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Assessing business readiness for Industry 4.0: A bibliometric analysis of research trends
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Keywords: Industry 4.0, enterprise readiness, maturity models, bibliometric analysis.
Abstract: This research provides a comprehensive analysis of the state of readiness assessment for enterprises in the context of Industry 4.0. It examines the most influential authors, countries, and journals in this field, identifies key research themes, and explores the evolving landscape of Industry 4.0. By bibliometric analysis, this study uncovers the intricate network of co-authorship and co-citation among researchers, journals, and countries. The analysis underscores the dominance of China in terms of both publication volume and citation impact, driven by its strategic "Made in China 2025" plan. The United States and India also make substantial contributions, reflecting the global nature of Industry 4.0 research. The key themes in this area include digital transformation, IT innovations, production, and supply chain management. This study pinpoints three distinct clusters of journals, demonstrating the multidisciplinary nature of Industry 4.0. In addition, a co-occurrence analysis of keywords highlights the most prevalent themes, including Industry 4.0, frameworks, big data, and performance. This research offers valuable insights into the research landscape, informing scholars and industry stakeholders of key players, trends, and emerging areas in assessing enterprise readiness for Industry 4.0.

1   Introduction

Industry 4.0 brings with it numerous challenges that are in synergy with the implementation of digital transformation, new technologies, process improvement, and changes in work methods, all aimed at enhancing the efficiency of manufacturing and decision-making processes within enterprises. We currently live in a world of extensive digitalization, in which industrial enterprises must adapt to new trends and technologies to improve their competitiveness and sustainability. Thus, it is essential to explore evaluative approaches for measuring the maturity level of companies within the context of Industry 4.0. This can aid in identifying the situation not only within the enterprise itself but also within the entire industry in national and international markets. Such insights can be valuable for developing of policies and strategies related to the concept of Industry 4.0.

Given the abundance of existing literature on Industry 4.0 in various countries, as well as the individual aspects of this concept, the aim of this article is to provide a systematic literature overview – a bibliometric analysis to determine the main research trends in the field of assessing business readiness within the framework of Industry 4.0. The main objective of this study is to offer a systematic review of existing literature and identify the top areas considered key in the examination of business readiness in

the context of the Industry 4.0 environment. Research questions are formulated to reflect the objective of this article:

1. What are the primary trends in terms of publishing authors?

2. What are the primary trends in terms of publishing countries?

3. What are the primary trends in terms of publishing scientific journals?

4. What are the primary trends in terms of keywords?

After presenting the theoretical background of the issue, we explain the methodology of this research, followed by the presentation of findings and the conclusion.

1.1   Theoretical background

The scientific term and concept of Industry 4.0 was first presented in 2011 at the Hanover trade fair in Germany. This referred to the transformation process within global value chains. In the report "The Fourth Industrial Revolution" presented by K. Schwab at the World Economic Forum, Industry 4.0 encompasses industrial business processes that involve the organization of global manufacturing networks based on new information and communication technologies and the Internet [1].

Industry 4.0 has garnered significant attention in recent years, both from manufacturing companies and service systems. It primarily involves the integration of manufacturing facilities, supply chains and service systems to enable the creation of value-added networks [2].

Popkova et al. [3] define the term "Industry 4.0" as a new industrial model characterized by autonomously managing, fully automated, self-learning, and interactive production systems. These systems are centred around new digital and internet technologies, and human involvement is limited to their initial setup, control, and technical maintenance. Modern industrial professionals need to acquire new skills and these changes go hand in hand with social changes.

According to [1], Industry 4.0 represents a new industrial area created by the emergence and spread of new digital and internet technologies. These technologies have enabled the development of fully automated manufacturing processes that interact through physical objects without human intervention. Industry 4.0 produces both traditional and new industrial products that cannot be produced in other sectors of the real economy. The process of shaping and developing Industry 4.0 affects all spheres of the economic system, including the social sphere, characterized by significant changes related to the necessity of human adaptation to the new economic conditions. Companies optimize their processes using the opportunities provided by Industry 4.0 and employees (industrial professionals) either acquire the necessary skills for Industry 4.0 or seek employment in other industries, while consumers interact with these new industrial products.

It can be observed that the literature on Industry 4.0, as well as the research on readiness and current status, is relatively extensive. This motivated us to examine the trends in this existing literature. The bibliometric analysis approach is relatively new, but its added value is beyond question. Scholars employ bibliometrics to identify primary areas of research focus by analysing the existing body of literature in their respective fields [4] [5]. They utilize the network analysis methodology known as "co-word analysis" (occasionally referred to as "keyword co-occurrence analysis") to make associations between words (or concepts) that frequently co-occur in publications. The first description of this technique was provided by Callon et al. [6].

