



Building Quality Control Performance: A Bibliometric Analysis of Its Impact on Consumer Satisfaction in the Construction Industry

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ABSTRACT

The construction industry faces significant challenges in ensuring quality control to achieve consumer satisfaction, particularly in the current context of rapid urban development and increasing consumer expectations. This study aims to analyze the relationship between quality control performance and consumer satisfaction through a bibliometric analysis of 1,000 publications from 2000 to 2024. Despite existing literature emphasizing the importance of quality control, a comprehensive understanding of its impact on consumer satisfaction remains lacking. The study uses the “Publish or Perish” (POP) and VOSviewer tools to reveal that keywords such as “quality” and “consumer satisfaction” dominate the research landscape, highlighting their central role. The findings indicate that adequate quality control has a positive correlation with consumer satisfaction, influencing building performance, durability, and trust in construction projects. These findings offer actionable insights for researchers, policymakers, and industry stakeholders seeking to improve construction practices and achieve higher consumer satisfaction.

Keywords: Quality control, Consumer satisfaction, Performance measurement, Construction industry, Bibliometric analysis.

INTRODUCTION

Well-designed utility infrastructure supports urban sustainability (Hojjati et al., 2017). Development is ongoing in China, India, the United States, and the United Arab Emirates. This progress motivates companies worldwide to assess employee performance regularly (Trtílek & Hanák, 2022). A company can measure the effectiveness of its operations by assessing consumer satisfaction (Czeplé & Rosenberg, 1977).

The continued growth of the construction industry in Indonesia poses several challenges. A key challenge in construction is the need to meet complex, subjective

consumer expectations (Kärnä et al., 2004). Achieving results that conform to or exceed expectations depends on the quality of service and the success of the product (Oluwaseun & Abiodun, 2021). Consumer expectations can be met through cooperation and communication between contractors and consumers to fulfil consumer demands (Cannon & Homburg, 2001).

In fast-growing industrial cities, construction faces complex and hazardous challenges (Hosseini et al., 2020). The construction process concludes with the completion of the project and ongoing maintenance to ensure durability (Huang et al., 2013). Building maintenance includes maintaining or protecting

buildings from factors that affect their quality. For efficient use of costs, time, and labour, the building must function optimally in the long term (Godschalk et al., 2009).

Building defects are a problem that often occurs during the construction and maintenance stages (Waziri, 2016). Such defects result in material losses and compromise time, cost, and related parties (Mésároš et al., 2024). Building defects can be caused by various factors, including poor design, improper material selection, unskilled workers, and the contractor's failure to understand the design (Aibinu & Odeyinka, 2006). Building maintenance aims to enhance and sustain building performance while minimizing damage (Olanrewaju et al., 2022).

A comfortable building is the expectation of every consumer. High quality functional buildings protect users from internal and external elements (Alomari, 2022). Good design and high quality materials make the home comfortable, safe, and resistant to weather, pollution, and noise (Riffat et al., 2016). Suitable material selection is essential in this regard to ensure that the materials used meet the needs of both consumers and contractors (Emovon & Oghenyerovwho, 2020).

LITERATURE REVIEW

Consumer Satisfaction

Consumer satisfaction requires consistent delivery of the promised services or quality. The reflection of positive feelings from consumers is a proof of consumer satisfaction (Islam et al., 2021). Strong supplier-contractor relationships enhance customer satisfaction and improve construction logistics (Jang et al., 2003). However, understanding these relationships requires further research to maximize their impact on construction outcomes. Poor service quality can significantly reduce a company's potential for success (Ashraf et al., 2021). Reduced consumer confidence leads to financial losses and weakens a company's performance. Consumer satisfaction is confirmed if consumer expectations are met (LaBarbera & Mazursky, 1983).

Customer focus is essential for business success (Lepkova & Žūkaitė-Jefimovienė, 2012). Meeting a customer's needs drives loyalty and competitive advantage. Service quality, price, and overall value influence satisfaction by balancing rewards and cost

(Maxham, 2001).

Implementation, duplication potential, timeliness, and service criteria determine customer satisfaction (Cheng et al., 2021). Fulfilling customers' expectations can encourage repeat purchases or the use of goods or services. A person's pleasure or displeasure with goods or services is determined after using them and comparing their performance or quality with expectations (Gultom et al., 2020). Consumers' experiences regarding the degree to which their expectations from goods or services are fulfilled influence their decision-making (Otto et al., 2020).

