

## Mapping the intellectual core of quality in supply chains: A bibliometric analysis of total quality management and supply chain management

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### ABSTRACT

Amidst rivalry and intricate value networks the relationship between Supply Chain Management (SCM) and Total Quality Management (TQM) has emerged as a fundamental element of contemporary operational strategies and is essential for securing long-term competitive benefits. This bibliometric analysis methodically charts the framework and research directions within this crucial overlap. Drawing on a collection of 371 publications from the Scopus database, this study offers an in-depth summary of the discipline's progression from 1994, to 2025. The study indicates a developed research area that has seen a significant rise in scholarly attention with the number of publications increasing more than threefold since 2017. Major contributions are regionally clustered with the USA, India and China standing out as the leading contributors. A thematic keyword map uncovers the fields framework: 'Total Quality Management' and 'Supply Chain Management' serve as central driving themes propelling the research. These are underpinned by fundamental themes, like 'sustainability'. The analysis also indicates an evolution in terminology, with older concepts like 'just in time' now appearing as declining themes, superseded by more integrated frameworks. This survey serves as a valuable resource for researchers and practitioners by providing a data-driven landscape of the field's foundational pillars, dominant topics, and future research trajectories.

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## 1. Introduction

Within the realm of management few frameworks have wielded as much impact as Supply Chain Management (SCM) and Total Quality Management (TQM). For years these two significant approaches frequently operated alongside each other. SCM outlined the strategy for overseeing the movement of products, data and finances from the initial raw material provider to the end consumer (Erengüç et al., 1999). TQM on the other hand provided a fundamental ideology for integrating excellence, ongoing enhancement and customer orientation into the core structure of a company (Talib et al. 2011). Although they originated separately, the demands of a competitive global marketplace, intricate worldwide systems and an immediate need for increased sustainability have led these two approaches to merge (Flynn & Flynn 2005).

Fundamentally Supply Chain Management represents a paradigm that surpasses the usual boundaries of logistics and purchasing. It entails the oversight of connections, data exchanges and financial dealings among various network participants, such as suppliers, intermediaries and customers (Chandra & Kumar 2000). This encompasses more than the physical transfer of products; it adopts a comprehensive strategy focused on aligning supply with demand minimizing overall system expenses and increasing value for the ultimate consumer. The primary objective of SCM is to establish an integrated and flexible network capable of rapidly adapting to market fluctuations thus generating a substantial competitive edge (Suryanto et al., 1999).

At its core Total Quality Management represents a dedication to outstanding performance that touches all tiers within a company. It is founded on a collection of principles, such as a steadfast attention to the customer enabling every employee, a work approach centered on processes and a pledge to ongoing enhancement, commonly known as Kaizen (Kannan & Tan

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2005; Zaid & Sleimi 2023). Depending on end-stage inspection to detect flaws TQM incorporates quality accountability into every task utilizing data-based tools and statistical techniques to oversee and enhance processes proactively. The approach focuses not on delivering a flawless product but on fostering a culture where quality is a collective duty, for all involved.

The real strength of their integration is found in this supportive inside-out dynamic. Essentially TQM guarantees that the "foundation is solid" by enhancing operations, minimizing variability and promoting a culture of high standards. Nevertheless, these internal advantages can be swiftly compromised by issues in parts of the supply chain like subpar materials from a supplier or slow delivery from a logistics provider. This is the point at which SCM acts as a link applying quality management principles outwardly to collaborators throughout the network (Foster Jr & Ogden 2008). By implementing methods such as supplier development, joint planning and common quality metrics SCM enables a company to oversee quality beyond its boundaries covering the entire process from start to finish.

Lately this collaboration has evolved significantly propelled by two worldwide trends: the demand for sustainability and the advancement of digital technologies. The fundamentals of TQM including waste reduction and efficient processes align seamlessly with Green Supply Chain Management (GSCM) offering an established set of methods for minimizing environmental effects throughout the value chain (Dubey et al., 2015). At the time the emergence of Industry 4.0 innovations, including the Internet of Things (IoT) big data analytics and blockchain presents unparalleled chances to oversee quality in real-time improve traceability and facilitate effortless data exchange, among supply chain collaborators thus allowing a more intelligent and agile integration of SCM and TQM (Sarangi & Ghosh 2024).

Nonetheless accomplishing this integration presents a significant strategic hurdle. It demands breaking down organizational barriers and cultivating a culture of trust and openness that spans across company borders. Within the organization divisions, like procurement, production and quality control need to synchronize their goals and performance indicators. Externally, the journey demands building robust supplier-buyer relationships grounded in mutual benefit and open communication, as a reluctance to share critical information on costs or process capabilities can quickly derail collaborative quality initiatives (Gunawan et al., 2024). This entire endeavor must be supported by significant investments in integrated information technology systems capable of providing the real-time visibility needed to manage quality on a network-wide scale (Basana et al., 2024).

Ultimately the drive to surmount these challenges lies in achieving enhanced -faceted performance. Academic research has reliably shown that the combined impact of SCM and TQM efforts directly affects results (Shaikh et al., 2024). Whereas initial studies mostly emphasized indicators, like cost savings, defect levels and delivery times the focus has expanded significantly. Modern research examines how this combination influences business success encompassing financial stability and competitive standing. Moreover, as corporate responsibility gains significance the emphasis has broadened to include the "bottom line," assessing how SCM and TQM approaches impact not just financial gain but also ecological conservation and social welfare (Huang et al. 2024).

The rationale for combining SCM and TQM is both straightforward and significant. Advocates claim that quality cannot simply be checked after production is complete; it needs to be planned, controlled and nurtured throughout every stage of the supply chain (Kaur et al. 2019). The internal process-oriented approach of TQM acts as the driving force behind excellence whereas SCM offers the external connections and cooperative structure necessary to push that excellence past the company's boundaries (Kaynak & Hartley 2008). This combination is more than conceptual. Studies have repeatedly demonstrated that companies effectively integrating these methods can build a competitive edge (Kannan & Tan 2005) resulting in improved operational, financial and also environmental outcomes (Jum'a et al., 2024).