This method is often used in the social sciences and humanities, especially when it comes to examining the content of publications on specific topics. It evaluates various attributes of words, including their frequency of occurrence in documents, their associations with other words, their relevance to the topic, and their semantic implications [7] [8].

The main goal of "co-word analysis" is to uncover central themes, concepts, and connections within a text corpus. According to Wang et al. [9], this process has the ability to reveal associations that span numerous topics and disciplines, while uncovering patterns and evolving trends within the respective fields.

2   Methodology

To obtain answers to our research questions, we employed the systematic literature review (SLR) method, which is used to identify, evaluate, interpret, and categorize all relevant articles on the topic under study [10]. Based on the publications of these authors, the systematic literature review consists of the following steps:

1. Identification of research questions: Formulation of research questions to be addressed.
2. Literature search and selection: Development of a document retrieval strategy using a specific combination of keywords to gain a comprehensive overview of the studied area. Appropriate filters are then set to obtain the most relevant sample of articles.
3. Bibliometric analysis: Presentation of quantitative analysis and data visualization of the selected sample of articles to understand key characteristics of the subject, such as publication trends, journals and citations, collaborations, and the focus of keywords.
4. Content analysis: Conducting an in-depth content analysis of selected articles to summarize contributions from several related thematic areas. This enables an understanding of the current research landscape and the identification of future research possibilities.

Following the PRISMA protocols, the SLR methodology begins with the establishment of eligibility criteria. Table 1 contains the exclusion criteria used in our systematic literature review.

Table 1 Exclusion criteria

Exclusion criterion	Description
EC 1	Publications do not belong to SSCI, SCI-E, A&HCI and ESCI indexing
EC 2	Publications are not research papers and research paper reviews
EC 3	Publications published out of range 2011/1 – 2023/1
EC 4	Publications in different than English language

Source: own elaboration

This table clarifies that eligible sources in this study include articles published in academic journals that employ a rigorous peer review system. In this work, we used the online publication database Web of Science (WoS) as a search platform, where, to meet the specified requirement, one of the criteria was the utilization of literature published in journals indexed in Clarivate Analytics' group of indexes. Specifically, these were the

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Social Sciences Citation Index (SSCI), the Science Citation Index – Expanded (SCI-E), the Arts & Humanities Citation Index (A&HCI), and the Emerging Sources Citation Index (ESCI).

Subsequently, we devised a direct search scheme to identify the initial set of articles. Based on the publication by Ghobakhloo et al. [11] and Sun et al. [10], the search scheme included the use of five primary search terms within the thematic group "Industry 4.0," namely, "Industry 4.0," "I 4.0," "Industrie 4.0," "The Fourth Industrial Revolution", and "Cyber-Physical Systems". According to Erboz [12], the last of these search terms represents a fusion of fundamental systems and pillars of Industry 4.0. Hence, we combined the individual search terms for different cyber-physical systems under this general term. Since our focus was on assessing the readiness level of companies in the context of Industry 4.0, this search came with the requirement to include additional key terms, namely, "readiness", "maturity", and "dimension", as explained by Hajoary [13]. These key terms were chosen to target the search directly to the key topics of evaluating business readiness in the context of Industry 4.0.

The search scheme was further refined by limiting the results within the "Document Type" subsection to article types and article reviews. In addition, the search included a publication year restriction that defined the period as January 2011 to March 2023. The final restriction included the exclusion of publications in languages other than English.

The search strategy used in this work included primary searches for publications that focus on assessing business readiness in the context of Industry 4.0, as well as supplementary searches for publications that focus directly on key topics related to the evaluation of business readiness in Industry 4.0.

The result of this search was the identification of a total of 2,232 publications for querying all defined topics and keywords. Of the total number of publications, 807 were excluded based on the exclusion criteria (Table 1). The resulting set of 1,425 publications was used to create the bibliometric analysis. The pioneering word analysis technique was initially developed by Callon et al. in 1986. In recent times, bibliometric analysis has gained prominence as a valuable tool for scholars and librarians across various disciplines, enabling them to navigate extensive collections of scientific articles and uncover patterns and trends. One of the most widely used tools for conducting bibliometric analysis is the VOSviewer software. Detailed instructions on this robust and versatile tool for creating and visualizing bibliometric maps of scientific literature can be found in the VOSviewer documentation [14]. As the authors explain, VOSviewer helps users navigate the complex field of scientific literature and understand the trends and patterns prevalent within it. This software can be used to create maps that illustrate the interrelationships between different academic

fields, authors, institutions, and other components, as well as to create and examine bibliometric diagrams of scientific publications.

