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A systematic literature review with bibliometric analysis of Quality 4.0

Design/Methodology/Approach: This study employed a comprehensive systematic literature review and bibliometric analysis of Quality 4.0 publications to identify the benefits, challenges, and trends of adopting Quality 4.0.

Purpose: This study aims to investigate and provide comprehensive insights into the state of research on Quality 4.0 across various sectors. The investigation focuses on studies conducted in different countries and is motivated by the perceived benefits of adopting Quality 4.0 and the existing research gap in this domain. The literature review examines two main aspects of Quality 4.0: implementation ingredients and its applications.

Findings: The applications of Quality 4.0 centered on six key areas, including agile product development, predictive quality algorithms, cloud databases, automation, reduced cost of quality, streamlined quality processes, accurate demand forecasting, and monitoring suppliers and quality metrics using digital dashboards. Geographical disparities in research were identified, with India and the United States emerging as the top publishing countries. The dominance of the subject of business, management, and accounting underscored the importance of quality management across diverse sectors.

Research Limitations/Implications: The limitations of this study include the novelty of the Quality 4.0 topic, which posed a challenge in finding academic material, and the analysis period of six years, which could potentially limit the coverage of recent developments.

Practical Implications: The insights and observations from this research offer valuable guidance to academics, practitioners, and professionals seeking to implement Quality 4.0 in diverse sectors.

Originality/Value: This study contributes a novel perspective to the field by examining the application, utilisation, and evaluation of Quality 4.0, providing valuable insights for effectively managing its implementation.

Keywords: Quality management, Industry 4.0, Technological innovation

1. Introduction

The emergence of Industry 4.0 has brought profound changes in engineering, manufacturing practices, processes, and technologies for modern organisations (Antony et al., 2021). The concept of Quality Management has been discussed since the 80s and 90s, emphasising analysing non-conformities within the production process to guarantee the reliability of products and services (Carvalho et al., 2021). As technology evolved, Quality Management could be integrated with technological processes to cope with new challenges (Aleksandrova et al., 2019). On the other hand, Industry 4.0 technologies such as Big Data and the Internet of Things (IoT) have been utilised in several industries to enhance efficiency and reduce cost (Carvalho et al., 2021). Therefore, it is essential to understand the integration of Industry 4.0 and quality management.

The Quality 4.0 term was introduced by Dan Jacob, indicating that with technology, quality should be a corporate strategy led by executives driving performance (Sony et al., 2020). There are two approaches to developing a comprehensive definition of Quality 4.0 (Sader et al., 2012). The first approach discusses Quality 4.0 in the context of Industry 4.0 technologies. The second approach sees Quality 4.0 as an independent evolvement of previous quality management iterations, such as quality control, quality assurance, and total quality management (TQM). In line

with the first approach, Quality 4.0 relies heavily on novel technologies. As a result, in many articles, Quality 4.0 is regarded as a technology-focused initiative rather than quality management-oriented (Küpper *et al*., 2019). The emergence of Industry 4.0 led to the creation of Quality 4.0, which resulted in the transformation toward continuous quality monitoring. According to Radziwill (2018), Industry 4.0 provided the required technologies and tools for quality management to establish new horizons for organisations, allowing them to succeed at running their businesses. Quality 4.0 is also called a digitalised version of quality management, where Industry 4.0 tools are utilised (Jacob, 2017a; Bowers & Pickerel, 2019).

The second approach recognises Quality 4.0 as an independent progression from prior quality management approaches unrelated to integrating with Industry 4.0. Nevertheless, the American Society for Quality (ASQ) mentioned that the evolution into Quality 4.0 occurred almost simultaneously with the progression from the previous industrial era into Industry 4.0. Further, Radziwill (2018) argued that it is essential to understand previous quality iterations that led to the coining of the term Quality 4.0. For instance, Walter Shewhart pioneered the first phase of quality management, which focused on inspecting commodities to eliminate nonconforming items. Quality Control (QC) is the name given to this quality iteration. After that, the second iteration of quality was initiated by introducing Quality Assurance (QA) which focuses on monitoring the quality of various processes that contribute to the final product. The third quality iteration is TQM, highlighting the importance of customer focus, continuous improvement and total involvement of the workforce responsible for quality. From this perspective, Quality 4.0 is an upgrade in quality tools and activities that not only discover and address problems from yesterday but also predict future problems and prevent them from developing (Sader et al., 2022). However, Broday (2022),

who studied the evolution of quality management from inspection to Quality 4.0, highlighted that up to this day, there is no universally agreed Quality 4.0 definition.

Quality 4.0 has a wide range of applications across several industries. For instance, Fettermann et al. (2018) discussed Quality 4.0 in the context of the manufacturing sector, whereas Küpper et al. (2019) and Johnson (2019) investigated the applications of Quality 4.0 in procurement and logistics, respectively. Sader, Husti, and Daroczi (2022) suggested that many other fields can apply Quality 4.0; however, the literature has yet to investigate these applications thoroughly. Many scholars studied Quality 4.0's implementation ingredients to facilitate an organisation's transformation toward the new era of quality management (Sony et al., 2020; Asif, 2020). Nonetheless, there is quite a dispersion among researchers regarding what constitutes a successful implementation of Quality 4.0. Antony et al. (2022) conducted a qualitative study that involved several senior quality managers in identifying the main readiness factors for Quality 4.0 in companies. Souza et al. (2022) created a model based on a systematic literature review approach that combines quality, technologies, and people to integrate quality management and Industry 4.0. A new approach for Quality 4.0 derived from the Lean Six Sigma Define-Measure-Analyse-Improve-Control (DMAIC) phases has been developed (Escobar et al., 2022). The new approach focuses on identifying, acsensorizing (i.e., using sensors to obtain real-time readings), discovering, learning, predicting, redesigning, and relearning (IADLPR2). Antonio et al. (2022) suggested an ISO 25010 reformation to assess software engineers resolving quality issues and meet Industry 4.0 specifications. Quality 4.0 is nascent (Antony, McDermott, et al., 2021). As a result, researchers should make additional efforts to conceptualise Quality 4.0 systematically and comprehensively and develop a thorough understanding (Sony et al., 2021). However, hardly any study discusses Quality 4.0 from a bibliometric perspective to systematically analyse the literature and identify the

key components and various applications of Quality 4.0 across different industries. Therefore, the main research questions for this study to provide an analysis and insightful study of the literature available on Quality 4.0 are as follows:

RQ1 What are the Quality 4.0 key ingredients and applications across different sectors?

RQ2 What are the Quality 4.0 studies present in various countries or territories?

RQ3 What are the main benefits and challenges presented in Quality 4.0 studies?

RQ4 Where must future researchers direct their efforts on Quality 4.0?

This study aims to assist industries in identifying the essential key ingredients that result in the successful adoption of Quality 4.0. In addition, it helps them identify the main specific areas and applications of Quality 4.0 across different industries. This study provides a detailed bibliometric analysis of Quality 4.0 to identify the research trends, prominent subject areas, commonly used keywords, most cited articles, prolific authors, active journals, and productive countries and institutions.

The study is structured as follows. The next section covers the methodology used, broken up into two parts, an SLR and a bibliometric analysis. The third section conducts an SLR examining the key elements and practical applications of Quality 4.0. The fourth section demonstrates a comprehensive bibliometric analysis of Quality 4.0. The following section reports the primary findings and results, whereas the final section conveys study conclusions, limitations, and recommendations.

2. Methodology

The methodology for the study consists of two parts: an SLR and a bibliometric analysis. The study employed this methodology because it can comprehensively analyse a large body of

literature and identify patterns and trends in the field. Figure 1 illustrates the methodological flow of an SLR, bibliometric analysis, and the article selection process.

2.1 Search Strategy

The scientific research database was selected to search and extract articles in Scopus. The researchers selected this database due to its reputation as one of the largest abstract and citation databases for peer-reviewed literature, including scientific journals, books, and proceeding from conferences (Aghaei Chadegani et al., 2013). It also includes articles in other online databases such as Emerald, Wiley Online Library, SpringerLink, and Science Direct, allowing data export (da Silva et al., 2018).

The period of 2010 through July 5, 2023, was used for extracting relevant articles to the research. The review process was limited to English language publications as it is the most commonly used language among scientific publications (Cisneros et al., 2018). The types of documents used in this study include journal articles in the final stage only. These documents are considered the most reliable resources in the literature due to the peer review process that the publications pass through (Garza-Reyes et al., 2016). Therefore, this study excluded conference papers, books, book chapters, letters, and editorials. Also, this study did not review non-academic databases and grey literature since they contain unreliable sources of publications.

The main objective of this study is to obtain an overview of the literature on Quality 4.0 terminology excluding individual Industry 4.0 technologies or topic subdomains. The term "Quality 4.0" was explicitly used in the Scopus database for the search in titles or keywords of the articles. Keywords such as "quality & industry 4.0" or "quality & digitalisation" were intentionally excluded from this study. This decision was motivated by the absence of a universally agreed-upon definition for Quality 4.0. Existing literature suggests that Quality 4.0 represents an

independent evolutionary phase that emerged concurrently with the transition from Industry 3.0 to Industry 4.0 (Sader et al., 2022; The American Society for Quality, 2018b).