Although there is increasing agreement on the importance of combining SCM and TQM, a comprehensive overview of the discussion on this subject is still hard to find. How has this field developed over the years? Who are the intellectual pioneers driving the discourse? What fundamental themes characterize its history, current state and prospects? This bibliometric analysis seeks to address these inquiries by charting the scholarly landscape where SCM and TQM intersect. Through examining a collection of 371 academic articles, from the Scopus database our research pursues several key questions: We chart the development path of the field and its geographical distribution. We ascertain the leading authors, journals and works that act as its cornerstones. We analyze the thematic groups to grasp the focal points of researchers and ultimately, we expose the conceptual frameworks that demonstrate how these concepts interlink.

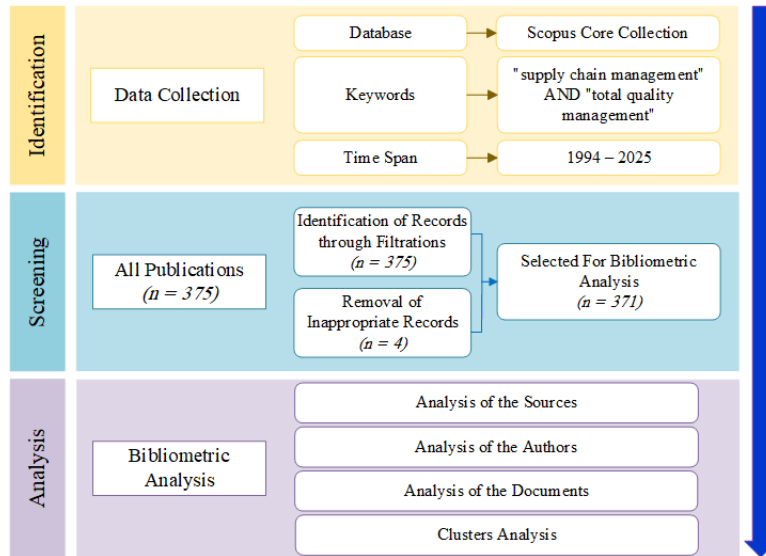
In order to offer an organized response to these inquiries the rest of this document is arranged into several main segments. We start by explaining the setup, in Section 2 describing the data gathering approach and the analytical methods applied to guarantee the research is thorough and can be replicated. The core of our examination is shown in Section 3 where we initially trace the field's performance illustrating its development and pinpointing the authors, publications and nations leading the discussion. The focus of the analysis then moves from performance metrics to ideas illustrating the framework of the discipline using science mapping methods such as word clouds and thematic maps. In Section 4 we take a perspective on the data to examine the wider significance of these results analyzing the principal trends and considering their impact on

both scholars and industry professionals. Lastly Section 5 wraps up the paper by recapping our contributions recognizing the study's constraints and suggesting a data-informed roadmap for upcoming research, in this evolving field.

This analysis will provide a consolidated overview of the state-of-the-art, serving as a foundational reference for scholars and practitioners aiming to contribute to this dynamic and impactful field of study.

## 2. Methodology

The data for this bibliometric analysis was retrieved from the Scopus database, a comprehensive, curated abstract and citation database of peer-reviewed literature. The data collection was conducted in November 2025. The search was designed to capture documents at the direct intersection of the two fields, using the following query string in the 'Article title, Abstract, Keywords' fields: ("supply chain management" AND "total quality management"). This query yielded a total of 371 documents published between the years 1994 and 2025. The complete bibliographic dataset was exported, including all available metadata such as titles, author names, affiliations, abstracts, author and index keywords, and cited references.



**Fig. 1.** Flow chart of the Research Process

The exported data was analyzed using a quantitative bibliometric approach. The analytical workflow was carried out using the bibliometrix R package (Aria & Cuccurullo, 2017), facilitated by its interactive web-based interface, Biblioshiny. The methodology was structured into two primary stages:

- 1) **Performance Analysis:** This stage focuses on quantifying the productivity and impact of the main actors and publications within the research field. It addresses questions related to “who, where, and when”.
- 2) **Science Mapping:** This stage aims to visualize the conceptual and intellectual structure of the field. It uses network analysis techniques to uncover the relationships between keywords, authors, and documents, addressing questions about “what” research is being done and “how” themes are connected.

The specific methods employed in each stage are detailed in the following subsections.

### 2.1 Performance Analysis

To evaluate the performance and key characteristics of the SCM-TQM research landscape, several core metrics were calculated and visualized.

**Annual Scientific Production:** The number of documents published per year was analyzed to map the historical growth and evolution of the research field. This metric is essential for identifying the field's lifecycle, from its inception to periods of accelerated growth, and for contextualizing its current state.

**Country Scientific Production:** The geographic distribution of research was determined by analyzing the country affiliation of the corresponding author for each document. This analysis identifies the leading countries contributing to the field, providing insights into global research hubs and potential collaborative networks. The results were visualized on a world map to highlight productivity hotspots.

**Most Influential Sources and Authors:** To identify the key publication outlets and researchers, the dataset was ranked by the most relevant sources (journals) and the most productive authors based on the number of publications within the dataset.

## 2.2 Science Mapping

To uncover the conceptual structure and dominant research themes within the SCM-TQM domain, a science mapping analysis was performed. Specifically, a thematic analysis based on keyword co-occurrence was conducted.

**Keyword Co-occurrence Analysis:** This method identifies and visualizes the primary research themes by analyzing how often author keywords appear together in the same documents. Keywords that frequently co-occur are considered to be conceptually related, and clusters of these keywords represent distinct thematic areas.

**Thematic Map:** The results of the keyword co-occurrence analysis were plotted on a two-dimensional thematic map, as proposed by Cobo et al. (2011). This map positions thematic clusters in a four-quadrant space based on two metrics:

**Centrality (Relevance):** Measured by the degree of interaction of a cluster with other clusters. High centrality indicates a theme's importance in the overall research structure. This is plotted on the x-axis.

**Density (Development):** Measured by the internal strength of the links within a cluster. High density indicates a theme's level of development and coherence. This is plotted on the y-axis.

The four quadrants are interpreted as follows: **Motor Themes** (upper-right: high centrality and density), which are well-developed and important; **Basic Themes** (lower-right: high centrality, low density), which are foundational and transversal; **Niche Themes** (upper-left: low centrality, high density), which are specialized and well-developed; and **Emerging or Declining Themes** (lower-left: low centrality and density), which are marginal or represent disappearing/nascent topics. This visualization provides a dynamic snapshot of the field's core topics, foundational concepts, and intellectual evolution.

