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SOCIAL MANUFACTURING ON INTEGRATED PRODUCTION SYSTEM: A SYSTEMATIC LITERATURE REVIEW

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Abstract:
Currently, the development of information technology in all fields is very rapid, including in the manufacturing sector, thus making the social environment of manufacturing change a lot. Traditional manufacturing research focuses on applying technology, such as production models, supplier arrangements, automation, advanced machines in the manufacturing industry, etc. Global competition and increasingly diverse customer demands are a phenomenon that occurs today. Social manufacturing is a new distributed, collaborative, and intelligent manufacturing, that every consumer can participate in the entire process of product design, manufacture, and even marketing. This study aims to examine the development of social manufacturing systems and the latest research in social manufacturing. The method used is to review the latest papers related to social manufacturing that provide a new paradigm for the manufacturing industry, then map based on the concepts, frameworks, and technologies used. The results of this review paper are in the form of mapping research papers taken from the database of a reputable international journal, Scopus. The mapping includes data on the author, co-author, terms on social manufacturing paper, year of publication, type of document and publisher. This systematic literature review can be one of the references for basic research on social manufacturing.

Key words: *social manufacturing, product personalization, review, manufacturing enterprise*

INTRODUCTION

The rapid development of information technology today, followed by the development of social media, has an essential role in the manufacturing sector [1]. The increasingly diverse customer demands make the industry must be able to adapt to these changes [2]. Everything has changed a lot, such as increasing global market competition, diverse customer demands, demand for product personalization, and much more [1, 3, 4]. Nowadays, the manufacturing industry is required to meet customer needs that are very diverse and can change at any time and follow specific trends [5]. In addition, to meet this trend, the manufacturing industry must also have various capabilities and flexibility in its production process, especially for customers who want product personalization [6]. However, it requires a lot of investment, for example, buying a new machine every time demand changes is not profitable from the manufacturer's development strategy [7]. Several companies implement a social manufacturing system to reduce production costs due to diverse and changing customer demands [8, 9].

Based on various product types and production quantities, the production model of manufacturing companies has undergone significant changes [10]. It is from handmade production, mass production, mass customization to individual production to meet increased efficiency, especially since the first industrial revolution [11, 12]. In addition to the social relations and developmental factors mentioned above, these changes also depend on the innovation of production organizations, the development of manufacturing technology itself [13], and technological products such as automation, computer science, information technology, etc. [14, 15, 16].

Internet-based communication in business has advanced along with the development of the internet, Internet of Things (IoT), and Cyber-Physical System (CPS) technology,

creating organizational structures, business interactions in manufacturing companies and between different companies, facing enormous challenges [17, 18]. Manufacturing companies must answer these considerable challenges, for example, by changing their product manufacturing activities during the product life cycle and how they did it [19].

The purpose of the establishment of social manufacturing is to process information systematically, manage resources, provide services flexibly and on time to meet rapidly changing customer demands [20, 21]. It makes manufacturing evolve into intelligent manufacturing capable of meeting the changing demands of mass product customization [22, 23]. Therefore, social manufacturing is designed to connect social needs and resources in an active, fast and organized manner. The new paradigm of social manufacturing will become dominant with product personalization [24].

Various studies on social manufacturing have been carried out to explore various insights on social manufacturing in different domains (Table 1). In Table 1, it is shown that most of the articles discussing social manufacturing have been published in the last seven years. The majority of this review article focuses on selecting various strategies and technologies used to develop social manufacturing systems. It was also identified that most of the studies focused on a particular aspect or problem, such as mathematical modeling, simulation modeling, sustainability indicators, product development techniques, operations research, etc. This systematic literature review is structured to increase understanding of social manufacturing from a different perspective. Descriptive analysis is needed to explore various insights and general characteristics of social manufacturing. This article explores the literature's insights and opportunities by categorizing and analyzing selected articles from January 2017 to September 2021. The selected papers have been organized by year, publisher, journal, country of author, university affiliation, manufacturing industry, research design, and methods used. Based on these studies, this study discusses the development of trends in the social manufacturing system to provide an overview of the production processes in the social manufacturing system.

Table 1

Existing studies of social manufacturing

Author	Title	Source	Methodology	Results
Ding et al., 2015 [25]	Modeling and analyzing of an enterprise relationship network in the context of social manufacturing	Journal of Engineering Manufacture	Propose Model of Social Manufacturing Enterprise Relationship Network (SMERN)	The results show that SMERN is more significant, clustering algorithm is effective and SMEs are organized for collaboration with the manufacturing community
Zhou et al., 2016 [26]	Social Manufacturing xx Realizing Personalization Production: A state-of-the-art Review	IEEE Explore	Literature review on social manufacturing	The results of a review paper on the basic concepts and frameworks in social manufacturing
Jiang et al., 2016 [27]	Towards a cyber-physical-social-connected and service-oriented manufacturing paradigm: Social Manufacturing	Manufacturing Letters	Comparative analysis of social manufacturing and other manufacturing paradigms	CPSS platform in social manufacturing connects production service providers, and prosumers, through cyber, physical and social to collect data, which is useful for dynamic decision making, market prediction and product innovation
Hamalainen et al., 2017 [28]	Social manufacturing: When the maker movement meets interfirm production networks	Business Horizon	Conceptually defining two distinct forms of the firm-individual collaboration in manufacturing industries and empirically investigate the nature of firm-individual collaboration	Contribute to increasing understanding of how companies can build business models in the manufacturing industry by leveraging individual networks
Jiang and Leng, 2017 [29]	The configuration of social manufacturing: a social intelligence way toward service-oriented manufacturing	International Journal of Manufacturing Research	Provide knowledge in outsourcing and crowdsourcing concepts on social manufacturing for the entire lifecycle of mass personalization processes	A novel approach for enabling individualized mass production

