A Bibliometric Analysis of Smart Manufacturing and Way Forward

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Abstract The term "smart manufacturing," often recognized as "intelligent manufacturing," remains widely utilized to indicate future manufacturing, or production of the future. It is an advanced style of manufacturing that blends industrial assets from the current and future perspectives with sensors, computer platforms, data-intensive modelling, communication technologies, management, simulation, and analytical engineering. It draws ideas from several fields, including data science, cloud computing (CC), artificial intelligence (AI), and cyber-physical systems (CPS). To give a comprehensive knowledge of the present understanding and many elements of smart manufacturing (SM), this study analyses the available literature, modern theories, information, and gaps for potential research initiatives. To determine the extent and trends of SM, a bibliometric study is utilized to reflect the various publishing sources, yearly publication numbers, keyword frequency, and top research and development regions.

Keywords Smart manufacturing (SM) · Circular economy (CE) · Industry 4.0 (I4.0) · Intelligent manufacturing · Sustainability

1 Introduction

Future production is often described by the phrase "smart manufacturing," often referred to as "intelligent manufacturing," which is used to describe such manufacturing [46, 56, 65]. In the area of smart manufacturing, publications are multiplying quickly. Numerous articles emphasize giving a detailed analysis of the problems

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K E K Vimal et al. (eds.), *Industry 4.0 Technologies: Sustainable Manufacturing Supply Chains*, Environmental Footprints and Eco-design of Products and Processes,
https://doi.org/10.1007/978-981-99-4819-2_10

affecting smart manufacturing. Several academics are interested in smart manufacturing, and they have published their findings in the literature. Smart manufacturing is a kind of production that uses optimized processes and procedures to increase yield while reducing energy footprint and costs. This is made feasible by the advancements in advanced modelling, controls, optimization, and big data that have occurred during the last decade. As a result, smart manufacturing is viewed as the industrial revolution 4.0.

Smart production systems are completely integrated, collaborative, and capable of real-time adaptation to changing plant circumstances and demands as well as supplier network and customer needs. Information and communication technologies are crucial to manufacturing systems. Cyber systems and associated intelligent and smart technologies [78, 87] still being in the development stage has led to the evolution and growth of CPS, Industry 4.0 (I4.0), digital twin, IoT, big data, cloud computing, and next-generation artificial intelligence [38, 54]. Several innovative manufacturing paradigms have been suggested to increase the "intelligence" or "smartness" of manufacturing systems and processes. "Smart manufacturing," a phrase that originated in the US but is now more widely used, is a collection of production processes that employ networked data, knowledge, and interaction tools to govern industrial activities. The application of AI techniques, such as big data analytics, business decision support systems, data-driven algorithms, and machine learning (ML), to improve industrial operations is referred to as "smart manufacturing." Although Smart Production primarily focuses on techniques for enhancing choices and processes inside industrial manufacturing settings, I4.0 primarily focuses on information sharing and interfaces.

The deliberation on the fundamental properties of CPS [66] gave an impression of the German I4.0 project and production activities in other nations [72]. The following scholars assessed the literature on smart manufacturing and the technology necessary for its development [35, 37, 41, 56]. The significance of data-driven industrial policymaking was emphasized by [31]. The investigations on the principles that impact smart manufacturing systems, products, and business aspects were done by [42].

Information and communication technology are crucial to manufacturing organizations. Future-proof AI, big data, I4.0, CPSs, IoT, cloud computing, [37, 75], digital twins (DT), CPSs are necessary to support the development of cyber systems and the related intellectual smart technologies [54]. Based on these ideas, a number of advanced manufacturing paradigms have been put out to increase manufacturing systems and processes as part of "intelligence" or "smartness" [46, 56, 86] or "Industrial Internet" (Bungart 2014), "Integrated Industry" [9], "Factory of the Future" [40], and "Smart Industry and Smart Manufacturing" [37]. This article seeks to advance the existing knowledge of Smart Manufacturing while presenting a novel angle for future research.

RQ 1. What is the present awareness and understanding of smart manufacturing?

RQ 2. What future research directions for smart manufacturing must be determined based on current works and recognized possible research gaps?

This research work is broken into eight categories. The first section gives a synopsis of the research area and describes the primary objective and directions we choose based on an examination of the literature depicted in the second section. The methods using the categorization of published literature from the Scopus database were drawn in the third section. Research analysis, conclusions, and findings were discussed in the fourth, fifth, and sixth sections, with respect to the area's significant topics, most illustrious journals, prolific writers, and scholarly and social structure. In the seventh section, a list of future research topics was provided, and in the eighth portion, this study's shortcomings were discussed.

2 Literature Review

Production companies are being propelled by I4.0 to transform into a modern production of CPSs that allow network-enabled smart manufacturing. The degree of "smartness" is mostly dependent on data-driven improvements that according to [37] put together all data about the manufacturing procedure available anytime, anywhere, and in a manner that is easy to realize throughout the organization and amongst linked companies. As SM turns into a fashion that influences industry and economic development, a lot of interacted equipment is applied more often to execute industrial tasks. Some of these devices, like a pipelined product line, heavily rely on the output from other equipment, while others could carry out the same or distinct functions or responsibilities. The link between networked equipment can also be energetically modified to improve tractability and adaptability to unique requirements. Therefore, the smart synergy of networked systems is crucial to increasing production system operation.