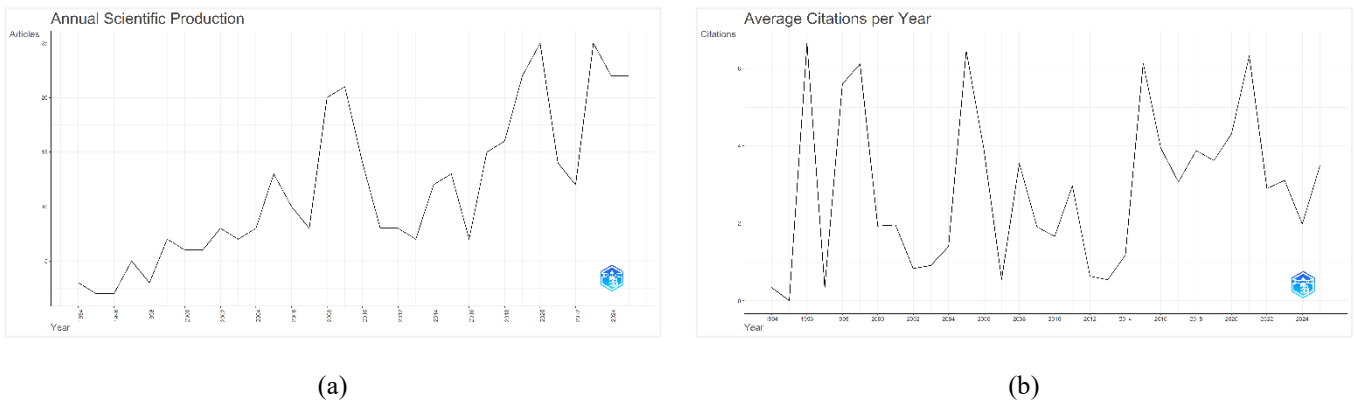
## 3. Results

This section presents the findings of the bibliometric analysis. The results are organized into two main parts: first, a performance analysis of publication trends and key contributors, and second, a science mapping of the conceptual structure of the research field.

### 3.1 Performance Analysis

#### 3.1.1 Publication and Impact Trends Over Time

The historical evolution of the SCM-TQM field was examined through two lenses: the volume of scientific production and the average citation impact of that production over time. Fig. 2 presents both of these trends.



**Fig. 2.** Publication and Impact Trends (1994-2025). (a) Annual Scientific Production, (b) Average Citation Per Year

Fig. 2a, showing the annual scientific production, reveals a field that has transitioned from a niche topic into a highly active area of research. After a period of steady but modest output, research activity accelerated dramatically from 2017 onwards, with the number of publications more than tripling and remaining high. This surge points to the growing recognition of the strategic importance of integrating quality and supply chain management.

Complementing this growth in volume, Fig. 2b illustrates the average citation impact of articles published each year. The trend is not one of steady increase but is instead characterized by high variability and distinct peaks, particularly around the years 1996, 2005, and 2015. This spiky pattern suggests that the field's intellectual advancement has been significantly shaped by the periodic publication of a few seminal, highly influential articles that disproportionately raised the average impact for their respective years. It is also important to note the decline in average citations for the most recent years, a

natural artifact of citation lag, as these papers have had less time to be cited. Taken together, these trends paint a picture of a field that has grown in size while its intellectual impact has been driven by key breakthrough studies.

3.1.2 Geographic and Institutional Hubs of Research

The geographic landscape of SCM-TQM research is global, yet concentrated in several key regions. Fig. 3 provides a world map of scientific production, with darker shading indicating higher publication output. This visual overview immediately identifies North America, Western Europe, and large parts of Asia as the primary research hotspots. The United States, India, and China are the three most productive nations, collectively accounting for a significant portion of the total publications.

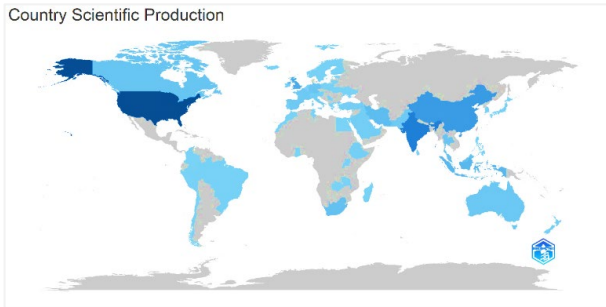


Fig. 3. World Map of Scientific Production by Country

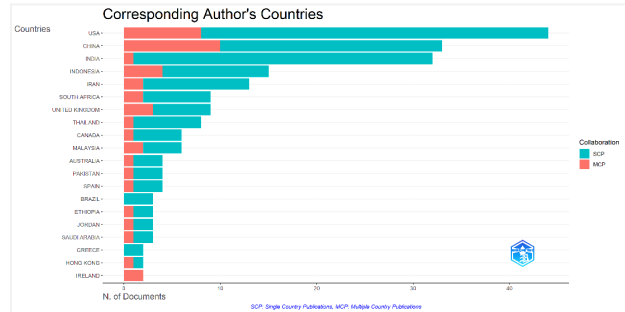


Fig. 4. Corresponding Author's Countries

To quantify these contributions, Fig. 4 displays the top contributing countries based on the corresponding author's affiliation. This confirms that the United States, India, and China are the definitive leaders in publication volume. Table 2 further enriches this view by showing that these same countries also lead in total citation impact, underscoring their dual role as high-volume producers and influential thought leaders.

Table 1  
Most Relevant Countries by Corresponding Author

Country	Articles	Articles %	SCP	MCP	MCP %
USA	44	11.9	36	8	18.2
China	33	8.9	23	10	30.3
India	32	8.6	31	1	3.1
Indonesia	15	4	11	4	26.7
Iran	13	3.5	11	2	15.4
South Africa	9	2.4	7	2	22.2
United Kingdom	9	2.4	6	3	33.3
Thailand	8	2.2	7	1	12.5
Canada	6	1.6	5	1	16.7
Malaysia	6	1.6	4	2	33.3

Zooming in from the national level, Fig. 5 identifies the specific institutions at the forefront of this research.