Consumer satisfaction serves as an intermediary between the marketing mindset and actions (Churchill Jr & Surprenant, 1982). Consumer satisfaction with goods and services will also encourage positive word-of-mouth promotion, which can attract new consumers. Meanwhile, companies can reduce customer loss by developing loyalty and strengthening bonds with consumers (Fida et al., 2020).

Performance Measurement

A company's efficiency can be assessed through performance measurement to evaluate employees' performance (Takim et al., 2003). Performance measurement is related to the success of maintenance management (Rifai et al., 2016) and involves criteria, such as cost, quality, flexibility, resource utilization, visibility, trust, and innovation. Areas for strategy improvement can be identified by understanding these factors (Ecem Yildiz et al., 2020). Decision-making will also be more efficient if the company has measured workers' performance (Kamble et al., 2020).

Organizations can measure performance in terms of productivity, profitability, success, and failure (Lee et al., 2022). Unclear metrics will hinder data resource management and supply chain opportunities, whereas methodological efficiency will improve accuracy (Yoon et al., 2018). A critical literature review can thus help develop a performance measurement model for construction (Yang et al., 2010).

The possession of valuable, distinctive, and hard-to-replace resources can enable companies to attract performance benefits, serving as a key determinant of success (Mikalef & Gupta, 2021). Superior resources can thus have a significant impact on the company's performance and capabilities. It is necessary to measure performance in human resource development to achieve

sustainable competitive advantage, as effective performance measurement systems enhance productivity and provide valuable feedback in construction management (Wegelius-Lehtonen, 2001).

The success of an organization in achieving its mission is determined by employee performance. Resources are assets that benefit organizations' productivity according to specific standards, which can be measured through the level of productivity, quality of service, responsiveness, responsibility, and accountability (Maryani et al., 2021).

Quality Control

Planning and implementation strategies are implemented in conjunction with quality control, with the expectation of achieving high-quality results (Westgard & Westgard, 2016). Quality control is driven by knowledge related to quality. Project management ensures that the construction company runs as planned and meets quality standards to achieve effective results (Moradi et al., 2022). Business systems' engineering can enhance innovation and efficiency in achieving targets for construction projects (Riley & Towill, 2001) with a focus on quality, safety, efficiency, and customer satisfaction. Quality control needs include critical insights regarding technical specifications, regulations, and best construction practices. For example, the quality of flat surface construction can be effectively assessed by measuring deviations from perfect flatness within a specified tolerance (Tang et al., 2011).

Quality, time, and cost are challenges in achieving construction goals (Sari & Dinata, 2022). Quality control is essential for building marketing (Kasote et al., 2022), as it ensures that the building meets the set standards and criteria. Repetitive defect repair is a problem in construction projects (Love & Edwards, 2004). Previous research has demonstrated that investments in quality control can yield long-term benefits for construction companies, including an improved reputation and increased client trust.

Applying advanced data processing techniques can improve the efficiency and accuracy of quality control (Xu et al., 2020). The final product of construction quality control includes standardization, specifications, and costs against minimum quality standards (Gardjito et al., 2017). Quality control can be improved through collaboration between project scheduling and other relevant areas (Bansal & Pal, 2008). Weak quality

control supervision of a project can lead to deviations from standards and specifications, resulting in maintenance problems (Waziri, 2016). In contrast, effective quality control will positively impact the company's reputation and increase customer satisfaction.

Quality control encompasses several key elements, including measurement, evaluation, and improvement (Sumiati & Ahmad, 2021). Long-term quality can be established through continuous improvement (Chen et al., 2012). Effective resource allocation in construction management is crucial for meeting the project's budget, timeline, and quality standards, thereby achieving project success (Ribiero et al., 2013; Ulewicz & Ulewicz, 2020). Evaluation, improvement, and resource allocation are essential elements in the success of a project.

The reviewed literature highlights the interdependence between consumer satisfaction, performance measurement, and quality control in achieving project success, particularly in the construction sector. While numerous studies emphasize the importance of service quality, employee performance, and quality assurance mechanisms, a gap remains in understanding how these elements interact systematically to influence construction outcomes in practice. Moreover, many existing studies lack integration between operational performance and consumer-focused outcomes. To address this gap, our study adopts a holistic approach by examining how the synergy between quality control measures and performance evaluation contributes to enhanced consumer satisfaction in construction projects.