Table 1 Continued
Existing studies of social manufacturing

Author	Title	Source	Methodology	Results
Guo and Jiang, 2018 [30]	An investigation on establishing small- and medium-sized enterprises communities under the environment of social manufacturing	Concurrent Engineering: Research and Applications	Propose a Socialized manufacturing resources (SMR) clustering and order allocation in SMEs community	Growing hierarchical self-organizing map (GHSOM) and the modified multi-objective bird swarm algorithm (MOBSA)
Xiong et al., 2018 [31]	From Mind to Products: Towards Social Manufacturing and Service	IEEE/CAA Journal of Automatica Sinica	Comparing mass customization and social manufacturing, then developing social manufacturing prototypes involving 3D printing, internet of things, cloud computing and intelligent systems	Development of three transformation models involving social manufacturing and 3D printing in different case studies
Shang et al., 2018 [32]	Social Manufacturing for High-end Apparel Customization	IEEE/CAA Journal of Automatica Sinica	Developing high-end apparel customization using cloud computing technology and crowdsourcing	Developing a social manufacturing model in the apparel industry by improving innovation, design, manufacture, marketing and service, to be more competitive in the future
Ding et al., 2018 [33]	RFID-enabled social manufacturing system for inter-enterprise monitoring and dispatching of integrated production and transportation tasks	Robotics and Computer–Integrated Manufacturing	Propose a radio frequency identification enabled social manufacturing system (RFID-SMS) to realize real-time monitoring and delivery of production and transportation inter-enterprise	Development of social manufacturing prototypes and case studies applied to printing machine companies, and the proposed model is evaluated by industry practitioners
Hirscher et al., 2018 [34]	Social manufacturing in the fashion sector: new value creation through alternative design strategies?	Journal of Cleaner Production	Developing a social manufacturing model for the fashion industry, using the do-it-yourself (DIY) and do-it-together (DIT) methods	A social manufacturing framework that has been demonstrated and uses data from Finland and the US
Xiao et al., 2019 [35]	Evaluating of dynamic service matching strategy for social-manufacturing in the cloud environment	Future Generation Computer Systems	Computational experiment-based evaluation framework, which can simulate all kinds of actual scenarios to verify the performance of strategy service matching, and has carried out case studies	Adaptive service supply-demand matching to maintain sustainable development in social manufacturing
Guo and Jiang, 2019 [36]	Product Service Systems for Social Manufacturing: A new service system with multi-provider	IFAC Papers OnLine	Implementing architecture and operational logic of Product-Service System (PSS) for social manufacturing	PSS for social manufacturing can help SMEs to improve and develop the transition to product services. Two case studies also confirm the effectiveness and feasibility of PSS for social manufacturing models
Song et al., 2019 [37]	Exploring robustness management of social internet of things for customization manufacturing	Future Generation Computer Systems	Manage the social reliability of the Internet of Things (SIoT) in a customization manufacturing (CM) environment from a complex systems perspective	Low interoperability and mismatch over high mismatch, and tight integration improves SIoT resilience under CM paradigm
Qian et al., 2020 [38]	Exploring the socialized operations of manufacturing resources for service flexibility and autonomy	Robotics and Computer Integrated Manufacturing	Develop a framework for socialized manufacturing resources, resourcing and service modeling virtually using finite state machines	The initial design of the social network was resource oriented and provided solutions that allowed for the development of autonomy and flexibility of manufacturing systems.

The studies on social manufacturing that have been described in Table 1 are the latest references in the last five years. From these studies, it can be further developed into other, more comprehensive research, with a variety of different methods.

LITERATURE REVIEW

The literature review was conducted to understand the definitions and terms in social manufacturing and integrated production systems. Research related to social manufacturing has been carried out as summarized in Table 2. The research is classified based on customer needs [4], approach used to customers [32, 34, 39], customization mode [26], production mode [31], customer participation [40], technology used [33, 35, 37, 41], advantage of social manufacturing [25, 27].

Table 2

Research of social manufacturing

Item	Description	Reference
Customer needs	Meeting personalization and individual needs at the same time	[4]
Approach to customers	Customer requests individually according to product personalized design	[32, 34, 39]
Production mode	Personalized product design and manufacture, with a higher degree of flexibility	[31]
Customization mode	One product personalization for one customization	[26]
Technology used	IoT, social network, 3D printing, cloud computing, Knowledge-based Intelligent Systems, and social manufacturing based on the cloud platform	[33, 35, 37, 41]
Customer participation	Interactive design and manufacture of personalized products, customization with any content and a higher level of accuracy	[40]
Advantage of social manufacturing	Highest added value at affordable cost	[25, 27]

Different industrial entrepreneurs in the manufacturing network are increasingly getting great opportunities along with the development of internet technology [42]. For example, People can use in-house manufacturing tools for decentralized production processes [11]. Through this type of crowdsourcing, enterprises can respond to request for personalized products [43]. This new type of producer-customer relationship allows the formation of a manufacturing model that can be referred to as "Social Manufacturing" [26]. This new method can reduce the cost of labor, financing, and other manufacturing capital expenditures, and will also improve market responsiveness [44, 45, 46]. Therefore, the advantages of using the social manufacturing model allow the manufacturing industry to save on production costs [25]. In addition, Professor Wang explores new social aspects of manufacturing in his article "From social computation to social manufacturing" [47].