Thoben et al. [66] presented an outline of the I4.0 strategy of Germany as well as the manufacturing endeavours of other nations while addressing the fundamental properties of CPSs. In their analysis of the literature on smart manufacturing, [35] recognized technologies that are essential to its development. The conditions for data-driven industrial policymaking were outlined by [31]. The essential tools and impediments to the adoption of data-driven policymaking in business were recognized based on these demands. Standards that may have an impact on SM goods, procedures, and industry considerations were explored by [42]. O'Donovan et al. [53] focused on tasks confronting industrial data analytics functions. The writers proposed that formal methods should be used in place of prescriptive strategies to develop analytical abilities. According to [45], standards are essential for the incorporation of SM tools to address change concerns. It was recommended to use a mobile device-based technique to run enquiries in the provision of new updates. Zhang et al. [83] explored all the latest technologies such as high-speed computing, model-driven approaches, IoT, and cloud computing. A paradigm for industrial entity expertise representation that includes pertinent information and knowledge was proposed by [61]. The framework's role as a component of a CPS was demonstrated. The idea of smart manufacturing equipment that is controlled by wireless and Internet of Things technologies was put out by Zhong et al. [84]. Investigating the behaviour of SM products involved data analytics. Devices, computer programs, transmission tools, data-intensive modelling, management, virtual reality, and analytical engineering combine with the future industrial resources in smart manufacturing. Smart manufacturing makes use of CPSs, the IoT (and everything), cloud computing, model-driven computing, AI, and data science. When put into practise, these interrelated ideas and tools will make industry the defining feature of the following manufacturing transformation. Table 1 summarizes the definition of SM.

Table 1 Definition of smart manufacturing

Author(s)/organization	Definition
[14]	The deployment of interacted value-based tools across the manufacturing and supply chain sector is known as smart manufacturing and is rapidly expanded and widespread. It simultaneously initiates and responds to a fundamental and drastic shift in the way business is conducted towards needs-based businesses, application based supply chain facilities, and widespread employee creativity and worker participation
[57]	SM is built on the concept of a smart plant and intends to enable effective, affordable, adaptable, and individualized mass manufacturing
[42]	Smart Production Processes (SMS) seek to optimize these capabilities via the deployment of modern tools that promote the quick movement and broad usage of digital information inside and across industrial structures. It is enabled by new stages of manufacturing responsiveness, excellence, and productivity across our facilities and businesses, enhancing long-term competitiveness
[37]	SM is about the independence, development, model, and optimization of the industrial organization, not the level of mechanization of the production floor. The level to which a manufacturing firm's basic business has been characterized in cyber space will define its degree of "smartness"
Mittal et al. [49]	SM was defined by five features: situation responsiveness, modularization, heterogeneousness, interactive, and architecture, as well as eleven technologies and three allowing features: legal and protocols
NIST (2017)	According to the definition of SM, these systems are "completely integrated, collaborative manufacturing systems that adapt in real time to changing demands and conditions in the plant, in the supplier network, and in consumer wants"
Abubakr et al. [1]	Utilizing the most recent advancements in AI, Cloud Computing and the IoT, the smart manufacturing concept (IoT)
Wang and Gao [79]	Computer-integrated manufacturing and AI are two examples of advanced manufacturing techniques that allow data-enabled flexibility through the manufacturing phase, from merchandise pattern through method development, management, and optimization to merchandise excellence policy

3 Methods

An objective method of studying patterns is done using Bibliometric analysis, related to a research field's included disciplines, keywords, authors, journals, institutions, and documents [4, 76]. Scopus database is used between 1996 and 2022 for the applications of thorough science mapping analysis. The bibliometric analysis is performed using bibliometrix package for the R programming language. The quantitative tool used for bibliometrics research and analysis is Bibliometrix software. The "Scopus" database's bibliographic information is imported using this software. This programme may also be used to build different kinds of network analysis. It is applied to present science mapping assessment by utilizing the Bibliometrix package capabilities and the Shiny user interface, Biblioshiny.

We examine the output and effects of search areas like "smart manufacturing" in research using performance analyses, and we search the literature for research topics using scientific maps. The search was started with a list of the fields that are involved in research on SM. The study area can be interdisciplinary or multidisciplinary, if it is associated with more than one discipline. The next step was to analyse the relevancy of the published venues using citation assessment of various journals. Co-citation evaluation of the journals uses the frequency of journal citations in other publications to pinpoint research topics. The citation analysis of the author was performed to examine the study output of the authors [12]. To identify themes in their works, the author used co-citation analysis. When multiple authors are conjointly referenced in another publication, this is known as a co-citation association. Co-citation analysis thus enables the classification of study issues, that are of particular relevance to quoting authors. Additionally, it enables the development of systems amongst leading scholars in a particular area (Rosetto et al. 2018). Based on the quantity of citations that a university's publications on smart manufacturing received, institution citation examination was utilized to observe each institution's research output. The connections between research institutes have been studied. The latent capabilities of smart manufacturing are the main subject of this study. Using keyword co-occurrence examination is an alternative way to spot research groups. This approach seeks to determine how frequently particular terms are used in conjunction. Using document citation analysis, journal manuscripts were tracked to ascertain their perceived usefulness. Researchers employed article co-citation examination to classify recurring subjects.