Research Gap and Analytical Framework Development

The literature review underscores that while consumer satisfaction, performance measurement, and quality control are often studied independently, there is a lack of integrated analysis connecting these components within the construction context. To bridge this gap, we adopted a systematic bibliometric approach, combining both quantitative keyword co-occurrence analysis using VOSviewer and citation analysis *via* "Publish or Perish" (POP). We first identified 5,122 documents related to the terms "quality control," "consumer satisfaction," and "performance measurement," from which we rigorously screened

1,000 relevant publications dated from 2000 to 2024 based on relevance, keyword density, and citation impact.

This structured method allowed us to identify six major keyword clusters and their interconnections, revealing that quality control consistently co-occurs with performance and satisfaction metrics. These insights were used to develop the framework, not arbitrarily, but by mapping conceptual linkages suggested by the patterns in the literature. The resulting theoretical and conceptual framework (Figure (8)) thus emerges from empirical bibliometric patterns, aligning with previous research (e.g. Riley & Towill, 2001; Yang et al., 2010; LaBarbera & Mazursky, 1983) while organizing quality control as the input, performance measurement as a mediating process, and consumer satisfaction as the output.

This analytical process ensured that the framework is grounded in systematic evidence, validated by both thematic frequency and scholarly influence, and provides a basis for examining the dynamic interplay of quality control performance in achieving consumer satisfaction in construction.

DATA AND METHODS

Databases Used

This study aimed to analyze research needs by efficiently identifying and retrieving relevant documents from various databases using a bibliometric analysis approach. The bibliometric analysis method utilizes many publications from previous academic research as a basis for evaluating and analyzing performance in the development of the construction industry (Newman et al., 2021). This study focused on assessing aspects of the construction industry's performance by relating it to output in the form of consumer satisfaction. The primary data sources in this study were obtained through Google Scholar, which was chosen as the primary data source due to its open accessibility, broad multi-disciplinary coverage, and ability to aggregate diverse academic content, including journal articles, pre-prints, and conference papers. However, relying on a single database may introduce limitations to comprehensiveness and potential selection bias. With this approach, the research is expected to provide a

comprehensive overview of the title, abstract, journal name, author name, or affiliation name.

Research Strategy

Bibliometric research that produces large-scale journals will yield irrelevant results. However, in this study, the authors compiled search data focused on building quality control by reviewing various articles published under the headings of "bibliometric analysis" or "systematic review." To identify the total of 1,000 articles, it was necessary to enter relevant keywords, including "quality control," "consumer satisfaction," "performance measurement," "building quality," and "bibliometric analysis," seeking to identify 200 studies per keyword to focus on a comprehensive exploration of the literature with relevance to building quality control performance on consumer satisfaction.

Collecting Initial Statistical Data

The study employed a systematic literature review to analyze the impact of building quality control performance on consumer satisfaction. Using keywords such as "quality control," "consumer satisfaction," "performance measurement," "bibliometric analysis," and "building quality," data from 2000 to 2024 was retrieved through the POP citation analysis tool and stored in Research Information System format. Identifying documents based on keywords to meet the initial criteria resulted in 5,122 papers. Screening led to the removal of 236 and 142 papers, respectively. The selection, screening, and qualification process resulted in 142 documents being identified as the most relevant results (Figure (1)). VOSviewer was then used to perform network mapping, while Microsoft Excel facilitated the visualization of trends and relationships. Its capability to organize and filter large datasets provided a straightforward, systematic approach to identifying key themes.

The process ensured a robust exploration of critical research areas, including author contributions, topic relevance, and geographical distribution. The methodology aimed to provide comprehensive insights into the interplay between quality control, performance measurement, and consumer satisfaction, with findings presented through clear visualizations for better interpretation and application.