The social model of manufacturing was proposed in 2012 and later researched by several experts [26, 27, 28, 41, 48]. Compared to traditional manufacturing modes, the features of social manufacturing are better, indicated by customer requests that can be reflected directly into a product, otherwise known as "From mind to product" [31], where every customer can participate in the whole process of product design, manufacture and even marketing [14]. Customer participation becomes a behaviour, which allows them to get more profit and satisfaction from the desired product [49]. User experience can be improved through personalization, the potential demand for released products, and increased production customization efficiency [50, 51, 52]. On the other hand, in the view of socialized producers, social manufacturing is a variety of stakeholders who have Socialized Manufacturing Resources (SMR), including micro, small, medium-sized industries (MSMEs), smart factories, workshops, logistics service providers, and public warehouse providers, who form social media-based communities with producers to collaborate on crowdsourcing or outsourcing tasks [53, 54, 55, 56]. Through the development of the internet and social networks, communication and exchange of information between SMRs has become easier [13, 57].

METHODS

The method used in writing this systematic literature review is to search for papers related to social manufacturing sourced from a reputable journal database, namely Scopus. The first step is to enter the keyword “social manufacturing”, and the year limit for the document to be processed. The second step is to select what information is needed, then download the metadata file from Scopus in the form of .csv and .isk extensions. After the metadata file is downloaded from the Scopus page, the third step is processed using the VOSviewer software version 1.6.17 for 2021 to map the Author and Co-Author networks and terms that usually appear in social manufacturing papers. VOSviewer is very popular and has the following characteristics:

- different mapping types of bibliometric analysis;
- supports several major bibliographic databases;
- the time dimension is ignored;
- limited to analyzing small to medium amounts of data;
- intended for the function of processing text;
- using layout and cluster techniques;
- use advanced visualization features;
- using a visual labelling system;
- using overlay and density visualization.

Types of bibliometric mapping that VOSviewer is capable of:

a) Co-authorship maps, consisting of authors, organizations, countries;
b) Citation maps, consisting of publications, journals, organizations, countries;
c) Co-citation maps, consisting of publications, journals, authors (first author only);
d) Bibliographic coupling maps, consisting of publications, journals, authors, organizations and countries;
e) Subject/keyword mapping (Co-occurrence maps), consisting of keywords and terms from the title and abstract.

In addition, the review paper is also carried out by entering the keywords "social manufacturing" and "production system" in the Scopus database. Next, download the data obtained and process it to map information on Publication Year, Document Type, and Publisher.

RESULTS AND DISCUSSION

Compiling a literature review begins with collecting data from a reputable international journal database, namely Scopus. The keyword entered to obtain information is "social manufacturing" and is limited to 2017 to 2021. The results obtained are that there are 2163 papers on social manufacturing. The first processing is data about what terms often appear in social manufacturing papers, which are developed using the VOSviewer version 1.6.17 for 2021 software. As a result, 5616 terms were found on social manufacturing, then 71 papers that met the threshold were found, and the most match is about 60% or about 43 items. Furthermore, the 43 items were divided into 5 clusters, with the distribution as presented in Table 3, with 249 links and 523 total link strength, as presented in Fig. 1.

Table 3
Cluster distribution of terms in social manufacturing

Cluster	Number of Items	Items
1	11	application, blockchain, context, decision, framework, human-robot collaboration, industrial robot, influence investigation, social manufacturing, sustainable manufacturing
2	11	corporate social responsibility, csr, evidence, financial performance, firm, manufacturing firm, moderating role, performance, relationship, role, social sustainability
3	8	additive manufacturing, approach, design, energy, optimization, process, system, trade
4	7	challenge, covid, implementation, India, opportunity, review, worker
5	6	circular economy, cloud, implication, internet, knowledge, thing