Conversely, Jacob (2017b) stated that Quality 4.0 does encompass the digitalisation of quality management. Moreover, Sony et al. (2022) argue that Quality 4.0 extends beyond merely utilising technology and quality management, emphasising it as a new methodology for delivering high-quality products. Specific inclusion and exclusion criteria were employed during the article selection and data extraction stages to ensure a focused and comprehensive search process. A detailed summary of these criteria is provided in Table 1, offering transparency and clarity regarding the study's methodology.

<INSERT TABLE 1 APPROXIMATELY HERE>

2.2 Study Selection

The search strategy yielded 166 publications matching the designated search term. Subsequently, the researchers thoroughly evaluated these publications to ensure adherence to the predetermined search strategy criteria. Of the initial 166 articles, 93 were incongruent with the search strategy criteria and consequently excluded from further analysis.

The remaining 73 articles underwent an additional screening to assess their relevance to the research questions. During this screening phase, the evaluation emphasised the presence of Quality 4.0 implementation components that could serve as valuable indicators for practitioners and professionals in adopting the Quality 4.0 methodology. Further, the screening process encompassed a comprehensive assessment of the diverse applications of Quality 4.0 across various sectors.

Following this stringent selection process, 45 articles were deemed suitable for inclusion in the systematic literature review. These articles were selected based on their alignment with the research objectives and their ability to examine Quality 4.0 and its associated implementation factors comprehensively.

2.3 Data Extraction

The research collected relevant information from the selected studies through a meticulous data extraction process. Specifically, a CSV file format containing bibliometric data was exported from Scopus, facilitating the analysis of 45 articles. The extracted data encompassed vital attributes such as title, authors, affiliations, year, source title, cited by, references, publication country, keywords, and document type.

The next step was to import the extracted information into the VOSviewer software for a comprehensive bibliometric analysis. VOSviewer offers a powerful platform for visualising and analysing relationships among authors, countries, institutions, co-citations, domains, and terms. The visual of similarities (VOS) framework generates a two-dimensional map, where the similarity or relatedness between two items is calculated and depicted. Further, the VOSviewer clustering method effectively organises topics into distinct groups, visually accentuating each group with a distinct colour (Van Eck et al., 2010; Waltman et al., 2010).

This robust methodology utilising VOSviewer facilitates a comprehensive and visually informative analysis, empowering a deeper understanding of the interrelationships and patterns within the dataset.

2.4 Data Analysis

The analysis and results section provides a comprehensive interpretation of the visualisations generated using VOSviewer, shedding light on key findings and insights. The

visualisations indicate the following: the circle size and font label correspond to the frequency of occurrences, different colours denote distinct clusters, and the proximity between circles signifies their degree of relatedness (Rizzi et al., 2014).

Articles published from 2010 to July 5 2023, were meticulously analysed to identify research gaps in the scientific literature and map the current state-of-the-art research on Quality 4.0. The Scopus scientific database was accessed to retrieve the necessary data, allowing for the identification of prominent research trends. The collected data underwent normalisation, enabling comprehensive analyses of publication trends, prevalent subject areas, prominent keywords, highly cited articles, prolific authors, active journals, and leading institutions. Moreover, the analysis also explored the major countries contributing to the scholarly discourse in this domain.

This robust data analysis approach, employing VOSviewer and utilising the extensive Scopus database, offers a deep understanding of the literature landscape surrounding Quality 4.0. The findings from this analysis illuminate the existing knowledge gaps and provide insights into emerging trends, key contributors, and essential research themes within the field.

<INSERT FIGURE 1 APPROXIMATELY HERE>

3. Systematic literature review

In an SLR, past and current published and unpublished works on a particular research topic are extensively analysed (Tranfield et al., n.d.). Further, the literature review covers different sectors to provide a comprehensive overview of Quality 4.0 applications. The SLR method primarily identifies research gaps by analysing existing research findings.

3.1 Essential Ingredients for the Implementation of Quality 4.0

Industry 4.0 contains a wide variety of technologies. The primary technologies include machine learning, deep learning, blockchain, big data, artificial intelligence (AI), and supporting technologies (sensors, actuators, and RFID readers) proposed for Quality 4.0. They are anticipated to be the most helpful (Radziwill, 2018). In addition, Quality 4.0 technologies can divide into four categories: connectivity, collaboration, big data, and data presentation (Jacob, 2017b). Other technologies such as IoT, cyber-physical systems (CPS), and cloud-based computing can also be utilised in Quality 4.0 to comply with quality of conformance and design requirements (Sony et al., 2020). Therefore, it is critical to identify the key components that enable enterprises to manage and adopt these technologies.

Asif (2020) mentioned five main components of aligning quality management practices with Industry 4.0 tools. The first component is intellectual capital management. It depends on understanding the factors that establish an organisation's human and social capital. This element highlights the skills and knowledge of the employees in the firm. The second component is the alignment between the technical and social sides of the organisation, which includes all Industry 4.0 technologies and the human element in the process, respectively. A Lean organisational structure is the third essential element in integrating quality management with Industry 4.0. It emphasises using AI and quality process monitoring to increase organisational flexibility. According to Asif (2020), the fourth element is managing the business relationship with networked organisations. It entails understanding the process of attaining a product handled by different organisations. Lastly, the fifth key component is utilising big data to make accurate predictions. The final element enables the firm to foresee and address future quality problems appropriately, allowing for high organisational resilience.

Sony, Jiju, and Douglas (2020) identified eight primary Quality 4.0 implementation ingredients. Transformation initiatives usually face stakeholders' resistance to change (Todnem By, 2005). Therefore, the authors highlighted that top management support is the first and foremost ingredient to Quality 4.0 adoption. Making the transition to Quality 4.0 necessitates the use of various Industry 4.0 technologies. These technologies promote better operations and quality control. However, implementing them demands a cultural transformation within the firm. It is also critical to run training programs for employees to learn how to utilise Industry 4.0 technologies. As a result, the second and third Quality 4.0 implementation components are a cultural shift toward Quality 4.0 and employee training programs. The successful transformation to Quality 4.0 calls for the fourth implementation ingredient, a proper leadership style that promotes innovation, knowledge diffusion, delegation, consulting, and monitoring (Shamim *et al*., 2016; Sony et al., 2020). Quality 4.0 delivers a competitive edge for the organisation that adopts it (Antony et al., 2021). It enables organisations to design higher-quality products and services at more affordable prices.

Additionally, Quality 4.0 encourages better future designs through product and service monitoring. The fifth component of Quality 4.0 adoption is using it to give the organisation a competitive advantage. Sony, Antony, and Douglas (2020) mentioned that the sixth Quality 4.0 implementation ingredient is the vertical and horizontal integration through Quality 4.0. Building a customisable and flexible production system is achievable through vertical integration between the different departments within the organisation (Sony, 2018). Further, organisations should invest in creating an efficient ecosystem that promotes building competent products and services. To accomplish this, organisations can create horizontal inter-organisation integration, mainly consisting of multiple connected firms. Lastly, the seventh and eighth components of the

successful implementation of Quality 4.0 are extensive data management and analytical algorithms.

To integrate quality management, quality control, and Industry 4.0, Souza *et al*. (2022) suggested creating a TQM 4.0 ecosystem. The ecosystem contains three main pillars for technology, quality, and people. Organisations must establish a collaborative environment based on interconnection for the ecosystem to function. Therefore, the authors proposed four key factors to consider. The first factor is using big data to create value for the industry, which fosters decentralisation in quality management through continuous monitoring of quality metrics. Big data allows businesses to have a more profound knowledge of their consumers. For example, a company may use customer data to segment them based on their purchasing habits and preferences. This segmentation enables the development of customised marketing strategies and personalised promotions (Varadarajan, 2020). Additionally, it facilitates better data analysis and visualisation within the firm (Sun et al., 2018; Chiarini, 2020).

The second key factor is promoting the integration between people and technology through the human-in-the-loop (HITL) concept. This concept highlights the need for skilled people to run and execute the algorithms (Cimini *et al*., 2020; Jwo et al., 2021). The perception of experienced individuals provided by the HITL approach enables improved data-driven decision-making (Bagozi *et al*., 2019). However, achieving a seamless integration of people and technologies dictates humans adapting to the usage of those technologies (Babatunde, 2020). According to Souza et al. (2022), maintaining employees' mental health is the third factor. Organisations can focus on this by supporting periodic check-ins and holding one-on-one sessions with employees to allow them to discuss their concerns, issues and seek help if required.

Additionally, the mental well-being of employees must develop a supportive culture where employees can share their experiences openly (Boulanger, 2023). This results in an enhanced work environment, resulting in better technology acceptance. Lastly, the fourth factor is continuously monitoring quality metrics such as defects rate, scrape and rework rate, response time, customer satisfaction rate, and process-related metrics such as process capability to create consistent quality standards across all organisation branches.