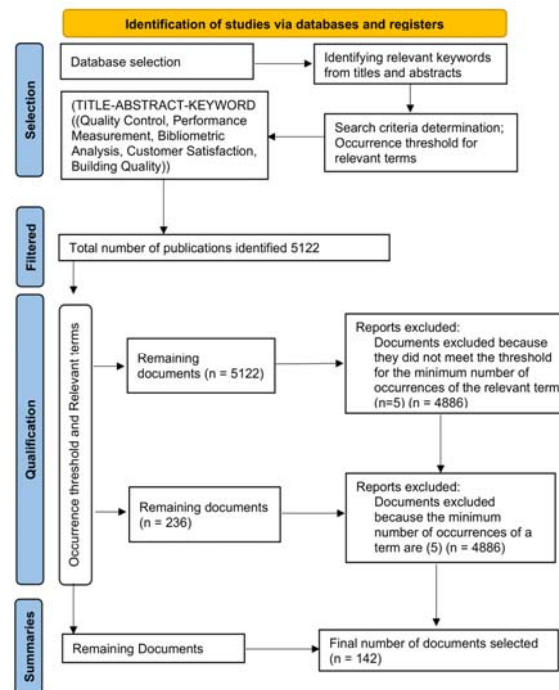


Figure (1): Flowchart for systematic bibliometric analysis

RESULTS AND DISCUSSION

Most Frequent Author Keywords

The description of an article's main content can be summarized using keywords to make it easier to find relevant data and information. Figure (2) illustrates the network of interconnected keywords identified in this study. Keywords occurring in articles published

between 2000 and 2024 that were relevant to the topic of this study, such as “quality control,” “performance measurement,” “bibliometric analysis,” “customer satisfaction,” and “building quality,” were included in POP. The data generated from POP comprised 5,122 papers, which were then processed using VOSviewer to produce a network map.

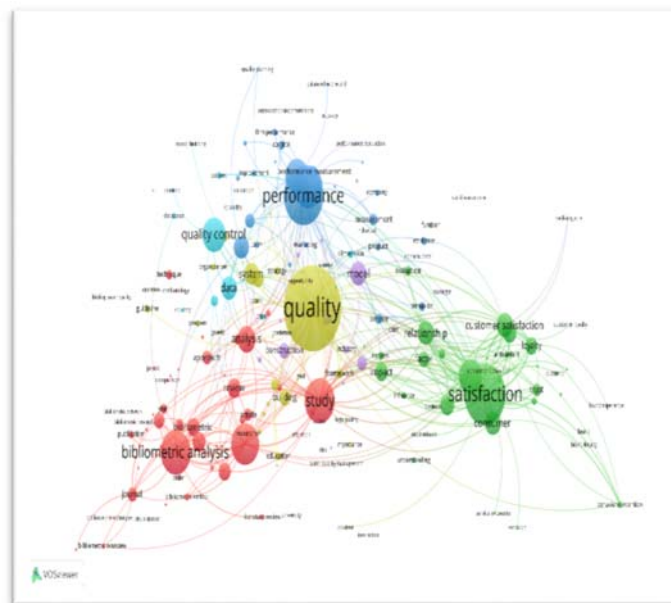


Figure (2): Visualization of the connections between research keywords

In the above visualization of network mapping based on keywords, the cluster in the mapping network with the highest level of elevation within the topic was the yellow cluster, which contained the keyword “quality” and occurred 341 times. The green cluster, with the keywords “satisfaction,” with 232 occurrences, and “consumer satisfaction,” with 82 occurrences, was the second largest cluster. According to the mapping, the most significant relationship strengths included “quality” and “satisfaction”.

The yellow cluster (cluster 1) was characterised by keywords linked to projects and modeling, including “bibliometric analysis,” “study,” and “research”. The keywords in the red cluster aligned with the title, as they emphasized the focus on bibliometric analysis, study, and research related to building quality control and its impact on consumer satisfaction. The term “bibliometric analysis” had 163 occurrences. Bibliometric analysis will reveal the chronological distribution and patterns of studies linking quality control and consumer satisfaction across journals, authors, countries, and institutions (Vilutiene et al., 2019).

The blue cluster (cluster 2) was primarily composed of performance-related keywords, such as “performance,” “performance measurement,” and “firm performance.” The high frequency of the word “performance” (206 occurrences) highlights the focus on performance metrics in the literature, directly aligning with this study’s emphasis on analyzing quality control performance and its impact on consumer satisfaction. Performance measurement is essential for construction industry organizations to ensure long-term survival in a competitive business environment (Tripathi & Jha, 2018).