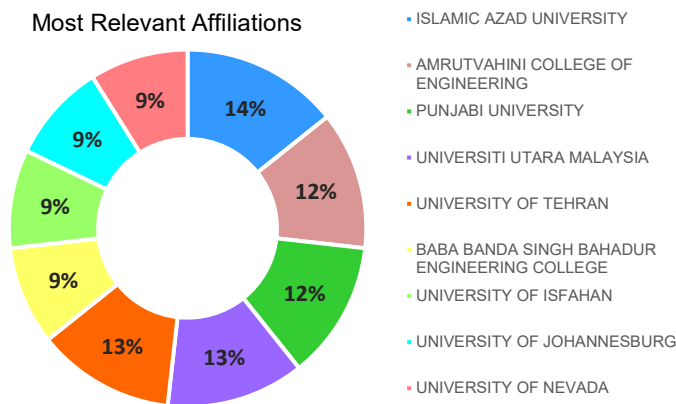


Fig. 5. Most Relevant Affiliations

The list of most relevant affiliations is led by Islamic Azad University and Amrutvahini College of Engineering. The presence of these leading universities underscores the academic rigor of the field and pinpoints the specific centers of excellence that are training researchers and producing seminal work in this domain.

As detailed in Table 2, the United States leads with 171 documents, followed by India with 104 and China with 70. Other substantial contributions come from countries such as the United Kingdom, Indonesia, Iran, and South Africa, highlighting the topic's relevance in both developed and emerging economies. This geographic distribution underscores the universal applicability of SCM and TQM principles across diverse industrial and economic contexts.

In addition to publication volume, the analysis of country-level impact, measured by total citations, reveals a similar hierarchy. The research originating from the United States has garnered the highest number of citations (4396), affirming its central role in shaping the field's intellectual trajectory. India's research also demonstrates significant impact with (794) citations, followed by China with (733). This alignment between high productivity and high citation impact in the leading countries suggests they are not only active but also highly influential in the SCM-TQM domain.

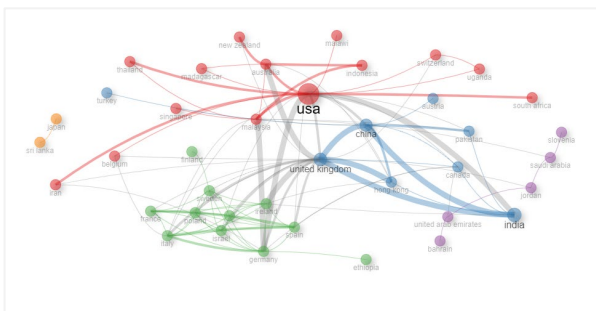
**Table 2**  
Top 10 Most Productive and Cited Countries

Rank	Country	Documents	Total Citations (TC)
1	USA	171	4396
2	India	104	794
3	China	70	733
4	United Kingdom (UK)	51	554
5	Indonesia	36	394
6	Iran	30	335
7	South Africa	24	243
8	Malaysia	23	168
9	Canada	20	133
10	Thailand	19	106

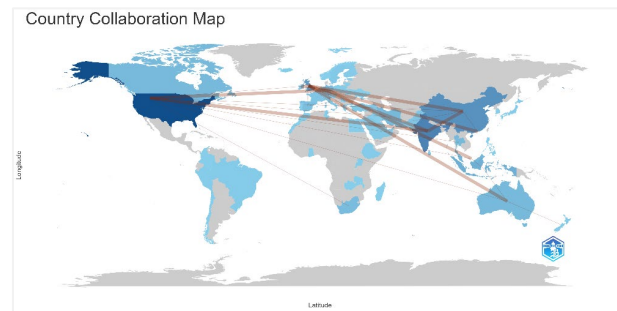
### 3.1.3 The Global Collaboration Network

Beyond individual country performance, the web of international co-authorship reveals the social architecture of the SCM-TQM field. To explore this, we analyzed the collaboration patterns between countries.

Fig. 6 presents the collaboration network, where the size of a country's node indicates its productivity and the thickness of the connecting lines represents the strength of its collaborative ties. This structural view immediately highlights the central role of a few key nations. The USA, United Kingdom, China, and India serve as the primary hubs, forming the backbone of the network. The clustering algorithm also reveals distinct communities, such as a dense European cluster (in green), suggesting strong regional partnerships.



**Fig. 6.** Country Collaboration Network

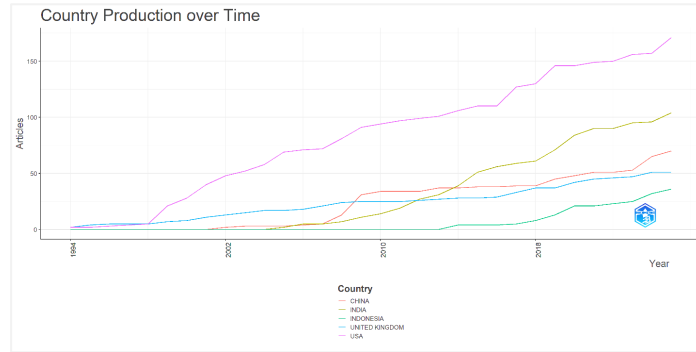


**Fig. 7.** Country Collaboration Map

While the network diagram shows the structure, the collaboration map in Fig. 7 visualizes the geographic scope of these partnerships. The map is dominated by a strong Transatlantic axis connecting North America and Europe, and an equally robust Transpacific axis linking these Western hubs with major research centers in Asia, particularly China, India, and Australia. The USA, in particular, acts as a critical global connector, bridging research across continents. Taken together, these two visualizations paint a clear picture: the SCM-TQM field is a highly interconnected global community. Its structure is built around a few key hub nations, and its geography is defined by powerful, long-distance collaborations that span the globe.

### 3.1.4 Scientific Production of Top Countries Over Time

To understand the evolving contributions of the leading nations, the scientific production of the top five countries over time is plotted in Fig. 8. The trend analysis reveals distinct trajectories for each country.

