Mapping the Evolution and Future Directions of ISO/IEC 25010: A Bibliometric and Thematic Analysis

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ABSTRACT

This study is a bibliometric analysis of 1,613 scientific articles focused on the ISO/IEC 25010, an international standard for software quality evaluation. The data were taken from the Scopus repository, from 1990 to 2025, indicating a consistent rise in the research productivity, reaching its zenith in 2023, providing further evidence of the international significance of ISO/IEC 25010 in areas, such as public administration, finance, education, and healthcare. While subjects of computer science and engineering continue to thrive, interdisciplinary applications are gaining popularity. The thematic mapping, keyword co-occurrence analysis, and publication trends revealed various articles centered around the normative models, user experience, empirical validation, structural design, quality assessment, and predictive modeling. These areas of expertise are founded on concepts, such as the software quality, quality control, and ISO standards, in addition to usability, machine learning, and cloud computing. International collaboration networks show strong connections between Spain, Philippines, and Indonesia. However,

despite its flexibility, the standard faces challenges, including structural rigidity and a lack of installation, especially for Small and Medium-sized Enterprises (SMEs). The present study emphasizes the necessity for hybrid approaches that integrate ISO/IEC 25010 with agile and AI-driven methodologies.

Keywords- ISO/IEC 25010; ISO 9126; software quality model; SQuaRE; standards, ISO/IEC 25000

I. INTRODUCTION

The increasing usage of software in many applications has led to the necessity of ensuring its reliability in many human activities [1, 2]. In this context, the ISO/IEC 25010 standard is a promising framework that provides a model for evaluating the quality of Information and Communication Technology (ICT) products and software systems [3]. The standard is used in different areas, including government and public administration [4], finance and banking [5], industrial and software development [6], education [7], healthcare [8], and e-commerce [9, 10], proving its versatility in enhancing the software quality in varied operational contexts. The ISO/IEC 25010 is an evaluation tool, used by the software industry, in order to understand, prioritize, and align various quality attributes with the functional and non-functional requirements of organizations [11, 12]. The software provides a strong testing framework by using quality characteristics as validation criteria [13], supports extensive non-functional testing, and facilitates the establishment of metrics and benchmarks for assessing software prior to installation [14]. The standard promotes the development of a clean, modular, and maintainable code, adaptable across different platforms, improving both the usability and portability [15, 16]. Furthermore, the standard plays a significant role in architectural and design decisions by including key elements, such as maintainability, performance, portability, and security in the structural and technical specifications of the software systems [11, 17, 18]. It also ensures compliance with the regulatory and quality assurance standards [19], thereby enabling the delivery of software products and services that meet the customer expectations and provide tangible value [15, 20, 21]. As software dependents on evolving technologies, the ISO/IEC 25010 standard must undergo modifications to address the associated social and ethical risks, enhance trust, and ensure a systematic quality evaluation. This requires an understanding of the quality assessment trends [22] and the proactive use of updated standards to support the responsible and sustainable development of solutions that increasingly impact the human activity. In order to achieve this objective, it is essential to understand the recent approaches to quality evaluation, allowing science to continuously evolve [23]. This is expressed as a temporal representation of knowledge, capable of characterizing a particular domain through systematic observation and measurement. Consequently, measurement serves as the fundamental basis for the development and advancement of scientific knowledge [24]. In this regard, science can be explored and understood through bibliometrics, which applies mathematical and statistical methods to analyze and quantify the volume and quality of scientific publications, thus enabling a deeper understanding of the dynamics that shape the research fields [25]. Within this framework, bibliometric analysis offers a quantitative-qualitative approach of the existing literature. It is of particular value for the researchers, practitioners, and policymakers seeking to understand how the ISO/IEC 25010 standard has been adopted, adapted, and how it has influenced the field of software engineering and quality assurance [26]. Additionally, it serves to identify areas that have not been extensively explored, which can inform future research directions and the ongoing development of the standard [27].

The following research questions are examined in this study:

- What is the performance of ISO/IEC 25010 based on the publication output, research areas, contributing countries, and most cited papers?
- What are the most significant research topics?
- What research areas can be identified within the literature addressing ISO/IEC 25010?

II. THEORETICAL FRAMEWORK

A. Transition from ISO 9126 to ISO 25000

The ISO 9126 standard, which was introduced in the early 1990s, served as the international benchmark for measuring the software product quality. This analytical framework focused on six key characteristics: functionality, reliability, usability, efficiency, maintainability, and portability [28] and on an inventory of proposed metrics for assessing the software quality [29]. However, as software development practices evolved, the limitations of ISO 9126 became increasingly evident, such as the absence of detailed guidelines for the measurement and evaluation of quality, which hindered the practical application. Also, the narrow scope of the standard primarily addressed the software product quality without covering the broader aspects of requirement specification and quality evaluation—factors that became critical as software systems grew in complexity [29, 30]. The continuous advancement of the computing capabilities, the development of system communications, and the introduction of novel technologies have created new challenges for the software industry. Consequently, developers had to ensure the quality of the software products operating on powerful, pocket-sized devices that were permanently connected to large systems, public communication networks, GPS technologies, and a growing ecosystem of innovations, such as artificial intelligence, IoT, and big data [31-33]. In this context, ISO 9126 transitioned into the ISO/IEC 25000 series, known as System and Software Quality Requirements and Evaluation (SQuaRE) [34]. The novel standard was developed to rectify the shortcomings of the previous one by providing a more systematic and exhaustive framework for the evaluation of the software quality [35]. It introduced new attributes, including security, flexibility, and safety, while refining existing characteristics and removing others, such as portability.