A thorough literature review identified ten essential factors for implementing Quality 4.0 (Thekkoote, 2022). Data, analytics, collaboration, connectivity, mobile application development, scalability, compliance, culture, leadership style, and Quality 4.0 training are factors. Reliable and accurate data is the most critical enabler for adopting Quality 4.0, according to Ranjith et al. (2022). Further, Vaidya, Ambad, and Bhosle (2018) emphasised five crucial data features, volume, variety, velocity, veracity, and transparency.

Antony *et al*. (2022) conducted a global study examining the successful implementation of Quality 4.0 by investigating and assessing the organisational readiness factors. The study found that it is vital for quality managers to understand the advantages and disadvantages associated with the implementation of Quality 4.0 before investing in the transformation. Further, organisations must ensure their readiness for Quality 4.0 by checking for the eight major Quality 4.0 implementation components discussed by Sony, Antony, and Douglas (2020) before embarking upon the Quality 4.0 journey.

Another study presented by Antony *et al*. (2023) concluded that having a clear strategy for digital transformation in the organisation plays a pivotal role in successfully adopting Quality 4.0. This finding includes acquiring the needed skills to handle big data analytics and relying on a more technology-centred supply chain. Additionally, Antony et al. (2023) argued that top management

must have an unprecedented understanding and commitment to Quality 4.0 to reap the benefits of the transformation.

Few scholars investigated the components of a successful Quality 4.0 adoption in organisations. Although academics agreed on several implementation components, considerable differences exist. The differences reveal a significant gap in the literature, where uniform and standardised implementation ingredients are highly needed to guide organisations toward a smooth Quality 4.0 transformation journey. Table 2 summarises the Quality 4.0 implementation components.

<INSERT TABLE 2 APPROXIMATELY HERE>

3.2 Applications of Quality 4.0

Quality 4.0 motivates organisations to implement it since it synergises and aligns with Lean concepts (Antony et al., 2021). The implementation of Quality 4.0 is also motivated by its vast benefits, such as higher customer satisfaction, real-time monitoring of process performance and interference, and superior quality products and services. Therefore, researchers have discussed multiple applications of Quality 4.0 across different fields.

According to Küpper *et al*. (2019), the five critical applications of Quality 4.0 are research and development (R&D), manufacturing, service and serviceability, logistics and sales, and procurement, with R&D and manufacturing being the most beneficial sectors. In R&D, Quality 4.0 enables workers to embed quality into the early stages of product design using technologies such as AI and simulations. For instance, an AI-supported failure mode and effect analysis (AI-FMEA) can help drastically identify product design and process failure points. Agile product

development is the main benefit of Quality 4.0 in R&D. Cross-functional collaboration is easier using an agile methodology, encouraging more durable designs and higher-quality results.

The main application of Quality 4.0 in the manufacturing sector is the usage of machine learning and AI to construct efficient algorithms that can monitor, predict, and analyse quality issues accurately, convert them into digital standard operating procedures (DSOPs), and achieve greater manufacturing visibility (Küpper *et al*., 2019; Sader et al., 2022). The core of Quality 4.0 is to connect people, technology, and process-generated data, by connecting the key components of Quality 4.0 in the manufacturing sector. These key components are cloud databases that speed up data retrieval and analysis, process optimisation using machine learning and AI algorithms, automation including 3D printing and IoT features, and data collection through smart devices and sensors (Javaid *et al*., 2022). Several scholars discuss applications of Quality 4.0 to enhance the overall quality in the manufacturing sector through automated inspection systems with robots, reduced cost of quality, automated quality control and monitoring, streamlined quality processes, realigned quality functions, and reshaped production standards (Lopes et al. et al., 2018; Fettermann et al., 2018; Frank et al., 2019; Villalba-Diaz et al., 2019; Ghobakhloo, 2020; Bag et al., 2021; Aheleroff, 2021; Riley et al., 2021).

Serviceability is the after-sale services provided to the customer by the service provider or the manufacturer. Integrating Quality 4.0 in services and serviceability is mainly accomplished using sensors and IoT devices to communicate valuable data back to the manufacturer (Küpper *et al*., 2019). This data includes the current condition of the product and performance reports. The manufacturer can analyse the data using AI algorithms and adjust processes and products accordingly to ensure better customer satisfaction (Seo & Lee, 2019; Sader et al., 2022). A product's usability and customer experience may be improved by better incorporating consumer

demands (Lin & Seepersad, 2007). Further, analysing the processes that result in the product might provide additional process changes, resulting in superior products.

Access to reliable data and advanced technologies is crucial for Quality 4.0 adoption in logistics and sales. For instance, during the planning phase, demand forecasting accuracy can be significantly boosted by utilising big data analytics (Küpper *et al*., 2019). Reliable data will provide organisations with high levels of resilience and responsiveness, allowing both micro and macro-level corrective actions whenever a quality issue is recognised (Johnson, 2019).

Küpper *et al*. (2019) mentioned that Quality 4.0 enables high synchronisation and collaboration across the entire value chain, allowing all suppliers to monitor processes and detect defects using digital dashboards. Organisations use the supplier's data to identify quality problems and, when necessary, to establish problem-rectifying programs. Furthermore, Sader, Husti, and Daroczi (2022) proposed decision-making as a sixth area to employ Quality 4.0.

Since the inception of Quality 4.0, scholars have explored its value for numerous applications in multiple areas, with the manufacturing sector receiving the most significant attention. The hype and the attention received open the gates for further researching the applications of Quality 4.0 in other sectors. Additionally, it highlights a significant gap in the literature to investigate Quality 4.0 in the context of new sectors such as construction, aviation, hospitality, and project management. For example, Emblemsvåg (2020) suggested that the impact of Quality 4.0 on workers' emotional intelligence in construction projects is worth examining. In addition, Amat-Lefort, Barravecchia, and Mastrogiacomo (2023) emphasised the dearth of research on implementing Quality 4.0 in the hospitality sector, particularly in the Airbnb industry. Table 3 summarises the Quality 4.0 applications discussed in this section.

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4. Bibliometric analysis

The bibliometric analysis contains indicators that are helpful to many researchers, as it allows them to recognise and evaluate trends in academic productivity across different scientific fields (Alsadi et al., 2022). In addition, it analyses journal performance across institutions and countries. Bibliometric analysis is influential in decision-making as it ranks applicants for academic positions. It helps in decision-making since the information is organised in a way that grant writers can use it to obtain funding (Jia et al., 2014). This study uses four basic bibliometric parameters, including the number of papers, number of citations per paper, number of citations, and average number of citations per year (Bornmann & Haunschild, 2017). The parameters included published articles, productive authors, active journals, institutions, and countries published until July 5, 2023. During the past few years, the quality evaluation of a study has been assessed based on the number of citations received for articles, authors, journals, institutions, and countries. In order to map the state-of-the-art of literature in Quality 4.0, the research employed data from the Scopus scientific database to identify the research trends. The processed data were normalised, enabling analyses on publication trends, common subject areas, keywords, most cited articles, productive authors, active journals, institutions, and significant literature-producing countries.

4.1 Initial Analysis

This approach identified 45 research papers on the topic of Quality 4.0 or Quality related to Industry 4.0. Figure 2 illustrates the growth of this research field over the analysed period. The number of Quality 4.0 papers significantly increased in 2022, with ten more papers compared to

2021, approximately doubling the previous year's count. The research topic gained attention in 2017 and has been steadily growing. The first paper, "The journey to Lean Quality 4.0 - Development of quality instruments of holistic production systems through Industrie 4.0", was published in the ZWF Zeitschrift für Wirtschaftlichen Fabrikbetrieb journal. This paper primarily focused on combining improvement approaches with new technologies within the integrated Lean Quality 4.0 concept. There has not been a decline in publications because the concept of Quality 4.0 is still emerging, and researchers are actively exploring it. The slight decline shown in Figure 2 is due to the analysis ending on July 5, 2023. Therefore, the researchers expect an increase by the end of the year and anticipate the number of publications to continue growing, as indicated by the cumulative number of publications, demonstrating an exponential growth trend.

<INSERT FIGURE 2 APPROXIMATELY HERE>

A total of 30 countries have published publications related to Quality 4.0. These 30 countries represent 14 European countries, eight Asian countries, and four African countries. The remaining four are the United States, Mexico, Canada, and Australia. The graph illustrated in Figure 3 shows that the most productive countries are India (n = 10) and the United States (n = 5). Combined, they make up one-third (33.3%) of all publications.

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There were ten subject areas assigned to all 45 publications on Quality 4.0. This lack of diversity shows that the topic is rarely discussed in different scopes as the subject still needs to be

explored. There were at least ten publications in four subject areas (78.1%) out of the ten subject areas. Figure 4 presents the top five most frequently assigned Scopus subject areas to Quality 4.0 publications and their division. Articles on business, management, and accounting have dominated the number of publications since 2020. Also, the engineering subject area has been increasing, illustrating the importance of Quality 4.0 in engineering and management.

