Article

Interpretive Structural Modeling: Research Trends, Linkages to Sustainable Development Goals and Impact of COVID-19

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Abstract: Interpretive Structural Modelling (ISM) is widely used to understand the complex connections between different components. This study presents a bibliometric overview of ISM research with a focus on its linkages to the Sustainable Development Goals (SDG) and the impact of COVID-19. The study analyzed 1988 publications on ISM published between 2012 and 2021, of which 1202 were directly mapped to the SDG and 59 were related to COVID-19. The study identified key authors, institutions, countries, and journals involved in the research and their linkages to the SDG. The results showed that ISM research is strongly linked to SDG 12 (Responsible Consumption and Production) and SDG 9 (Industry, Innovation, and Infrastructure). We also identified influential SDG based on centrality measures like betweenness and eigenvector. The top four countries contributing to ISM publications were India, China, the United Kingdom, and the United States. The most frequently cited journals were Benchmarking: An International Journal, Sustainability, Journal of Modelling in Management, and Journal of Cleaner Production. Four main clusters were identified in the ISM research, including (1) integration with AHP & Fuzzy Logic for promoting sustainability alignment, (2) ISM-based strategy development for various stakeholders, (3) ISM-based decision-making in various fields, and (4) ISM-based risk evaluation. For the first time, studies that used the ISM approach to understand the epidemiological characteristics of COVID-19 were identified, and their key findings were discussed. The study also identified several emerging topics for future ISM research, such as blockchain & IoT, environmental management systems, climate change adaptation, smart cities, and humanitarian logistics and their potential linkages to SDG.

Keywords: interpretive structural modeling; SDG; COVID-19; bibliometrics; citation analysis; science mapping

1. Introduction

In today's academic, industrial, and research fields, people and organizations often face complex problems due to rising digitalization, increased information access, advancing technology, networked society, and cross-cultural differences, among other factors. These individuals deal with large amounts of complex, ill-defined, or basic information that they struggle to manage with their current tools. As a result, multiple solutions can be generated for a single issue, requiring a shared framework for similar interpretations. To address this, Interpretive Structural Modelling (ISM) helps people understand the intricate connections between these pieces from a common perspective. ISM transforms a poorly defined model into a systematic and well-articulated model by establishing relationships between its elements.

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J.N. Warfield established “ISM” as a potent tool for organizing complex problems (Janes, 1988). Warfield has developed a mathematical dialect relevant to many complicated issues, given that they can be evaluated from the perspective of sets of components and relations, relying on discrete or finite mathematics. The created structural models are presented to the client as a collection of words and digraphs, with the mathematics being concealed in a computer program (Janes, 1988). ISM entails conducting a thorough, systematic, and complete review of the literature on a subject at hand, speaking with specialists in the field about it first-hand, breaking down a complicated problem into smaller ones, and then creating an extensive multi-level structured model (Attri et al., 2013; Mathiyazhagan et al., 2013). This technique has the added benefit of MICMAC analysis, which allows researchers to understand the forces that drive and depend on the factors they are studying (Kumar et al., 2021).

In contrast to ISM, Total Interpretive Structural Modelling (TISM) employs nodes and linkages to illustrate the relationships. ISM and TISM are interpretive methodologies used to clarify poorly organized mental models into structured, hierarchical ones. Both scholars and practitioners use them as tools in theory development (Sushil, 2018). These interpretive techniques address important questions in theory development, such as "what," "how," and "why." While ISM successfully answers the first two questions of "what" and "how," TISM goes further by also addressing the question "why" and adding more explanatory power in theory development. The m-TISM model is utilized to categorize these linkages because ISM alone is insufficient to explain the interdependencies of components. Paired comparison is then employed to lessen the cognitive load during model construction. The MICMAC method is beneficial for analyzing indirect linkages (Dhir et al., 2020).

A group of seventeen goals and one hundred sixty-nine (169) targets known as the Sustainable Development Goals (SDG) were established by the UN general assembly in 2015 as a component of the 2030 Agenda Sustainable Development. These goals provide a universal framework for sustainable development and aim to end poverty, protect the planet, and ensure peace and prosperity for all. The SDG are integrated and indivisible, recognizing that economic growth, social development, and environmental protection are interdependent and mutually reinforcing. ISM is a research methodology that can analyze the interconnections and interdependencies between different elements in a system. In the context of the SDG, ISM can be used to understand the interrelationships between the various SDG and their associated targets and to identify the key drivers and barriers to achieving these goals. This information can then inform decision-making and prioritize actions to achieve the SDG. In addition, ISM can also be used to analyze the relationships between stakeholders involved in achieving the SDG, such as governments, businesses, and civil society organizations.

ISM can also be used to prioritize actions to achieve specific SDG targets. For example, ISM can be used to prioritize actions to achieve SDG 7 Target 7.2 (Access to affordable, reliable, sustainable, and modern energy for all). This can involve identifying the key drivers of energy access, such as the availability of renewable energy sources, the level of investment in energy infrastructure, and the level of political commitment to energy access. ISM can also be used to identify the key drivers and barriers to achieving SDG 3 Target 3.8 (Universal health coverage), such as the availability of healthcare resources, the quality of healthcare infrastructure, and the level of political commitment to health. Recent bibliometric studies have analyzed research topics like green hydrogen, women entrepreneurship, virtual learning environments, and their SDG mappings (Raman et al., 2022a; Raman et al., 2022b; Achuthan et al., 2022).

The scope of ISM has also been expanded to include identifying obstacles to knowledge management in engineering institutions. The study suggested that the ISM method could benefit these contexts by developing approaches for integrating technology and capturing and developing knowledge (Shankar et al., 2003). Furthermore, the ISM approach is increasingly being used in chemical laboratories to support the instruction of students in knowledge-based settings (Shankar et al., 2003).ISM is used in the service

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sector, which includes the healthcare industry, start-ups, and higher education (Thomas et al., 2022; Vaishnavi et al., 2019; Sreenivasan et al., 2022a; Menon et al., 2020) to discover enablers for effective management. This model has generated crucial inputs for government officials to improve the policies for enhancing these service sectors. Risk interrelations play a significant part in green building projects, another trend in the construction sector currently getting a great deal of attention (Guan et al., 2020). Apart from these studies, the ISM has been employed in the current pandemic situation, COVID-19. This approach is used to solve various issues about COVID-19 and to make the organization more resilient and agile in the present scenario (Badhotiya et al., 2022; Kumar et al., 2022; Poduval et al., 2022; Pilevari et al., 2021; Lakshmi Priyadarsini et al., 2020; Harikumar et al., 2018, July).

The following discourse will examine ISM-related research work in various contexts.

Authors from various fields have employed the ISM technique in multiple contexts. Broome et al., (2019) look into the issue of creating a welcoming environment for intercultural communication. In the context of rural India, Sharma et al., (2021) pinpoint the main difficulties common service centres face and establish their hierarchical relationships using ISM. According to the research, the main difficulties faced by the common service centres in rural India include "higher travel distances and transaction costs," "poor digital literacy," and "low awareness" of e-government services. In a study in India by Mathiyazhagan et al., in 2013. the ISM method was used to identify the 26 challenges to implementing green supply chain management in 10 auto parts manufacturing companies in Tamil Nadu. Based on a literature review and input from business professionals and industry leaders, the study identified the main obstacles as a lack of consumer knowledge, skepticism about environmental principles, insufficient green infrastructure, and poor supplier obligations. The ISM approach has also been used to improve the efficiency of inventory and manufacturing control systems. For example, by working together, a company could enhance its clustering algorithms and other classification technologies (Yenradee et al., 2000). Additionally, the ISM method combined the information systems of the Indian Railways and Indian Airlines. The study showed how the method could improve communication in these organizations by displaying detailed information structures and using digraphs (Kanungo et al., 2002).

An approach to identifying the key success factors of encouragement and motivation for the effective implementation of sustainable supply chain management practices in Indian oil and gas sectors was provided by Raut et al., (2017). The mutual links between the drivers were established using ISM methodology, which not only aids in understanding the relative relationship between the critical success factors but also helps to build their interdependence while implementing sustainability. MICMAC analysis was also used to determine the significance of critical success factors in sustainability based on their driving and dependency power. Also, due to governmental regulations and growing public awareness of environmental protection and waste reduction, the return of old goods is becoming a crucial logistical operation (Kannan et al., 2008). ISM and fuzzy techniques are used to prioritize orders based on how closely they resemble the idea solution.

The critical components for applying knowledge management in engineering businesses have been examined to produce an ISM, which demonstrates the interrelationships of the variables and their levels, in the study published by Shankar et al., 2003. Organizations need to have a strong capacity to develop, organize, and use their knowledge assets in this era of globalization if they want to thrive. Also, in a lean manufacturing company, Thomas et al., (2017) employed ISM to pinpoint various wastes. The study aided in the discovery of the interconnectedness of various wastes in a manufacturing organization using the ISM tool.

Even during the current COVID-19 scenario, the ISM technique is used to solve various issues, such as studies done by Saha et al., (2021), Tang et al., (2022), Rafiq et al., (2021), Singh et al., (2022), Abbas et al., (2021), Tamtam et al., (2021), Agrawal et al., (2021) and many more. The study done by Saha et al., (2021) emphasized the interdependencies of the factors affecting artificial intelligence in the healthcare sector during COVID-19. The

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paper offered an interpretive structural model to broaden the skeleton of intricate relationships and significance among the crucial pieces that have been uncovered. Tang et al., (2022) integrate an enhanced "type-2 fuzzy TISM" with a Bayesian network to create an integrated model to assess COVID-19 medical waste transportation risk.

Since management practices are the foundation of every business, their importance to the success of renewable energy organizations cannot be understood. Energy companies are dealing with serious environmental problems, so the industry eventually needs environmentally friendly production. This can only be accomplished by implementing concurrent management methods, as slow management practices result in dormancy and poor performance. The study done by Rafiq et al., (2021) looked into the new management techniques that will allow the market's current demands to be met by the renewable energy industry, especially in the wake of the COVID-19 pandemic's emergence. On the side of the consumer, as they could not make offline payments during the purchases in India due to the COVID-19 pandemic, Singh et al., (2022) concentrated on identifying crucial impediments to mobile payment systems adoption.

In light of the COVID-19 issue, the automotive industry is unstable and unpredictable. Automotive firms need to manage their agile supply chains properly if they want to thrive in this new market. The discovery of the agile drivers driving the supply chain is the major determinant of this management. Tamtam et al., (2021) employ MICMAC analysis after an ISM technique to determine the link between these enablers. Agrawal et al., (2021) utilized the ISM method to create a structural model and examine digital learning drivers. The COVID-19 pandemic presented numerous difficulties for human life. The practice of teaching and learning is one of these difficulties. Although digital media is a part of teaching and learning, digitizing the educational system is necessary. In light of this, the study done by Agrawal et al., (2021) examines the factors influencing digital learning in the COVID-19 and post-COVID-19 contexts.