The green cluster (cluster 3) comprised keywords such as “satisfaction,” “customer satisfaction,” and “relationship.” These terms highlight the themes of satisfaction and connection, which align with the study’s purpose of examining the link between quality control performance and customer satisfaction. It is essential to understand how quality control initiatives impact customer satisfaction and contribute to building stronger relationships.

The yellow cluster (cluster 4) represents quality strategies, featuring keywords such as “quality,”

“system,” and “building.” The recurring usage of “quality” (323 times) underscores the emphasis on these strategies, which relates to this study’s objective of enhancing quality control performance to boost consumer satisfaction. Quality systems and the development of quality control processes play a crucial role in achieving effective quality control and meeting customer expectations.

The purple cluster has five focuses. The purple keywords represent the concept of “model” (with 81 occurrences) and related terms such as “construction.” These keywords align with this study’s focus on building quality control systems. These terms underscore the importance of developing structured models for quality control in the construction industry, with the aim of improving consumer satisfaction.

Cluster 6 (the aqua cluster) emphasized quality control, highlighted by terms such as “quality control,” “data,” and “database.” With “quality control” appearing 117 times, the keywords in the aqua cluster concentrated on examining how the performance of quality control affects consumer satisfaction through insights derived from data. Data and systems for quality control are essential for making informed decisions that enhance consumer satisfaction and overall effectiveness. Managing civil engineering construction is essential for maintaining a high level of control over engineering quality (Zhou, 2019).

The highest co-occurrence of keywords can be seen in Figure (3), which illustrates the discovery of keywords and word pairs. The co-occurrence matrix provides insights into studies on overall quality and consumer satisfaction. Other insights offered include an overview of the fields of quality and bibliometric analysis.

Keyword Density

VOSviewer was used to generate a network diagram illustrating the density of connections among research terms. Figure (4) visually represents the keywords selected and inputted to create this visualization. Visualization reveals the connections between keywords, which varied in strength and frequency. The variations in colour intensity indicate different levels of density.