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4.2 Analysis of publication sources

The ten most prolific journals, with their respective impact factor and subject area, are presented in Table 4. Quality 4.0 publications appeared in 22 different journals. The presented journals correspond to approximately three-quarters of the published articles (73.3%; n = 33/45). The TQM Journal has the highest number of publications (9) in the literature. Regarding subject areas, Engineering and Business, Management, and Accounting are the most popular. Therefore, the publications will primarily discuss managing and operating systems and engineering-related topics.

There were 45 publications affiliated with 83 different research institutions since one author can have multiple affiliations, or several authors can write publications for various institutions. Table 5 illustrates the top five productive institutions publishing on Quality 4.0. With four publications, the University of Galway in Ireland is the most productive institution, followed by Namibia University of Science and Technology in Namibia, Khalifa University of Science and Technology in the United Arab Emirates, and the others with three publications. There were two publications from another seven institutes and only one from the remaining institutes.

<INSERT TABLE 4 APPROXIMATELY HERE>

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4.3 Authorship and citation analysis

In this study, Table 6 identifies the most productive authors by ordering them based on the number of publications. One hundred and six different authors accumulated 45 articles in total. The first three authors, Antony, McDermott, and Sony, had an equal number of publications, four. In contrast, Escobar and Morales-Menendez had only three publications. The equal number of publications between authors indicates the collaborative work between them. There is a very narrow range in the number of citations per publication among the top five authors (from 14.00 to 14.25). The limited number of publications per author indicates that the topic is relatively new in the scholarly domain.

A publication's citations represent its knowledge output since other publications reference them. The citation analysis indicates the number of times the other publications reference the publication, as listed in Scopus. The 45 publications resulting from the research were referenced and used 487 times. Among the publications, 20.0% (n = 9/45) had no citations, while 33.3% (n = 15/45) had more than ten citations. Table 7 presents the top ten cited publications. The paper with the most citations since its publication is 'Quality 4.0—the challenging future of quality engineering' by Zonnenshain and Kenett (2020). Regarding average citations per year, the paper with the highest average citations is by Fonseca, Amaral, and Oliveira, entitled 'Quality 4.0: The EFQM 2020 model and Industry 4.0 relationships and implications.'

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According to the co-citation analysis method, the research grouped publications according to their relationship or interaction with other publications (van Nunen et al., 2018). A publication's similarities are more evident when cited by other publications (Li & Hale, 2015). The 45 publications on Quality 4.0 used in total 2,833 unique references. The inclusion criteria state that the minimum number of citations for an author is three. Out of the 2,833 citations, 28 met the threshold. Figure 5 provides the co-citation map on Quality 4.0. An arrow connects each node in the graph, indicating the number of one-way and two-way citations each author has received. As citations are received from authors to establish the network, the size and proximity of the circles are proportional to the number of citations received between them. The map also shows three clusters, with the red cluster being the main one.

<INSERT FIGURE 5 APPROXIMATELY HERE>

4.4 Term analysis

This section aims to identify trends in Quality 4.0 research through bibliometric analysis of the co-occurrences of words in titles, abstracts, and keywords in 45 articles published since the start of the trend (2017- July 2023). This study extracted all noun terms from the analysis, but terms such as 'article' and 'introduction' were excluded. Quality 4.0 is relatively new; therefore, this study identified terms that appeared at least twice from 369 terms, of which 52 met the threshold. Figure 6 illustrates the result of VOSviewer's analysis. The analysis clustered the Quality 4.0 keywords in the term analysis map, with the green cluster (middle) representing the major keywords used.

In the green cluster, Quality 4.0, quality management, and Industry 4.0 were the most common keywords. As a result of the paradigm shift in terms, quality control and digital transformation were the most popular terms in 2021. In 2022, terms used included Quality 4.0 framework, organisational readiness, and predictive analysis.

<INSERT FIGURE 6 APPROXIMATELY HERE>

5. Discussion and Implications

RQ1 What are the Quality 4.0 applications present across different sectors?

Quality 4.0 applications are in six primary sectors, including R&D, manufacturing, service and serviceability, logistics and sales, procurement, and decision-making. Although the R&D and manufacturing sectors reap the most benefits from Quality 4.0, other sectors stand to gain significant benefits. This indicates the potential groundbreaking impact Quality 4.0 in deriving excellence across a wide array of industries. The applications of Quality 4.0 in the six areas include agile product development, predictive quality algorithms, cloud databases, automation, reduced cost of quality, streamlined quality processes, accurate demand forecasting, and monitoring suppliers and quality metrics using digital dashboards (Küpper *et al*., 2019; Johnson, 2019; Riley et al., 2021; Javaid *et al*., 2022; Sader et al., 2022). Despite the Quality 4.0 impact in the manufacturing industry, it is noteworthy to state that there is a gap in exploring the impact of Quality 4.0 across various other industries. Figure 7 shows a Pareto diagram of the Quality 4.0 applications covered in each area. Table 4 in Section 3.3 summarises Quality 4.0 applications and their respective area. Nonetheless, the literature has not thoroughly examined Quality 4.0 in the

context of numerous other areas. For example, the scope of Quality 4.0 should expand to encompass other industries, such as hospitality, construction, and call centers.

<INSERT FIGURE 7 APPROXIMATELY HERE>

RQ2 What are the Quality 4.0 studies present in various countries or territories?

A geographic application of Quality 4.0 is illustrated in Figure 8, showing the location of the studies. Notably, European countries account for a significant portion, representing 46.4% of contributions, with Ireland, Portugal, and Serbia emerging as key players. Meanwhile, Asian countries followed closely behind by contributing to 25% of Quality 4.0 publications, with India as the top contributor. Among all nations, the United States published the most, indicating the leading role it plays in shaping Quality 4.0 discourse. Publication from India primarily discusses the critical success factors of Quality 4.0, motivation, benefits, challenges, and readiness factors. In addition, some studies tested the integration of different Industry 4.0 technologies with quality management systems in a case study. On the other hand, publications coming from the United States primarily reviewed the managerial implications of Quality 4.0 and its potential impact on organisational performance. This clear disparity in Quality 4.0 research among various regions and countries highlights the multifaced nature of Quality 4.0 and pinpoints the multidimensional impact Quality 4.0 exhibits on organizations located in different places of the world. In addition, this pertains to the need for a more subtle understanding of Quality 4.0 implications across different geographical contexts.

<INSERT FIGURE 8 APPROXIMATELY HERE>

RQ3 What are the main benefits and challenges presented in Quality 4.0 studies?

Benefits

In most improvement programs, performance is the most critical factor. Moreover, the obtained publications outline several benefits of adopting Quality 4.0, identified in the literature. Through rigorous research and empirical evidence, studies have consistently demonstrated the role of Quality 4.0 in deriving significant improvements across various dimensions of operations, finance, and production, offering a roadmap towards elevated efficiency and effectiveness (Gunasekaran et al., 2019; Sony & Naik, 2020a; Antony et al., 2021; Carvalho et al., 2021; Sony et al., 2021; Chiarini & Kumar, 2022). Table 8 summarises the performance benefits identified in the articles reviewed. For professionals and practitioners alike, these insights serve as a call to action, compelling them for Quality 4.0 integration into their organizational frameworks. The profound changes introduced by Quality 4.0 make it pivotal for decision makers to improve their operations and businesses, allowing for achieving excellence.

<INSERT TABLE 8 APPROXIMATELY HERE>

Challenges

The adoption of Quality 4.0 is a challenging process for organisations. Therefore, drawing from the reviewed literature, the authors have developed a list of several challenges shown in Table 9. Senior practitioners and decision makers embarking on this transformative journey stand to benefit considerably from these insights, which serve as guidance for navigating the inherent complexities of Quality 4.0 adoption. The high initial investment in adopting Quality 4.0 is one of the considerable challenges to be encountered by organisations in the adoption of Quality 4.0.

Also, the need for more knowledge and skills on Quality 4.0 and the lack of resources, including technology and labour force, are significant barriers to adopting Quality 4.0. Additionally, effective adoption entails precise planning strategies to provide managers with clear guidelines for implementation, mitigating uncertainties, and streamlining the transition process. Pinpointing primary challenges serves as an essential step during the planning for Quality 4.0 adoption phase, as it allows top management to anticipate problems and develop proactive solutions. Table 9 summarises the barriers discussed while adopting Quality 4.0 that organisations must consider and mitigate to ensure appropriate adoption.

<INSERT TABLE 9 APPROXIMATELY HERE>

RQ4 Where must future researchers direct their efforts?

The literature reviewed in this study presented significant scientific gaps in the Quality 4.0 research domain. For instance, a comprehensive definition of Quality 4.0 is still missing, on which scholars agreed. No explicit curriculum is available to teach managers and employees about Quality 4.0. Also, exploring the potential performance implications through empirical studies is necessary to motivate organisations to adopt Quality 4.0. Although the current studies indicate the potential performance impact from a theoretical lens, the empirical studies on this topic are still inadequate and under-researched.