The recent COVID-19 has negatively impacted the pharmaceutical supply chain, particularly in emerging economies that are most vulnerable because of their insufficient resources. Identifying any potential obstacles keeping supply chains from performing sustainably in the post-COVID-19 environment has become crucial. To aid decision-makers, Liza et al., (2022) looked into and analyzed the obstacles that the pharmaceutical supply chain of a growing country faces in its pursuit of sustainability. Narula et al. (2021) identified and classified the major difficulties associated with applying industry 4.0 technology in the medical device sector. Global industry executives and politicians are overcoming obstacles as their firms undergo a digital transition following COVID-19. When developing a strategy for industry 4.0 transformation and ensuring they get off to a good start, medical device manufacturing businesses may use the industry 4.0 implementation problems found and categorized in their research as a reference.

The impact of the COVID-19 pandemic has further emphasized the significance of researching ISM and its linkages to the SDG. Both new and exacerbated difficulties to sustainable development have been brought up by the pandemic. ISM can assist in identifying and ranking the important elements that are essential to achieving the SDG while accounting for the pandemic's effects. ISM can support decision-making processes and aid in identifying more effective and efficient solutions by modelling the relationships and trade-offs between the many SDG and associated variables. Therefore, understanding ISM and how it relates to the SDG is essential in light of the COVID-19 pandemic because it can promote sustainable development initiatives that are sensitive to changing global issues. Despite the widespread use, existing literature on ISM techniques has yet to fully explore its potential, specifically its linkages to SDG and the impact of COVID-19. To address this gap, further research using bibliometrics and science mapping analysis is necessary to examine the literature comprehensively covering a wider range of years.

Our study has identified the following research questions.

RQ1: How has the area of study on ISM transformed in terms of publications, citations, source titles, countries, institutions, etc., and how well do they map to various SDG?

RQ2: How well does ISM research map to various SDG?

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RQ3: What themes have emerged in ISM research?
RQ4: How has COVID-19 impacted ISM research?

2. Study Methods

Our study employed quantitative statistical analysis using a reliable dataset of peer-reviewed publications from various academic and geographical areas. The Dimensions database was chosen for its trustworthy data integrity and field-normalized citation scores, which were determined using a field categorization scheme (Achuthan et al., 2022). The validity of this database has been reinforced by other research studies (Visser et al., 2021).

Science mapping tools are a fundamental aspect of bibliometrics. Bibliographic coupling, the most widely used citation-based method in science mapping, is especially useful for analyzing the growth of new research fields and tracking recent research trends (Belussi et al., 2019; Choudhary et al., 2022). This method is well-suited for capturing emerging patterns in a field as it is forward-looking (Boyack et al., 2010; Thukral et al., 2022). The present study combined country and journal bibliographies to determine the similarity of cited articles and applied network analysis to identify research hotspots and changes over time, as well as to gain insights into new research areas (Fahimnia et al., 2015). The visualization tool VOSviewer was utilized to map and highlight the temporal and structural features of the corpus of scientific research, and it has been commonly used for science mapping purposes (Van Eck et al., 2017; Oladinrin et al., 2022; Kuzior et al., 2022; Guleria et al., 2021; Ramos et al., 2020).

The study was organized by initially describing the protocol used for the literature review. With SDG mappings in context, results, and discussion were focused on the overall trend of publications and citations, the top contributing nations and their bibliographic couplings, the most productive institutions and authors, the highly cited journals, keyword co-occurrence analysis, and the impact of COVID-19. The final section includes conclusions and future research directions.

2.1. SPAR-4-SLR protocol

A systematic literature review requires a protocol to ensure careful planning, consistent execution, and transparency for replicability (Sreenivasan et al., 2022b). However, few protocols exist for conducting a comprehensive literature review (Kumar et al., 2022). The commonly used PRISMA protocols are primarily used by researchers performing systematic literature reviews (Harju, 2022). While these protocols enable researchers to present their studies in an organized and consistent manner, they provide limited support for conclusions and justifications (Thakur et al., 2022). To address these limitations, an alternative protocol was suggested - the SPAR-4-SLR protocol - specifically created for systematic literature reviews (Paul et al., 2021). Figure 1 shows the SPAR-4-SLR protocol used in this study.

2.1.1. Assembling

The first step in the process is called "assembling" and involves gathering publications for review. In this study, the Dimension database was used for this purpose. The search was conducted using the search term provided in figure 2 in the title and abstract on November 29, 2022. The search resulted in a list of 1988 publications from 2012-2021.

2.1.2. Arranging

The next step in the process is "arrangement," which involves organizing and cleaning up the publications using inclusion and exclusion criteria. The search data for the publications were coded using standard bibliometric characteristics, such as publication title, journal title, number of citations, country of affiliation, and author name. The filtering process excluded monographs and preprints.

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2.1.3. Assessing

The "evaluation" section of the article discusses the analysis method and study constraints. The primary tool used for analysis was VOSviewer. No additional ethics clearance was required as the study utilized secondary data accessible to anyone with access to the Dimension database.

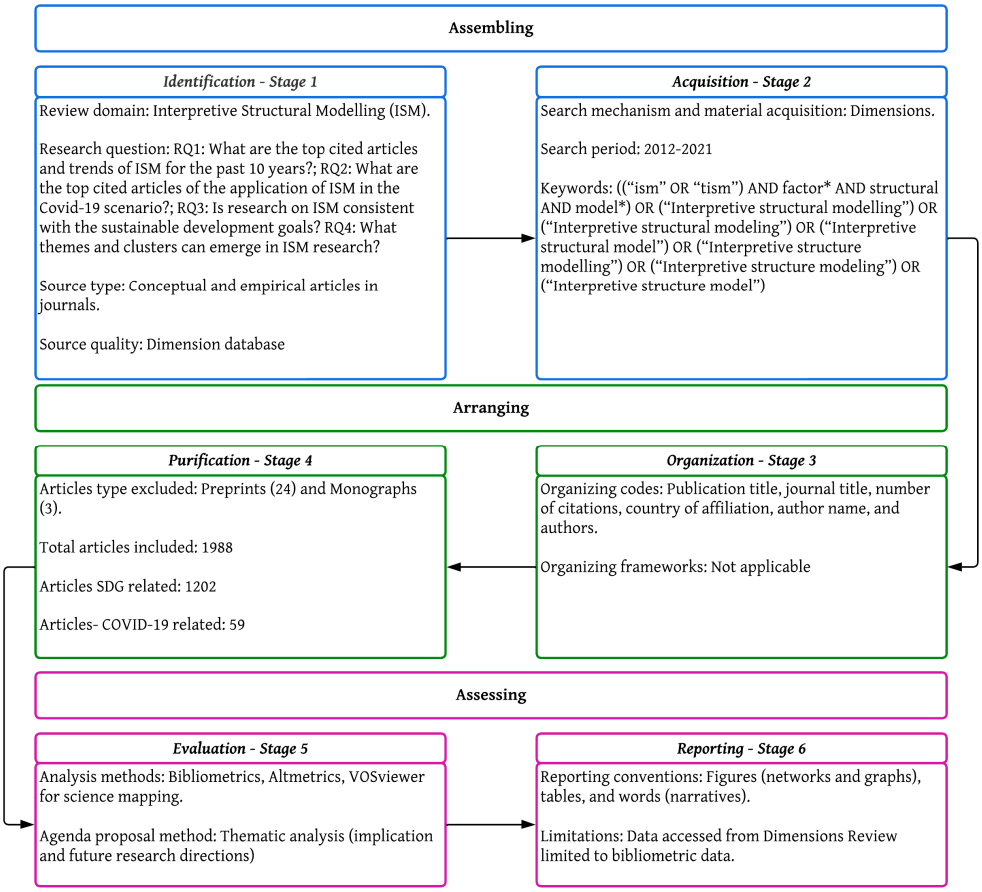

Figure 1. SPAR-4-SLR protocol framework.

3. Results and Discussion

3.1. Publications and Citations trends

The growth of ISM-related publications over the years reflects the field's dynamic and rapidly evolving nature. Figure 2 displays the number of publications and citations received each year. To answer RQ1, the authors analyzed the publication patterns in the ISM literature between 2012 and 2021 using the data collected for the number of total publications and citations. The results show a yearly increase in both the number of publications and citations. The highest number of publications, 494, was recorded in 2021, and the most citations, 10503, were received in the same year, surpassing the number of citations received in 2020 (6655 citations). These findings highlight that 2021 was a particularly productive year for research in the field of ISM.

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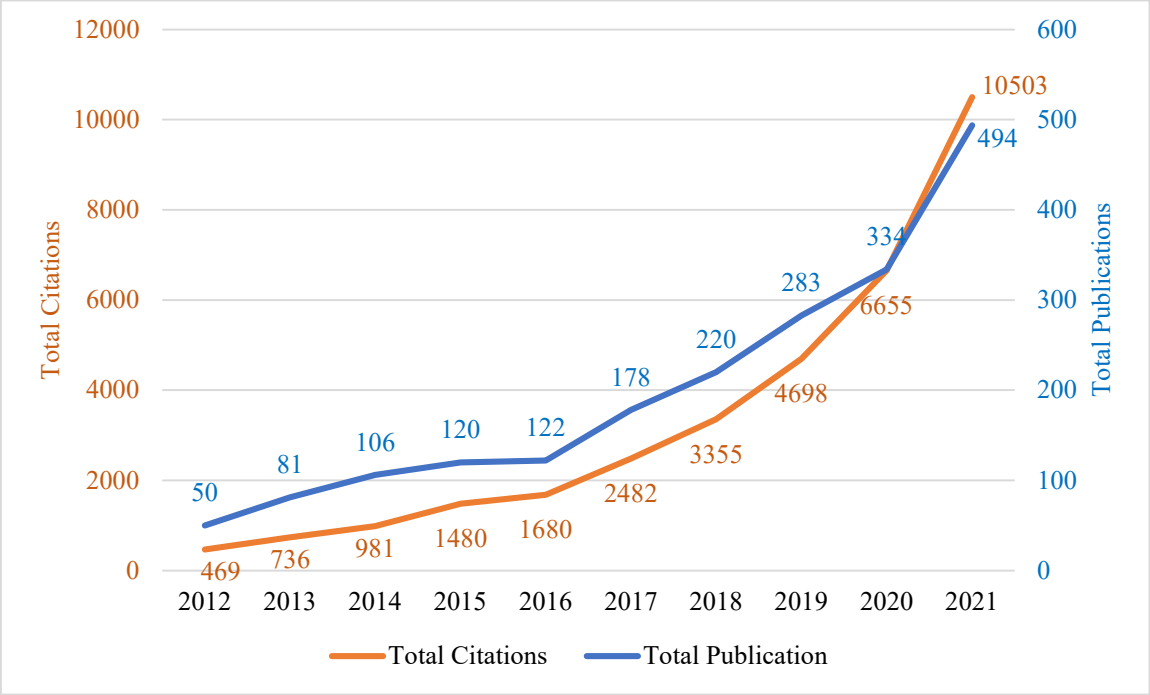

Figure 2. Publications and citations trends.