3.1 Search String

Data to be evaluated was gathered for the studies through the Scopus database regarding the population of all works on SM published between 1996 and 2022. The major objective is to classify publications that examine the development of smart manufacturing. The results guided the selection of the subsequent groups of

Table 2 Search string

Source	Search String
Data extracted on 5 December 2022 from Scopus database	'Smart AND manufacturing' OR 'smart AND production' OR 'smart AND factory' OR intelligent AND manufacturing OR industrial AND internet AND of AND things OR integrated AND industry OR factory AND of AND the AND future OR smart AND industry AND (LIMITTO (DOCTYPE, "ar")) AND (LIMITTO (SUBJAREA, "BUSI")) AND (LIMIT TO (LANGUAGE, "English")) AND (LIMIT-TO (SRCTYPE, "j"))

keywords, with the requirement that they appear somewhere in the search chain. The phrases "smart manufacturing," "smart production," "smart factory," "intelligent manufacturing," "industrial internet of things," "integrated industry," "factory of the future," and "smart industry" are most popular and well-known in searches, respectively. As mentioned previously, these keyword groups are searched and are mostly located in the titles or abstracts of the database publications we were looking for. We did a search on 5 December 2022, and discovered one list containing English-language materials from 1989. Table 2 provides more information on the search syntax utilized in the investigation.

The above-mentioned search string was used and it should be covered either in abstract, title, or keyword methods, is restricted to the English language, ans is found using the advanced exploration options. Simply copying and pasting the syntax on the Scopus database as needed will fetch the results. However, the likelihood of the conclusion being unchanged is essentially non-existent because the digital data is updated continuously.

3.2 Database Selection and Collection of Data

The Scopus database was chosen since it is a commonly used and acknowledged resource for scholars to undertake this sort of study. The above-mentioned keywords were searched for in Scopus titles and abstracts, yielding 1989 articles between 1996 and 2022.

4 Analysis

The section contains findings related to the study topic provided at the conclusion of the introduction.

4.1 Sources

In the explanatory assessment, the overall number of manuscripts, year-over-year, evolution trend, highly pertinent journals, h-index, and source progress are all provided (Table 3). According to the data, the search yielded 1989 papers from 2354 authors between 1996 and 2022.

The annual publication over the previous 26 years is displayed in Table 4 and Fig. 1. The growth in the number of publications is growing at a rate of 29.19 per cent every year. Over the past ten years, publications have been continuously rising in number. The pattern indicates that starting in 2014, there will be more than 20 publications per year, with a cap of 669 publications in 2021. This shows that the area is still developing and that, in the years to come, there will be an increase in publications.

The publishing pattern throughout time is seen in Fig. 1. The amount of research on smart manufacturing has clearly increased since 2014 (n26). The year 2021 saw a modest amount of paper published on smart manufacturing resulting in 669 articles.

Publications of the top journals on SM are shown in Fig. 2. The picture clearly shows that the top five journals with the most papers published are the JCP, TFSC, IJPR, IJPE, and PPC.

Table 5 below includes information on the most referenced journals in addition to the data shown in Fig. 2. The top five journals most frequently referenced in the area of SM are IJPR, IJPE, JCP, IJIM, and Procedia Cirp.

The journal with the highest h-index is shown in Fig. 3. IJPR, JCP, TFSC, IJPE, Production Planning and Control, and Industrial Management and Data Systems are six journals that have a h-index of more than 20.

To determine the most popular journals on this subject, an analysis was done. The most popular journals from 2016 are "Technological Forecasting and Social Change" and "Journal of Cleaner Production," according to Fig. 4. The top three journals with the most papers published are JCP (n = 147), TFSC (n = 144), and IJPR (n = 132).

Table 3 Summarized data

Main information	
Time frame	1996:2022
Total manuscript	1989
Keywords Plus (ID)	6374
Authors	5098
Per document average citation	43.04
Per document per year average citation	11.98
Document by Single-authored	155

Source Authors' expansion

Table 4 Yearly publications

Year	Number. of documents
1996	1
1999	1
2000	1
2001	1
2002	1
2003	2
2004	5
2005	1
2006	2
2007	6
2008	7
2009	9
2010	12
2011	3
2012	15
2013	16
2014	26
2015	38
2016	54
2017	78
2018	108
2019	196
2020	263
2021	669
2022	474

Source(s) Author's specific creation

4.2 Highly Prominent Authors and Keywords

Information about the most influential authors is provided in this section. The authors with the most documents in the field of SM are Zhang, Y., Kumar, A., Liu, Y., Dwivedi, Y. K., Javaid, M., Kumar, V., Gunasekaran, A., Liu, W., Haleem, A., Chen, Y., Huang, G. K., and Li, X, are the authors with the most publications in the field of SM, as shown in Fig. 5.