VOSviewer utilizes several techniques for generating economic maps, such as the word co-occurrence algorithm, the bibliographic coupling method, and the co-authorship algorithm [15]. Once the bibliometric map is assembled, it can be customized to accentuate specific features or connections. It is essential to recognize that the conclusion of a bibliometric study is to understand patterns and trends of the map and ultimately derive insights about the research landscape from these findings.

3 Results and discussion

Using publications from the WoS database from 2011 to 2023, publication trends in the area of assessing business readiness in the context of Industry 4.0 were examined. Based on Figure 1, it is clear that there has been a significant increase in the number of published papers from 2019 to the present.
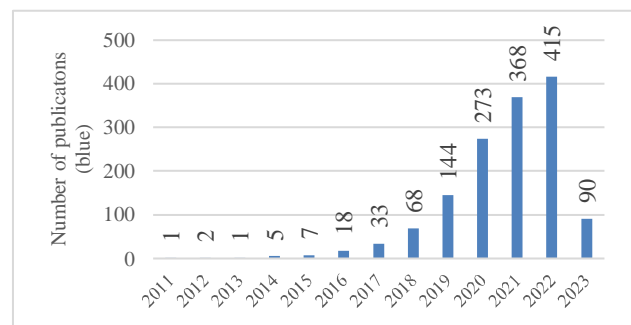

Figure 1 Publications trend
Source: own elaboration according to WoS (2023)

It has been shown that the number of publications more than doubled between 2018 and 2019. Almost 30% of all publications were published last year, and an increasing trend towards addressing this topic is expected in the coming years. Over the years, the number of publications on this topic has increased due to the growing interest in this field and concerns about Industry 4.0, as well as the technological benefits in the manufacturing industry resulting from the implementation of Industry 4.0 [16].

The most prolific authors are listed in the WoS database based on their total number of publications (CPP). Authors with the same number of publications are ranked among themselves based on the total number of citations without self-citations (CPC). Additional data includes the average number of citations per author's publication (PPCP) and the author's Hirsch Index (H-Index), which explains the impact of an author's work on their field of activity [17]. According to this method, the top 10 most productive authors are presented in Table 2. With 15 publications and 655 citations in the literature, Tortorella is the most contributing author in the field of assessing

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business readiness levels in the context of Industry 4.0. His average number of citations per publication is almost 44 citations, and his H-Index stands at 6, meaning that at least 6 of his 15 publications have been cited at least 6 times. Frank follows with 10 publications. Antony is the third most prolific author. The fourth, fifth, and sixth productive authors are Muller, Sony, and Singh. In the seventh position, with 7 publications, is Garza-reyes. Wuest, Jabbour, and Ghobakhloo occupy the 8th, 9th, and 10th positions with 6 publications.

Table 2 Top 10 most productive authors

Author	TNP	CPP	ACPP	H-Index
Tortorella, GL	15	655	43.67	6
Frank, AG	10	1077	107.70	7
Antony, J	9	20	2.22	3
Muller, JM	8	1074	134.25	8
Sony, M	8	156	19.50	5
Singh, RK	8	91	11.38	4
Garza-reyes, JA	7	260	37.14	4
Wuest, T	6	494	82.33	5
Jabbour, CJC	6	354	59.00	5
Ghobakhloo, M	6	165	27.50	5

Source: own elaboration according to WoS (2023)
Note: TNP – total number of publications; CPP – total number of citations excluding self-citations; ACPP – average citation per paper

To create a list of the most influential authors, authors were ranked based on the total number of citations in all their works. This list is shown in Table 3. Frank, AG, who is the second most prolific author with 10 publications, is also the most influential author with 1077 citations in the WoS database. His average number of citations per publication is almost 108 citations, and his H-Index is at 7, indicating that at least 7 of his 10 publications have been cited at least 7 times. Muller and Ayala are the second and third most influential authors with 1074 and 1060 citations, respectively. Following them are authors with CPC below 1000. Voigt and Dalenogare occupy the fourth and fifth positions. The most productive author, Tortella, is ranked as the 6th most influential author with a CPC of 655. He is followed in places 7 to 10 by the authors Buliga, Orzes, Wuest and Sarkis.

Table 4 provides information on authors, publication year, research focus, and the number of citations for the ten most influential articles during the study period. The publication year is also linked to the web link to the respective article. The most cited article was published by Frank et al. [18] and focuses on the examination of patterns in the implementation of Industry 4.0 technologies. The second most cited article by Muller et al. [19] explores how

Industry 4.0 impacts the business models of small and medium-sized manufacturing companies. The third, fourth, and fifth most cited articles delve into cyber-physical systems, specifically addressing the issue of cyber-physical system security [20], key aspects, technologies, and emerging trends in industrial cyber-physical systems [21], and new challenges in data recording in intelligent cyber-physical systems that provide detailed access to various aspects of the physical world [22]. The aim of the article by Mittal et al. [23] is to critically evaluate the available maturity models of Smart Manufacturing and Industry 4.0 and analyze their suitability with regard to the specific requirements of small and medium-sized enterprises.