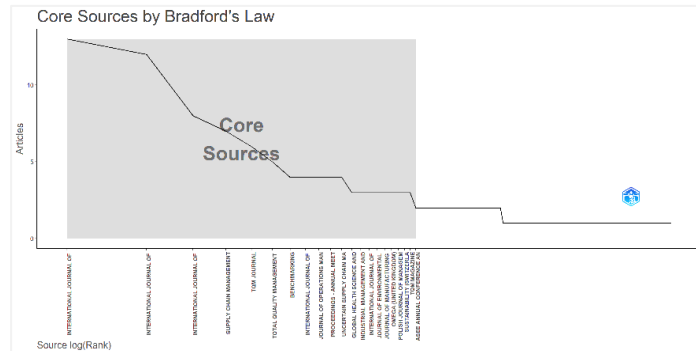


**Fig. 8.** Top 5 countries’ production over time (1994-2025)

The United States, as an early contributor, shows consistent but fluctuating output throughout the entire period. In contrast, the contributions from India and China are a more recent phenomenon, demonstrating a steep increase in publication activity, particularly in the last decade. This pattern suggests that while the USA established the foundational research, India and China are now major drivers of the field's contemporary growth.

### 3.1.5 Analysis of Core Publication Sources

A deep analysis of the publication sources reveals the structure, hierarchy, and evolution of the academic venues that shape the SCM-TQM conversation. To determine if the research is concentrated or dispersed, we applied Bradford's Law. As shown in Fig. 9, the steep drop-off in publications per journal confirms that a small nucleus of "Core Sources" is responsible for a large proportion of the articles, indicating a well-defined and mature research field.



**Fig. 9.** Bradford's Law

Table 3 identifies these core sources and ranks them by productivity. The International Journal of Production Research, the International Journal of Supply Chain Management, and the International Journal of Quality and Reliability Management are clearly established as the top-tier venues, collectively publishing a significant share of the research.

**Table 3**  
Top 10 Most Relevant Sources

Rank	Source	Articles
1	International Journal of Production Research	13
2	International Journal of Supply Chain Management	12
3	International Journal of Quality and Reliability Management	8
4	Supply Chain Management	7
5	TQM Journal	6
6	Total Quality Management and Business Excellence	5
7	Benchmarking	4
8	International Journal of Environmental Research and Public Health	4
9	Journal Of Operations Management	4
10	Proceedings - Annual Meeting of the Decision Sciences Institute	4

To understand the historical role of these key journals, Fig. 10 plots their cumulative production over time. This dynamic view reveals the evolution of the field's publication landscape. For example, journals like Benchmarking, Proceedings -

Annual Meeting of the Decision Sciences Institute, and Supply Chain Management can be identified as foundational pioneers, while the rapid recent growth of journals like International Journal of Supply Chain Management highlights their emergence as leading outlets in the modern era.

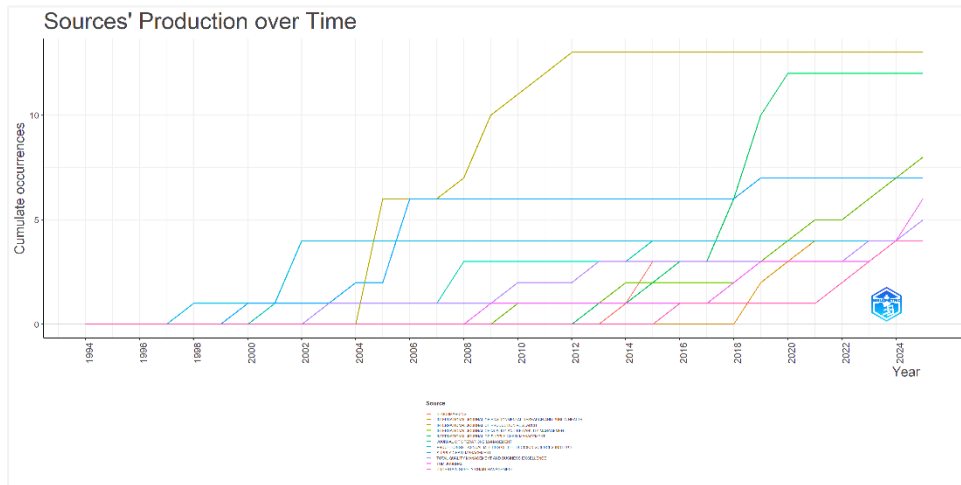


Fig. 10. Sources' Production over Time

Finally, to assess influence beyond productivity, Fig. 11 shows the local citation impact of these sources. It is noteworthy that The International Journal of Production Research, while highly productive, also demonstrates significant influence within the scholarly conversation, as its articles are frequently cited by other researchers in this specific domain.

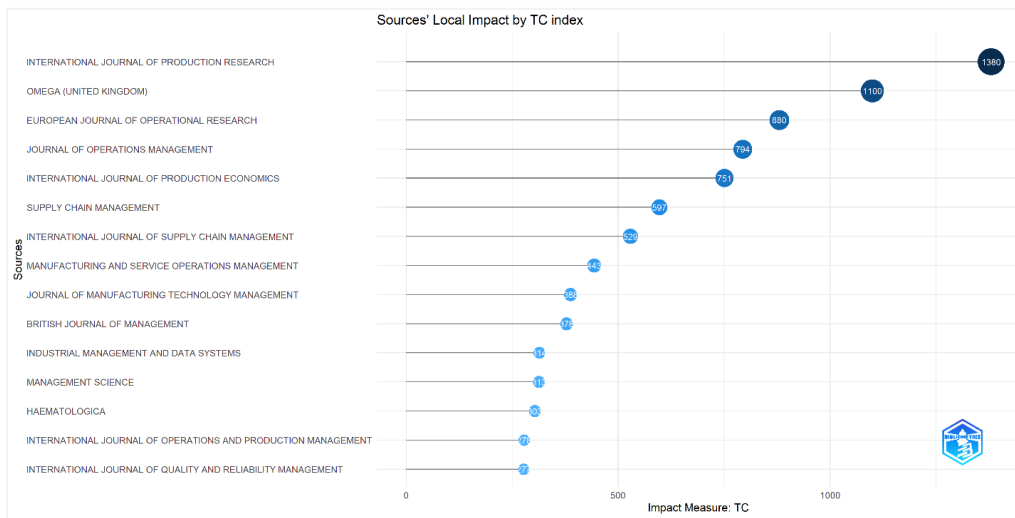


Fig. 11. Sources' Local Impact by Total Citation Index

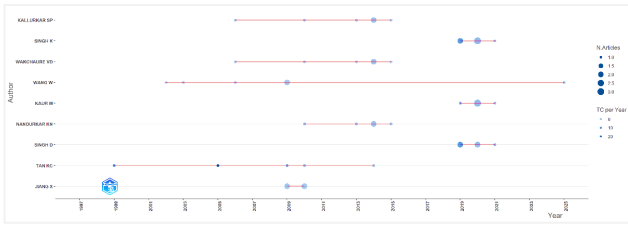
### 3.1.6 Most Influential Authors and Documents

An analysis of authorship identifies the key researchers who have shaped the SCM-TQM field. Table 4 presents the most productive authors based on their total number of publications within the dataset.