3.2. Most influential authors

The study uses Table 1 to list the most influential authors in the field of ISM and cross-disciplinary topics relevant to ISM from 2012 to 2021. The author with the most publications is M. Suresh (TP: 41), but with a citation of 997, followed by Sushil (TP: 36; TC: 1578) and Rakesh D Raut (TP: 30; TC: 1068). Suresh's article "Factors influencing the epidemiological characteristics of COVID-19 pandemic: A TISM approach" received the most citations and used TISM to identify the factors influencing the spread of the pandemic. The findings suggest that a country's susceptibility to the virus can be predicted based on its geographic location and future meteorological conditions. These factors are important in supporting the virus's lifespan and airborne dispersion. The authors suggest that addressing the issue should prioritize the connection elements, such as changes in host behavior and the number of contacts, identified in the paper.

Table 1. Top 10 most influential authors in terms of publications.

Authors	Country	TP	TC
M. Suresh	India	41	997
Sushil	India	36	1578
Rakesh D Raut	India	30	1068
Bhaskar B Gardas	India	27	933
Sunil Kuma Luthra	United Kingdom	24	1791
Ravi Shankar	India	24	502
Balkrishna Eknath Narkhede	India	24	869
Abid Haleem	Qatar	23	950
Sekar Vinodh	India	20	413
Nripendra Pratap Rana	Qatar	19	1116

3.3. Mapping ISM research to SDG

Figure 3 shows ISM research publications mapped to SDG, with the top five being SDG 12 (Responsible Consumption and Production, TP: 277), SDG 9 (Industry, Innovation, and Infrastructure, TP: 206), SDG 7 (Affordable and Clean Energy, TP: 82), SDG 11

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(Sustainable Cities and Communities, TP: 66), and SDG 2 (Zero Hunger, TP: 56) based on total publications.

SDG 12 (Responsible Consumption and Production, TC: 9792), SDG 9 (Industry, Innovation, and Infrastructure, TC: 5057), SDG 2 (Zero Hunger, TC: 1768), SDG 11 (Sustainable Cities and Communities, TC: 1711), and SDG 7 (Affordable and Clean Energy, TC: 1486) are most mapped ISM research in terms of the total citations.

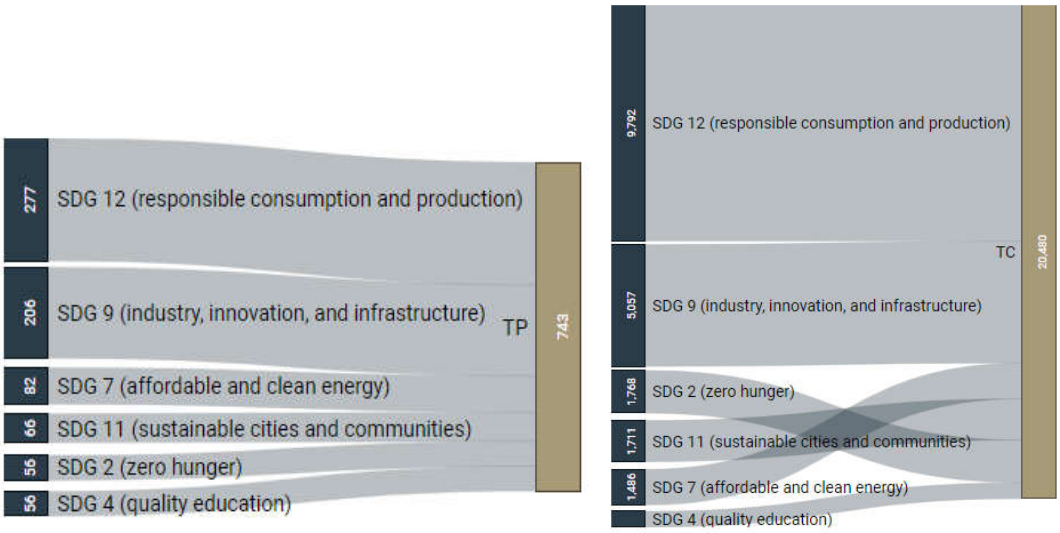

Figure 3. ISM research publications mapped to SDG.

Table 2 shows the highly cited publications from the top three SDG, namely SDG12, SDG 9, SDG 7

Table 2. Highly cited publications mapped to SDG.

Title	Authors	Citation	SDG mapping
"An ISM approach for the barrier analysis in implementing green supply chain management"	Mathiyazhagan et al., 2013	505	12 RESPONSIBLE CONSUMPTION AND PRODUCTION
"Industry 4.0, Digitization, and Opportunities for Sustainability"	Ghobakhloo, 2020	454	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
"Adoption of smart grid technologies – An analysis of interaction among the barriers."	Luthra et al., 2014	142	7 AFFORDABLE AND CLEAN ENERGY

The top-cited study by Mathiyazhagan et al. (2013) focuses on the barriers to implementing green supply chain management, making it relevant to SDG 12's target of "Responsible Consumption and Production." The study aims to identify the dominant obstacle to implementing the green supply chain management concept, making it easier for companies to adopt. The study results show that green supply chain management challenges vary among different sectors in India producing auto components and that the vendor hurdle is the dominant obstacle, particularly in promoting environmental awareness. By eliminating the dominant obstacle, the study's results will aid companies in implementing green supply chain management, contributing to SDG 12's target of sustainable management and efficient use of natural resources (Target 12.2).

The study by Ghobakhloo (2020) received 454 citations and is the most significant SDG 9 mapped publication that focuses on the sustainability roles of Industry 4.0 and adds to the body of research on sustainability. This is relevant to SDG 9, which aims to "Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.". The study methodically defines the sustainability roles of Industry 4.0 by first explaining its design and architecture and analyzing key design concepts and technological trends. This research can help stakeholders in the private and public sectors,

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businesspeople, and academics better understand the sustainability potential of the digital age and promote closer collaboration to ensure that Industry 4.0 achieves its sustainability objectives efficiently, equitably, and effectively worldwide.

The most significant SDG 7 mapped publication was the article by Luthra et al. (2014), which received 142 citations. The article addresses the rapidly increasing demand for electricity on a global scale and the need for more cost-effective, environmentally friendly, and socially responsible energy supply, consumption, and technologies. The study focuses on the need to improve grid operations and resource availability to meet the rising energy demands in an economical, effective, and environmentally responsible way. The study also examines the barriers to implementing smart grid technology and identifies ways to improve its deployment. This study is relevant to SDG 7 as it addresses the need for affordable and clean energy, which is crucial in addressing climate change and reducing radiative forcing.

In our study, a co-citation network was created to reveal the linkages between the SDG as measured by citations (Figure 4). The proximity between the SDG on the network indicates their similarity in terms of co-citation occurrence, meaning that publications from the two SDG are often cited together in the same set of publications. The nodes' size reflects the SDG frequency in terms of overall publications, and the thickness of the edges shows how often these SDG are co-cited. Two clusters of SDG were identified: Cluster 1 (red) includes SDG with a strong industrial and economic growth orientation, such as SDG 12 (responsible production), SDG 9 (industry & innovation), SDG 11 (sustainable cities), and SDG 8 (economic growth). Cluster 2 (green) groups SDG 7 (clean energy) and SDG 13 (climate action), possibly focussing on the environmental aspects along with linkages to SDG 3 (health) and SDG 4 (education).

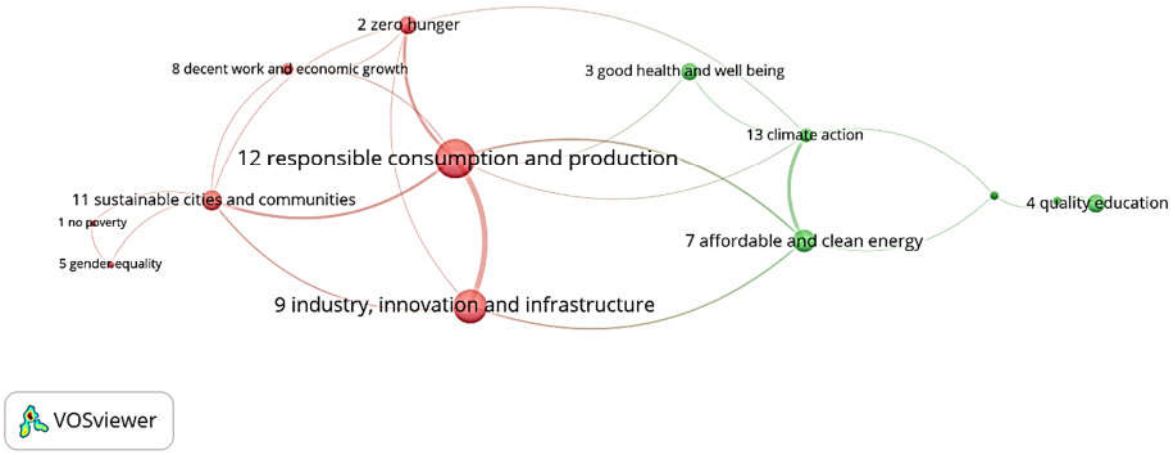

Figure 4. Co-citation network showing SDG linkages.

We analyzed the SDG network using two network analysis measures: betweenness and eigenvector. The betweenness centrality of an SDG node measures its significance as a connecting point in the flow of information within the network. This is determined by counting how many times the node lies on the shortest path between two other SDG nodes. An SDG node with high betweenness centrality serves as a bridge between different sections of the network. Eigenvector centrality is another metric used in social network analysis to measure a node's influence within a network (Hansen et al., 2011). This considers the number of connections a node has and the centrality of the nodes it is connected to. In other words, the importance of a node is determined by the number of important nodes it is connected to. SDG nodes with high eigenvector centrality in SDG networks will be considered key centers of attention.