Additionally, the most frequently mentioned articles are shown in the Table 6. The findings show that the article by [24] in the TFSC, Xu et al. [81] in the IJPR, [60] in the IJPR, [23] in the IJPE, and others, published in the IJPR, [33] in Journal of Business Venturing, [35] in International Journal of Precision Engineering and Manufacturing-Green Technology, [29] in Electronics Markets, and [13] in IJPE

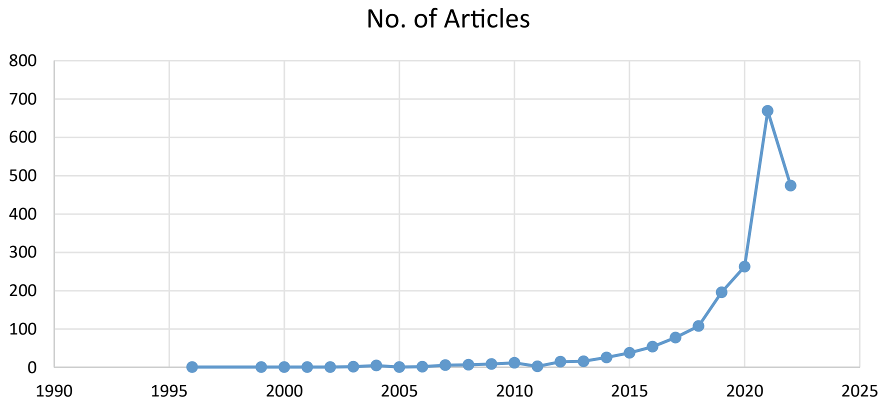

Fig. 1 Published document per year. *Source(s)* Author's specific creation

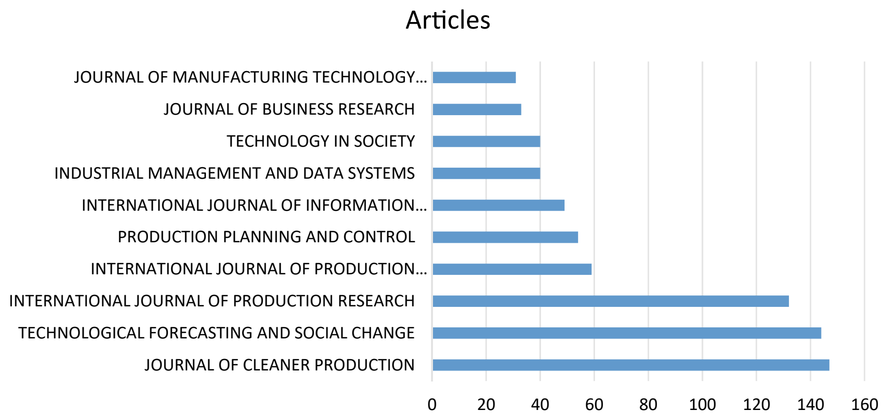

Fig. 2 Top Relevant Journals. *Source(s)* Author's own creation

are the seven most cited authors who have advanced the field with more than 700 document citations.

Co-word analysis is the most beneficial technique for comprehending the theoretical framework of the study conducted on a certain topic. The most often occurring words in the research paper are determined using a similar methodology. The most popular terms in the area are shown in Table 7. The outcome reveals that the keyword "Industry 4.0" is the most popular one.

The analysis of co-words reveals that "Industry 4.0," "Internet of Things," "Artificial Intelligence," "Big Data," "Blockchain," "Supply Chain Management," "Sustainability," and "Internet of Things" make maximum recurrently used keywords in the research papers (Fig. 6).

Table 5 Highest cited journals

Journals	Citation
International Journal of Production Research (IJPR)	3072
International Journal of Production Economics (IJPE)	2046
Journal of Cleaner Production (JCP)	1535
International Journal of Information Management (IJIM)	1234
Procedia Cirp	1230
Sustainability	1120
Journal of Business Research (JBR)	1103
IEEE Access	1034
Technological Forecasting and Social Change (TFSC)	1030
MIS Quarterly	983

Source(s) Author's own elaboration

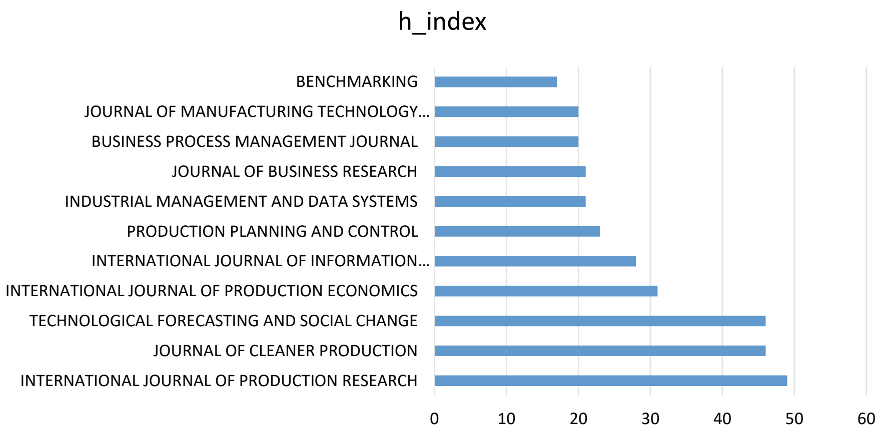

Fig. 3 High Impact Journals. *Source(s)* Author's specific creation

The most common terms used in the research were also revealed by analysing the current issues (see Fig. 7). For instance, the study reveals that the most often used phrases in the subject field are I4.0, decision-making, IoT, supply chain management, manufacturing, Big Data, Blockchain, and the AI.