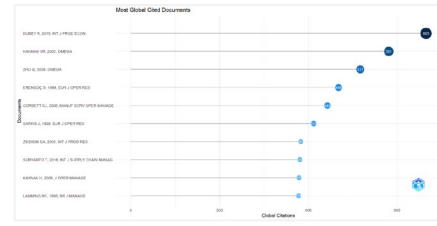
**Table 4**  
Top 5 Most Productive Authors

Rank	Author	Articles
1	Kallurkar, Sp.	6
2	Singh, K.	6
3	Wakchaure, Vd.	6
4	Wang, W.	6
5	Kaur, M.	5

While this table shows who the most active researchers are, Fig. 12 provides a more dynamic view of their careers, showing when they published and the impact of their work over time. In this plot, the size of each bubble represents the number of articles published in a given year, while the color intensity indicates the average citations per year for those articles.



**Fig. 12.** Authors' Production over Time



**Fig. 13.** Most Globally Cited Documents

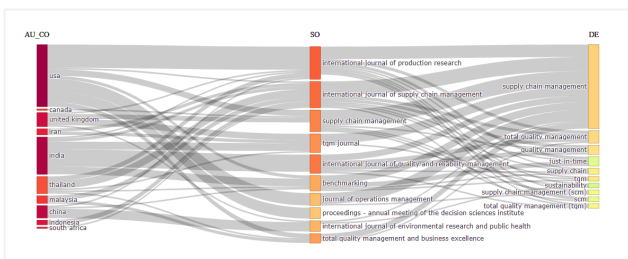
This visualization reveals different patterns of scholarly contribution. For instance, authors like Tan KC can be identified as foundational pioneers, with early and highly influential publications (indicated by the dark bubble in 2005). In contrast, a new wave of highly productive authors, such as Singh K, has emerged more recently, driving the field's contemporary expansion post-2018. This chart effectively illustrates the evolution of intellectual leadership within the field.

Beyond individual author contributions, the influence of specific articles is best measured by their total global citations. Fig. 13 displays the most cited documents from the dataset. The work of Dubey et al. (2015) stands out as the most influential publication, having garnered 665 citations. Other pivotal works, as shown in the figure, include those by Kannan & Tan (2005) and Zhu et al. (2008). These highly cited articles represent the intellectual cornerstones that are most frequently referenced by researchers in the SCM-TQM domain.

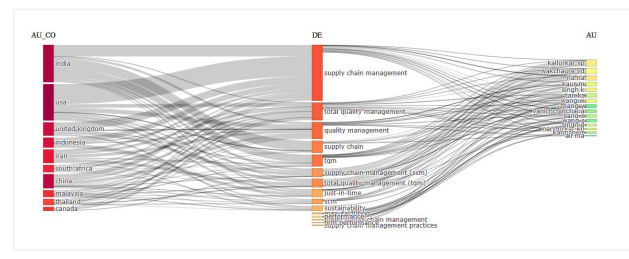
*3.1.7 Synthesis of Research Streams: A Three-Fields Analysis*

To conclude the performance analysis, a three-fields plot was used to synthesize the relationships between the key elements of the research landscape: countries, publication sources, keywords, and authors. This visualization provides a holistic, systems-level view of the field's structure.

Fig. 14 illustrates the dominant pathways from research origin to publication and topic. The thickness of the flows represents the strength of the connection. A powerful stream is evident, originating from leading countries like the USA and India, flowing through a core set of journals such as the International Journal of Production Research, and concentrating on the primary keywords of “supply chain management” and “total quality management”. This map reveals the main arteries of knowledge production and dissemination in the SCM-TQM field.



**Fig. 14.** Sankey Diagram (Three-Fields Plot): Country-Source-Keyword



**Fig. 15.** Sankey Diagram (Three-Fields Plot): Country-Keyword-Author

Shifting the perspective from publications to people, Fig. 15 connects the primary research themes to the individual authors responsible for the work. This diagram provides a granular view of the intellectual ecosystem, linking conceptual topics to the researchers and their national contexts. For instance, it visually confirms that a significant portion of the research on core SCM themes is driven by a prolific group of authors based in India. Together, these Sankey diagrams provide a powerful synthesis, mapping not just the individual top performers, but the entire dynamic system of relationships that defines the SCM-TQM research community.

*3.2 Science Mapping: Conceptual Structure*

To dissect the conceptual structure of the SCM-TQM research domain, we employed a multi-stage science mapping approach. The analysis began by identifying the most prominent keywords, then mapped their interconnections to reveal thematic clusters, and finally analyzed the strategic role of these themes.

### 3.2.1 Most Frequent and Relevant Keywords

First, to identify the foundational concepts, we ranked all author keywords by frequency. Fig. 16 displays the top 20 most relevant words. The plot is overwhelmingly dominated by “total quality management” (265 occurrences) and “supply chain management” (226 occurrences), confirming that the research is tightly focused on this specific intersection. Following these, a family of terms related to quality tools (“quality control”, “quality assurance”) and performance outcomes (“customer satisfaction”) appear as the next most important concepts.