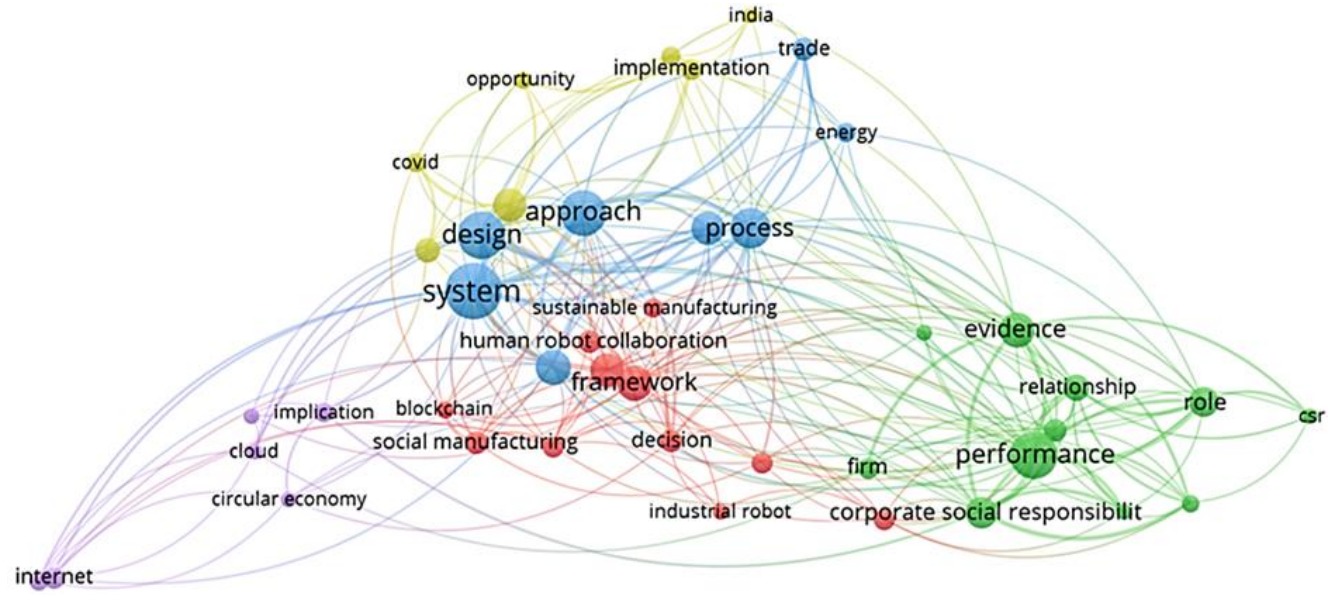

Fig. 1 Network distribution link of the terms of paper

Then, an analysis was carried out using the No Normalization method from 43 items of terms that often appear in social manufacturing, as presented in Fig. 2. The terms that most often appear in social manufacturing papers include system, design, performance, framework, process and collaboration. The larger the round sign of the mapping result, it indicates that the term is often used in social manufacturing papers.

The next process is mapping the Author and Co-Author using VOSviewer. From the search results, data were obtained from 5675 authors who write about social manufacturing. Then, from the 5675 number, screening was carried out to find author data with a minimum number of 5 paper titles. The screening results show 101 authors and co-authors from 5675 authors who have at least five social manufacturing papers. From these data, 93 authors match a minimum of 5 papers and a maximum of 25 papers, with the keyword "social manufacturing".

These 93 authors are divided into 9 clusters based on the collaboration of writing and authorship. Cluster 1 (17 items), cluster 2 (16 items), cluster 3 (13 items), cluster 4 (11 items), cluster 5 (10 items), cluster 6 (9 items), cluster 7 (9 items), cluster 8 (4 items), cluster 9 (4 items), as presented in Fig. 3.

In addition to the data mentioned above, this review also searched the Scopus page with the keywords "social manufacturing" and "production system", from 2017 to 2021. The search results showed there were 167 papers with these two keywords. These 167 papers were analyzed, starting from the year of publication, the type of document, and the publisher's name.