B. ISO/IEC 25000 and ISO/IEC 25010

The ISO/IEC 25000 standard constitutes a series of international standards that provide a comprehensive framework for specifying and evaluating the quality of the software products [36]. The study's primary focus is on two processes: the specification of software quality requirements and the evaluation of software quality [36, 37]. The ISO/IEC 25000 framework is divided into five sections, which include the quality management (2500n), quality models (2501n), quality measurements (2502n), quality requirements (2503n) [38], and quality evaluation (2504n) [39]. Within this structure, ISO/IEC 25010 corresponds to the quality model section (2501n), specifically addressing the product quality model, which provides a detailed framework for software quality evaluation. The model defines nine key quality attributes, each of which is further subdivided into additional factors to facilitate comprehensive assessments:

- Functional suitability: measures the degree to which the software satisfies the specified requirements.
- Performance efficiency: assesses the system performance relative to the number of the resources consumed.
- Compatibility: examines the software's ability to operate in different environments.
- Interaction capability: evaluates the usability and user experience.
- Reliability: assesses the software's ability to perform under specified conditions over a given period.
- Security: focuses on protecting the information and data from unauthorized access.
- Maintainability: analyzes how easily the software can be modified.
- Flexibility: evaluates the software's ability to adapt to various environments.
- Safety: defines the conditions that prevent the threats to human life, health, property, or the environment.

III. METHODOLOGY

A. Data Source and Search Strategy

Scopus was selected as the primary research database because it offers the largest and most multidisciplinary coverage of journals and publication volumes compared to other databases [40]. In comparison to Web of Science (WoS)—which, in conjunction with Scopus, is among the most widely used databases for bibliometric literature studies [41]—Scopus indexes approximately 66% more unique journals [42]. Scopus employs a rigorous selection process for peer-reviewed content, and its ongoing quality control ensures high reliability and data accuracy [43, 44]. Additionally, it offers integrated analytical capabilities, thereby enabling large-scale bibliometric studies using standardized metrics [45].

B. Inclusion and Exclusion Criteria

The literature search was conducted on April 7, 2025. To ensure a thorough coverage of the research articles related to the ISO/IEC 25010 standard, a comprehensive search strategy was used, also considering ISO/IEC 9126, its predecessor. The search string was applied to titles, abstracts, and keywords, with the search terms: "ISO 25010," "ISO/IEC 25010," "ISO/IEC 9126," "ISO 9126," and "software quality model." The search generated a total of 1,613 articles that were relevant to the subject.

IV. RESULTS

A. Descriptive Statistics

Table I presents the descriptive information of the literature that was examined with the bibliometrix program, which was developed in [46].

TABLE I. DESCRIPTIVE STATISTICS

Description	Results
Timespan	1990:2025
Sources (journals, books, etc)	838
Documents	1613
Annual growth rate %	9.37
Document average age	9.46
Average citations per doc	8.792
Keyword plus (ID)	6359
Author's keywords (DE)	3508
Authors	3829
Authors of single-authored docs	121
Single-authored docs	142
Co-authors per doc	3.28
International co-authorships %	15.62
Article	487
Book	1
Book chapter	30
Conference paper	1050
Conference review	24
Letter	1
Review	2

B. Year and Number of Publications

Figure 1 shows that the number of documents related to the ISO/IEC 25010 standard published between 1990 and 2025 has steadily increased, with some fluctuations. In 2025, a total of 23 documents were identified. However, this apparent decrease is not considered significant given the timing of the database query.

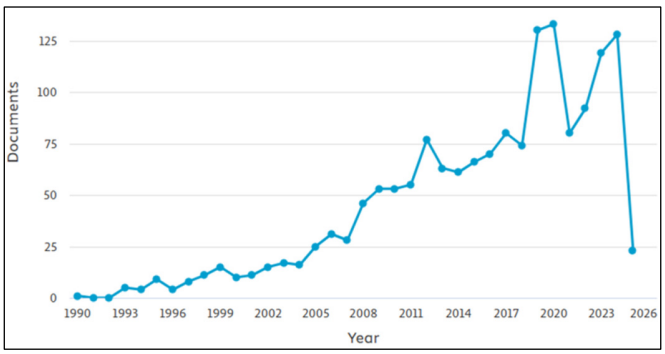

Fig. 1. Documents by year (Scopus).