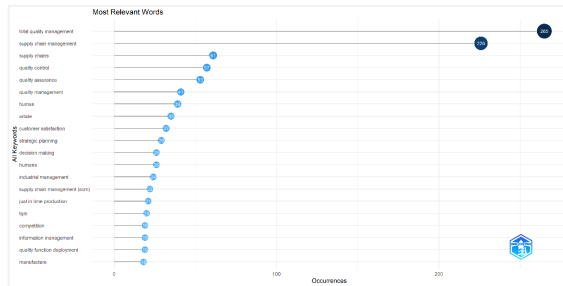


Fig. 16. Most Relevant Words



Fig. 17. WordCloud of the most frequent author keywords

### 3.2.2 Thematic Clusters and Keyword Co-occurrence

While frequency identifies key terms, the co-occurrence network reveals how they are structurally related. Fig. 18 visualizes this network, where keywords are nodes and the links between them represent their appearance in the same articles. The node size reflects the keyword's frequency, and the colors group them into distinct thematic clusters. The network is anchored by the central hubs of “total quality management” and “supply chain management”, which bridge all thematic communities. The analysis clearly identifies several key clusters, including a sustainability-focused cluster (orange), a classic operations cluster (blue), a quality tools and performance cluster (red), and a strategic management cluster (purple). This network provides the foundational map of the field's primary research themes.

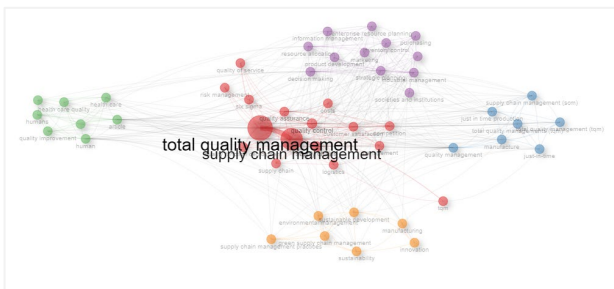


Fig. 18. Keyword Co-occurrence Clustering Network

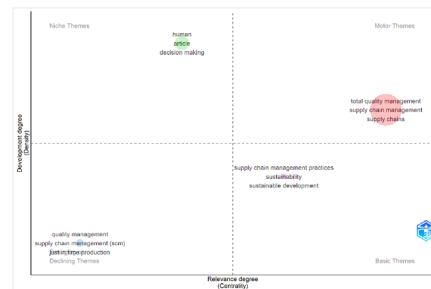


Fig. 19. Thematic Map

### 3.2.3 Strategic Thematic Analysis

Finally, to analyze the maturity and importance of these identified clusters, the network was abstracted into a strategic diagram known as a Thematic Map (Fig. 19). This map positions the themes based on their centrality (relevance) and density (development). The core concepts of 'SCM' and 'TQM' are confirmed as Motor Themes, driving the research front. The 'sustainability' cluster is identified as a foundational Basic Theme, indicating its cross-cutting importance. This final step provides a strategic interpretation of the field's structure, highlighting its core, foundational, and emerging areas.

**Motor Themes (Upper-Right Quadrant):** This quadrant contains the themes that are both well-developed and central to the research field. The primary motor themes identified are 'total quality management', 'supply chain management', and 'supply chains'. Their high centrality and density indicate that these concepts form the mature, driving core of the research domain. The majority of studies are directly focused on the integration and interplay of these core principles.

**Basic Themes (Lower-Right Quadrant):** This quadrant represents themes that are important and transversal but not as developed as the motor themes. The key basic themes are 'sustainability', 'sustainable development', and 'supply chain management practices'. Their high centrality but lower density suggest they are foundational, cross-cutting topics that connect to many other areas of research, particularly linking the core SCM-TQM framework to broader corporate goals.

*Niche Themes (Upper-Left Quadrant):* Themes in this quadrant are well-developed internally but are more peripheral to the main body of research. The analysis identifies 'human' and 'decision making' as niche themes, suggesting the existence of a specialized research stream focused on the managerial and behavioral aspects of SCM and TQM.

*Emerging or Declining Themes (Lower-Left Quadrant):* This quadrant contains themes with low centrality and density, indicating they are either newly emerging or are being phased out. The analysis places 'quality management', 'just in time production', and the acronym 'scm' in this quadrant. Given the long history of these terms, their position suggests an intellectual evolution where they are being superseded by more comprehensive or modern terminology, such as 'total quality management' and the full phrase 'supply chain management', which are found in the motor quadrant.

#### 4. Discussion

Having mapped the performance and conceptual structure of the SCM-TQM field, we now turn to interpreting what this landscape reveals. Our analysis confirms that the intersection of these two domains has evolved from a niche academic interest into a vibrant and essential field of study, experiencing remarkable growth since 2017. The findings not only highlight a globalized research effort, with new intellectual centers of gravity emerging in Asia, but also uncover a sophisticated conceptual architecture. The performance analysis highlights the field's global nature, with established leadership from the USA complemented by the recent and substantial rise of contributions from India and China. More profoundly, the science mapping analysis uncovers the conceptual architecture of the field, revealing not only its core driving themes but also its intellectual evolution. This discussion delves into the meaning behind these trends, connecting the data to broader theoretical and practical shifts in the world of operations and management.

##### 4.1 *The SCM-TQM Synergy: From Concept to Core Paradigm*

Our thematic analysis provides compelling quantitative evidence for what has long been a central premise in the literature: the powerful synergy between SCM and TQM (Flynn & Flynn, 2005). The positioning of 'total quality management' and 'supply chain management' as dominant motor themes is not a trivial finding. It signifies that the field has reached a state of maturity. The conversation is no longer about if these two should be integrated, but how this integration can be leveraged for superior performance (Kannan & Tan, 2005). They are not merely co-existing topics but have fused into a central, intertwined paradigm for modern operations, where the external reach of SCM is powered by the internal discipline of TQM (Saragih et al., 2020).

##### 4.2 *Sustainability: The New Foundation of Quality*

One of the most significant insights from our analysis is the emergence of 'sustainability' as a foundational basic theme. Its high centrality but lower density suggests it functions as the conceptual bedrock upon which the motor themes are increasingly built. This confirms a profound shift in the field: sustainability is no longer a peripheral concern but has been integrated into the very definition of quality and operational excellence (Green et al., 2018). This finding resonates strongly with the rise of Green Supply chain Management (GSCM), which extends TQM principles like waste reduction ('muda') and continuous improvement beyond the firm to address environmental and social goals across the entire value chain (Singhal et al., 2025).