Table 3 Top 10 most influential authors

Autor	TNP	CPP	ACPP	H-Index
Frank, AG	1077	10	107.70	7
Muller, JM	1074	8	134.25	8
Ayala, NF	1060	5	212.00	3
Voigt, KI	947	4	236.75	4
Dalenogare, LS	834	1	834.00	1
Tortorella, GL	655	15	43.67	6
Buliga, O	548	2	274.00	2
Orzes, G	542	3	180.67	5
Wuest, T	494	6	82.33	3
Sarkis, J	447	4	111.75	3

Source: own elaboration according to WoS (2023)
Note: TNP – total number of publications; CPP – total number of citations excluding self-citations; ACPP – average citation per paper

The article by Sanders et al. [24] aims to analyze the relationship between Lean Manufacturing and Industry 4.0 and explore whether Industry 4.0 can implement Lean methods. The following most cited articles focus on the context of supply chain sustainability, specifically identifying and analyzing key challenges of the Industry 4.0 initiative in the context of supply chain sustainability in emerging economies with a focus on the Indian manufacturing industry [25], exploring the potential opportunities available in the integrated sustainable supply chain of the Internet of Things for Industry 4.0 transformation [26], and investigating the adoption of blockchain technology (a digital technology based on decentralized data storage) that ensures secure information storage and distribution in supply chain management [27].

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Table 4 Top 10 most influential papers

Author and year	Area of focus of the publication	Number of citations
Frank et al. (2019)	Engineering; Operations Research and Management Science	834
Muller et al. (2018)	Business and economics; Government	437
Mitchell & Chen (2014)	Computer science	377
Leitao et al. (2016)	Computer science	358
Cai & Zheng (2020)	Engineering, Mathematics	347
Mittal et al. (2018)	Engineering; Operations Research and Management Science	342
Sanders et al. (2016)	Engineering	336
Luthra & Mangla (2018)	Engineering	332
Manavalan & Jayakrishna (2019)	Computer Science, Engineering	330
Kamble et al. (2019)	Engineering; Operations Research and Management Science	311

Source: own elaboration according to WoS (2023)

Collaboration is a fundamental aspect of research culture and provides a multidimensional perspective on scientific research and technological development [17]. To examine the relationships and interconnections between authors in the field of scientific publications focused on assessing readiness in the context of Industry 4.0, we used analytical software VOSviewer. The identification of the most contributing collaborations and active interactions between different authors in this area was achieved through co-authorship and co-citation mapping, as shown in Figures 9 and 10. We conducted a comprehensive analysis of the co-authorship network of 4,422 authors, resulting in the representation of the 14 authors with the most contributions and their collaboration over time. In this technique, the weight of the connection between two authors is determined by the number of citations between each author's publications. The more citations authors share, the stronger their connection. Additionally, the average number of citations to their publications is used to determine a score for each author. This score provides information about the overall quality of each author's research results, enabling the identification of the most influential authors in the research area. As shown in Figure 2, these 14 authors are divided into seven clusters with different numbers of co-authored works and citations. The group of authors, including Frank, Dalenogare, and Ayala, achieved the highest average co-citation score, reaching 1,158. This means that this group made the most significant contributions in the field of assessing enterprise readiness in the context of Industry 4.0.
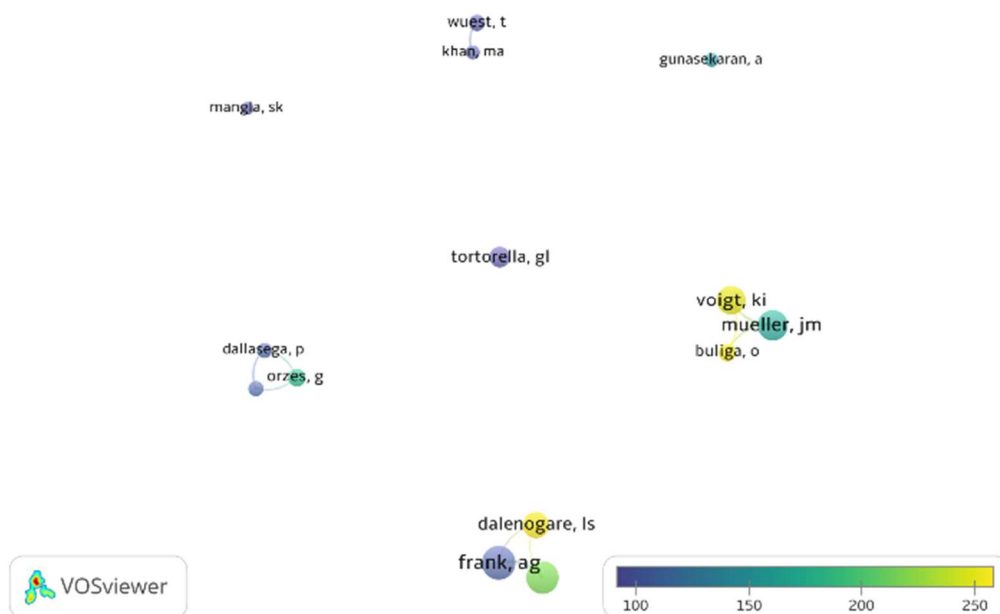