A country-wise study (Fig. 8) was done to determine which nations contributed the most writers to papers about smart manufacturing. In this analysis, the names of nations with matching writers who have written influential works in this area were included. The nations that contributed the most to the article on smart manufacturing include China, India, the UK, the United States, Italy, Germany, Australia, Brazil, and Finland.

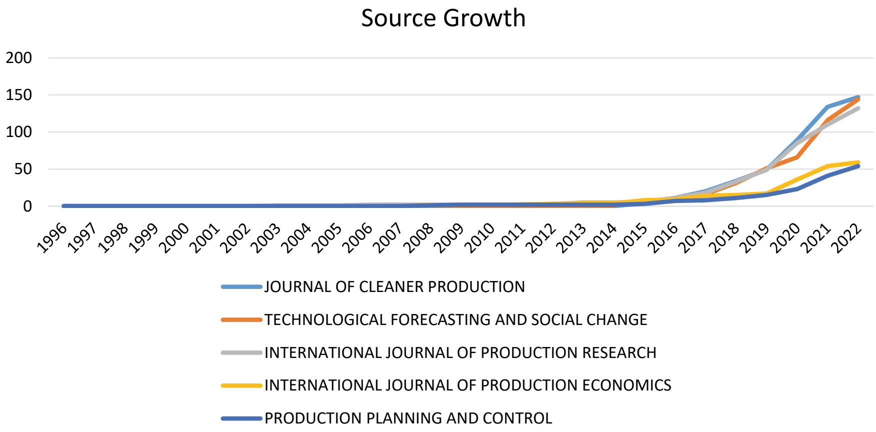

Fig. 4 Most trending Journals. *Source* Authors' elaboration using Biblioshiny

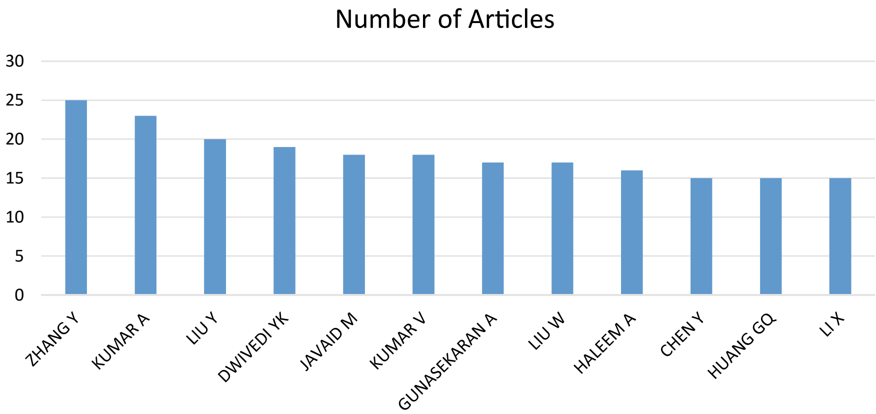

Fig. 5 Authors with a number of articles. *Source* Authors' elaboration using Biblioshiny

The study of citations for various nations is performed to determine which nations have the most citations in SM. The United Kingdom is in first place, with over 11,998 citations in the previous 26 years. China is in second place, with around 9821 citations. The United Kingdom, China, the United States, Italy, Germany, India, Brazil, and Korea are amongst the eight nations with more than 3000 citations. Brazil was discovered to be at the top of the average article citations study, having 85.5 citations. Table 8 displays the specifics of different nations' citations as well as the average article citations.

Table 6 Highest cited articles

Articles	Total citations	TC per Year
[24]	1838	306.333
Xu et al. (2018)	1333	266.6
[60]	1020	255
[23]	884	221
[33]	792	66
[35]	777	111
[29]	756	94.5
[13]	715	143
[80]	698	26.222
[30]	619	88.429
[32]	586	146.5
[37]	579	115.8
[51]	545	36.333
[27]	543	108.6

Source Authors' elaboration

Table 7 Most popular terms

Words	Occurrences
Industry 4.0	235
Decision-making	184
Internet of Things	165
Sustainable development	156
Manufacture	142
Supply chains	128
Supply chain management	123
Blockchain	102
Big data	101
Artificial intelligence	95
Design/methodology/approach	93
Technology adoption	82
Industrial research	80
Information management	75
Innovation	73
Technological development	72
Data analytics	64
Smart city	63
Competition	59
Embedded systems	57