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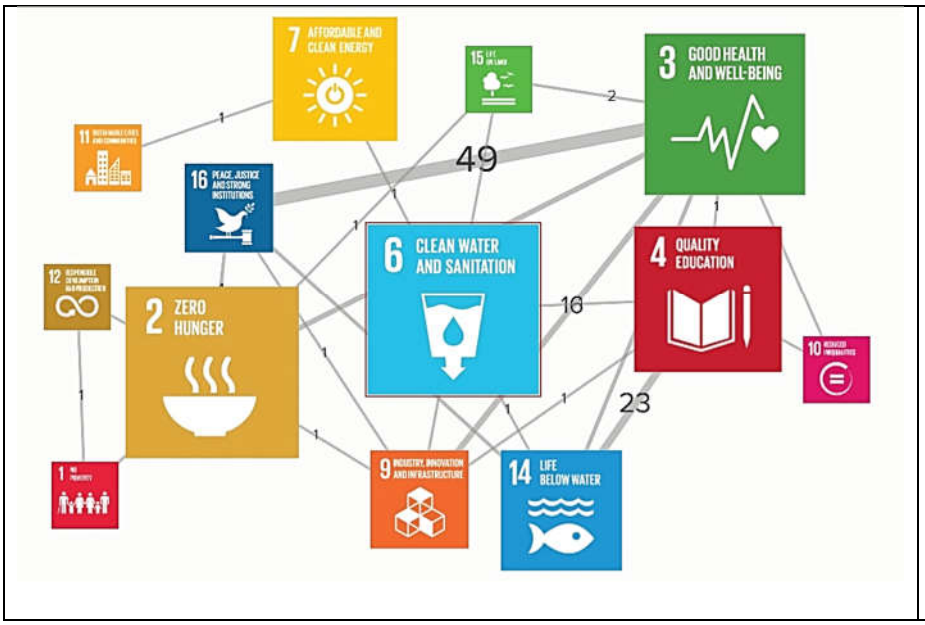
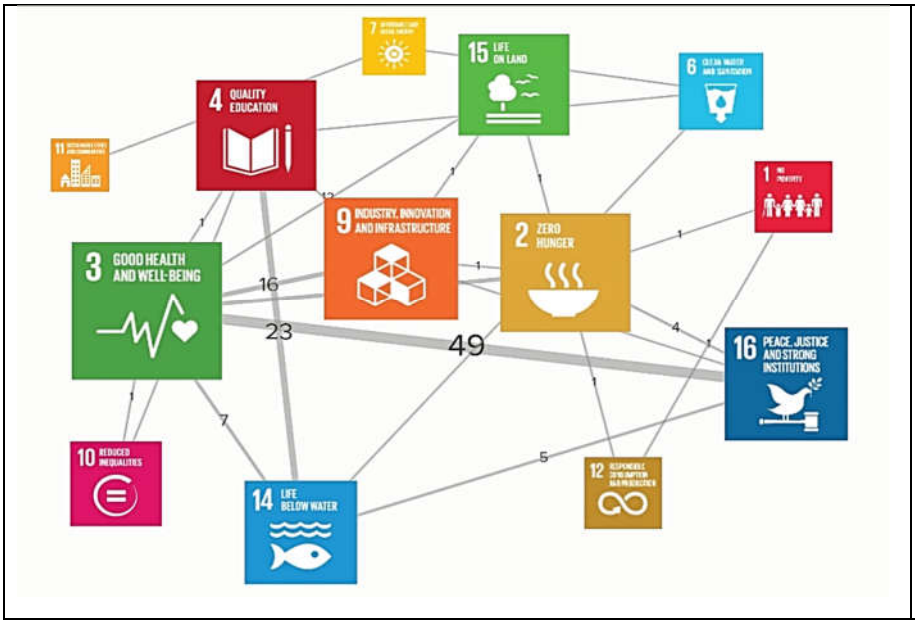
Figure 5 displays the three SDG with the highest betweenness centrality in the field of ISM research. The thickness of the links between the two goals on the map represents the strength of the connection between the two SDG. The strongest links are between Health and Peace (SDG 3, 16), between Health and Hunger (SDG 3, 2), between Education and life below water (SDG 4, 14), and between Health and Industry (SDG 3, 9). The figure highlights the central role of SDG 2, 6, and 3 in the network.



SDG	Value
SDG2	0.169
SDG6	0.167
SDG3	0.156

Figure 5. ISM research and SDG linkages (betweenness centrality).

In Figure 6, SDG 3 (good health) is seen as the network leader, having the highest eigenvector centrality value. SDG 9 (industry innovation) and SDG 2 (zero hunger) are the second most influential SDG in the eigenvector network.



SDG	Value
SDG3	0.157
SDG9	0.131
SDG2	0.123

Figure 6. ISM research and SDG linkages (eigenvector centrality).

3.4. Top contributing countries and their SDG mappings

Table 3 shows that India, China, and Iran are the top contributing countries in the field of ISM, with 32%, 11%, and 4% of total publications, respectively. These three countries have a total of 1210 publications, which represents 47% of all ISM publications in the

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review corpus. The authors of ISM publications in the review corpus came from 67 countries.

The citation mean (TC/TP), calculated to understand the quality and impact of the publications from each country, shows that Denmark received the highest TC/TP of 109.6, despite having only 22 publications. Uruguay received 59 citations for one publication, with a TC/TP of 59, while France had a TC/TP of 52.9 with 846 citations. In terms of the total number of citations (TC), India ranked first with 21507 citations, followed by China (TC: 4905), the United Kingdom (TC: 3382), and the United States (TC: 3083). These rankings reflect the quality and impact of each country's contributions to the field of ISM.

Table 3. Top contributing countries in terms of publications and citations.

	According to TP				**According to TC**		
Name	**TP**	**TC**	**TC/TP**	**Name**	**TC**	**TP**	**TC/TP**
India	818	21507	26.3	Denmark	2411	22	109.6
China	281	4905	17.5	Uruguay	59	1	59.0
United Kingdom	89	3382	38.0	France	846	16	52.9
United States	83	3083	37.1	Belgium	96	2	48.0
Denmark	22	2411	109.6	Netherlands	388	9	43.1
Iran	111	1474	13.3	Kuwait	84	2	42.0
Australia	51	1316	25.8	United Kingdom	3382	89	38.0
United Arab Emirates	35	1272	36.3	Portugal	486	13	37.4
Taiwan	65	1255	19.3	United States	3083	83	37.1
France	16	846	52.9	United Arab Emirates	1272	35	36.3

The bibliographic coupling analysis in Figure 7 highlights the collaboration and exchange of ideas in the field of ISM among different countries. It shows various countries' contributions to the ISM field in different years. In 2016, Japan, Taiwan, and Denmark made notable contributions. India, China, the United States, Indonesia, United Arab Emirates, and France dominated the field in 2017 and 2018. The number of publications from countries such as the United Kingdom, Australia, Iran, Pakistan, Italy, and Bangladesh increased in 2019. The graph shows strong connections between India and China, the United States, the United Kingdom, and Australia in ISM studies. India also seems to have connections with France, Canada, Thailand, Malaysia, Italy, and other countries. This information provides an understanding of international collaboration in the field of ISM.

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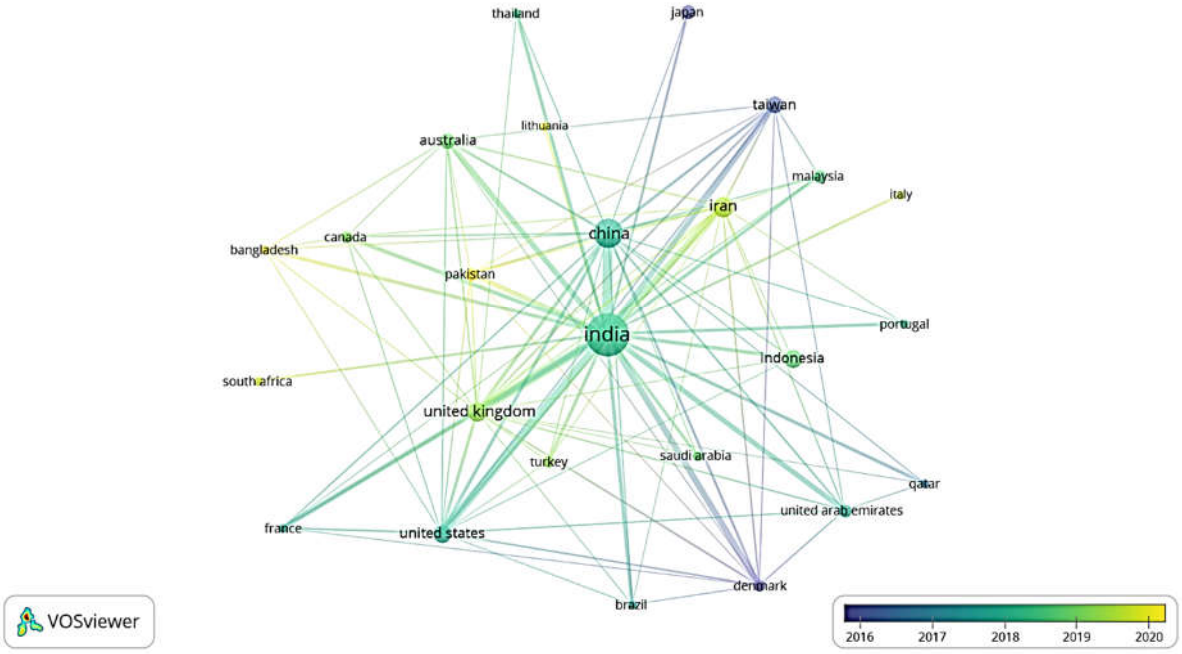

Figure 7. Bibliographic coupling of countries.

According to Figure 8, India has the highest number of publications mapped to most SDG. SDG 12 (Responsible Consumption and Production) and SDG 9 (Industry, Innovation, and Infrastructure) are the most frequently mapped SDG among the top contributing countries.

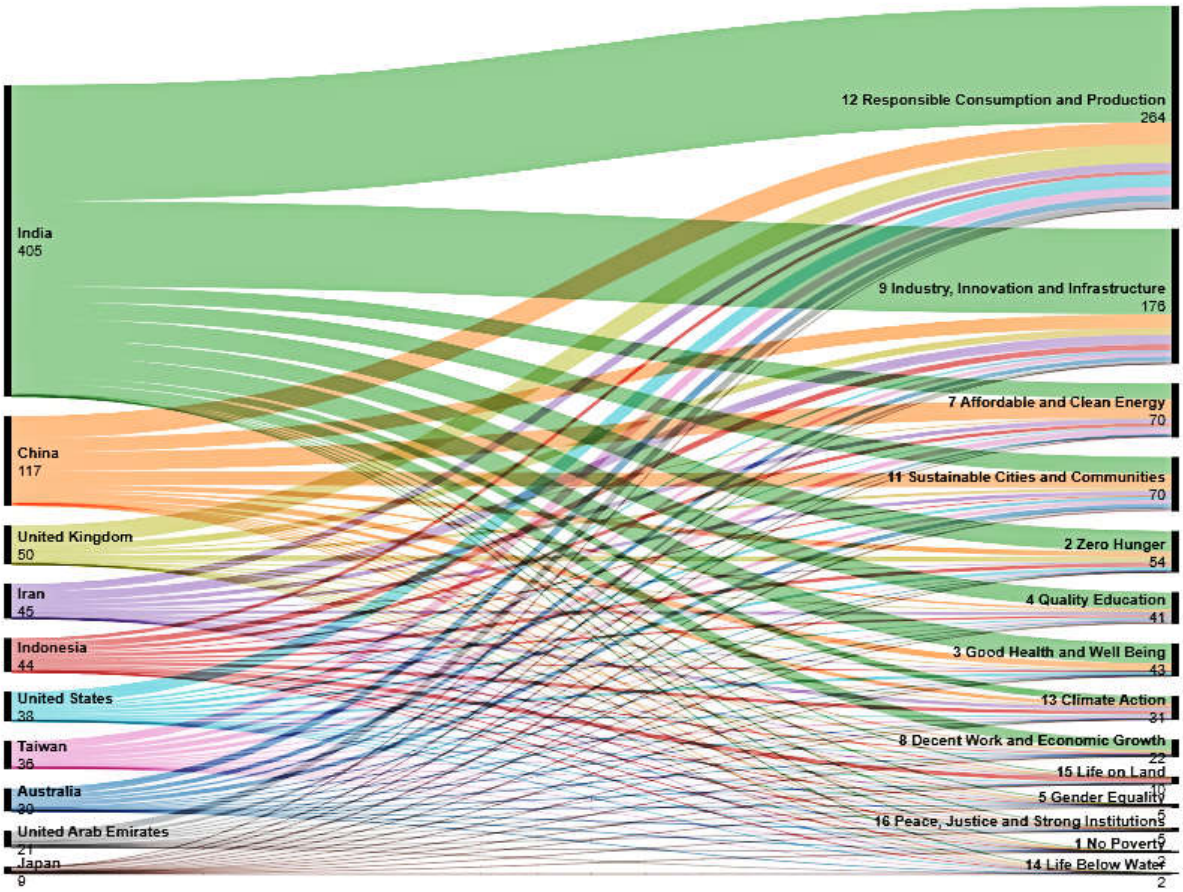

Figure 8. Mapping publications to SDG based on countries.