Figure 2 Collective authors´ citation
Source: own elaboration in VOSviewer

Co-citation mapping (Figure 3) focuses on the shared citations between two different documents in other publications. If two documents have a significant number of shared citations, they may be considered similar or

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related. VOSviewer represents such relationships as connections between documents. In this analysis, the minimum number of citations for an author was set at 130 to identify the most influential authors who have supported the development of this field. The results revealed the top 20 most influential authors and their co-citation networks.

The authors in the network are divided into two groups, with the red part of the network dominated by author Schumacher and the green part of the network dominated by author Gobakhloo. This indicates that these authors frequently collaborated with other authors and their work was often cited by other authors in the network.
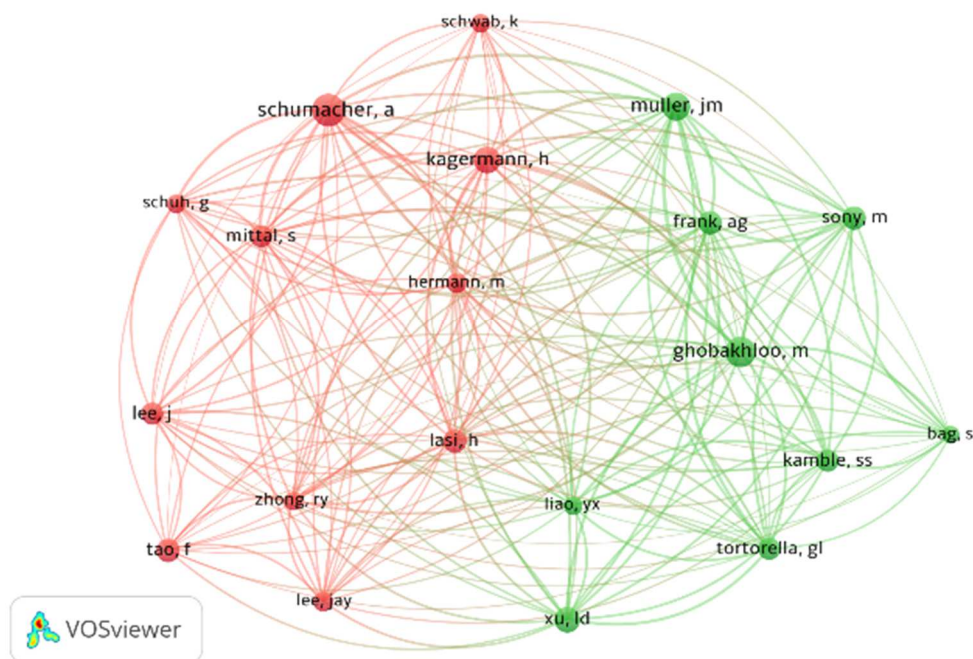

Figure 3 Authors´ interconnections in collaboration
Source: own elaboration in VOSviewer

In the ranking of countries contributing the most to addressing the issue of business readiness in the context of Industry 4.0 through their publications, China secured the top position with 191 publications (Table 5). This number represents more than 13% of the total published studies in this area. The total citations for these publications amounted to 4,108, and the achieved H-Index reached 34, which was the highest H-Index achieved among all countries. This means that at least 34 citations were received for 34 of the published papers. China is a country that has successfully incorporated ideas, technologies, and innovations ranging from computers to additive manufacturing [28]. China's prominent position in this field is not a matter of luck, as the country diligently pursues the goals of the "Made in China 2025" strategic plan, which focuses on modernization and raising the technological level in the context of Industry 4.0 [29]. The United States and India secured the second and third positions with an equal number of 139 publications, but the U.S. studies also had the highest number of citations (5,177). Following them, countries like Germany, Italy, the United Kingdom, Brazil, Australia, France, and, at the tenth position with 60 publications, Spain. Slovakia is an additional country mentioned in this ranking, ranking 21st with 31 publications.