Source(s) Authors' elaboration

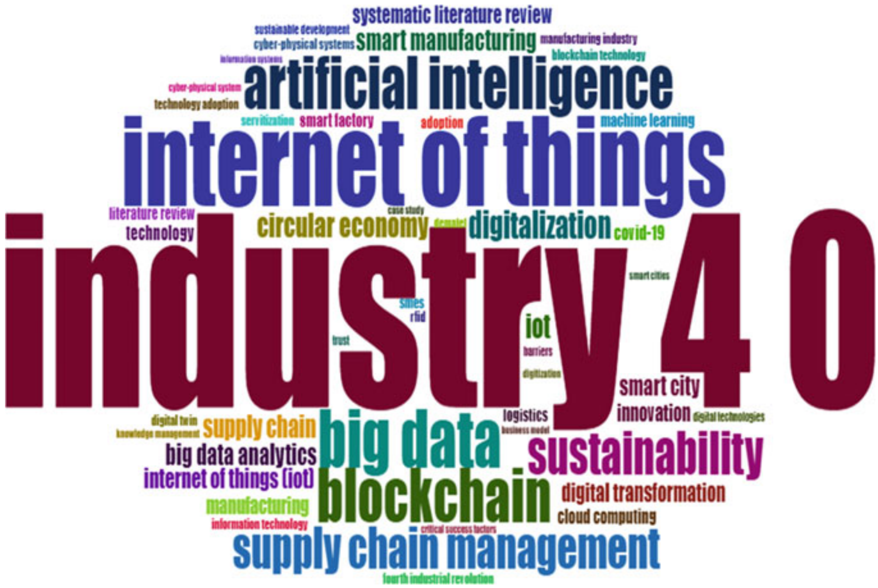

Fig. 6 Common words. *Source* Authors' elaboration using Biblioshiny

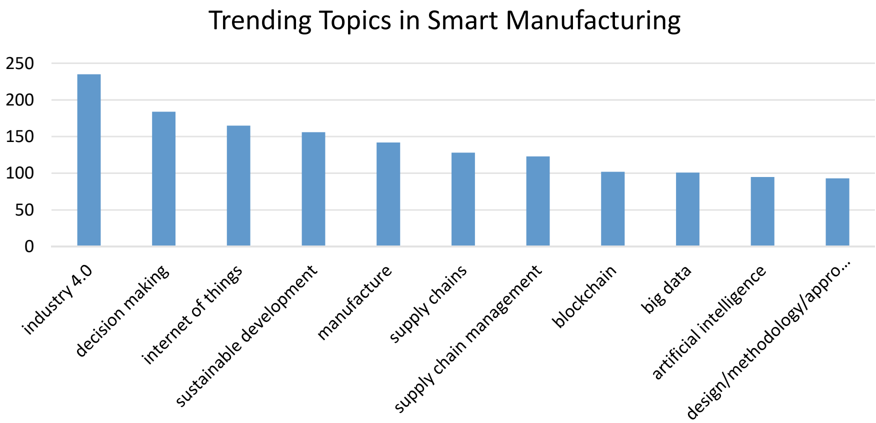

Fig. 7 Keyword productivity. *Source* Authors' elaboration using Biblioshiny

4.2.1 Conceptual Structure

The heat map visualization is a reliable method of determining the intensity of relationships between keywords. Since VOSviewer software provides a powerful GUI, a density map was constructed. Distinct colours in the SM term co-occurrence heat map (Fig. 9) represent distinct intensity standards. The more often used notion or topic is indicated by a higher density yellow colour. For example, "Industry 4.0" and "Internet

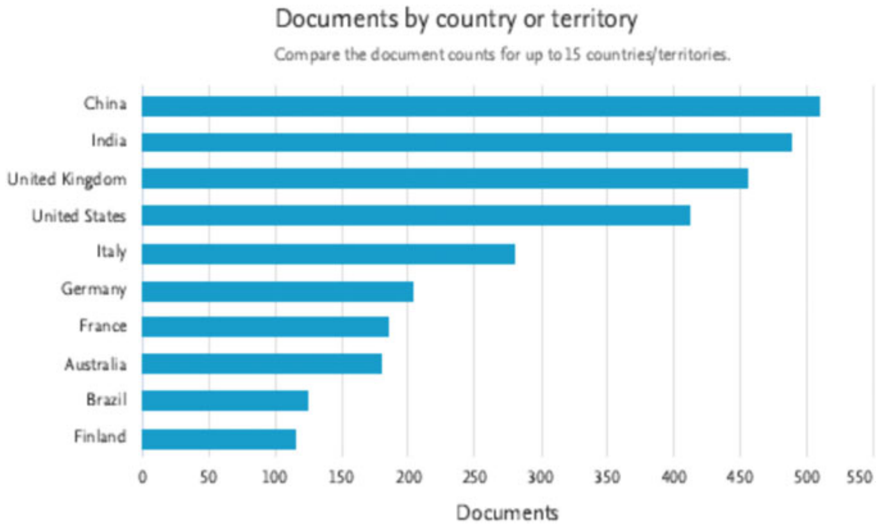

Fig. 8 Publications country-wise. *Source* Authors' elaboration

Table 8 Top-most cited countries

Country	Total citations	Average article citations
United Kingdom	11,998	69.8
China	9821	37.9
USA	8243	74.3
Italy	4897	37.4
Germany	3934	53.2
India	3927	25.5
Brazil	3678	85.5
Korea	3608	76.8
France	2610	49.2
Hong Kong	1707	53.3
Finland	1493	43.9
Sweden	1448	65.8
Malaysia	1421	52.6
Australia	1371	29.2
Iran	1286	44.3
Canada	1091	37.6