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3.5. Highly cited journals and their SDG mappings

Determining the most frequently cited journal sources is important because it will help future scholars focus their research on these journals. Table 4 lists the top cited journals on ISM research led by Benchmarking: An International Journal (TP:54) and The Journal of Cleaner Production with the highest citations (TC:3999).

Table 4. Top cited journals in terms of publications and citations.

According to TP				
Journal name	**TP**	**TC**	**TC/TP**	**Impact Factor (2021)**
Benchmarking An International Journal	54	1586	29.37	2.6
Sustainability	51	864	16.94	3.9
Journal of Modelling in Management	51	671	13.16	2.8
Journal of Cleaner Production	45	3999	88.87	9.3
International Journal of System Assurance Engineering and Management	28	562	20.07	2.0
According to TC				
Journal of Cleaner Production	45	3999	88.87	9.3
Global Journal of Flexible Systems Management	27	1682	62.30	4.9
Benchmarking An International Journal	54	1586	29.37	2.6
International Journal of Production Research	18	1160	64.44	8.6
Production Planning & Control	15	1049	69.93	6.8

The overlay visualization of the most frequently cited journals in the ISM field is presented in Figure 9. This figure displays the similarity between different journals based on the ISM publications they cite. The closer the journal nodes, the more similar their cited ISM publications are. The figure shows a strong connection between Sustainability and the Journal of Cleaner Production, International Journal of Production Research, Benchmarking: An International Journal, and Journal of Modelling in Management. Additionally, a large number of ISM-related publications appeared in the journal Sustainability post-2020, as well as in Benchmarking between 2017 and 2019. These findings highlight the strong connections between certain ISM journals and indicate where future research in this field may be directed.

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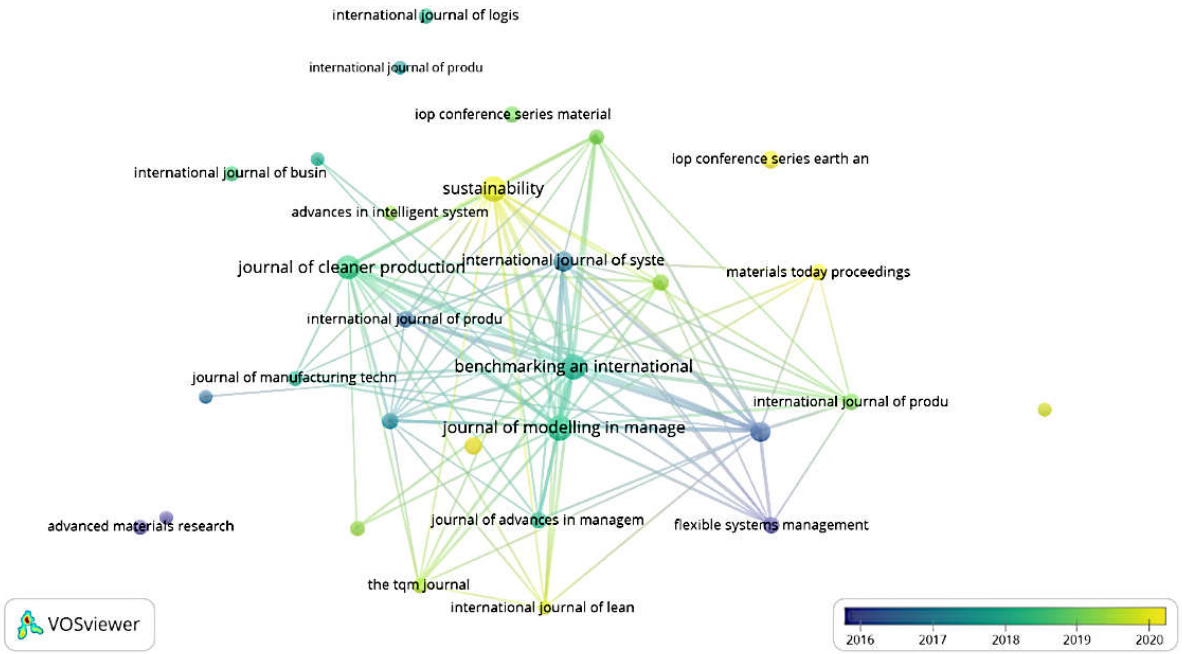

Figure 9. Top Journals overlay visualization.

According to Figure 10, the Journal of Cleaner Production has the highest number of publications mapped to twelve SDG. Among the top-cited journals, SDG 12 (Responsible Consumption and Production) and SDG 9 (Industry, Innovation, and Infrastructure) are the most frequently mapped SDG.

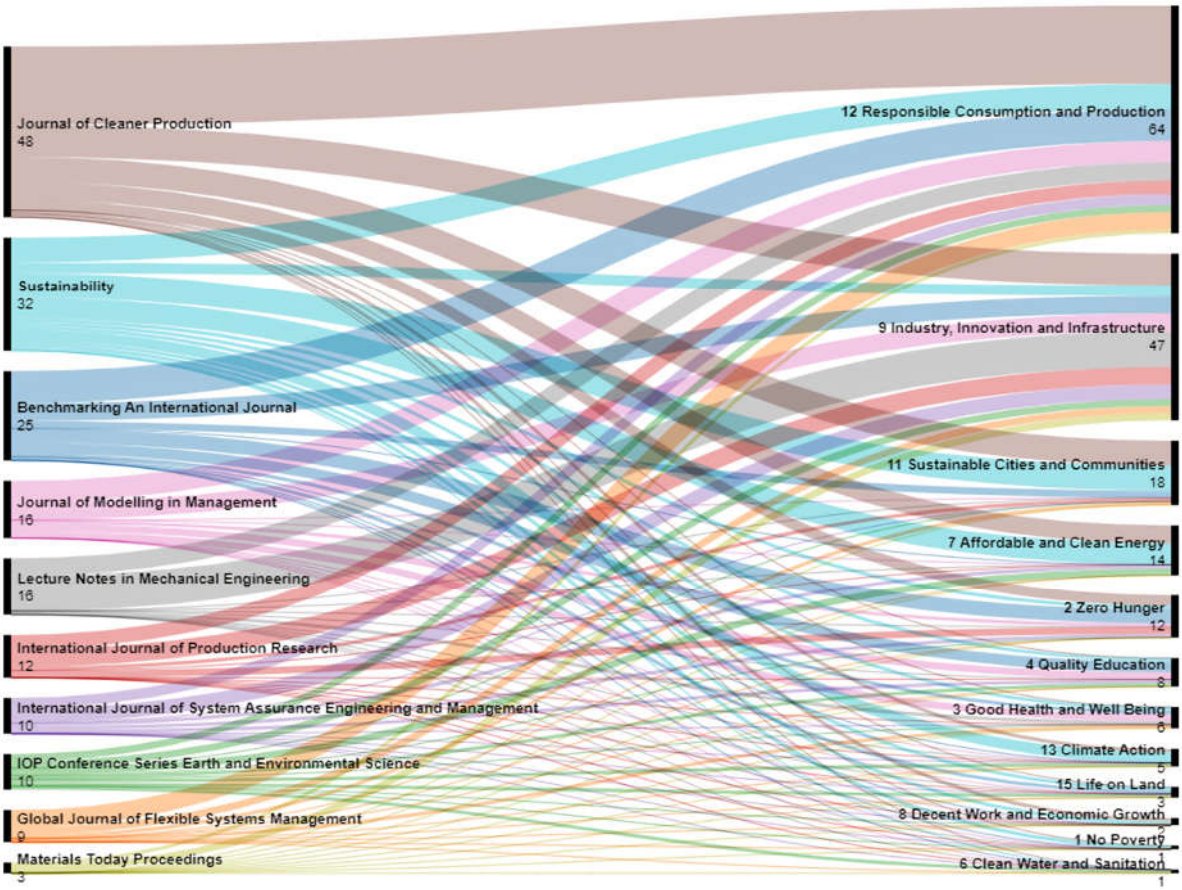

Figure 10. Mapping publications to SDG based on journals.

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3.6. Most productive institutions and their SDG mappings

Table 5 presents the most productive institutions in terms of ISM publications. The top ten institutions are in India, China, Iran, the United Kingdom, Taiwan, the United States, Indonesia, Australia, Japan, and Pakistan. India is the leading country with 122 institutions contributing to the field, followed by China with 81 institutions and the United Kingdom with 27 institutions. The Indian Institute of Technology, Delhi, stands out as the top contributor with 130 publications, followed by Amity University with 48 publications and Amrita Vishwa Vidyapeetham University with 44 publications.

Table 5. Most productive institutions in terms of publications.

University	Country	TP	TC
Indian Institute of Technology Delhi	India	130	4226
Amity University	India	48	906
Amrita Vishwa Vidya-peetham University	India	44	1012
National Institute of Industrial Engineering	India	37	1725
Indian Institute of Technology Roorkee	India	34	1285
Birla Institute of Tech-nology and Science, Pilani	India	29	399
National Institute of Technology Tiruchi-rappalli	India	28	1149
University of Mumbai	India	28	1126
Dalian University of Technology	China	24	756
Jamia Millia Islamia	India	22	817

As seen in Figure 11, the Indian Institute of Technology Delhi has the highest number of publications mapped to SDG, with SDG 12 having the most. Among the top-cited jour-nals, SDG 12 (Responsible Consumption and Production), SDG 9 (Industry, Innovation, and Infrastructure) are the most frequently mapped SDG.