Table 5 Top 10 most publishing countries

No.	Country	No. of publications	% of 1.425	No. of citations	H-Index
1.	China	191	13.40%	4108	34
2.	USA	139	9.75%	5177	33
3.	India	139	9.75%	3005	24
4.	Germany	116	8.14%	3746	26
5.	Italy	106	7.44%	3220	30
6.	UK	103	7.23%	3143	29
7.	Brazil	95	6.67%	2917	22
8.	Australia	65	4.56%	844	16
9.	France	61	4.28%	1915	18
10.	Spain	60	4.21%	1215	16
21.	Slovakia	31	2.18%	284	10

Source: own elaboration according to WoS (2023)

To identify strong or weak connections between countries, we used a metric called "Cumulative Strength of Relations" (CSR), which expresses the strength of the connection between countries in a network of collaboration based on the weight values determined by the number of common publications among authors from those countries. Within the context of our search, we defined collaborative countries as those with at least 10 published papers,

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resulting in a total of 50 countries. Table 6 shows that the United States and China are the most collaborative countries, with CSR values of 141 and 138, respectively. They are followed by the United Kingdom, India and Germany.

Table 6 Top most collaborating countries

No	Country	CSR
1.	USA	141
2.	China	138
3.	United Kingdom	117
4.	India	103
5.	Germany	85

Source: own elaboration according to WoS (2023)

Figure 4 shows a graphical representation of these connections. In this image, we can observe not only the strength of connections between countries as a whole but also the placement of countries into various color-coded clusters. These clusters represent groups of countries that cooperate more with each other than with other countries. Clusters are formed based on the similarity in the number of common publications and often include countries with similar scientific profiles or geographic locations.
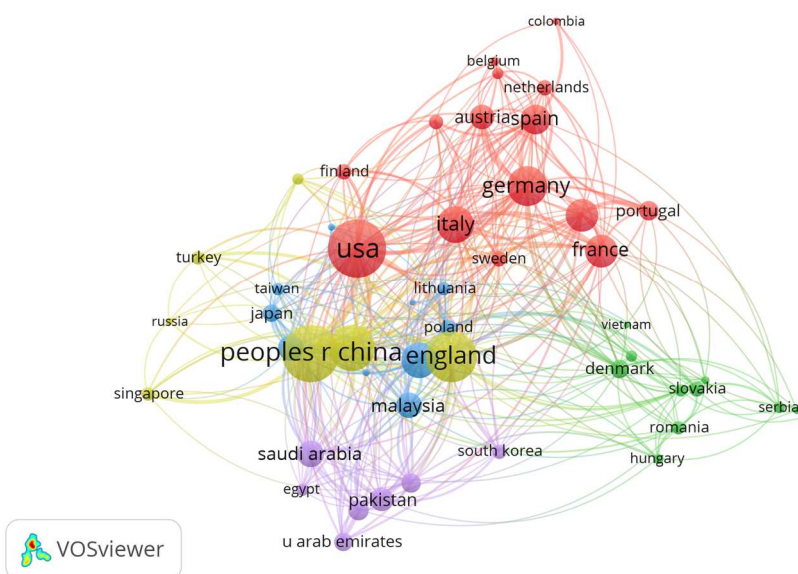

Figure 4 Co-authorship collaboration among countries
Source: own elaboration in VOSviewer

Table 7 displays the number of publications in areas related to the assessment of business readiness in the context of Industry 4.0. We can see that mechanical engineering had the highest number of publications, with 623, accounting for almost 44% of all published works. Business and economics followed with a representation of 23.79%, and computer science with 23.65%. These three areas have the largest share of the total number of publications. From this, we can infer that these areas are considered crucial for enterprise readiness in the context of Industry 4.0, and that's why scientists and researchers are most active in them. Science and technology constituted 10.39%, environmental science and ecology 8.91%. Operations research, telecommunications, materials science, and chemistry had a representation of less than 10% of all publications. Autonomous control systems had the smallest share at 4.70%.