Source Authors' elaboration

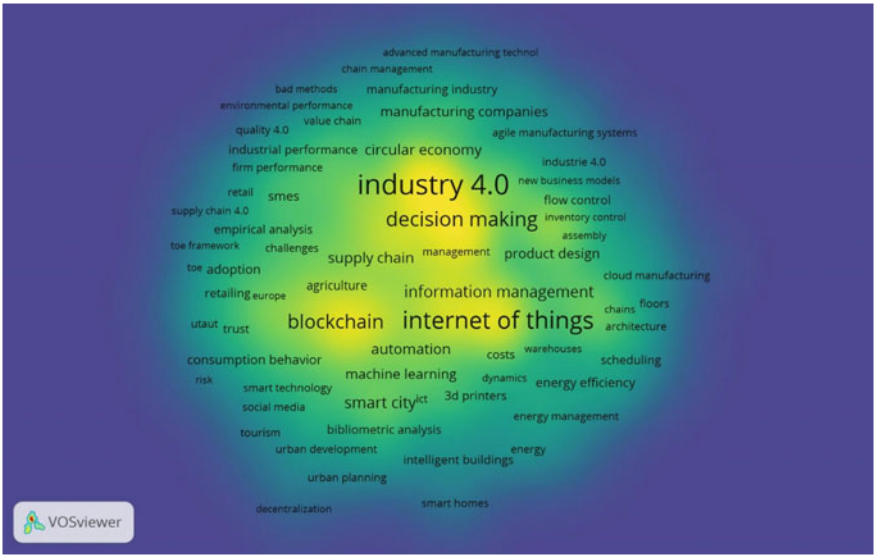

Fig. 9 Heat map of SM. *Source* Authors' elaboration using VOSviewer

of Things" have the maximum yellow colour density and are hence the most important terms. Aside from these two phrases, the greater intensity yellow colour can also be found on "Blockchain," "Decision-Making," "Information Management," "Supply Chain," and "Automation." The central subject in smart manufacturing research is the role of I4.0 in manufacturing over the use of the IoT, Blockchain, and information management.

Interpreting and understanding the arrangement and examining the subjects through keyword co-occurrence is another method. As Fig. 10 and Table 9 show, as well as additional assessment, five groups stand out. First is "Industry 4.0," which encompasses "Smart Manufacturing," "Technology Adoption," "Innovation," "Digitalization," "Global Value Chain," and "Additive Manufacturing." The next group includes "Artificial Intelligence," "Big Data," "Smart Factory," "Internet of Things," "Cyber physical system," "Big Data Analytics," and "Sustainability." 3rd group is "Competitive Advantage," "Digital Transformation," "Digital Technologies," "Digitization," "Manufacturing Industry," and "Servitization". In the 4th group "Emerging Economies," "Lean Manufacturing (LM)," "Lean Production (LP)," "Organizational Performance," and "Production Management" are considered as the main topic. The terms "Circular Economy (CE)," "Sustainable Development (SD)," and "Sustainable Manufacturing" make up the 5th and last group.

We may draw the conclusion that there are essentially two study streams that arise from the analysis of these five groups. The first stream is mostly technological and connects I4.0 with manufacturing. It uses big data, CPS, AI, and digital manufacturing transformation to achieve SM through enhanced organizational implementation and operation management. The 2nd is aimed at attaining manufacturing

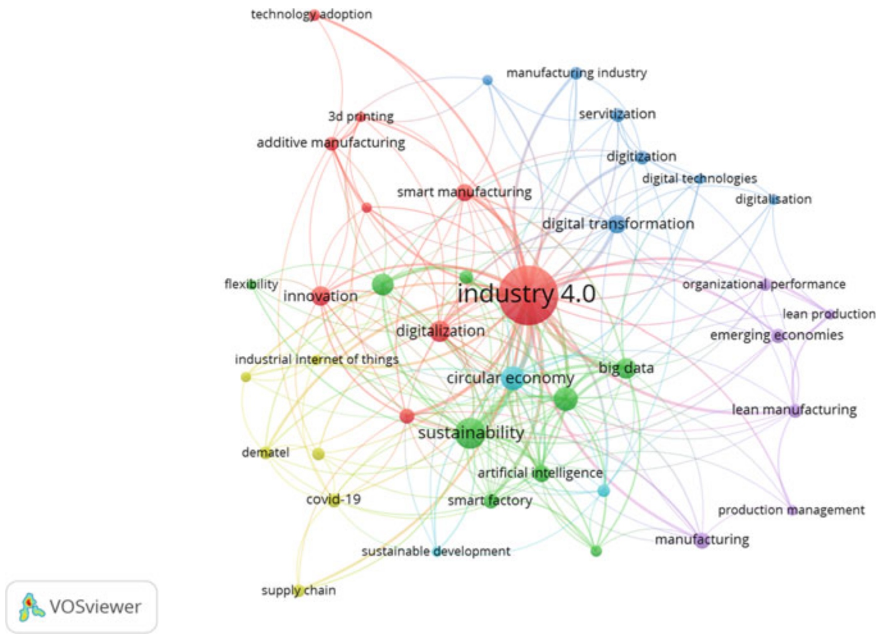

Fig. 10 The network of co-occurring keywords

Table 9 The group keywords

Group 1	Group 2	Group 3	Group 4	Group 5
I4.0	AI	Competitive advantage	Emerging economies	CE
SM	Big data	Digital transformation	LM	SD
Technology adoption	Smart factory	Digital technologies	LP	Sustainable manufacturing

Source Authors' elaboration using VOSviewer

sustainability through the adoption of CE, SD, and lean manufacturing, which are important for improving organizations' environmental implementation and providing competition to enterprises.