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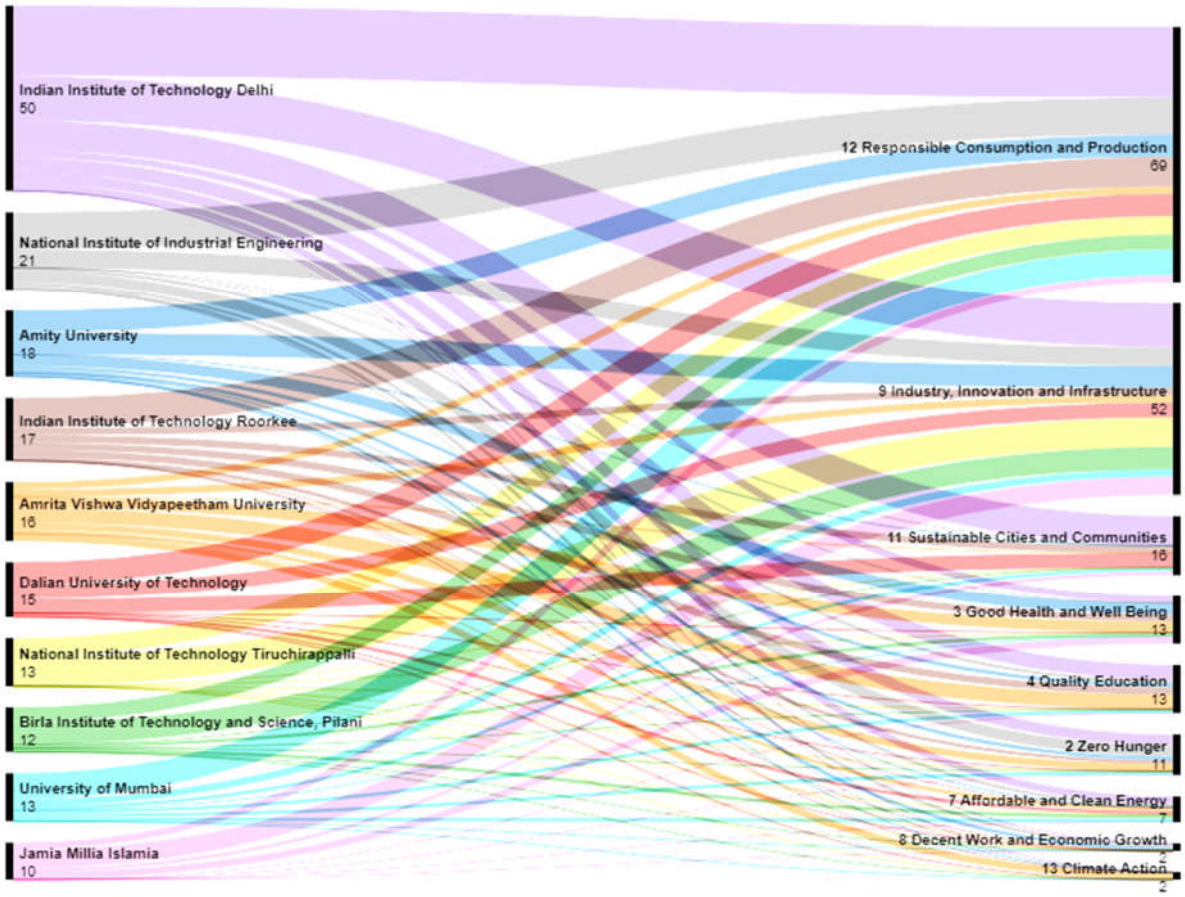

Figure 11. Mapping publications to SDG based on institutions.

3.7. Co-occurrence analysis based on keywords.

The visualization in Figure 12 shows the connection between different keywords and the topics related to ISM. The keywords are grouped based on their relationship and frequency of occurrence in the literature. The size of each node represents the frequency of occurrence, while the strength of the connection between nodes represents the co-occurrence relationship. The keywords related to ISM can be seen as clusters, with the strongest connections being in the center of the network. This information provides a clear picture of the main topics and subtopics related to ISM and their relationships. By visualizing the keywords network, researchers can get an understanding of the research structure and the trends in the ISM field.

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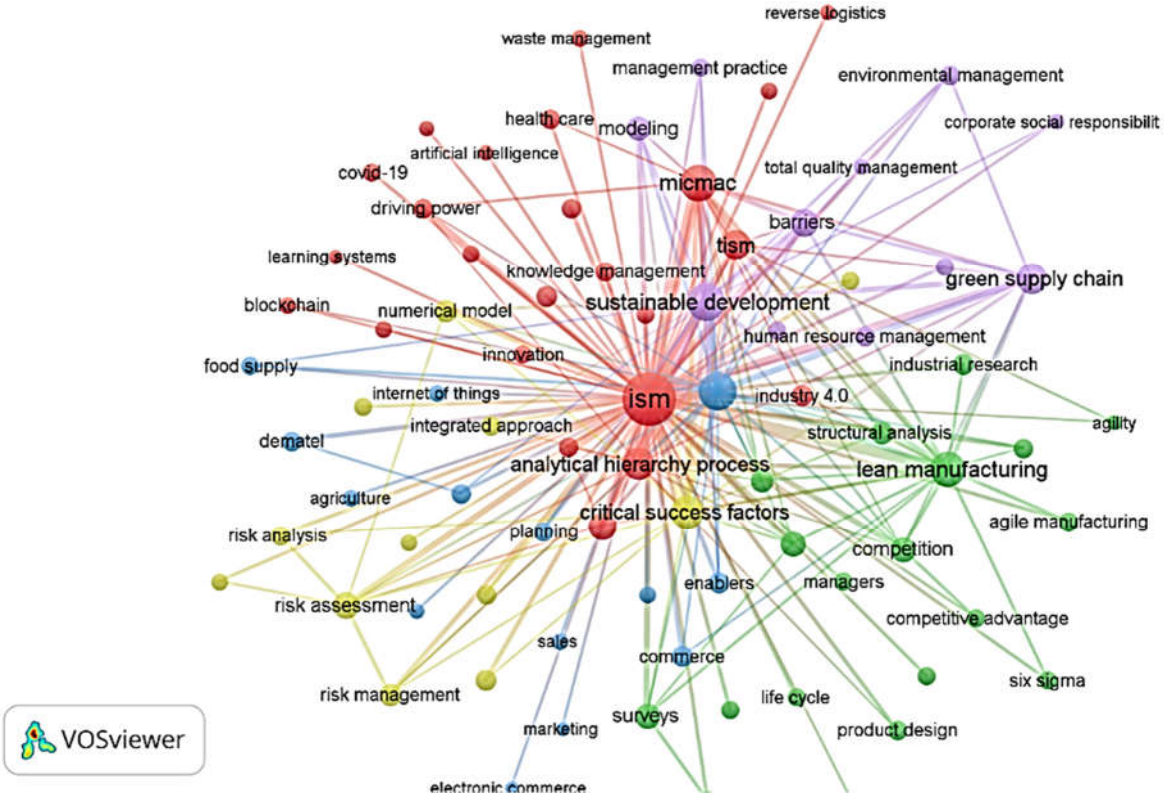

Figure 12. Co-occurrence network of keywords.

Table 6 displays the clusters of keywords on the map of ISM research based on their co-occurrence network. Each cluster comprises keywords that frequently appear together in the same research articles. The table shows the size of each cluster, the number of publications, and the main keywords representing the cluster. The thematic mapping of the keywords provides insight into the structure and connections of the research topics in ISM. It helps identify the research areas that are most prominent in the field.

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Table 6. Overview of clusters based on keyword co-occurrence analysis.

	Cluster 1 (red)	Cluster 2 (purple)	Cluster 3 (green)	Cluster 4 (yellow)
Cluster theme	Integration of ISM with MICMAC/TISM/AHP/Fuzzy Logic and alignment to sustainability	Framing strategies for various stakeholders using the ISM technique.	Decision-related matters using the ISM technique in various fields	Evaluation of various risks by using the ISM approach
Top keywords	ISM MICMAC Analytical Hierarchy Process TISM Fuzzy Logic Industry 4.0 Technology adoption Driving power Decision Theory Multi-Criteria Decision Making Blockchain Sustainable Development	Competition Surveys Design/Methodology/Approach Structural Analysis Contextual Relationships Industrial Research Agile Manufacturing Product Design Automotive Industry Green Supply Chain Environmental Management	Supply Chain Enablers Commerce Planning DEMATEL Decision-Making Trial and Evaluation Laboratories Managerial Implications Agriculture Internet of Things Big Data Traceability Lean Manufacturing	Critical Success Factors Risk Assessment Numerical Model Risk Management Project Management Risk Analysis Integrated Approach Construction Industry Investments Energy Efficiency
TP	1434	282	425	265
TC	29335	6724	13475	5322
TC/TP	20.5	23.8	31.7	20.1

Four thematic areas emerge from the cluster analysis.

3.7.1. Cluster 1 (Red): Integration of ISM with MICMAC/TISM/AHP/Fuzzy Logic and alignment to sustainability.

The first cluster, shown in red, focuses on integrating ISM with other methodologies and aligning it with sustainability. This cluster has the highest number of publications (1434) and citations (29335) but has a lower TC/TP ratio (20.5) compared to other clusters. The top three cited articles are shown in Table 7.

The highly cited article by Mathiyazhagan et al. (2013) explores the challenges to implementing green supply chain management and uses ISM to analyze the 26 identified obstacles. It highlights that the main barrier is the supplier and calls for proper consideration of the client and distribution network in supply chain management, including green supply chain management. The second highest-cited article in the red cluster is "Industry 4.0, digitization, and opportunities for sustainability" by Ghobakhloo (2020). The study sheds light on the potential of Industry 4.0 to contribute to sustainability, despite the radical changes brought about by digital transformation. And further identifies the sustainability roles of Industry 4.0 and helps stakeholders, including government entities, business owners, and academicians, to better understand the opportunities for sustainable development presented by the technological age. They aim to ensure that Industry 4.0 meets its sustainability goals efficiently, equitably, and equivalently throughout the world. The third highest-cited article in this cluster is "Analysis of third party reverse logistics provider using ISM" by Govindan et al. (2012). The article examines how a corporation can participate in reverse logistics activities by employing a third-party logistics provider in a complex business environment. The study highlights the importance of selecting the right

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suppliers for reverse logistics as the idea and practice of reverse logistics matures (Govindan et al., 2012).

Table 7. Top cited articles in cluster 1.

Article	Authors	Citation
"An ISM approach for the barrier analysis in implementing green supply chain management"	Mathiyazhagan et al., 2013	522
"Industry 4.0, digitization, and opportunities for sustainability"	Ghobakhloo, 2020	406
"Analysis of the third-party reverse logistics provider using interpretive structural modeling"	Govindan et al., 2012	323

3.7.2. Cluster 2 (Purple): Framing strategies for various stakeholders using the ISM technique.

The second cluster contains 282 publications that use the ISM approach to develop strategies for various stakeholders. The ISM approach effectively identifies decision-making factors with 6724 citations and a TC/TP of 23.8. Table 8 shows the top three cited articles in this cluster.