Table 7 TOP 10 areas of investigation within the assessment of the company's readiness

Research area	No of publications	% of 1.425
Engineering	623	43.72%
Business and economics	339	23.79%
Computer sciences	337	23.65%
Science and Technology	148	10.39%
Environmental sciences and Ecology	127	8.91%
Operational Research Management Science	126	8.84%
Telecommunications	85	5.96%
Material Science	79	5.54%
Chemistry	76	5.33%
Autonomous control systems	67	4.70%

Source: own elaboration according to WoS (2023)

Table 8 lists the top 10 most popular journals in the field of assessing business readiness in the context of

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Industry 4.0. Together, they published a total of 322 articles, accounting for almost 23% of the total quantity. With 88 published works, Sustainability leads in the number of publications, representing over 6% of the total. Sustainability is an interdisciplinary journal primarily focused on theoretical advancements and practices in sustainable development and the circular economy (Sun et al., 2021). Other highly popular journals include Applied Sciences Basel, IEEE Access, Journal of Manufacturing Management, and Sensors, which published 40, 39, 28, and 25 articles, respectively. Among the top 10 journals, Sustainability, Applied Sciences Basel, IEEE Access, and Sensors have open access, while the others have partially open access, with some articles freely available but most requiring a subscription or payment for access. These 10 journals cover various topics such as sustainable development, manufacturing and economic aspects, engineering, computer and data sciences, process optimization, and the development of new technologies, highlighting the interdisciplinary nature of the field of assessing business readiness assessment in the context of Industry 4.0.

Table 8 TOP 10 most popular journals from an I4.0 readiness perspective

Journal	No of publications	% of 1.425
Sustainability	88	6.18%
Applied Sciences Basel	40	2.81%
IEEE Access	39	2.74%
Journal of Manufacturing Technology Management	28	1.96%
Sensors	25	1.75%
International Journal of Production Economics	24	1.68%
Technological Forecasting and Social Change	22	1.54%
International Journal of Production Research	20	1.40%
IEEE Transactions on Industrial Informatics	18	1.26%
International Journal of Advanced Manufacturing Technology	18	1.26%

Source: own elaboration according to WoS (2023)

Subsequently, we conducted a co-citation analysis to understand the interactions between the most influential journals in the field. The minimum number of citations for a journal was set to 600 using VOSviewer, resulting in 11 high-quality sources for co-citation analysis. The results are shown in Figure 5. Based on the co-citation activity, we identified three groups of journals. Group 1 collectively address issues related to manufacturing and production processes and related topics. Journals in Group 2 focus on innovations in IT but also provide theoretical and practical solutions for efficient management, production, distribution, and sustainability. Journals in Group 3 deal with topics related to production and the economy. Additionally, active interactions between Groups 1 and 3 and between Clusters 2 and 3 suggest that journals related to production and the economy serve as a bridge connecting issues of manufacturing and production process management with innovations in IT and the provision of theoretical and practical solutions for efficient management, production, distribution, and sustainability.
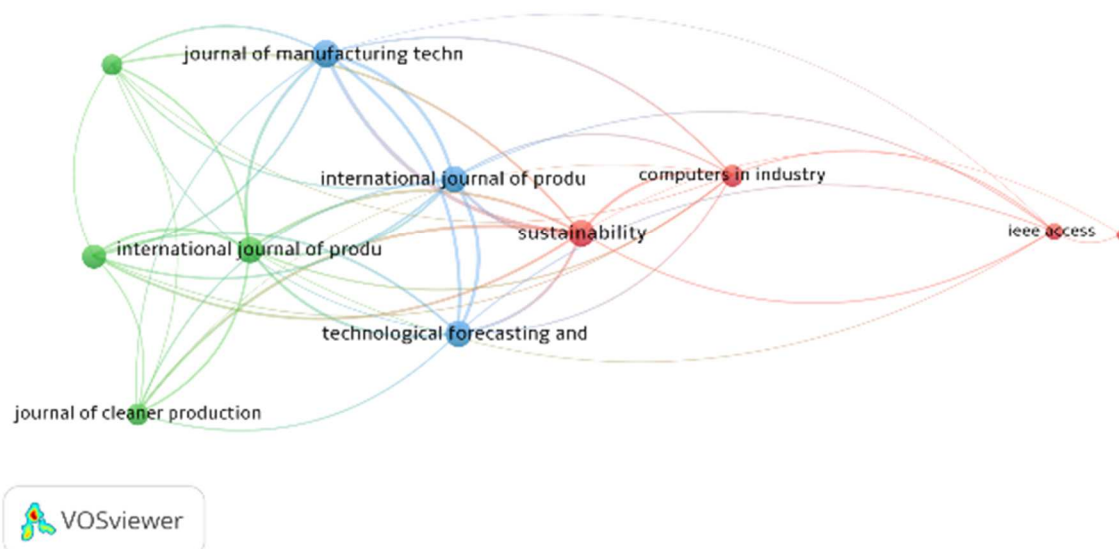