C. Documents by Subject Area

Figure 2 presents the distribution of research across academic fields related to the ISO/IEC 25010 standard. The data reveal that computer science has the highest percentage of publications (43.4%), followed by engineering (19.6%), indicating a strong emphasis on technology-oriented disciplines. It is noteworthy that the standard is also linked to a plurality of fields, including decision sciences, social sciences, business, management and accounting, physics and astronomy, medicine, material sciences, and energy, among others.

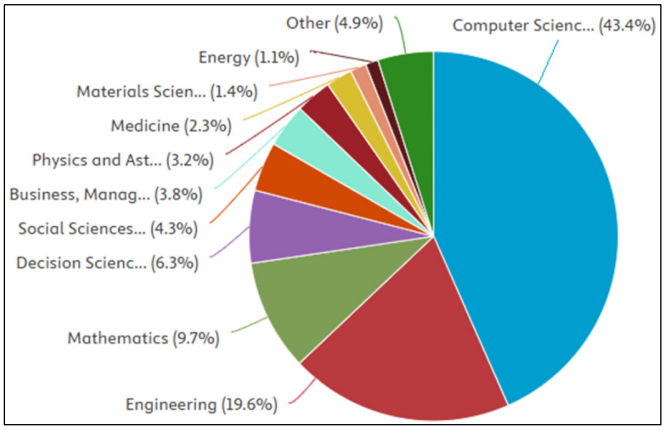

Fig. 2. Documents by subject area (Scopus).

D. Geographic Distribution of Publications

Figure 3 portrays the countries that have achieved the highest levels of research productivity concerning the ISO/IEC 25010 standard. Philippines has the highest rate of contributions, followed by Indonesia, both of which are classified as developing countries. Furthermore, several developed countries, including Spain, the United States, Germany, Canada, and Brazil, also feature prominently. This distribution indicates that the quality of software is a matter of universal concern that supersedes the economic development levels, emphasizing the necessity to adapt the standards to ensure the compatibility with diverse institutional and regional contexts.

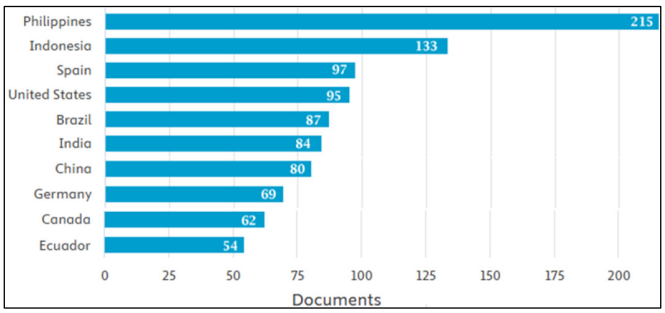

Fig. 3. Documents by country (Scopus).

E. International Collaboration

Figure 4 demonstrates that a vast network of countries is interconnected through collaborative research on the ISO/IEC 25010 standard. The use of lighter colors, particularly yellow, serves to distinguish the collaborations from more recent years. Spain has emerged as the leading country in terms of the number of collaborations, followed by Canada and Germany, which act as key hubs. Research in this area has been underway in countries, such as the United States, Canada, Australia, and Switzerland since the early 2010s. In contrast, nations such as Philippines, Indonesia, Peru, Ecuador, and Russia have shown more recent involvement (post-2018), suggesting a growing strategic interest in the software quality within the developing regions. Additionally, the analysis discloses a degree of regionalization in collaboration networks: a highly interconnected pattern is exhibited by Western Europe (Spain, Germany, the Netherlands, and Italy). The Latin American region exhibits robust connections with Spain, particularly evident in countries, such as Ecuador, Peru, and Argentina. Asia has exhibited an uptick in engagement, albeit with greater variability in participation.

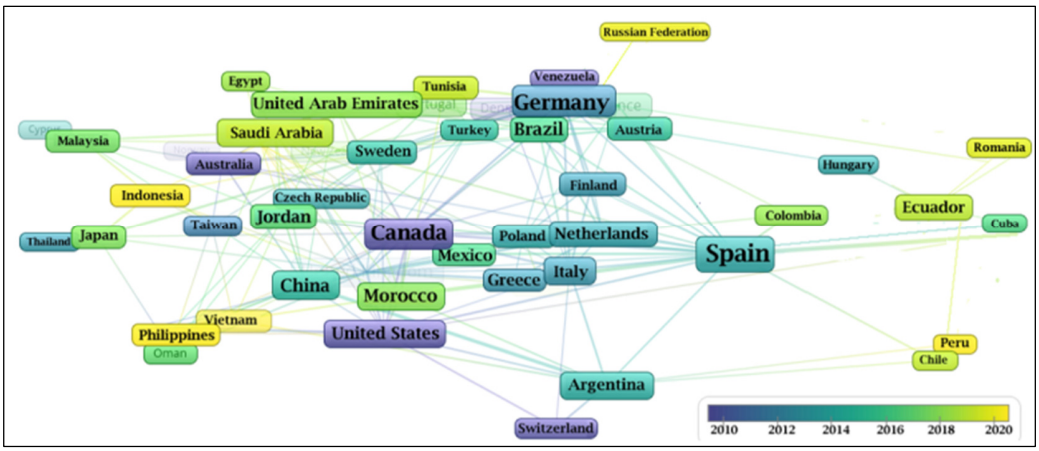

Fig. 4. International collaboration network (VOSviewer).