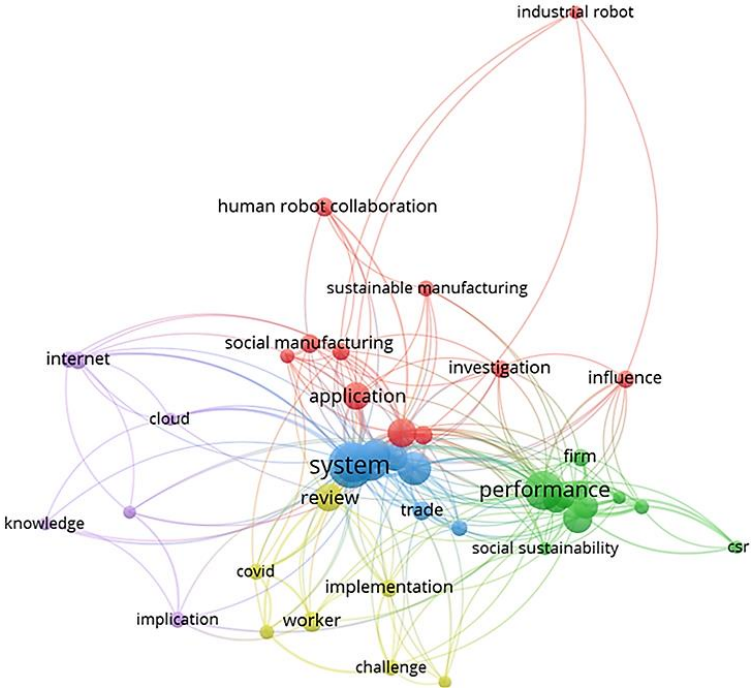

Fig. 2 No Normalization analysis from VOSviewer

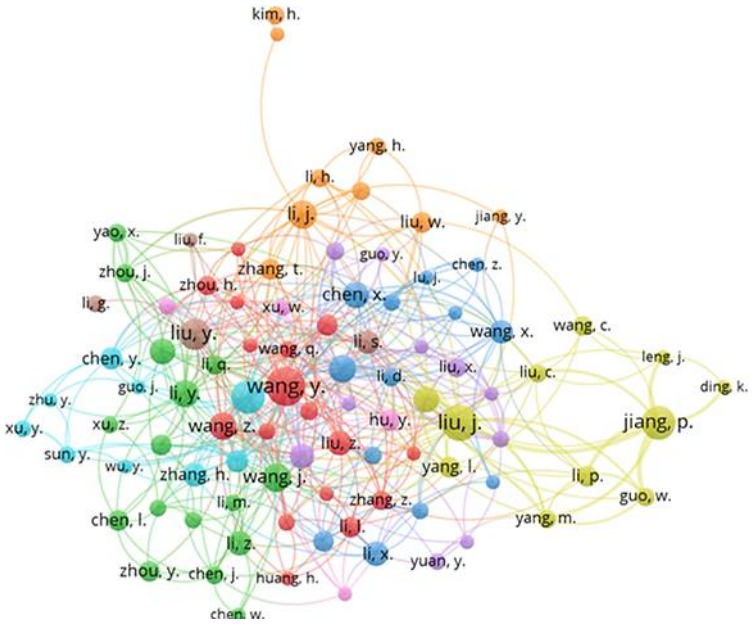

Fig. 3 Mapping of author and co-author

The analysis results for the Year of Publication are presented in Fig. 4, namely the publication data from 2017 to 2021. In the graph of Fig. 4. It can be seen that the publications on social manufacturing in 2021 are 40 paper titles (23.9%), in 2020, there are 43 paper titles (25.7%), in 2019, there are 29 paper titles (17.4%), in 2018, there are 27 paper titles (16.2%), and in 2017 there were 28 paper titles (16.8%).

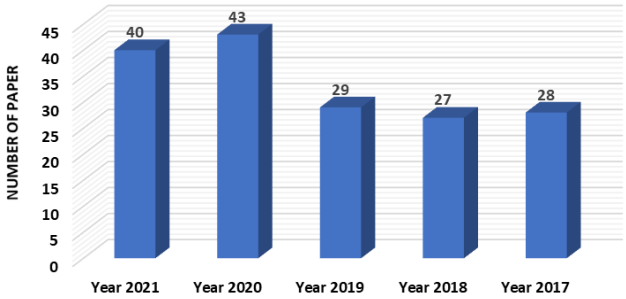

Fig. 4 Year of publication

Then for the Document Type, it is divided into four types, namely articles, book chapters, conference papers, and review papers. In Fig. 5, you can see the number of papers of Article type (90 titles), Book Chapters (3 titles), Conference Papers (68 titles), and Review Papers (6 titles).

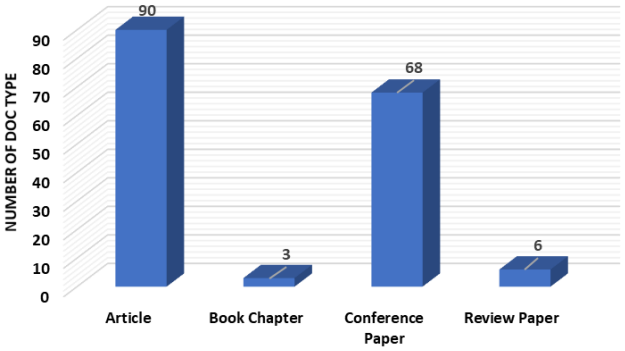

Fig. 5 Document type

The distribution of papers by the publisher is presented in Fig. 6, with a minimum number of 5 papers, including Elsevier B.V., IEEE, IOP, Springer, MDPI, SAGE, Taylor and Francis Ltd., and others. The total number of papers divided into these publishers is 167.

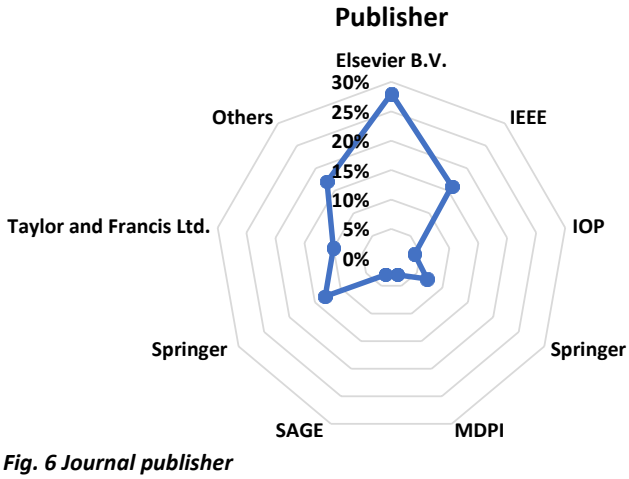

Fig. 6 Journal publisher

There are 13 other publishers in the 'Others' category in the picture, eight publishers with one each, two publishers with two each, and three publishers with three titles each. Social manufacturing papers are widely published by reputable publishers such as Elsevier, IEEE, IOP, Springer, MDPI, SAGE, and also Taylor and Francis Ltd.

CONCLUSION

This systematic literature review aims to discuss the development of research in the field of social manufacturing. The method used to search the data is to download files from a reputable international journal database, Scopus, with the keywords social manufacturing and production system. One of the contributions to this research is the mapping and categorization of papers based on auto, co-author, definition of social manufacturing, terms that often appear in social manufacturing papers, year of publication, document type, and publisher. This contribution can be seen from the results of data mapping using VOSviewer software to classify author, co-author and terms data in social manufacturing. This research still has shortcomings, so it can be improved in future research. Research opportunities that can be carried out are by conducting a more in-depth systematic literature review, such as the author's country of origin, affiliation data, and others. In addition, for further research, other application software can be used for mapping research papers. This systematic literature review can be one of the references for basic research on social manufacturing.

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REFERENCES

[1] P. Oberoi, C. Patel, and C. Haon, "Technology sourcing for website personalization and social media marketing: A study of e-retailing industry ☆", *J. Bus. Res.*, vol. 80, no. July 2016, pp. 10-23, 2017, doi: 10.1016/j.jbusres.2017.06.005.