##### 4.3 *An Evolving Lexicon: How the Field Matures*

Perhaps the most nuanced story our data tells is one of intellectual evolution, visible in the changing language of the field. The placement of foundational terms like 'just in time' and the generic 'quality management' in the declining themes quadrant does not signal their irrelevance. Instead, it points to a sophisticated process of conceptual absorption. These pioneering ideas have been so successful that they are now embedded within more holistic, modern frameworks. For instance, 'just in time' is a critical component of broader Lean Six Sigma strategies, and 'quality management' has evolved into the more comprehensive, philosophy-driven 'total quality management' (Agyabeng-Mensah et al., 2021). This demonstrates a field that is not static but is actively refining its vocabulary as it builds upon its foundational pillars.

##### 4.4 *What's Driving the Momentum? Global Trends and New Voices*

The dramatic surge in publications since 2017 is no academic accident; it is a direct reflection of seismic shifts in the global business environment. The rise of Industry 4.0 has provided new tools for achieving unprecedented levels of integration and quality control (Al-Okaily et al., 2024). The growing urgency of the sustainability agenda has made GSCM a strategic imperative (Chang et al., 2019). And perhaps most powerfully, the profound disruptions of recent years, from pandemics to geopolitical shocks, have thrust supply chain resilience and quality into the public spotlight (Welch et al., 2025). This "perfect storm" has fueled a torrent of new research questions.

This growth has been accompanied by a geographic rebalancing. While the USA remains a key player, the rise of India and China as research powerhouses is transformative. It signifies that SCM-TQM challenges are being investigated in the context of the world's most dynamic and complex production networks, enriching the global conversation with vital perspectives from emerging economies.

#### *4.5 Implications of the Study*

The findings of this bibliometric analysis carry significant implications for both the academic community and practicing managers.

##### *4.5.1 Theoretical Implications*

For researchers, this study provides a clear, data-driven map of the SCM-TQM research landscape, which can help in several ways. First, the identification of motor themes ('TQM', 'SCM') and basic themes ('sustainability') validates the theoretical integration of these domains and confirms that sustainability is a core theoretical lens, not just a sub-topic. Researchers should feel confident in building integrated models that treat SCM, TQM, and sustainability as deeply intertwined constructs. Second, the thematic evolution from foundational concepts like 'JIT' to more holistic frameworks suggests that future theoretical development should focus on integration and systems-level thinking rather than on optimizing isolated components. Finally, the identification of niche themes ('decision making', 'human') and emerging areas signals fertile ground for theory building, particularly around the behavioral and cognitive aspects of managing quality in complex supply chains.

##### *4.5.2 Practical Implications*

For managers and practitioners, the analysis underscores a critical strategic imperative: SCM and TQM must not be managed in silos. The synergistic link to performance is a dominant theme in the literature, suggesting that organizations that successfully integrate their quality management systems with their supply chain partnership strategies are more likely to achieve a sustainable competitive advantage. The prominence of 'sustainability' as a basic theme serves as a clear signal that environmental and social performance are no longer optional but are core components of quality in the modern supply chain. Managers should leverage TQM tools like continuous improvement and statistical process control to address sustainability goals (e.g., waste reduction, emissions control) across their entire network. Finally, the rise of Industry 4.0 as an emerging theme implies that managers must invest in digital technologies to enable the next generation of integrated SCM-TQM, facilitating data-driven quality control and real-time visibility across suppliers and customers.

## **5. Conclusion, Limitations, and Future Research**

### *5.1 Conclusion*

This bibliometric analysis has systematically mapped the research landscape at the intersection of Supply Chain Management and Total Quality Management, revealing a vibrant and rapidly evolving field. Through a quantitative analysis of 371 documents, this study has charted the field's significant growth, identified its key contributors and intellectual cornerstones, and visualized its conceptual structure. The findings confirm that the integration of SCM and TQM is a mature, core paradigm (motor theme) for achieving organizational performance, increasingly underpinned by the foundational principles of sustainability (basic theme). The study also highlights a clear intellectual evolution, with foundational concepts being integrated into more holistic, modern frameworks. In essence, the integration of SCM and TQM is no longer a niche topic but a strategic necessity for competing in a complex, global, and sustainability-conscious environment.

### *5.2 Limitations*

While this study provides a comprehensive overview, it is subject to certain limitations inherent in the bibliometric method. First, the analysis is based solely on the Scopus database. While Scopus offers extensive coverage, excluding other databases like Web of Science or Google Scholar may lead to the omission of some relevant publications. Second, the search query, while specific, may not have captured all relevant literature, particularly articles that discuss the concepts without using the exact phrases "supply chain management" and "total quality management." Finally, the analysis is based on metadata (titles, abstracts, keywords) and does not include a full-text qualitative analysis of the articles, which could provide deeper contextual insights.

### *5.3 Future Research Directions*

The findings of this analysis illuminate several promising avenues for future research. Based on the thematic map (Fig. 19) and recent publication trends, we propose the following directions:

- 1) **Integrating Digital Technologies:** While not yet a dominant theme, the impact of Industry 4.0, Blockchain, and AI is a clear emerging area. Future research should move beyond conceptual papers to provide empirical evidence on how

these technologies can be leveraged to operationalize SCM-TQM integration, for instance, by using IoT for real-time quality monitoring across the supply chain or AI for predictive quality analytics.

- 2) Deepening the Sustainability-Quality Link: While 'sustainability' is a basic theme, there is an opportunity to explore more specific and emerging concepts within it. Future studies could investigate the integration of circular economy principles with TQM frameworks. For example, how can 'total quality' be redefined to include product end-of-life, remanufacturing, and waste elimination in a circular supply chain?
- 3) Exploring the Human and Behavioral Dimensions: The identification of 'human' and 'decision making' as niche themes suggests that the behavioral aspects of SCM-TQM integration are underdeveloped. Research is needed to explore the role of leadership, organizational culture, and cross-functional team dynamics in successfully implementing integrated quality and supply chain strategies, especially in a digitally transformed environment.
- 4) Building Resilient and Quality-Driven Supply Chains: In the wake of recent global disruptions, supply chain resilience has become paramount. Future research should explicitly investigate the role of TQM principles, such as risk management (FMEA), continuous improvement (Kaizen), and robust process design, in building supply chains that are not only efficient and high-quality but also resilient to shocks.

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