F. Most Globally Cited Documents

The ten most frequently cited articles in the field of the ISO/IEC 25010 standard are presented in Figure 5, reflecting their impact, relevance, and influence within the academic community.

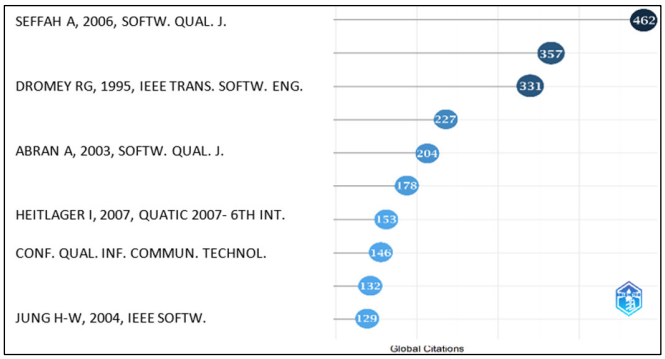

Fig. 5. Most cited documents.

Authors in [47] focused on developing a consolidated model for usability measurement and the article is at the top of the list with 480 citations. This model integrates various standards and metrics to enhance the usability evaluation and decision-making processes. Authors in [48] examined the development of a model for enhancing the software quality through the systematic classification and refinement of the quality attributes and defects, with 357 citations. Authors in [49], which has been cited 329 times, analyzed the software usability within the framework of ISO standards, highlighting the existing limitations and proposing an enhanced evaluation model. Authors in [50], with 227 citations, presented a novel model for measuring the software maintainability, addressing the shortcomings of existing models, such as the Maintainability Index. Authors in [51] explored the dimensionality of software quality characteristics based on ISO/IEC 9126, emphasizing the empirical evaluation and the identified limitations. Authors in [52] discussed the importance of user-centered design in achieving high usability in software products, with 178 citations. Authors in [53], with 146 citations, examined the challenges and standards involved in evaluating package quality characteristics and models. Authors in [54], with 132 citations, focused on adapting the ISO 9126 quality model for evaluating B2B applications. Authors in [55], with 125 citations, conducted a systematic review of the quality requirements for electronic health records. Finally, authors in [56], with 129 citations, explored search-based software quality modeling using multiple data repositories to enhance the predictive capabilities. Moreover, Table II provides a comprehensive list of the keywords associated with the ten most cited articles pertaining to the ISO/IEC 25010 standard. It is noteworthy that three of the most frequently cited papers focus on usability, indicating that this attribute has been a subject of extensive discussion and critical examination in the literature. The repeated reference to ISO/IEC 9126, the precursor to ISO/IEC 25010, signifies the historical influence and conceptual evolution that have shaped the present model. The development of predictive models, including methodologies such as genetic programming and machine learning, has been examined. These findings signify a progression towards the usage of more automated and intelligent quality evaluation techniques.

V. MAPPING

A. Density Map

Figure 6 displays a density analysis aimed at highlighting the areas of greater research intensity and conceptual development within the thematic field. The map mainly reflects a normative and structured focus, with its core centered around the terms ISO 25010, ISO 9126, and software quality, defining structured models for quality evaluation. Furthermore, an evolution toward specific applications and new technologies—such as machine learning, mobile computing, cloud computing, and e-learning—is evident, suggesting a growing interest in adapting the quality standards to the contemporary technological contexts. Additionally, the increased use of terms related to user experience indicates that research has expanded beyond the examination of internal software attributes to include the way in which end-users perceive and interact with the software quality. The presence of terms, such as ontology, cloud computing, data mining, and decision support systems, indicates an emerging trend toward more automated and semantically enriched approaches to quality representation and evaluation.

B. Author Keyword Co-Occurrence Network

Figure 7, generated using VOSviewer, depicts a network map of the keywords that have guided the research activities. The term software quality, a fundamental concept in the field, holds a central position in the network, followed closely by the themes of quality model and ISO/IEC 25010. The co-occurrence analysis of keywords yielded the identification of several discrete research clusters:

- The green cluster is characterized by a normative and structured orientation, with a notable emphasis on models, standards, metrics, and formal processes for software quality management and assurance. This cluster includes quality models and frameworks, testing and measurement practices, quality requirements, and continuous improvement processes. It emphasizes the systematic and practical implementation of quality throughout the software lifecycle.
- The orange cluster is indicative of the significance attributed to user perception, external quality, and the interaction between the users and software systems. The text places particular emphasis on the usability and quality in use, often linked to ISO 9241, which addresses the ergonomics of human-computer interaction [57].
- The yellow cluster is centered on the quantitative and empirical foundations of the software quality. While connected to the central node of the software quality, the present study approaches the topic from a scientific validation perspective, focusing on the quality and efficiency metrics.