[2] Y. Zhang, D. Zhang, Z. Wang, and C. Qian, "An optimal configuration method of multi-level manufacturing resources based on community evolution for social manufacturing", *Robot. Comput. Integr. Manuf.*, vol. 65, no. May 2019, p. 101964, 2020, doi: 10.1016/j.rcim.2020.101964.

[3] K. Kaneko, Y. Kishita, and Y. Umeda, "Toward Developing a Design Method of Personalization: Proposal of a Personalization Procedure", *Procedia CIRP*, vol. 69, no. May, pp. 740-745, 2018, doi: 10.1016/j.procir.2017.11.134.

[4] V. Pontevedra, "Mass Personalization with Industry 4.0 by SMEs: a concept for collaborative networks a concept for collaborative networks Costing models for of capacity in Ind", *Procedia Manuf.*, vol. 28, pp. 135-141, 2019, doi: 10.1016/j.promfg.2018.12.022.

[5] S. Garg and S. Garg, "Automated Cloud Infrastructure, Continuous Integration and Continuous Delivery using Docker with Robust Container Security", *Proc. – 2nd Int. Conf. Multimed. Inf. Process. Retrieval, MIPR 2019*, pp. 467-470, 2019, doi: 10.1109/MIPR.2019.00094.

[6] K. Zywicki and P. Rewers, "A simulation-based approach to study the influence of different production flows on manufacturing of customized products", *Adv. Prod. Eng. Manag.*, vol. 15, no. 4, pp. 464-480, 2020, doi: 10.14743/APEM2020.4.379.

[7] A. Fayoumi, "Ecosystem-inspired enterprise modelling framework for collaborative and networked manufacturing systems", *Comput. Ind.*, vol. 80, pp. 54-68, 2016, doi: 10.1016/j.compind.2016.04.003.

[8] H. Sadeghi, H. Golpîra, and S. Abdul Rehman Khan, "Optimal integrated production-inventory system considering shortages and discrete delivery orders", *Comput. Ind. Eng.*, vol. 156, no. January, 2021, doi: 10.1016/j.cie.2021.107233.

[9] A. Ait-El-Cadi, A. Gharbi, K. Dhouib, and A. Artiba, "Integrated production, maintenance and quality control policy for unreliable manufacturing systems under dynamic inspection", *Int. J. Prod. Econ.*, vol. 236, no. September 2020, p. 108140, 2021, doi: 10.1016/j.ijpe.2021.108140.

[10] A. Beltagui, N. Kunz, and S. Gold, "The role of 3D printing and open design on adoption of socially sustainable supply chain innovation", *Int. J. Prod. Econ.*, vol. 221, no. April 2018, p. 107462, 2020, doi: 10.1016/j.ijpe.2019.07.035.

[11] A.W.W. Yew, S.K. Ong, and A.Y.C. Nee, "Towards a griddable distributed manufacturing system with augmented reality interfaces", *Robot. Comput. Integr. Manuf.*, vol. 39, pp. 43-55, 2016, doi: 10.1016/j.rcim.2015.12.002.

[12] R.Y. Zhong, Q.Y. Dai, T. Qu, G.J. Hu, and G.Q. Huang, "Robotics and Computer-Integrated Manufacturing RFID-enabled real-time manufacturing execution system for mass-customization production", vol. 29, pp. 283-292, 2013, doi: 10.1016/j.rcim.2012.08.001.

[13] L. Ouyang, Y. Yuan, and F.Y. Wang, "A Blockchain-based Framework for Collaborative Production in Distributed and Social Manufacturing", *Proc. – IEEE Int. Conf. Serv. Oper. Logist. Informatics 2019, SOLI 2019*, vol. 3, pp. 76-81, 2019, doi: 10.1109/SOLI48380.2019.8955075.

[14] S. Fox and Y. Mohamed, "Technology in Society Moveable social manufacturing: Making for shared peace and prosperity in fragile regions", *Technol. Soc.*, vol. 51, pp. 1-7, 2017, doi: 10.1016/j.techsoc.2017.07.003.

[15] H. Robert, V. Daniel, and A. Bilal, "Engineering the smart factory Engineering the Smart Factory", no. October, 2016, doi: 10.3901/CJME.2016.0908.109.

[16] K. Sree Poornalinga and P. Rajkumar, "Continuous Integration, Deployment and Delivery Automation in AWS Cloud Infrastructure", *Int. Res. J. Eng. Technol.*, 2016, Accessed: Sep. 30, 2020. [Online]. Available: www.irjet.net.

[17] P. Zheng *et al.*, "Smart manufacturing systems for Industry 4.0: Conceptual framework, scenarios and future perspectives", vol. 13, no. 2, pp. 137-150, 2018.

[18] R.Y. Zhong, L. Wang, and X. Xu, "An IoT-enabled Real-time Machine Status Monitoring Approach for Cloud Manufacturing", *Procedia CIRP*, vol. 63, pp. 709-714, 2017, doi: 10.1016/j.procir.2017.03.349.

[19] N. Shahrubudin, P. Koshy, J. Alipal, M.H.A. Kadir, and T.C. Lee, "Challenges of 3D printing technology for manufacturing biomedical products: A case study of Malaysian manufacturing firms", *Heliyon*, vol. 6, no. 4, p. e03734, 2020, doi: 10.1016/j.heliyon.2020.e03734.