Moreover, although plenty of studies integrate quality management tools with Industry 4.0, there needs to be a systematic, organised, strategic, and practical framework to integrate quality management tools and Industry 4.0 technologies existing in the literature. Therefore, articles that

present evaluations of organisational performance based on the initiated framework are also yet to be made available.

One of the most significant scientific gaps is the need for real case studies. Although the literature has featured the benefits of Quality 4.0, studies must implement the integration. Several organisations must still understand the importance of embedding Industry 4.0 in their processes and operations. This gap impacts professionals and practitioners as they need more studies integrating quality management practices, quality improvement methodologies, and tools with Industry 4.0. Also, it portrays a successful Quality 4.0 integration and compares performance impacts to prove the integration efficiency. Therefore, conducting a longitudinal case study in various settings, including manufacturing and service, is recommended.

Another significant gap in the literature is the need for more empirical studies. However, several research papers discussed Quality 4.0 in a qualitative study focusing on semi-structured interviews. However, the need for quantitative-based research still exists globally, in the authors' opinion. Also, a study showed the need to conduct an empirical study in various environments involving more interviews to get more robust and convergent findings (Antony et al., 2021). Moreover, the existing literature needs to cover the implementation frameworks of Quality 4.0 and how Quality 4.0 impacts sustainable performance. There are many research gaps, and the authors are confident that many scholars will address these gaps over the forthcoming years. A mapping exercise on digitalisation tools/technologies across various quality problems can have immense value to many practitioners and senior managers in industry.

6. Conclusion, limitations, and future research direction

The rapid emergence of Industry 4.0 has ushered in sweeping changes in modern organisations, sparking a heightened focus on Quality 4.0. As organisations strive to thrive in

today's highly competitive landscape, professionals face the challenge of effectively processing essential data. This paper presented a comprehensive systematic literature review and bibliometric analysis of Quality 4.0 publications to identify their benefits, challenges, and trends and address this research gap.

This study revealed several noteworthy observations and findings by thoroughly reviewing articles published between 2010 and 2022. Geographical disparities in research were identified, with India and the United States emerging as the top publishing countries. The dominance of the subject of business, management, and accounting underscored the importance of quality management across diverse sectors. The TQM Journal was a leading publication outlet for Quality 4.0 research.

This research makes a significant contribution by addressing gaps in the existing literature through a unique combination of systematic literature review and bibliometric analysis. It provides researchers and practitioners with a valuable guide, offering insights into the main sectors, research topics, and literature trends, thereby encouraging the exploration of emerging issues. Further, it emphasises the need for comprehensive journals with specific scopes and sheds light on the underexplored areas of Quality 4.0 adoption in higher education, service industries, and healthcare. The comparative analysis of intercontinental findings offers a global perspective, facilitating a more comprehensive understanding.

While this study encountered certain limitations, such as the novelty of the Quality 4.0 topic posing challenges in finding academic material and the analysis period of six years that could potentially limit the coverage of recent developments, these shortcomings provide opportunities for future research. Future studies should consider expanding the scope by incorporating other databases and employing action research methodologies to enhance the understanding and

application of Quality 4.0. Developing and validating a conceptual framework for implementing Quality 4.0 is recommended, addressing organisational resistance to change and mitigating the risk of failure factors. Empirical studies should explore researchers' and practitioners' perceptions of Quality 4.0, supported by industrial case studies and practical guidelines for implementing Quality 4.0.

In conclusion, this study successfully fills a research gap through its comprehensive approach of systematic literature review and bibliometric analysis, providing valuable insights into Quality 4.0 adoption. The findings have theoretical implications for understanding the field and practical implications for researchers, practitioners, and organisations striving to implement Quality 4.0. Future research endeavours should focus on expanding the scope, developing frameworks, and conducting empirical studies to enrich the understanding and application of Quality 4.0 in various organisational settings.

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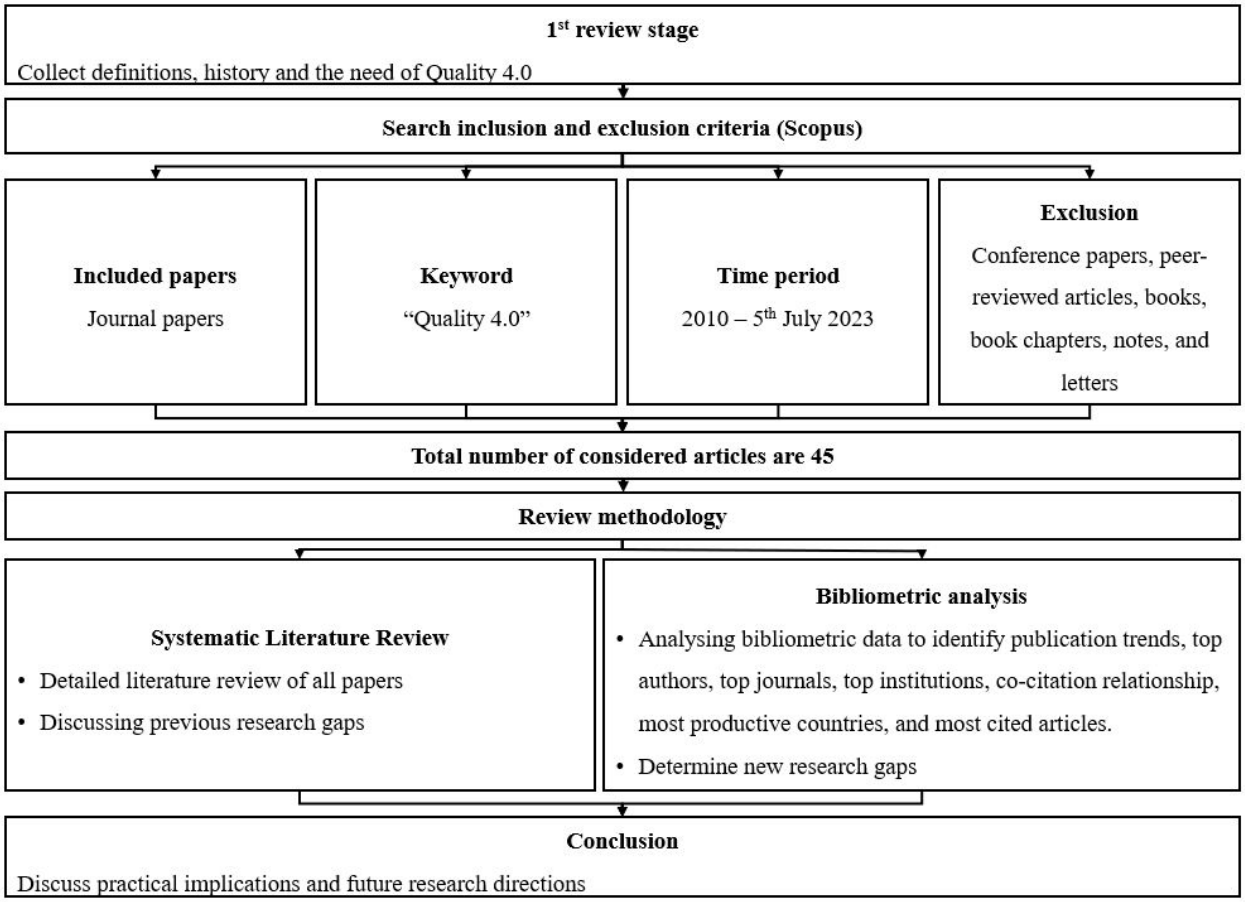