TABLE II. TOP 10 MOST CITED PAPERS IN THE FIELD

Paper	Title	Keywords	Total citations
[47]	Usability measurement and metrics: A consolidated model	Usability, measurement, metrics, effectiveness, efficiency, user satisfaction, software engineering, quality models	482
[48]	A model for software product quality	Software quality, software standards, software maintenance, buildings, refining, computer languages, code standards, standards' development, Australia, knowledge management	357
[49]	Usability meanings and interpretations in ISO standards	Software usability, software measures, usability, ISO 9126, ISO 9241, software quality, usability, models	331
[50]	A Practical Model for Measuring Maintainability	Software quality, software maintenance, ISO standards, communication system software, software systems, software testing, IEC standards, software standards, communications technology, software measurement	227
[51]	Measuring software product quality: a survey of ISO/IEC 9126	Software measurement, software quality, ISO standards, IEC standards, software packages, packaging, writing, software standards, multidimensional systems, standards' development	204
[52]	Quality in use: Meeting user needs for quality	No defined	178
[53]	Using quality models in software package selection	Software packages, ISO standards, IEC standards, packaging, software quality, software standards, procurement, usability, maintenance, context modeling	153
[54]	Customizing ISO 9126 quality model for evaluation of B2B applications	Quality model, software evaluation, business to business application, customizing method, ISO 9126	146
[55]	Electronic health records. A systematic review on quality requirements	Electronic health record, personal health record, medical records, quality, requirements, review	132
[56]	Evolutionary optimization of software quality modeling with multiple repositories	Software quality, software measurement, predictive models, software metrics, electronic mail, genetic programming, robustness, costs, machine learning, software engineering	129

- The blue cluster comprises themes related to the structural design of software systems and the processes necessary to maintain the operational performance, including software maintenance, software architecture, and cloud computing, grounded in quality attributes.
- The red cluster adopts an evaluative focus, centered around the concept of software product quality. This emphasis is on systematic and measurable quality evaluation across various systems, including information systems, mobile applications, and e-learning platforms. Additionally, it delves into the application of technologies, such as machine learning to automate or enhance the evaluation and prediction processes.
- The purple cluster offers a perspective that is centered on key quality attributes, including reliability, maintainability, and functionality. These attributes are based on the SQuaRE standard. The methodology under examination uses multicriteria evaluation techniques, including the Analytic Hierarchy Process (AHP), to prioritize and select among multiple quality attributes.
- The light blue cluster represents a research line focused on the quantitative and predictive evaluation of the software quality. This evaluation is conducted through the use of software metrics and architectural characteristics. In addition, statistical models and data mining techniques are employed to predict the quality attributes, particularly reliability.
- Finally, the brown cluster focuses on the usage of ontologies to distinctly structure, semantically express, and represent the software requirements. This approach enhances traceability, validation, consistency, and, consequently, the software quality.

C. Thematic Analysis

The thematic map presented in Figure 8 is based on the authors' keywords and classifies the topics into four quadrants based on two principal dimensions. The horizontal axis represents the degree of relevance or the strength of a theme's connections to other themes within the network (Callon's centrality). The vertical axis indicates the degree of internal development or cohesion within a cluster or theme (Callon's density) [58]. In the upper left quadrant (Niche themes), characterized by low centrality and high density [59], specialized areas of ISO 25010 research stand out. For instance, studies on natural language processing exhibit strong internal development but limited connections to the main research core in the software quality. The presence of the term human, suggests a focus on aspects of human-computer interaction, which, although well developed, are not central to the broader discourse surrounding ISO 25010.

The upper right quadrant, characterized by its high centrality and density, includes significant topics, such as software engineering, software quality models, and computer software, comprising the core of research related to ISO 25010. Their elevated status, as indicated by their high centrality and density, signifies their status as foundational elements within the field. At the intersection of these two quadrants, themes, such as mobile applications, students, and efficiency, emerge as hybrid topics, demonstrating significant thematic evolution and intermediate centrality. Mobile applications represent a significant application domain, while the presence of students, signifies the mounting pertinence of ISO 25010 in educational contexts, particularly in the instruction of software quality principles [60]. The emphasis on efficiency, is indicative of its recognition as a key quality attribute. The placement of these subjects indicates the possibility of future expansion, with the probability of developing into well-established motor themes as the mobile applications and educational contexts gain prominence within the field of software quality research.

Fig. 6. Density map.