Figure 5 Most influential journal
Source: own elaboration in VOSviewer

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To identify the most important and frequently occurring themes in the field of assessing business readiness in the context of Industry 4.0, we decided to analyse all the keywords that appeared in previous publications, including titles, abstracts, keywords, and author names. Figure 6 shows the mapping and interactions of the 30 most frequently occurring keywords out of a total of 5872 keywords. These keywords are grouped into three categories that can pinpoint the main research directions in the field of business readiness assessment in the context of Industry 4.0. Group 1 contains 14 keywords focused on digital transformation and innovation in the industry and management, specifically related to the concept of Industry 4.0. They are also focused on organizational preparedness and on concepts and technologies used to improve production and process management, including digitization, the implementation of new systems and technologies, and the creation of new models. In this group, the keyword "Industry 4.0" appeared most frequently, with 732 occurrences, and this keyword also showed the highest level of connectivity with other keywords. Group 2 contains 9 keywords related to information technologies, their use in the industry, and in optimizing production processes. It includes terms such as "Big Data," "Cyber-Physical Systems," "Internet of Things," "Smart Manufacturing," as well as various technological and design aspects. In this group, the keyword "Framework" appeared most frequently, with 168 occurrences, and this keyword also showed the highest level of connectivity with other keywords. Group 3 contains 7 keywords related to various factors and aspects of supply chain management and sustainability, as well as technological challenges and barriers that can influence a business's performance and success. In this group, the keyword "Performance" appeared most frequently, with 121 occurrences. The keyword "Challenges" showed the highest level of connectivity with other keywords.
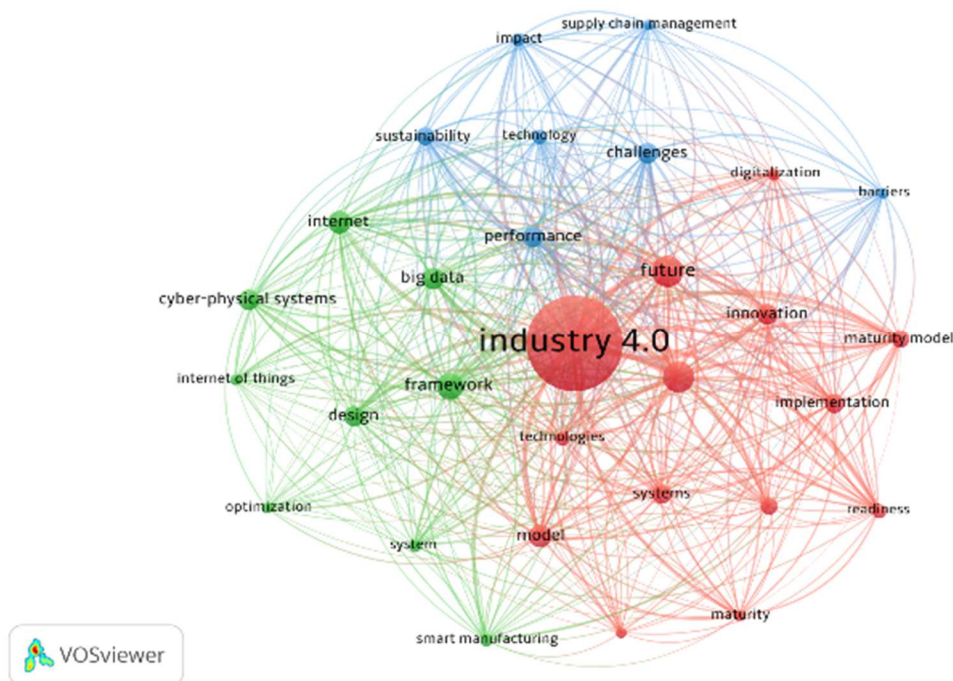

Figure 6 Most used keywords
Source: own elaboration in VOSviewer

4 Conclusions

The study has presented a detailed analysis of the state of readiness assessment for enterprises in the context of Industry 4.0, offering insights into the influential authors, countries, journals, and key research topics. China emerged as the leading contributor in terms of publication volume and citation impact, reflecting its strategic focus on technological advancement within Industry 4.0. The United States and India also play significant role in shaping this area of research.

Multidisciplinarity is a hallmark of this field, as demonstrated by the three distinct clusters of journals that span manufacturing, IT innovation, and economic aspects. Co-occurrence analysis of keywords revealed a focus on digital transformation, IT innovations, and performance.

This research serves as a valuable resource for academics, policymakers, and industry stakeholders, providing a comprehensive overview of the evolving landscape of assessing Industry 4.0 readiness. By identifying key players, trends and emerging areas, it

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informs future research directions and facilitates collaboration between stakeholders in this dynamic and evolving field. However, the authors are fully aware of the complexity of the topic and possibilities of expanding this research or narrowing its scope to one´s aims.

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