Kamble et al.'s article has the highest number of citations, at 276. This study aimed to investigate the obstacles to Industry 4.0 adoption in manufacturing companies and provide insights into the key barriers, their short-term and long-term effects, and their driving forces. This information can assist professionals and policymakers in overcoming the challenges of a successful digital manufacturing platform. The second most highly cited article in Cluster 2 is "Barriers in green lean six sigma product development process: An ISM approach" by Kumar et al. (2016), which has a citation count of 169. The article explores the use of ISM to identify barriers to implementing green lean six sigma, a strategy aimed at reducing costs, optimizing processes, and promoting sustainability in product development. The study highlights the strategic value of this approach in the highly competitive business environment. The third most highly cited article in Cluster 2 is "Strategic response to Industry 4.0: an empirical investigation on the Chinese automotive industry" by Lin et al. (2018), with 145 citations. This study investigates the strategies adopted by the Chinese automotive industry towards Industry 4.0 and identifies the key factors for successful adoption. The findings suggest that factors other than company size and nature positively impact technology deployment but do not necessarily lead to the use of advanced production methods.

Table 8. Top cited articles in cluster 2.

Article	Authors	Citation
"Analysis of the driving and dependence power of barriers to adopt industry 4.0 in Indian manufacturing industry"	Kamble et al., 2018	276
"Barriers in green lean six sigma product development process: An ISM approach"	Kumar et al., 2016	169
"Strategic response to Industry 4.0: an empirical investigation on the Chinese automotive industry"	Lin et al., 2018	145

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3.7.3. Cluster 3 (Green): Decision-related matters using the ISM technique in various fields.

The third cluster consists of 425 publications that use ISM to make informed decisions across various fields. With 13475 citations, this cluster has the highest TC/TP of 31.7. Table 9 shows the top three cited articles in this cluster.

Agriculture was studied specifically in the current investigation by various researchers, but businesses in this field are often globally-focused and face numerous issues. The ISM method can address these problems simultaneously, making it a valuable tool for conducting regular business. It is believed that the implementation of blockchain technology in the agriculture supply chain will bring about a transformation in the way transactions are conducted, reducing the number of intermediaries, late payments, and long process lead times. India, a developing country facing sustainability challenges in the agriculture supply chain, needs this technology to meet its expanding population's growing food security demands (Kamble et al., 2020). Businesses are under pressure from customers, international competitiveness, and government regulations to adopt sustainable practices, leading to a focus on environmental performance over economic success (Diabat et al., 2014). Organizations must develop resilient supply chains to mitigate risk and gain a competitive advantage in a changing business environment. The research into supply chain resilience helps firms quantify and evaluate the resilience of their supply chains, aiding decision-making and potentially making it easier to manage supply chain disruptions in dynamic settings (Soni et al., 2014).

Table 9. Top cited articles in cluster 3.

Article	Authors	Citation
"Modeling the blockchain-enabled traceability in the agriculture supply chain."	Kamble et al., 2020	305
"Measuring supply chain resilience using a deterministic modeling approach."	Soni et al., 2014	241
"Analysis of enablers for implementation of sustainable supply chain management - A textile case"	Diabat et al., 2014	220

3.7.4. Cluster 4 (Yellow): Evaluation of various risks using the ISM approach.

The fourth cluster of the publication studies focuses on risk elimination through the application of ISM. There are 265 publications, with 5322 citations and a TC/TP of 20.1. Table 10 shows the top three cited articles in this cluster.

The increased vulnerability of supply chains to risks due to unpredictable demand, global economic integration, accelerating product life cycles, and complex international supply network relationships have led to the need for effective risk management techniques. Companies today need to adopt innovative supply chain management strategies, such as "lean," "green," and "resilient" practices, to remain competitive. However, these practices face challenges in terms of incorporating essential issues. Therefore, senior management must concentrate on identifying the crucial "lean," "green," and "resilient techniques" to enhance the efficiency of automotive supply chains (Govindan et al., 2012). As unpredictability increases, the supply chain becomes increasingly vulnerable to risks. This is especially true for businesses that rely heavily on outsourcing and have complex international supply network relationships. To mitigate these risks, it is crucial to understand the sources of risk and how they interact (Diabat et al., 2012). Companies today need to adopt effective supply chain management strategies to be competitive. The concepts of "lean," "green," and "resilient" are seen as innovative solutions, but incorporating and addressing essential issues in these approaches is a challenge. To improve the efficiency of

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automotive supply chains, senior management should focus on identifying and utilizing the key "lean," "green," and "resilient" techniques (Govindan et al., 2012).

Table 10. Top cited articles in cluster 4.

Article	Authors	Citation
"Lean, green and resilient practices influence on supply chain performance: an interpretive structural modeling approach."	Govindan et al., 2015	205
"Supply chain risk management and its mitigation in a food industry"	Diabat et al., 2012	197
"Analysis of critical success factors of world-class manufacturing practices: An application of interpretative structural modelling and interpretative ranking process"	Haleem et al., 2012	177

3.8. ISM research and COVID-19

Studying the relationship between ISM research and the COVID-19 pandemic is important. The pandemic caused significant concerns and speculation due to its rapid global spread, the high number of deaths, the lack of treatment, the emergence of various variants, and reliance on social media as a source of information and communication. Using the SPAR-4-SLR framework, COVID-19 was filtered in the title and abstract of a sample of 1988 publications, resulting in 59 articles from 34 countries, with the majority coming from India, Pakistan, and South Africa. The author with the most publications on the topic is M. Suresh, with 11 publications, followed by Tehmina Fiaz Qazi and Abdul Aziz Khan Niazi, each with six publications (Table 11).

Table 11. Top authors based on publication.

Name	TP	TC
M. Suresh	11	248
Tehmina Fiaz Qazi	6	38
Abdul Aziz Khan Niazi	6	38

The top cited articles related to ISM methodology and COVID-19 are shown in Table 12.

Table 12. Top cited articles related to COVID-19.

Article	Author	Citation
"Improving supply chain sustainability in the context of the COVID-19 pandemic in an emerging economy: Exploring drivers using an integrated model"	Karmaker et al., 2021	159
"Factors influencing the epidemiological characteristics of pandemic COVID 19: A TISM approach."	Lakshmi Priyadarsini et al., 2020	140
"What can we learn from previous pandemics to reduce the frequency of emerging infectious diseases like COVID-19."	Lakshmi Priyadarsini et al., 2020	49

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The top cited article is titled "Improving supply chain sustainability in the context of COVID-19 pandemic in an emerging economy: Exploring drivers using an integrated model." This research aims to study the drivers of sustainable supply chains in the context of the COVID-19 pandemic in Bangladesh and proposes a methodology based on Pareto analysis, fuzzy theory, and TISM to improve supply chain sustainability. Findings from this study suggest that financial support and policy development focused on health protocols and automation are necessary for long-term sustainability in supply chains. The MICMAC analysis also clusters drivers to provide insights into supply chain sustainability. These findings can help industrial managers, supply chain partners, and government policymakers address sustainability in the context of the COVID-19 pandemic. The second most cited article is titled "Factors influencing the epidemiological characteristics of pandemic COVID-19: A TISM approach." This research uses the TISM approach to identify and categorize the socio-biological and climatic factors influencing the global spread of COVID-19. The MICMAC analysis of these factors found that air temperature, humidity, age, airflow, and ventilation can increase the mortality rate of COVID-19 compared to other epidemics. The model also predicts the susceptibility of countries based on their geographic location and upcoming climatic conditions. The study suggests that host behavior and the number of contacts can be targeted to address the spread of the virus, as these factors can be altered by human intervention. This is the first study to use the TISM approach to understand the epidemiological characteristics of COVID-19.

This is followed by an article, "What can we learn from previous pandemics to reduce the frequency of emerging infectious diseases like COVID-19?" as the third highest cited article. Climate change is a leading global risk, according to the 2020 Global Risks Report. In recent decades, the frequency of new infectious diseases has increased, and rapidly mutating viruses, epidemics, and climate-sensitive vector-borne diseases are expected to increase and intensify. Susceptible disease hosts, human activities, and environmental changes contribute to the "adaptive evolution" of infectious agents. Mathematical modeling tools were used to identify and rank risk factors, including TISM and MICMAC. Immediate action is needed to address the factors contributing to the evolution of pathogens and the frequent emergence of pandemics, as we are not prepared for another pandemic outbreak like COVID-19.

4. Future research directions

The results of this study suggest several research topics for further study. We arrived at future research topics based on the prominence percentile from SciVal. Prominence, a measure of a field's momentum, is used to order topics. Topic prominence will help answer the following questions (SciVal, 2022, February): "Which are the topics with high momentum that are likely to be well-funded and thus have higher grant success rates?"; "Who else is active and publishing research on a similar topic to mine, whom I could partner and co-author with?"; "What are some related Topics adjacent to mine with a lot of momentum, where I could focus my research attention?" The prominence percentile, which measures the topic's popularity and dynamism, is derived from the number of citations, Scopus view, and journal CiteScore. Identifying themes with high prominence percentile might be helpful for academics and policymakers because topic prominence is positively correlated with research funding and grants (Wang et al., 2021). Table 13 shows the top topics ranked by prominence percentile.

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Table 13. Emerging research topics related to ISM.

Topics	Prominence Percentile
Blockchain; Internet of Things; Cloud computing	99.982
Sustainability; Environmental Management Systems	99.947
Technology Management; Innovation; Productivity	99.928
Climate Change Adaptation; Urban Climate; Resilience	99.878
Smart Cities; Sustainable development	99.863
Information Modeling; Facilities Management; Construction Industry	99.836
Humanitarian Logistics; Disaster Relief; Disaster	99.145

Blockchain; Internet of Things; Cloud computing

This topic has the highest prominence percentile of 99.982. One of the most potential emerging economy innovations is "blockchain technology." The enormous market opportunity of blockchain technology has captured the interest of scholars and business professionals, taking the corporate world by storm (Kamble et al., 2020). ISM can be used to understand the relationships between stakeholders, such as miners, developers, users, and regulators, and how they influence the functioning and evolution of the blockchain. It can also be used to analyze the dependencies between different components of the blockchain, such as the network infrastructure, consensus mechanisms, and smart contracts. Developing intriguing new technologies like cloud computing, big data, machine learning, and cognitive computing promise to fundamentally alter how businesses operate (Prasad et al., 2018). Industry and technological attempts should be heavily concentrated on "enhancing regulatory clarity," "fostering industry collaboration," "creating a rich ecosystem," "creating industry standards," "investing in blockchain technology," and, last but not least, "engaging and educating leaders on blockchains' capability and applications" to accomplish the consistent success of blockchain-based cloud services (Prasad et al., 2018). Through the use of ISM methodologies, the hierarchical structure can be developed to lead sustainable organizations. The studies can also suggest fostering new business prospects with intelligent technology to create a predictable business climate by enhancing administrative effectiveness, openness, economic mobility, and infrastructural services. The corporate sectors are trying to adopt advanced technologies to sustain themselves in the VUCA world. ISM can help identify the potential benefits and challenges of integrating these technologies into sustainable development strategies and can be used to prioritize actions to achieve specific SDG targets.