Figure 1. Research methodological flow

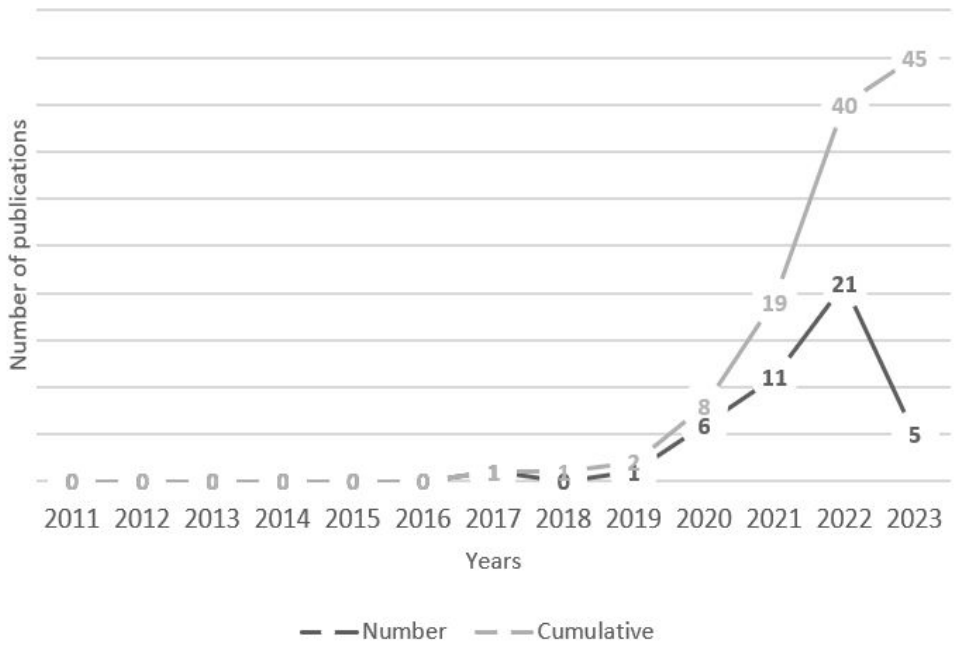

Figure 2. The number of publications of Quality 4.0

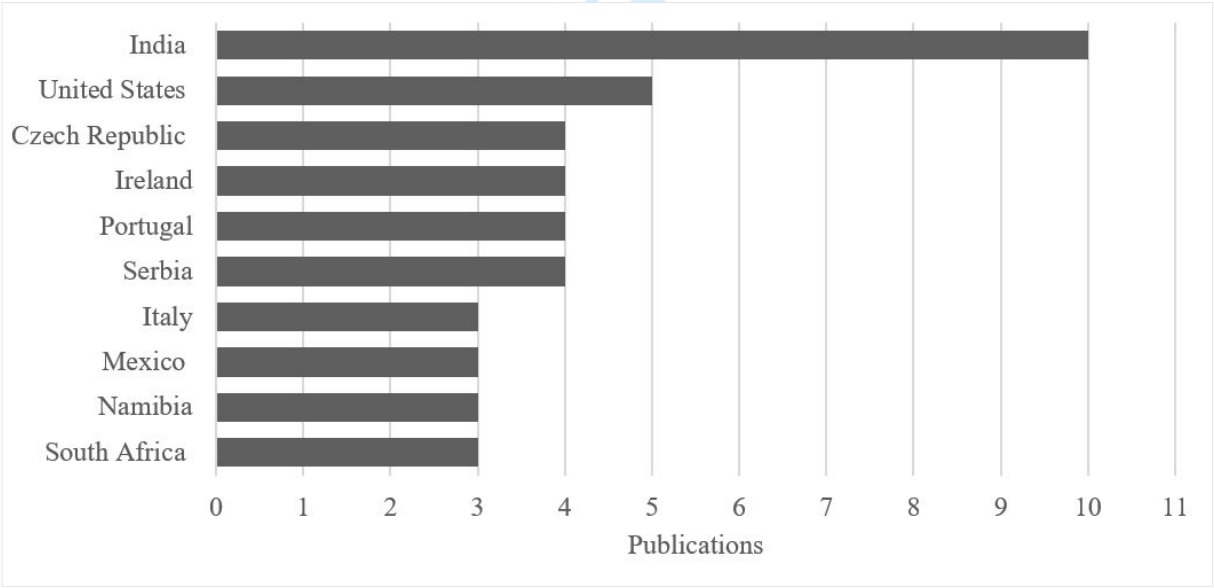

Figure 3. Top 10 countries or territories publishing on Quality 4.0

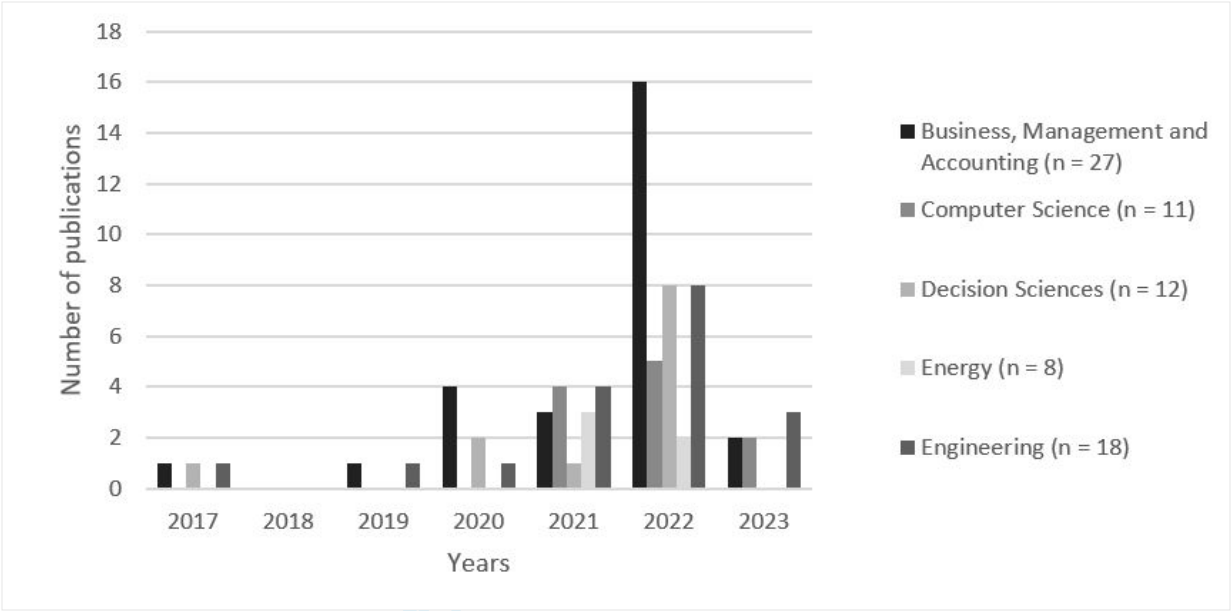

Figure 4. Top 5 subject areas assigned to Quality 4.0 publications

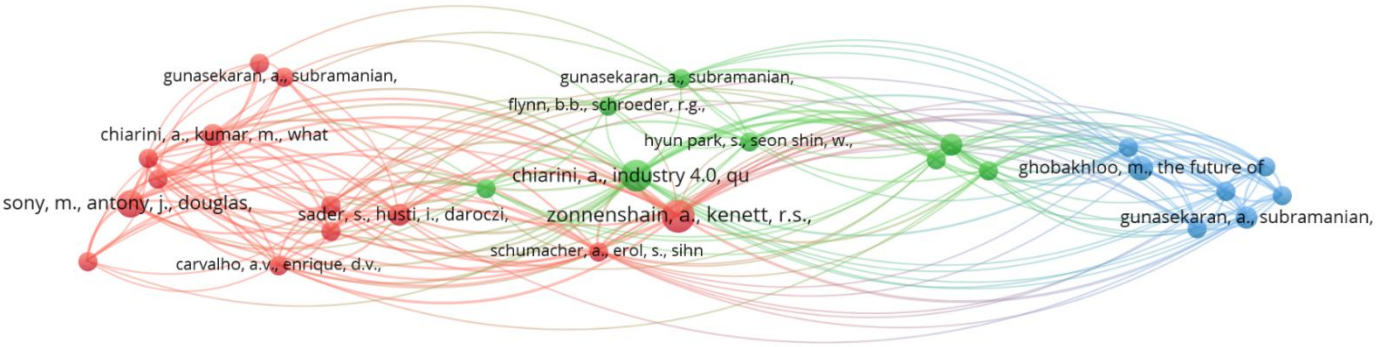

Figure 5. Co-citation map on Quality 4.0

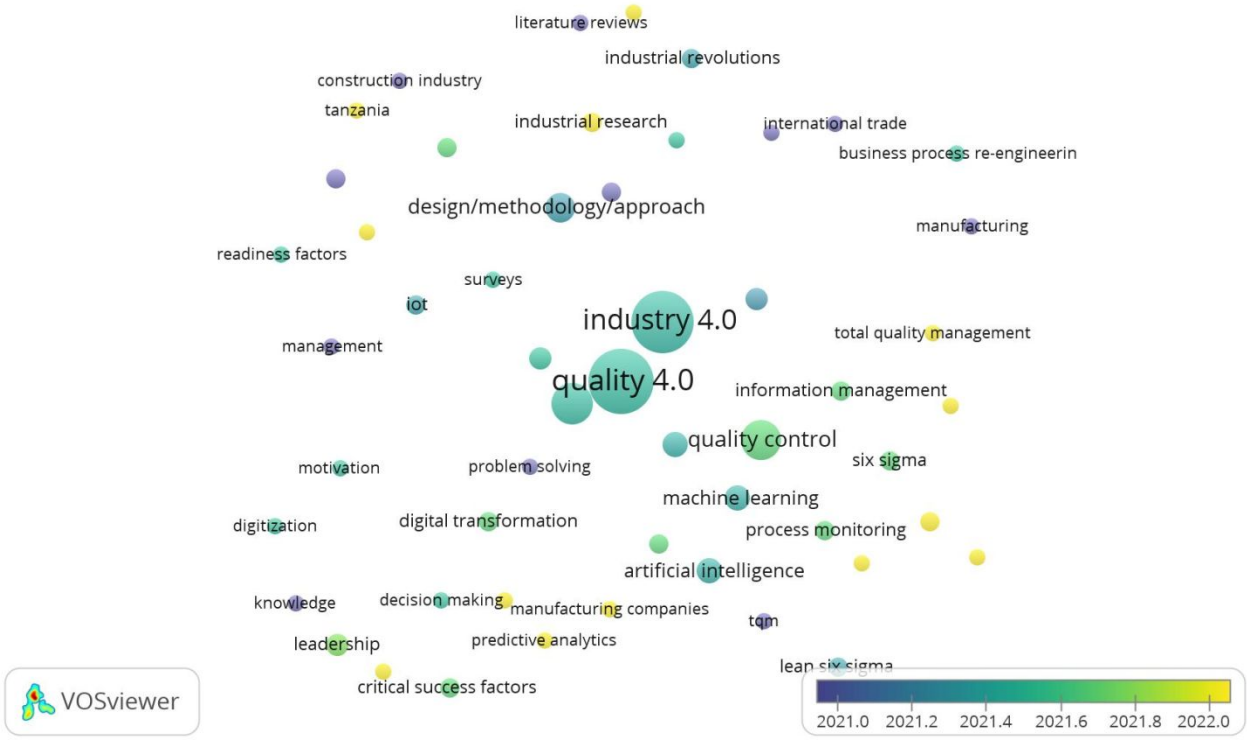

Figure 5. Terms analysis of Quality 4.0 publications with time information

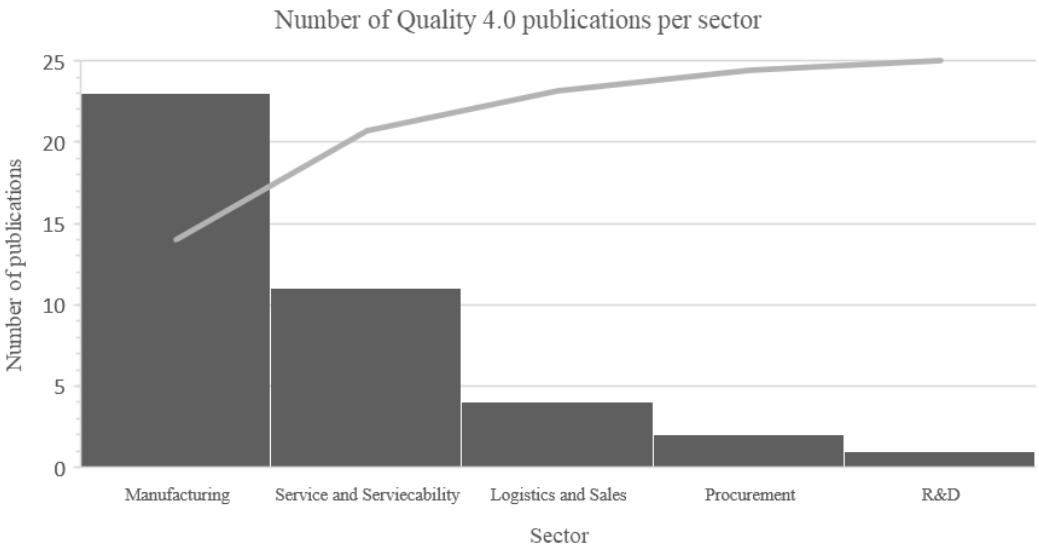

Figure 6. Pareto diagram of the number of Quality 4.0 applications

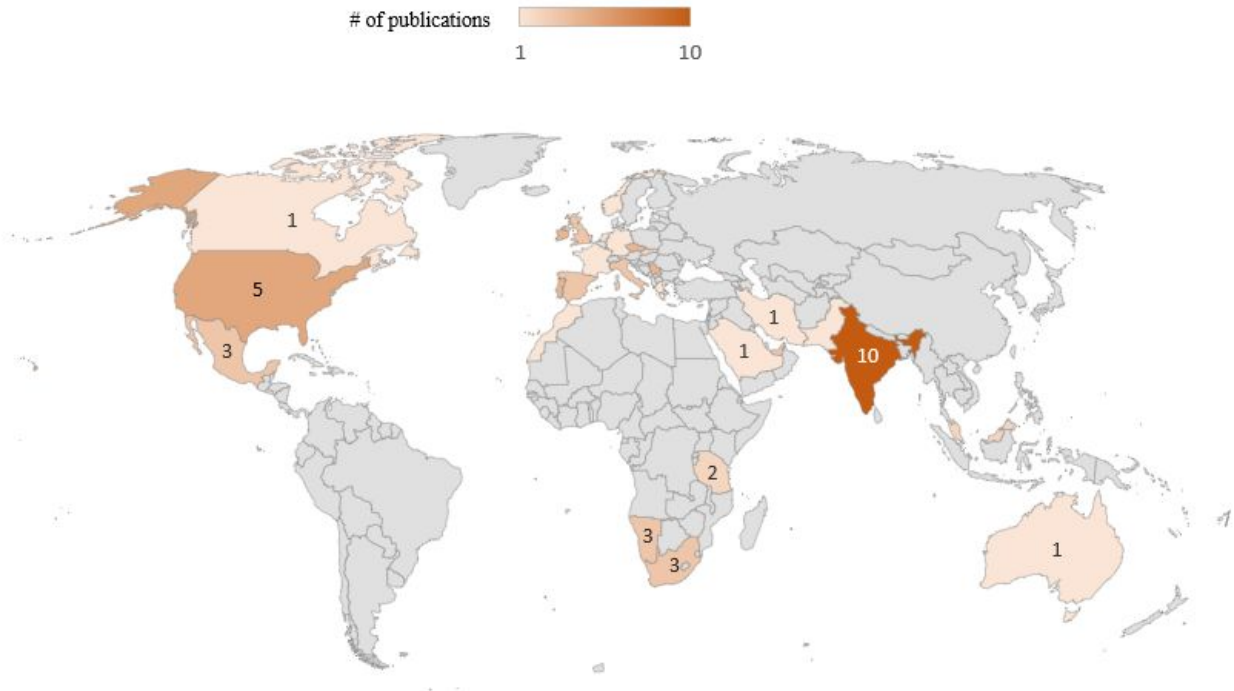

Figure 7. Countries and territories publication distribution

Table 1. Articles inclusion and exclusion criteria

Search Criteria	Inclusion criteria	Exclusion Criteria
Research database	Scopus	All other databases
Time period	From 2010 – July 5 2023	Articles published before 2010 and after July 5, 2023
Document Type	Journal articles	Conference papers, Books, book chapters, notes, letters
Language	English	All other languages
Subject area	All	-

Table 2. Summary of Quality 4.0 essential ingredients

Implementation Components	**Source**
• Intellectual capital management • Alignment between the technical and social sides of the organisation • Lean organisational structure • Management of business relationships with networked organisations • Utilisation of big data to make accurate quality predictions	Asif, 2020
• Top management support • Cultural shift toward Quality 4.0 • Employee training programs • Proper leadership style • Competitive advantage of Quality 4.0 • Vertical and horizontal integration through Quality 4.0 • Big data management • Analytical algorithms	Sony, Antony and Douglas, 2020
• Using big data to create value for the industry • Integrating people and technology through the concept of HITL • Maintaining the mental health of employees • Utilising continuous monitoring of quality metrics to establish standardised quality principles	Souza *et al*., 2022