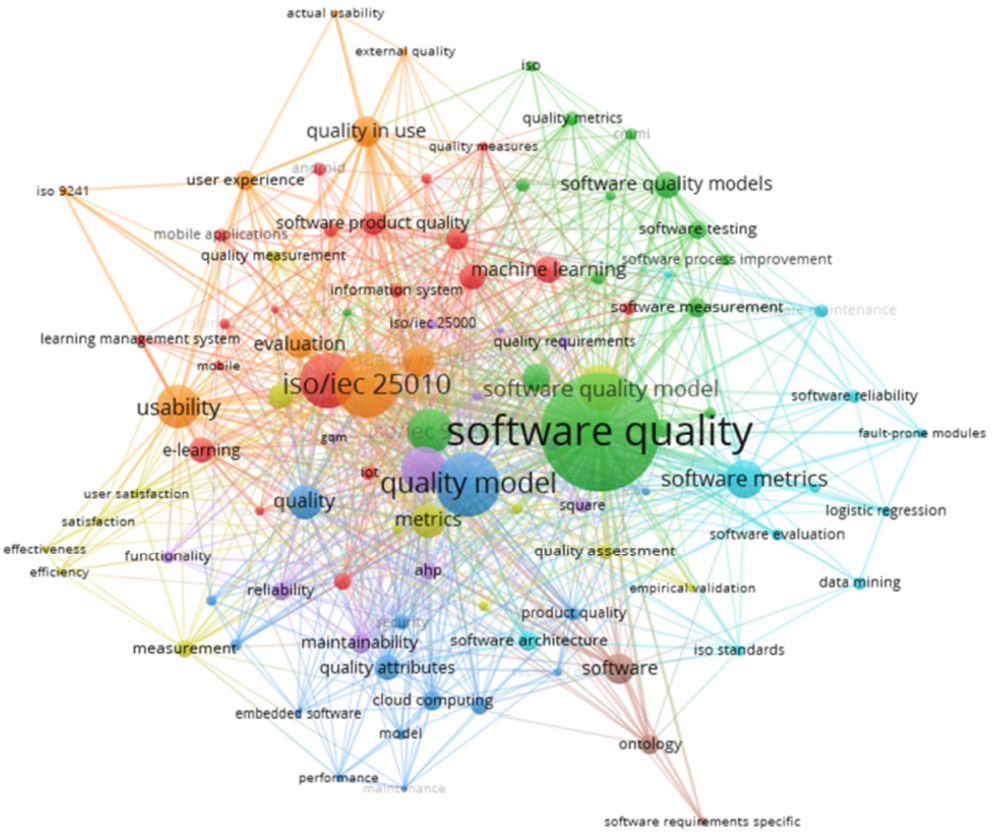

Fig. 7. Author keyword co-ocurrence network.

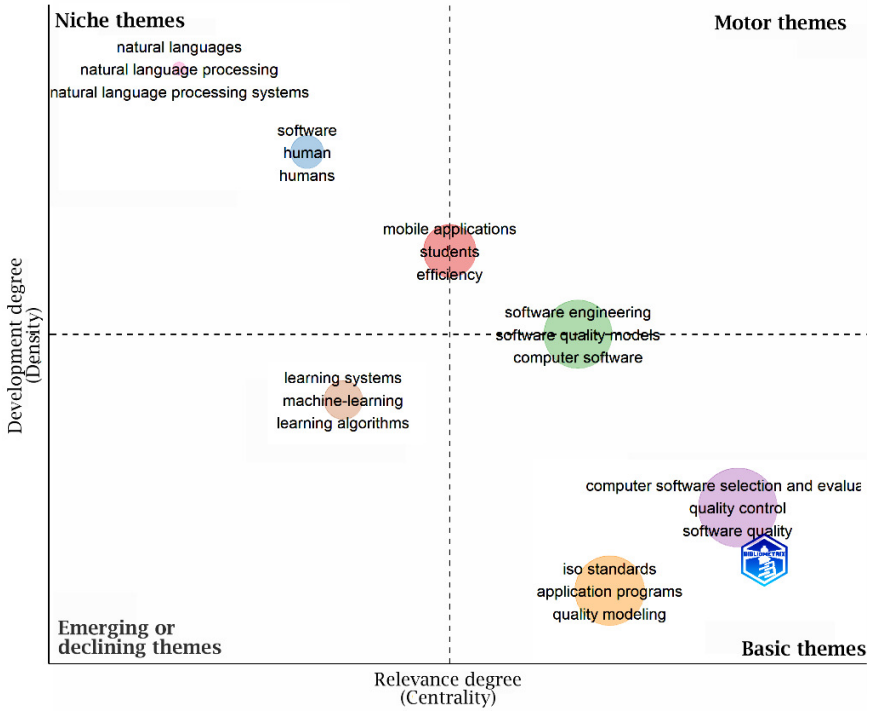

Fig. 8. Thematic map.