5 Findings

Around passing through an embryonic stage, the review on SM is expanding and attracting interest from both academia and business after 2015. The work significantly extends and adds to the form of understanding of SM (Buchi et al. 2020). The research adds to and improves the literature on SM by recognizing important writers, relevant themes, and the most significant publications in the field. The findings show that the most convincing research was directed by a select group of authors, including Frey, C. B., Xu, L. B., Saberi, S., Frank, A. J., Jones, K. V., Gretzel, U., and Dalenogare, L. S. Since 2015, there has been a multi-fold growth in academic interest in the topic of smart manufacturing, according to the trend of all 1939 papers. Most articles in the research field were written by the following authors (e.g., Zhang, Y; Kumar, A; Liu, Y; Dwivedi, Y. K; Javaid, M; Kumar, V; Gunasekaran, A., Liu, W; Haleem, A; Chen, Y; Huang, G. K; and Li, X). Consequences associated with pertinent authors, journals, citations, and associations in the area of Smart manufacturing reveal that the International Journal of Production Research, Journal of Cleaner Production, Technological Forecasting and Social Change, International Journal of Production Economics, Production Planning and Control, and Industrial Management and Data Systems arose as the greatest important journals in the area. An assessment of the associations and countries suggests that Hong Kong Polytechnic University, The University of Hong Kong, Indian Institute of Technology Delhi, University of Tehran National Institute of Industrial Engineering, and University of Johannesburg are the highest participating institutes. Additionally, the countries, which provided the maximum articles related to SM are the UK, China, the USA, Italy, Germany, India, Brazil, and Korea and have more than 3000 citations. According to group analysis, there are basically two research streams that make up the literature on smart manufacturing. The use of AI, big data, CPS, and digital transformation in production is part of the first stream, which is heavily focused on technology and connects I4.0 with manufacturing. SM is achieved due to improved execution at equally the organizational degree and fabrication management. The next focuses is on attaining sustainability in production beyond the adoption of lean manufacturing (LM), the circular economy, and sustainable development, all of which are important for improving companies' environmental performance and giving businesses a competitive edge.

6 Contributions and Implications

This study adds to the essence of understanding the subject of SM by compiling a list of the extremely influential authors, the highly pertinent and referenced journals, the highly quoted papers, promising keywords, and research groups. By emphasizing the key terms that make up the central part of the study for these topics and providing original and probable instructions for further investigation, the review also subscribes to the form of information on SM and sustainability.

Production is a source of the goods and facilities necessary for individual well-being, security, and comfort. From the perspective of both organizations and modern society, production is tied to all social events. Due to their role in producing goods that are crucial to both the quality of human existence and the health of the international financial system, industrial processes should be carefully examined in the framework of sustainability. As a consequence of the necessity for sustainable manufacturing practises in the present industrial revolution, the current research focuses on smart manufacturing. Additionally, a framework must be created for smart manufacturing for both practitioners and academics. The possible advantages of the SM method that the production industry is dealing with don't seem to be well understood by many businesses. The literature study shows that there has been a substantial surge in the importance of smart manufacturing since 2015, which is clearly obvious in the paper's focus on the topic. Certain strategies would be developed to try to raise the production area's proficiency. This approach helps to boost future business projections for the industrial sectors while also improving the condition of the ecosystem for potential productions. By offering thorough information on the researchers, articles, periodicals, and potential upcoming study issues, it also aids future research.

7 Future Research

The term "smart manufacturing" currently only refers to specific industrial companies and locations (maximum researches are in the United Kingdom, China, the USA, Italy, Germany, India, Brazil, and Korea). However, it is possible to expand it to other regions of the world. We recommend the following study areas based on our evaluation and subsequent analysis.

1. The adoption of smart manufacturing is driven by a big data system, thus industrial data must be properly gathered and processed. To create a more effective division of labour between intelligent robots and people, significant financial investments including advanced scientific equipment for vast data storing, recovery, handling, and assessment are required.
2. There isn't any clear explanation of "smart manufacturing" to increase manufacturing and sustainability understanding amongst producers, dealers, and consumers. There is a substantial difference amongst engineering and academic study in the subject of SM.
3. The innovative SM arrangement's complexity should be decreased to enhance interoperability with other environments. The social acceptability of factories 4.0 can be raised by providing training to employees on how to use factory 4.0 principles effectively. The strongest human resistance arises when workers are required to cooperate with robots and admit that computers can execute greater level cognitive functions.

8 Limitations

The current research has significant limitations, as do all others. To start, this assessment is thorough but not meticulous. The Scopus database is used in the study. We advise leveraging databases like Web of Science, EBSCO, and others for absolute and thorough analysis in future studies. Obtaining samples from many databases will greatly enhance the study. Increasing the relevance of the terms used to search the database will strengthen the search and enrich the manuscript. Researchers looking into smart manufacturing may find the study's findings useful regarding the investigation background and asperity. Next, we restricted our research to academic journal articles, eliminating theses, book chapters, and reports.

Other credible sources can be used to get further knowledge. Furthermore, while we made every effort to be trustworthy and inclusive, the subsequent evaluation may be theory-driven. Last, but not the least, these discoveries can serve as a springboard for future study into the domains of smart manufacturing.

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