• Data • Analytics • Collaboration • Connectivity • Mobile application development • Scalability • Compliance • Culture • Leadership style • Quality 4.0 training	Thekkoote, 2022
• Understanding the positive and negative aspects of Quality 4.0 before the adoption • Checking if the other implementation components are present within the organisation ahead of the implementation	Antony *et al*., 2022
• Clear digital transformation strategy • Understanding and commitment of leadership towards Quality 4.0	Antony *et al*., 2023

Table 3. Summary of Quality 4.0 applications

Application(s)	Sector	Source
• AI-FMEA • Agile product development	R&D	Küpper *et al*., 2019
• Predictive and analytical quality algorithms • Digital standard operating procedures (DSOPs) • Greater manufacturing visibility	Manufacturing	Küpper *et al*., 2019; Sader, Husti and Daroczi, 2022
• Cloud databases • Process optimisation • Automation • Data collection	Manufacturing	Javaid *et al*., 2022
• Automated inspection system	Manufacturing	Lopes de Sousa Jabbour *et al*., 2018; Bag, Gupta, and Kumar, 2021
• Reduced cost of quality	Manufacturing	Fettermann *et* al., 2018; Frank, Dalenogare and Ayala, 2019
• Automated quality control and monitoring	Manufacturing	Villalba-Diaz *et al*., 2019
• Streamlined quality processes	Manufacturing	Ghobakhloo, 2020
• Adjusted production standards that facilitate faster and more efficient production	Manufacturing	Riley, Vrbka, and Rowland, 2021
• After-sale data collection	Service and serviceability	Küpper *et al*., 2019; Seo, and Lee, 2019; Sader, Husti, and Daroczi, 2022
• Demand forecasting using big data analytics	Logistics and sales	Küpper *et al*., 2019
• Corrective actions at micro and macro levels: - Reduce errors by digitalising logistics processes. - Use previous data and analytics to predict suppliers' shortages and develop contingency plans to mitigate such risks.	Logistics and sales	Johnson, 2019