[20] A. Kumar, "Methods and Materials for Smart Manufacturing: Additive Manufacturing, Internet of Things, Flexible Sensors and Soft Robotics", *Manuf. Lett.*, vol. 15, pp. 122-125, 2018, doi: 10.1016/j.mfglet.2017.12.014.

[21] D. Gorecky, S. Weyer, A. Hennecke, D. Zühlke, D. Gorecky, and S. Weyer, "Design and Instantiation of a Modular System Architecture for Smart Factories", *IFAC Pap.*, vol. 49, no. 31, pp. 79-84, 2016, doi: 10.1016/j.ifacol.2016.12.165.

[22] R.Y. Zhong, X.Xu, E. Klotz, and S.T. Newman, "Intelligent Manufacturing in the Context of Industry 4.0: A Review", *Engineering*, vol. 3, no. 5, pp. 616-630, 2017, doi: 10.1016/J.ENG.2017.05.015.

[23] A. Santana, P. Afonso, A. Zanin, and R. Wernke, "Smart changeable manufacturing systems Costing models for capacity optimization in Industry 4.0: Trade-off between used capacity an", *Procedia Manuf.*, vol. 28, pp. 3-9, 2018, doi: 10.1016/j.promfg.2018.12.002.

[24] P. Zheng, P. Stief, J. Dantan, A. Etienne, and A. Siadat, "Cloud-based approach for smart product personalization", *Procedia CIRP*, vol. 72, pp. 922-927, 2018, doi: 10.1016/j.procir.2018.03.256.

[25] K. Ding, P. Jiang, J. Leng, and W. Cao, "Modeling and analyzing of an enterprise relationship network in the context of social manufacturing", 2015, doi: 10.1177/0954405414558730.

[26] Y. Zhou, G. Xiong, T. Nyberg, B. Mohajeri, and S. Bao, "Social Manufacturing Realizing Personalization Production: A state-of-the-art Review", *2016 IEEE Int. Conf. Serv. Oper. Logist. Informatics*, pp. 7-11, 2016, doi: 10.1109/SOLI.2016.7551653.

[27] P. Jiang, K. Ding, and J. Leng, "Towards a cyber-physical-social-connected and service-oriented manufacturing paradigm: Social Manufacturing", *Manuf. Lett.*, vol. 7, pp. 15-21, 2016, doi: 10.1016/j.mfglet.2015.12.002.

[28] M. Hamalainen and J. Karjalainen, "Social manufacturing: When the maker movement meets inter fi rm production networks", *Bus. Horiz.*, vol. 60, no. 6, pp. 795-805, 2017, doi: 10.1016/j.bushor.2017.07.007.

[29] P. Jiang and J. Leng, "The configuration of social manufacturing: a social intelligence way toward service-oriented manufacturing Pingyu Jiang* and Jiewu Leng", *Int. J. Manuf. Res.*, vol. 12, no. 1, pp. 4-19, 2017.

[30] W. Guo and P. Jiang, "An investigation on establishing small – and medium-sized enterprises communities under the environment of social manufacturing", *Concurr. Eng. Res. Appl.*, vol. 00, no. 0, pp. 1-14, 2018, doi: 10.1177/1063293X18770499.

[31] G. Xiong, S. Member, F. Wang, T.R. Nyberg, and X. Shang, "From Mind to Products: Towards Social Manufacturing and Service", *IEEE/CAA J. Autom. Sin.*, vol. 5, no. 1, pp. 47-57, 2018, doi: 10.1109/JAS.2017.7510742.

[32] X. Shang et al., "Social Manufacturing for High-end Apparel Customization", *IEEE/CAA J. Autom. Sin.*, vol. 5, no. 2, pp. 489-500, 2018, doi: 10.1109/JAS.2017.7510832.

[33] K. Ding, P. Jiang, and S. Su, "RFID-enabled social manufacturing system for inter-enterprise monitoring and dispatching of integrated production and transportation tasks", *Robot. Comput. Integr. Manuf.*, vol. 49, no. July 2017, pp. 120-133, 2018, doi: 10.1016/j.rcim.2017.06.009.

[34] C.M. Joyner, A. Hirscher, and K. Niinim, "Social manufacturing in the fashion sector: New value creation through alternative design strategies ?", vol. 172, pp. 4544-4554, 2018, doi: 10.1016/j.jclepro.2017.11.020.

[35] X. Xiao, W. Shufang, Z. Le-jun, and F. Zhi-yong, "Evaluating of dynamic service matching strategy for social manufacturing in cloud environment", *Futur. Gener. Comput. Syst.*, vol. 91, pp. 311-326, 2019, doi: 10.1016/j.future.2018.08.028.

[36] W. Guo and P. Jiang, "Product Service Systems for Social Manufacturing: A new service system with multi-provider", *IFAC Pap.*, vol. 52, no. 13, pp. 749-754, 2016, doi: 10.1016/j.ifacol.2019.11.205.

[37] Z. Song, Y. Sun, J. Wan, L. Huang, Y. Xu, and C. Hsu, "Exploring robustness management of social internet of things for customization manufacturing", *Futur. Gener. Comput. Syst.*, vol. 92, pp. 846-856, 2019, doi: 10.1016/j.future.2017.10.030.

[38] C. Qian, Y. Zhang, W. Sun, Y. Rong, and T. Zhang, "Exploring the socialized operations of manufacturing resources for service fl exibility and autonomy", *Robot. Comput. Integr. Manuf.*, vol. 63, no. December 2018, p. 101912, 2020, doi: 10.1016/j.rcim.2019.101912.

