparency among supply chain participants, including donors, NGOs, governments, and local partners, for the effective delivery of aid. In catastrophe situations, distrust and misinformation can significantly hinder logistics operations. This subject is more pertinent, as humanitarian supply chains globalize and encompass a varied range of players with differing interests and capacities. The third theme, humanitarian operations and relief management, focuses on tactical and operational challenges, including last-mile delivery, warehousing, transportation, and coordination in resource-constrained environments. An essential observation is the operational vulnerability of humanitarian systems in remote or politically unstable areas, which requires flexible, decentralized logistics networks bolstered by local stakeholders.

The fourth theme, strategic perspectives in humanitarian supply chains, addresses overarching governance and planning frameworks. This includes donor coordination, regulatory adherence, disaster preparedness frameworks, and strategic decision-making procedures. This research typically embraces a policy-orientated perspective, examining how macro-level planning enhances micro-level efficiency and effectiveness. Nonetheless, the literature underscores significant fragmentation, as numerous organisations lack standardized protocols or interoperable systems, especially across borders or sectors. This results in inefficiencies, redundant efforts, and donor weariness.

The most urgent and developing theme identified is sustainability and regional challenges. Despite the triple bottom line (social, environmental, and economic) being a well-established structure in commercial supply chains, its implementation in humanitarian situations is patchy. Much literature predominantly emphasises social sustainability, guaranteeing equitable aid allocation, safeguarding disadvantaged groups, and fostering inclusive policies. Nonetheless, environmental sustainability is markedly under-represented. There is a significant lack of research on emissions from transportation, sustainable packaging, and waste management in humanitarian activities. The rising prevalence of climate-related disasters signifies a significant deficiency in research and policy. Furthermore, regional analyses indicate that nations in Africa, South Asia, and Latin America encounter distinct issues related to infrastructure, financing, and governance; nevertheless, global frameworks frequently lack the adaptability to accommodate these contextual variations.

The discourse also highlights the significance of digital technologies for revolutionizing HSCM. Technologies such as artificial intelligence, blockchain, drones, and the Internet of Things are progressively suggested as means to improve traceability, resource distribution, and operational transparency. The research illustrates a scenario of "digital optimism"; although these tools hold promise, their effective adoption is significantly hindered by reasons including inadequate internet connection, substandard infrastructure, insufficient digital literacy, and erratic donor assistance. The lack of standardized performance measures and centralized data repositories hinders the assessment of technology deployment success. Investment in digital ecosystems designed for the limitations of humanitarian contexts is essential.

This study uncovers a troubling trend: the theoretical foundation of HSC research is superficial and disjointed. Despite referencing concepts like the Resource-Based View (RBV), Institutional Theory, Stakeholder Theory, and Contingency Theory, their implementation often lacks depth. Most research concentrates on empirical or descriptive analysis, without a foundation in solid conceptual frameworks. This theoretical gap constrains the generalizability of results and the formulation of predictive or explanatory models. Future research must bridge the divide between theory and practice while developing integrative models that consider technological, social, economic, and environmental factors in humanitarian contexts.

6 CONCLUSION

This study's findings reveal significant insights into the present condition and future trajectory of

humanitarian supply chain management. A triadic methodological approach comprising systematic literature reviews, bibliometric mapping, and subject modelling facilitated the identification of significant trends, difficulties, and gaps in the literature. HSCM is an emerging and increasingly essential domain, influenced by global crises and the necessity for effective, equitable, and sustainable help delivery systems. Despite the rise in academic output, the discipline continues to contend with three fundamental challenges: insufficient theoretical integration, inadequate environmental considerations, and restricted practical use of sophisticated digital technologies. A significant result is that social sustainability has appropriately become the focal point in humanitarian logistics discussions. Equity, inclusivity, and safeguarding marginalised groups are universally acknowledged as the ethical foundations of any humanitarian effort. Nonetheless, the evidence indicates that these goals are rarely consistently implemented in practice due to obstacles in funding, coordination, and governance. At the same time, environmental sustainability remains largely overlooked in most academic discussions, despite its growing importance in areas prone to disasters. Humanitarian logistics must rectify this disparity to achieve genuine sustainability.