- Adjust sales targets and key performance indicators (KPIs) to reflect the company's organisational goals better.		
• Monitoring suppliers' processes' using digital dashboards. • Designing recovery and development plans for suppliers	Procurement	Küpper *et al*., 2019
• Evaluating different cases and scenarios • Monitoring quality metrics of every department and process	Decision making	Sader, Husti, and Daroczi, 2022

Table 4. Top 10 journals publishing on Quality 4.0

NO.	Journal Title	No. of Publications	Impact Factor	Subject Area
1	TQM Journal	9	4.59	• Business, Management, and Accounting • Decision Sciences
2	International Journal of Quality and Reliability Management	5	2.77	• Business, Management, and Accounting
3	Sustainability	5	3.89	• Engineering • Decision Sciences • Computer Science • Energy
4	Quality Innovation Prosperity	5	0.27	• Business, Management, and Accounting
5	International Journal of Computer Integrated Manufacturing	2	3.21	• Engineering • Computer Science
6	Quality Engineering	2	2.13	• Engineering
7	Total Quality Management and Business Excellence	2	4.17	• Business, Management, and Accounting
8	Computers and Industrial Engineering	1	5.43	• Engineering • Computer Science
9	Computers in Industry	1	7.64	• Engineering • Computer Science
10	EMJ Engineering Management Journal	1	2.07	• Engineering

Table 5. Top 5 most productive institutions publishing on Quality 4.0

NO.	Institution	Country	Number of publications
1	University of Galway	Ireland	4
2	Namibia University of Science and Technology	Namibia	3
3	Khalifa University of Science and Technology	United Arab Emirates	3
4	General Motors	United States	3
5	Tecnologico de Monterrey	Mexico	3

Table 6. Top 5 productive authors publishing on Quality 4.0

NO.	Author Name	Country of Author	No. of Publications	Total No. of Citations	Citations Per Publication
1	Antony, J.	United Arab Emirates	4	57	14.25
2	McDermott, O.	Ireland	4	57	14.25
3	Sony, M.	South Africa	4	57	14.25
4	Escobar, C.A.	United States	3	42	14.00
5	Morales-Menendez, R.	Mexico	3	42	14.00

Table 7. Top 10 cited publications on Quality 4.0

No.	Title	Author(s)	Published Year	Times Cited	Average citation per year
1	Quality 4.0—the challenging future of quality engineering	Zonnenshain and Kenett	2020	105	35.0
2	Industry 4.0, quality management and TQM world. A systematic literature review and a proposed agenda for further research	Chiarini	2020	88	29.3
3	Quality 4.0: The EFQM 2020 model and industry 4.0 relationships and implications	Fonseca, Amaral, and Oliveira	2021	80	40.0
4	Quality 4.0: a review of big data challenges in manufacturing	Escobar, McGovern, and Morales-Menendez	2021	46	23.0
5	The new EFQM model: What is really new and could be considered as a suitable tool with respect to quality 4.0 concept?	Nenadál	2020	45	15.0
6	New needed quality management skills for quality managers 4.0	Santos, Sá, Félix, (...), Zgodavová, and Stefanović	2021	45	22.5
7	Critical success factors for lean six sigma in quality 4.0	Yadav, Shankar, and Singh	2021	32	16.0
8	Motivations, barriers and readiness factors for Quality 4.0 implementation: An exploratory study	Sony, Antony, Douglas, and McDermott	2021	31	15.5

9	Quality 4.0 conceptualisation and theoretical understanding: a global exploratory qualitative study	Antony, McDermott, and Sony	2022	21	21.0
10	End-to-end industrial IoT platform for Quality 4.0 applications	Christou, Kefalakis, Soldatos, and Despotopoulou	2022	21	21.0

Table 8. Quality 4.0 adoption benefits

Benefits	**References**
Reliable and accurate data	Sony *et al.*, 2021
Quality Management driven by Big Data	Gupta *et al.*, 2020; Hyun Park *et al.*, 2017; Sony *et al.*, 2021
Better supplier management	Antony *et al.*, 2021; Gunasekaran *et al.*, 2019
Enhanced customer satisfaction	Kupper *et al.*, 2019; Sony *et al.*, 2020; Sony *et al.*, 2021
Environmental impact reduction	Antony *et al.*, 2021; Bag *et al.*, 2021; Oláh *et al.*, 2020
Enhanced productivity	Sony *et al.*, 2021; Sony and Naik, 2020a
Save cost and time in the long run	Sony *et al.*, 2020; Sony *et al.*, 2021
Minimised human errors and enhanced accuracy	Antony *et al.*, 2021; Salimova *et al.*, 2020
Enhance internal business processes	Carvalho *et al.*, 2021; Milunovic Koprivica *et al.*, 2019; Sony *et al.*, 2021

Table 9. Quality 4.0 adoption challenges

Challenges	**References**
High initial investment	Sony *et al.*, 2021
Lack of resources	Schönreiter, 2017; Shin *et al.*, 2018; Sony *et al.*, 2020: Sony *et al.*, 2021
Lack of knowledge and skills needed for the implementation	Sony *et al.*, 2021; Zonnenshain and Kenett, 2020
Existing organisational culture	Armstrong, 2009; Nafchi and Mohelská, 2020; Sony *et al.*, 2021
Resistance to change with no sense of urgency	Antony *et al.*, 2022; Modrák and Soltysová, 2020
Lack of proper strategy	Antony *et al.*, 2022; Kupper *et al.*, 2019
Lack of management support	Antony *et al.*, 2022; Rauch *et al.*, 2020
Lack of organisational readiness	Antony *et al.*, 2022; Napier *et al.*, 2017; Sony and Naik, 2020b

Manuscript title: A systematic literature review with bibliometric analysis of Quality 4.0

Manuscript ID: TQM-02-2024-0050

REVIEWER – 1		
Sr.No.	**Comment**	**Response**
1	Results are clear. However, when addressing the research questions, further critical analysis would benefit, followed by a succinct paragraph that ties everything together.	Thank you for your comment. We expanded our discussions and added more criticality in addressing RQ1, RQ2, and RQ3. In RQ1, as shown on page 22, more discussions on the applications of Quality 4.0 in each industry are included, highlighting the major impact of Quality 4.0 and some major gaps. In RQ2, on page 23, the critical difference in Quality 4.0 research in each region is given more prominence. In addition, the need for a more subtle understanding of Quality 4.0 implications across different regions has been further emphasized. In RQ3, on pages 24 and 25, The discussion extends beyond merely listing the benefits and challenges of Quality 4.0. Instead, it delves deeper into the implications of identifying these benefits and challenges. Specifically, the role of discerning these factors in the planning process for adopting Quality 4.0 is thoroughly examined and elucidated. As for RQ4, no significant changes have been introduced since critical discussions have on the current state and future directions of Quality 4.0 research have been already provided.
REVIEWER – 2		
1	The paper is very well written but there are inconsistencies and contradictions in some of the tables as regards to quantity or papers per	Thank you for your insightful feedback. Table 5 is located within the section labeled 4.2 Analysis of publication sources, where it showcases the most productive institutions within their respective locations or countries.

	author etc. in one graph versus another and versus the bibliography. Table 5 the number of journal articles on Quality 4.0 attributed to Sony (1. Namibia, 2. South Africa and now 3. Oxford) McDermott (National University of Ireland, Galway and now renamed as University of Galway) and Antony (1. Herriot Watt and 2. Khalifa) does not match that of the no. of Quality 4.0 papers in the bibliography; and the numbers should be higher than the "4" mentioned in Table 5.	Therefore, I believe the issue you are addressing pertains to Table 6. Table 6, presented under the section labeled 4.3 Authorship and Citation Analysis, displays the number of publications attributed to each author along with their respective affiliations. According to the data extracted from Scopus, each author is credited with four publications. If the concern lies with changes in author affiliation, it's important to note that Scopus reflects the latest updates on author affiliations. If there hasn't been an update on an author's new affiliation, Scopus will display the latest available information. It's worth mentioning that Scopus does not segregate each affiliation with its respective publications. In other words, when an author changes their affiliation, all their publications are associated with the new affiliation, regardless of when they were released. This is because publications are linked to authors, so any change in affiliation results in all publications being attributed to the new affiliation.
2	Ireland is mentioned as having the most papers published (most productive) in Table 5 but doesn't feature in Figure 7: Figure 7 doesn't seem to match the Table 5 summary?	Thank you for your comment. Table 5 is situated within the section labeled 4.2 Analysis of publication sources. As such, it illustrates the most productive institutions within their respective locations or countries, rather than indicating the most productive country in the subject area. The discussion on the most productive country is presented in Section 5, specifically under RQ2, and is visually represented in Figure 8. Figure 7, on the other hand, is presented in Section 5 under RQ1, where it provides a summary of the publications discussed, categorizing them by sector to identify the predominant sector within the context of Q4.0. Consequently, Table 5 and Figure 7 are not correlated, as each presents findings from distinct types of the bibliometric analysis.