Sustainability; Environmental Management Systems

This topic has the second highest prominent percentile of 99.947. There is a trend among businesses to adopt green practices as part of their strategic agendas to reduce their environmental impacts and potentially improve their performance. Using Environmental Management Systems (EMS) can give organizations a competitive edge as market rivalry rises. Due to growing consumer understanding of environmental concerns and market concern for the environment, EMS use is rising across many industries. Although there is a wealth of literature on the advantages of EMS implementation, more attention should be paid to the difficulties (Yang et al., 2017). Green human resource management is currently a popular topic. Still, the literature on this subject lacks a clear definition of green human resource management practices and a lack of theoretical contributions to the concept of "greening" the workforce (Moktadir et al., 2019). Future research could explore the factors that help organizations implement green human resource management practices, referred to as antecedents. These antecedents may include prerequisites that encourage enterprises' green human resource management practices (Raut et al., 2020). By considering the interconnections between EMS and specific SDG targets, ISM can support the development of integrated and effective strategies for environmental management and the achievement of the 2030 Agenda for Sustainable Development.

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Technology Management; Innovation; Productivity

Innovation plays a crucial role in firms obtaining a competitive advantage in the quickly evolving commercial sector. The extant literature covers various issues related to technology management and business innovations. Therefore, it is necessary to close these gaps in ways that contribute to organizational innovations (Rajan et al., 2020). Companies are putting more effort into finding novel collaborations and methods due to adopting open innovation forms to detect outside knowledge better. Despite the significance of knowledge-sharing practices for businesses, only a few studies have considered how open innovation arrangements can improve knowledge-sharing practices (Crupi et al., 2020). How can ISM be used to identify potential barriers to technological innovation and productivity within an organization, and how can these barriers be overcome? How do external factors, such as regulations or market conditions changes, impact an organization's technological innovation and productivity? For example, ISM can be used to analyze the potential impact of technology management and innovation on SDG Target 9.5 (Improve the technological capacity of the industrial sectors in all countries, especially those that are developing).

Climate Change Adaptation; Urban Climate; Resilience

Global pandemics like COVID-19 harm people's physical and emotional health (Xu et al., 2021). To improve community resilience, particularly within the cities and our communities, ISM could be used to understand the interdependencies between adaptation strategies, such as green infrastructure, early warning systems, and disaster risk reduction measures, and how they influence each other. There is much focus on how cities should prepare for and recuperate from such catastrophes, and resilience has become crucial. How do external factors, such as regulations or funding changes, impact urban areas' adaptation and resilience to climate change? Future researchers can determine the variables that affect resilience and investigate their causal relationships to assist in managing the risks related to COVID-19, drawing on research on resilience. ISM can be used to analyze the potential impact of reducing greenhouse gas emissions and promoting sustainable land use on SDG Target 13.3 (Boosting institutional and human capability for advance detection, impact mitigation, adaptation, and reduction of climate change).

Smart Cities; Sustainable Development

Smart cities are seen as the way the economy of the country would flourish in the future. Over the last twenty years, this idea has grown in significance. Due to their access to cutting-edge technology, robust resources, and efficient city-planning techniques, industrialized nations find it easier to construct smart cities. However, existing smart cities are helpful since they guide future developments (Yadav et al., 2019). Smart cities offer suggestions for future urban development and building orientations due to the constant change in technology and society. The smart city includes and engages with human and social capital in addition to just integrating innovative infrastructure and technology or efficient transmission of information among tall buildings (Jiang et al., 2020). In the context of smart cities and sustainable development, ISM can be used to identify the key drivers of sustainable development and the factors that influence the adoption and implementation of smart city technologies. For example, it could be used to understand the interdependencies between smart city technologies, such as intelligent transportation systems, smart energy systems, and smart waste management systems, and how they influence each other. ISM could potentially be used to understand the relationships between the various elements contributing to achieving the SDG in a smart city. For example, ISM could be used to understand the relationships between different technologies, infrastructure, policies, and other factors that influence the progress toward the SDG in the smart cities context.

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Information Modeling; Facilities Management; Construction Industry

The complexity of the construction business can be attributed to operational inefficiency, uncertainty, and dependency, which have led to a growth in the industry's complexity. "Total Quality Management (TQM)," "lean practices," "sustainability," "partnering," and "building information modeling (BIM)," among others, have all been suggested as solutions. These are directed at enhancing the procedures used in the construction sector. But only BIM has had a significant impact on the entire industry. The introduction of BIM presents novel chances to maximize the effectiveness of prefabricated construction. A significant line of "integration" offered by BIM, a digital depiction of a built facility, is also essential for delivering prefabricated buildings (Tan et al., 2019). The information and data made accessible by the BIM may be easily changed, duplicated, and distributed with the project stakeholders, improving interoperability throughout different stages of the undertaking (Saka et al., 2020).

Humanitarian Logistics; Disaster Management; Big Data

Researchers can look into the humanitarian logistics aspect using the ISM approach, especially in disaster management using Big data. The key components of commercial and humanitarian supply chain management systems are the delivery of the "right suppliers" at the "right time," to the "right place," in the "right quantities," and to the "right people" (Petrudi et al., 2020). Future studies might also examine the impact of combining blockchain and big data analytics in the humanitarian supply chain. Future academics should devote more attention to "performance metrics" and "metrics in sustainable humanitarian supply chain management." Using ISM, it is possible to investigate the effects of behavioral factors on the humanitarian structure, including leadership and culture. The humanitarian logistics and supply chain field have a rare chance to combine ecological footprints. A growing community known as responsible humanitarian logistics and supply chain will also result from this (Yadav et al., 2016). Future research in this area seems highly promising and will be crucial in determining the obstacles to using solar energy in different nations and their relative importance (Sindhu et al., 2016). ISM can be used to analyze the potential impact of efficient humanitarian logistics and disaster management on SDG Target 11.5 (With an emphasis on safeguarding the underprivileged and those in susceptible situations, considerably decreasing the number of fatalities, the number of those impacted, and the immediate economic losses as a percentage of the world's gross domestic product by 2030).

5. Conclusions

This study provides a comprehensive examination of ISM tool usage in the literature. By analyzing 1988 publications from 2012 to 2021, the study used bibliometric analysis and visualization techniques to highlight research hotspots and address gaps in the existing literature to respond to RQ1. The rise in publications over time highlights the research community's growing interest and commitment to further understanding and promoting ISM. M. Suresh was identified as the most influential author in the field. India, China, the United Kingdom, and the United States were the top four countries contributing to ISM publications, and Benchmarking: An International Journal, Sustainability, Journal of Modelling in Management, and Journal of Cleaner Production were the most cited journals.

The research question RQ2 was to determine how well ISM research maps to SDG. The findings suggest that ISM research maps to multiple SDG, with a particular focus on SDG 12 (Responsible Consumption and Production), SDG 9 (Industry, Innovation, and Infrastructure), SDG 7 (Affordable and Clean Energy), SDG 11 (Sustainable Cities and Communities), and SDG 2 (Zero hunger). The study identified four key clusters in ISM research, including the integration of ISM with AHP & Fuzzy Logic for sustainability alignment, ISM-based strategy formulation for various stakeholders, ISM-based decision-making in various fields, and ISM-based risk evaluation. These findings answer RQ3 of what clusters and themes exist in the current ISM literature. RQ4 examined the

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relationship between COVID-19 and ISM. Research on COVID-19 and ISM has been conducted in 58 countries, with most publications coming from India, Pakistan, and South Africa.

Recognizing that no research is comprehensive and completely free from limitations is important. One potential limitation is that some publications may have been missed in the analysis of the keywords used to shortlist articles that were not explicitly stated in the title, abstract, or keywords of the publications. This could result in some inconsistencies in the statistical analysis. Additionally, the citation analysis technique used in this study only considers the importance of the referenced papers. It does not differentiate between articles that focus specifically on the SDG and those that mention ISM and the SDG in part. The current analysis also focused on peer-reviewed publications and excluded grey literature, such as government reports, which could potentially affect the results. In this study, only published literature available on well-known databases like Dimensions was considered. Additionally, the scope of the study was limited to 2012 to 2021, so any studies published outside these years are not included in the analysis.

Implications

The method known as ISM is used to examine and comprehend the connections between diverse system components, such as objects, thoughts, and ideas. ISM aims to visually depict the system's structure so that users can make more informed decisions. ISM can be used by researchers to provide practitioners with many implications. Identifying a system's essential components, ISM can assist authors in determining which components of a system are most important and how they interact. This can aid readers in understanding the important aspects that affect a specific topic or situation. ISM can give a visual depiction of the intricate connections between the system's various components. This can aid the researchers or practicians in understanding the different interdependencies and cause-and-effect linkages between the elements. ISM can assist the researchers in finding the source of a problem by looking at all the elements that go into the problem. This can aid readers in comprehending the issue's root causes and developing workable remedies. ISM can aid researchers in assessing alternative solutions to the problem by examining how they might affect the various system components. This can aid the practitioners in better understanding the potential effects of various solutions and aid them in making more informed choices. Therefore, ISM can be a helpful tool for researchers to help practitioners comprehend complex systems and make better judgments in general. Researchers can assist practitioners in recognizing important elements, outlining relationships, identifying the core cause, and assessing potential remedies by presenting a visual picture of a system's structure.

6. Recommended approaches

ISM is a valuable tool for understanding the complex interrelationship among the elements. The ISM can be used in the future using various approaches. The experts and stakeholders can be involved in the ISM process. This collaborative approach can help ensure that the model accurately reflects the interrelationships among the elements and that the results are meaningful and actionable. Multiple perspectives can be considered when developing the ISM. Different stakeholders may have different views on the relationships among the elements, and these perspectives should be taken into account to develop a comprehensive model. Various software tools can be utilized to facilitate the creation and analysis of the ISM. The ISM can be evaluated and refined continuously as new data and information become available. Systems are dynamic and constantly evolving, and the ISM should be updated to reflect changes in the system. The ISM can be integrated with other analytical methods such as fuzzy TOPSIS-ISM (Kannan et al., 2009), DEMATEL-ISM (Shakeri et al., 2020), ISM and fuzzy ANP (Yadav et al., 2021), ISM and type-2 fuzzy (Tavoosi et al., 2021) and many more, to gain a more comprehensive understanding of the system. In conclusion, ISM is a valuable tool for understanding complex systems, and its use should be informed by a collaborative, multi-perspective approach, and

utilization of software tools. Ongoing evaluation and refinement of the ISM are critical for ensuring that it accurately reflects the evolving nature of the system.

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