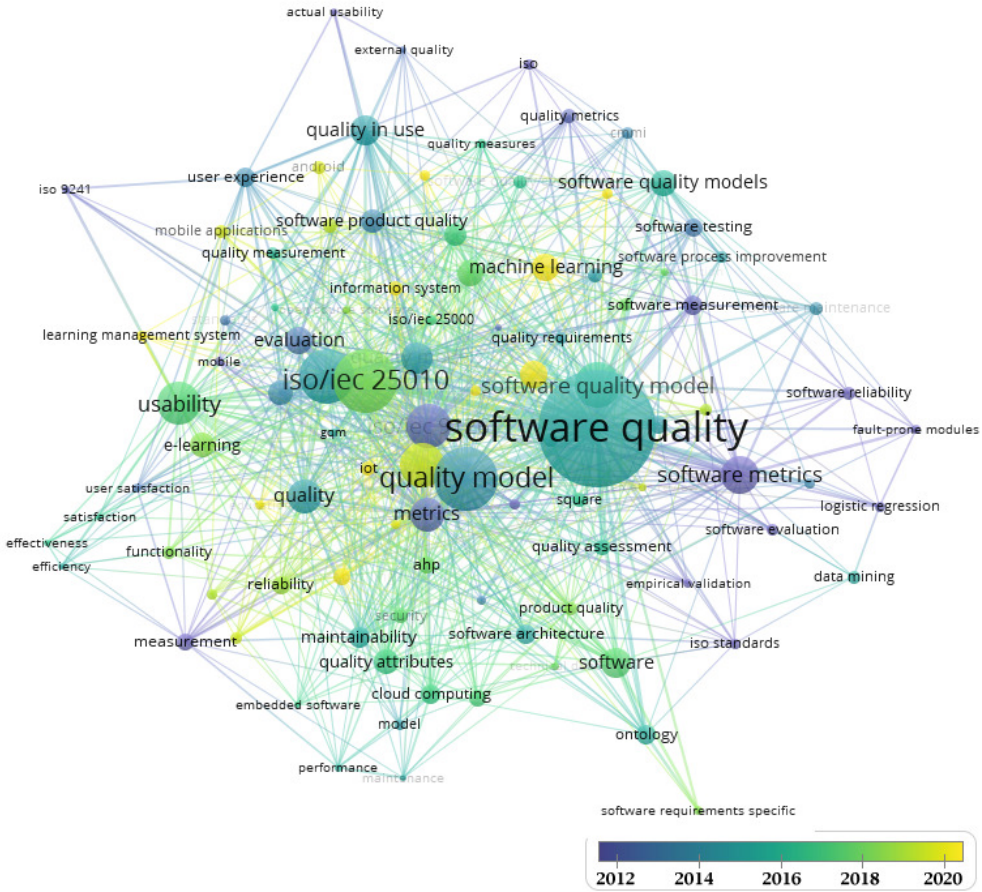

Fig. 9. Network overlay visualization.

The lower left quadrant, which includes emerging or declining themes, exhibits low centrality and density. It contains topics, such as learning systems, machine learning, and learning algorithms, which are gradually shifting towards the central area of the quadrant. This suggests that the field of artificial intelligence is beginning to integrate into the software quality studies, potentially for automating the quality assessments, although it has not yet become a central area of inquiry. Conversely, the lower right quadrant (basic and transversal themes) covers foundational concepts, such as computer software selection and evaluation, quality control, software quality, ISO standards, application programs, and quality modeling, serving as the basis for ISO/IEC 25010.

At the intersection of the basic themes and motor themes' quadrants, topics, such as software engineering, software quality models, and computer software, function as both theoretical and practical foundations, while also acting as drivers of research, evolving toward fully developed motor themes.

D. Correspondence Between Clusters and Quadrants

The thematic map facilitates the characterization of previously identified clusters. The core subjects concerning the software quality and quality models (green cluster) are regarded as the primary motivators within this field. Conversely, more specific or methodological perspectives (referred to as the red, purple, light blue, and brown clusters) are oriented toward the quadrant of emerging or developing themes. The fundamental topics related to selection, evaluation, and quality control (orange, yellow, and blue clusters) are situated as transversal fundamentals within the body of research on ISO 25010.

E. Network Overlay

Figure 9 presents the network overlay map, which shows the evolution of research on the ISO/IEC 25010 standard from 2012 to 2022. The employment of lighter colors symbolizes the exploration of novel research domains or the emergence of subjects within the realm of software quality, including machine learning, mobile applications, and the Internet of Things (IoT). Conversely, darker colors represent earlier research areas that were established prior to 2014, including software metrics, software measurement, traditional quality models, and software architecture. These research areas have been extensively studied since 2012.

VI. DISCUSSION

A. Temporal Evolution of Research

The network overlay map with a temporal gradient (2012–2020) revealed significant patterns in the evolution of research. Fundamental concepts, such as software quality model and quality characteristics, were established as historical foundations of the field. The transitional areas (in green tones) demonstrated how research has evolved towards specific applications, including mobile applications, e-learning, and embedded software. This evolution is consistent with the findings in [61], where a diversification of the application domains for software quality standards was identified. The advent of machine learning, cloud computing, and ontology (presented in yellow) signifies a paradigm shift toward adapting quality models to novel technological frameworks. This observation aligns with the findings in [62] and addresses the evolving technological and organizational imperatives [63].