[39] K. Watcharapanyawong, S. Sirisoponsilp, and P. Sophatsathit, "A Model of Mass Customization for Engineering Production System Development in Textile and Apparel Industries in Thailand", *Syst. Eng. Procedia*, vol. 2, pp. 382-397, 2011, doi: 10.1016/j.sepro.2011.10.052.

[40] F. Gregori, A. Papetti, M. Pandolfi, M. Peruzzini, and M. Germani, "Digital manufacturing systems : a framework to improve social sustainability of a production site", *Procedia CIRP*, vol. 63, pp. 436-442, 2017, doi: 10.1016/j.procir.2017.03.113.

[41] C. Design, Z. Yi, W. Meilin, C. Renyuan, A. Etienne, and A. Siadat, "ScienceDirect ScienceDirect Research on Application of SME Manufacturing Cloud Platform Based on Research on Application of SME Manufacturing Cloud Platform Based on Micro Service Architecture Micro Service Architecture A new methodology to analyze the fu", *Procedia CIRP*, vol. 83, pp. 596-600, 2019, doi: 10.1016/j.procir.2019.04.091.

[42] C. Kan, H. Yang, and S. Kumara, "Parallel computing and network analytics for fast Industrial Internet-of-Things (IIoT) machine information processing and condition monitoring", *J. Manuf. Syst.*, vol. 46, pp. 282-293, 2018, doi: 10.1016/j.jmsy.2018.01.010.

[43] D.A. Coelho, F. Nunes, and F.L. Vieira, "The impact of crowdsourcing in product development : an exploratory study of Quirky based on the perspective of participants", *Int. J. Des. Creat. Innov.*, vol. 0349, no. September, pp. 1-15, 2016, doi: 10.1080/21650349.2016.1216331.

[44] H. Lu and C. Weng, "Technological Forecasting & Social Change Smart manufacturing technology, market maturity analysis and technology roadmap in the computer and electronic product manufacturing industry", *Technol. Forecast. Soc. Chang.*, vol. 133, no. March, pp. 85-94, 2018, doi: 10.1016/j.techfore.2018.03.005.

[45] F. Salvador, F.T. Piller, and S. Aggarwal, "Surviving on the long tail: An empirical investigation of business model elements for mass customization", *Long Range Plann.*, no. May, p. 101886, 2019, doi: 10.1016/j.lrp.2019.05.006.

[46] P.K. Kannan and H. Alice, "Digital marketing: A framework, review and research agenda", *Int. J. Res. Mark.*, vol. 34, no. 1, pp. 22-45, 2017, doi: 10.1016/j.ijresmar.2016.11.006.

[47] S. Wang, J. Wan, D. Li, and C. Zhang, "Implementing Smart Factory of Industrie 4.0: An Outlook", vol. 2016, 2016.

[48] J. Leng, P. Jiang, and M. Zheng, "Outsourcer – supplier coordination for parts machining outsourcing under social manufacturing", *J. Eng. Manuf.*, pp. 1-13, 2015, doi: 10.1177/0954405415583883.

[49] J. Liu and P. Jiang, "A Manufacturing Network Modeling and Evolution Characterizing Approach for Self-Organization among Distributed MSMEs under Social Manufacturing Context", *IEEE Access*, vol. 8, pp. 119236-119251, 2020, doi: 10.1109/ACCESS.2020.3005195.

[50] J. Leng and P. Jiang, "Mining and Matching Relationships From Interaction Contexts in a Social Manufacturing Paradigm", *IEEE Trans. Syst. Man, Cybern. Syst.*, vol. 47, no. 2, pp. 276-288, 2017, doi: 10.1109/TSMC.2016.2623630.

[51] P. Jiang, J. Leng, and K. Ding, "Art and Future Challenges", *2016 IEEE Int. Conf. Serv. Oper. Logist. Informatics*, pp. 12-17, 2016.

[52] Y. Zhou, G. Xiong, T. Nyberg, B. Mohajeri, and S. Bao, "Social manufacturing realizing personalization production: A state-of-the-art review", *Proc. – 2016 IEEE Int. Conf. Serv. Oper. Logist. Informatics, SOLI 2016*, pp. 7-11, 2016, doi: 10.1109/SOLI.2016.7551653.

[53] E. Hozdić, "Smart factory for industry 4.0: A review", no. January 2015, 2016.

[54] E. Mueller and X.C. Ralph, "Challenges and Requirements for the Application of Industry 4.0: A Special Insight with the Usage of Cyber-Physical System", *Chinese J. Mech. Eng.*, vol. 30, no. 5, pp. 1050-1057, 2017, doi: 10.1007/s10033-017-0164-7.

[55] N. Shariatzadeh, T. Lundholm, L. Lindberg, and G. Sivard, "Integration of digital factory with smart factory based on Internet of Things", *Procedia CIRP*, vol. 50, pp. 512-517, 2016, doi: 10.1016/j.procir.2016.05.050.

[56] S. Wang, J. Wan, D. Li, and C. Zhang, "Implementing Smart Factory of Industrie 4.0: An Outlook", vol. 2016, 2016, doi: 10.1155/2016/3159805.

[57] J. Liu, P. Jiang, and J. Leng, "Jiajun Liu, Pingyu Jiang, Jiewu Leng", pp. 36-40, 2017.

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