The incorporation of digital technology into humanitarian supply chains, however intriguing, has not yet fulfilled its potential. People frequently emphasize the potential of blockchain, artificial intelligence, drones, and the Internet of Things to enhance transparency, reduce lead times, and improve inventory management. Nonetheless, these instruments predominantly remain aspirational in the majority of field operations. The conclusion is to not forsake these advances but to invest in contextually suitable digital solutions bolstered by capacity building and infrastructural advancement. Moreover, real-time data analytics and performance monitoring systems should be standardized to facilitate flexible decision-making in dynamic crisis contexts. HSCM should progress beyond arbitrary allusions to current ideas and focus on creating integrated conceptual models that accurately represent the distinct realities of humanitarian situations. The discipline requires a more stringent methodology that integrates operational methods with theoretical frameworks, allowing both practitioners and scholars to leverage a common knowledge repository. By doing so, HSCM can evolve from a reactive function into a proactive system that predicts, prepares for, and mitigates the effects of disasters.

This study ultimately suggests that humanitarian supply chains must be redefined as flexible, inclusive, technologically advanced, and sustainability-orientated ecosystems to achieve true effectiveness. This reconceptualization must transpire at both the theoretical and operational levels, bolstered by multi-stakeholder collaborations, varied funding structures, and localized implementation techniques. By addressing the observed deficiencies and implementing the proposed strategies, humanitarian organisations, researchers, and policymakers can enhance the resilience and equity of global disaster response systems.

7 SOCIAL IMPLICATIONS

This study has considerable social ramifications. From a societal standpoint, future humanitarian supply chains must emphasize equity, inclusivity, and local engagement. Assistance models must be realigned to address the specific needs of marginalized populations, such as women, children, the elderly, and individuals with disabilities. A critical necessity exists for the establishment of community-orientated logistics systems that engage local stakeholders in both the planning and execution phases, thereby improving the pertinence and adaptability of relief operations. Localized logistics planning, incorporating regional warehouses and community volunteers, can markedly diminish lead times and reliance on central models. Moreover, the ethical implementation of technologies, particularly regarding data protection and informed consent, should serve as a fundamental principle to avert the intensification of existing disparities.

8 MANAGERIAL IMPLICATIONS

The study presents various actionable insights for managers and decision-makers. Humanitarian agencies and NGOs must develop performance monitoring methods specifically designed for crisis settings. Real-time dashboards and automated tracking systems can improve visibility, coordination, and

accountability. Technological solutions, like blockchain for transparent fund allocation, IoT for real-time asset monitoring, and AI for demand forecasting, ought to be integrated into humanitarian logistics planning. Nevertheless, these necessitate concurrent expenditures in human capital. Capacity-building initiatives must educate logistics professionals, field agents, and local authorities in digital competencies and data literacy. The uncertain nature of donor funding means that different ways to get money need to be explored, such as impact bonds, public-private partnerships, and logistical support focused on corporate social responsibility (CSR). These tactics can assist humanitarian organisations in stabilizing operations and efficiently scaling efforts during extended emergencies.

9 LIMITATIONS

This study, despite its thorough methodology, has significant shortcomings. The analysis is confined to the Scopus database, which, while comprehensive, omits pertinent literature from other significant databases such as Web of Science and regional repositories. This constraint may lead to a limited portrayal of global viewpoints, particularly in non-Western or marginalized areas. The analysis is limited to English-language publications, which may result in a language bias that neglects significant research published in local languages, especially from Latin America, East Asia, and the Middle East. The methodological framework is predominantly bibliometric and lacks qualitative insights from field research or practitioner reports, which are essential for comprehending operational realities in crisis contexts.

Furthermore, environmental sustainability is considerably underexamined in the reviewed literature. Subjects like sustainable packaging, carbon footprint assessment, and waste management continue to be marginal, despite their significance in disaster-prone and ecologically vulnerable areas. A significant constraint exists in the disparity between technological optimism and practical viability. The literature regularly promotes AI, blockchain, and IoT but frequently neglects the infrastructural, economic, and skill-related obstacles that hinder their implementation in practical humanitarian contexts. In the end, even though many theories are mentioned, most studies lack a thorough use of these theories, resulting in a weak overall understanding. The exclusion of practitioner perspectives, such as those from local NGOs, logistical volunteers, and community leaders, diminishes the practical significance and contextual depth of the evaluation .

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