B. Thematic Structure and Research Clusters

This study confirmed the establishment of the theoretical foundations underlying ISO/IEC 25010, with core themes, such as software engineering, software quality models, and quality control, forming a coherent semantic network that reflects the structured organization of the domain [64]. The normative-structural cluster (green) is characterized by a strong emphasis on models, metrics, and formal processes that provide a systematic framework for evaluating the software products based on well-defined characteristics and subcharacteristics [65]. Its high density and centrality in the thematic map reaffirm its foundational role. A distinct emphasis on user experience is evident in the orange cluster and the most cited documents. Authors in [66] emphasize that integrating usability with other quality attributes is fundamental for achieving a holistic evaluation of the software, particularly in the transition from ISO 9126 to ISO 25010. The position of this cluster indicates a growing importance of the human factors in software quality assessment. Additionally, the red cluster and the quadrant of emerging themes indicate an inclination toward the integration of automated methods, advanced statistical models, and algorithms simulating human cognitive processes. Authors in [67] observed that the application of machine learning techniques for automated quality evaluation signifies an emerging frontier for the practical implementation of ISO/IEC 25010.

C. Thematic Density and Areas of Concentration

The density network revealed a high concentration of terms related to ISO/IEC 25010 and software quality, thereby affirming the strength of the conceptual foundation and the maturity and stability of the research field. The concept of intermediate density encompasses the notions of quality in use, stability, and maintainability. These elements, when considered collectively, reflect the practical application of the standard. According to [68], these areas function as intermediaries between the theoretical foundations and practical implementations. It was observed that peripheral yet significant areas of density, such as mobile applications, e-learning, and cloud computing, have emerged as specialized research domains. Authors in [15] posit that the implementation of ISO 25010 within particular domains necessitates contextual adaptations that enhance the overarching model. A significant observation is the growing integration of ISO 25010 with emerging technologies. The strategic position of machine learning within the network suggests that it is a promising area of future development [69]. Furthermore, the interrelation between ontology and software requirements specification, exemplifies endeavors to semantically formalize the quality requirements. According to the findings in [69], ontologies provide a formal basis for the representation of quality attributes, facilitating their systematic evaluation in accordance with ISO/IEC 25010.

D. Challenges and Limitations

The analysis revealed the strictly hierarchical structure of ISO/IEC 25010, was composed of characteristics and subcharacteristics, which can pose a problem when representing the multidimensional nature of software quality [70]. This structure functions to restrict a subcharacteristic from belonging to multiple main characteristics. Furthermore, several gaps were identified in the integration of ISO 25010 with agile development and DevOps paradigms. Notwithstanding the 2023 update to the standard, emerging concepts, such as ethical considerations in AI usage and data quality and security—particularly for AIoT systems involving sensitive data—remain underrepresented [67, 71]. Another critical challenge is the lack of generalizability when attempting to quantify the quality characteristics across diverse contexts and development environments [72]. Additionally, the application of the standard itself remains intricate, frequently necessitating specialized knowledge and substantial resources, which can impede its adoption by SMEs [73]. Finally, although bibliometric indicators provide a robust foundation for analyzing the scientific output, it is important to complement these findings with in-depth qualitative approaches that explore the practical applications, success cases, and observed limitations in the real-world usage of ISO/IEC 25010.

E. Future Research Directions

In order to promote the conceptual evolution of the standard, future research should concentrate on the development of more flexible models that incorporate new subcharacteristics aligned with emerging technologies, as well as the integration of ethical and social dimensions into quality evaluation. From a methodological perspective, there is a need for simplified measurement frameworks that require fewer resources and less specialized expertise. Extensive empirical validation through longitudinal studies across diverse contexts will facilitate the broader generalization of evaluation metrics, supporting a better alignment of ISO/IEC 25010 with modern development practices that emphasize continuous delivery and collaboration.

VII. CONCLUSIONS

This bibliometric analysis has allowed for the broad and in-depth identification of the evolution, distribution, predominant themes, and emerging trends related to the ISO/IEC 25010 standard. The upward trend in publication volume from the 1990s to the present demonstrates a growing academic interest in the field of software quality assurance. A significant finding of the study is the heterogeneity of contexts in which the standard has been applied, such as healthcare, education, banking, and e-commerce, as well as in emerging technological domains, such as artificial intelligence, cloud computing, and mobile applications. Moreover, an analysis of the geographic distribution of scientific production reveals the preeminence of countries, such as the Philippines, Indonesia, and Spain, indicative of the global adoption of the standard across diverse contexts. The co-occurrence analysis of terms revealed a rich and diverse thematic structure articulated around six main research approaches: normative, user-centered, empirical, structural design, evaluative, predictive, and conceptual. The thematic map, network overlay map, most cited documents, and density map collectively revealed the structural thematic core of the field, centered on concepts, such as software quality, quality control, and software quality models. These maps also demonstrate the standard's transition towards emerging technologies, such as machine learning, mobile applications, cloud computing, and e-learning. Furthermore, there has been a notable increase in the number of user experience studies, along with a shift toward the use of automated and semantic methods for quality evaluation. Significant challenges persist, including the limited integration of the standard with agile methodologies and DevOps environments, indicating a discrepancy between the normative framework and modern development practices. Furthermore, the implementation of these systems poses significant challenges for SMEs, primarily due to the technical complexity and resource demands associated with these processes. To support the evolution of the standard, continuous and context-sensitive updates are proposed, alongside the development of accessible tools and frameworks that facilitate its application in resource-constrained environments. Complementary qualitative studies are also crucial to deepen the understanding of the practical and social implications of its application.

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