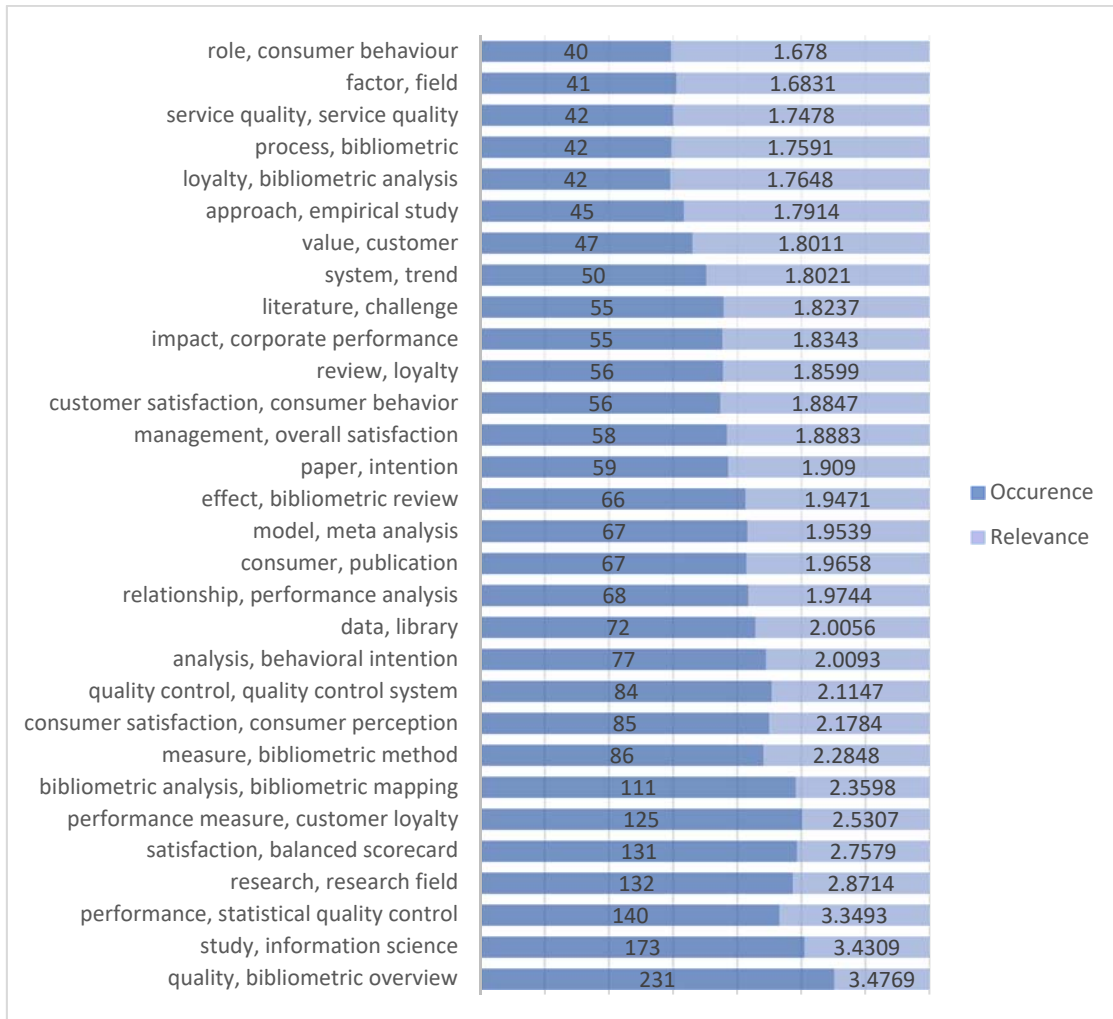


Figure (3): Co-occurrence of keywords based on occurrence and relevance

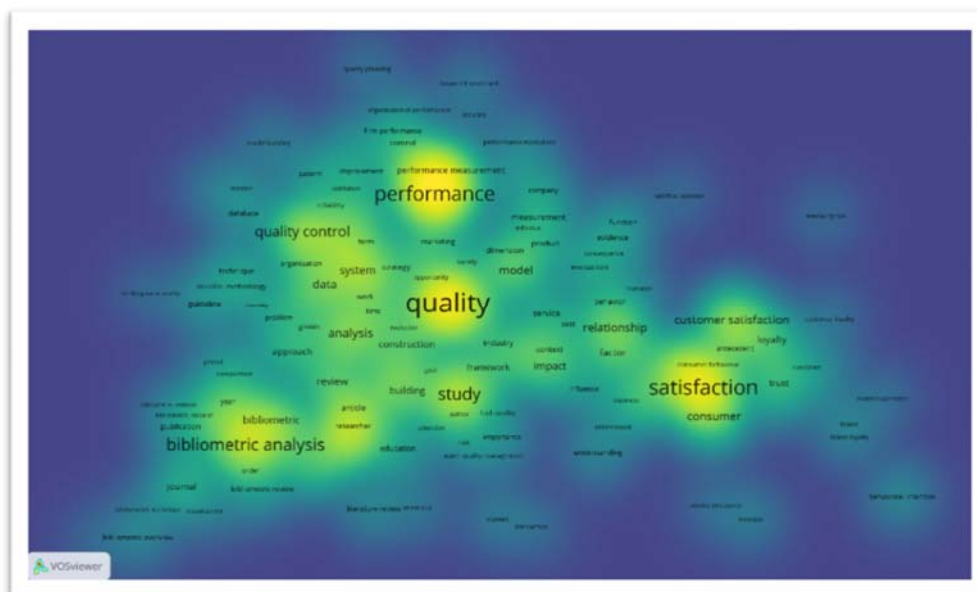


Figure (4): Network diagram of keyword density

Figure (4) shows that “quality” was the most prominent keyword. The deep yellow indicates a high frequency of co-occurrence with other keywords related to the research topic. While other keywords were also associated with the research topic, their connections to the core concept varied in strength, as indicated by their different density levels.

Research Topic Ranked by Keywords

POP tends to be influential in specific fields and contains research articles that are widely cited. Sorting the research focus is based on the order connected by the relevant article keyword network. The research ranking

data is provided in Table 1. The studies were ranked based on the number of citations within a specific time pertinent to the topic.

Figure (5) highlights the keywords identified through our analysis of the collected dataset. The ranking indicates that research related to “quality” leads with 341 citations, followed by “performance” at 232, “bibliometrics” with 223, “research” at 164, and “consumer satisfaction” with 163. While many other studies should be categorized under these four major topics, they are still connected to the overarching theme of this research.

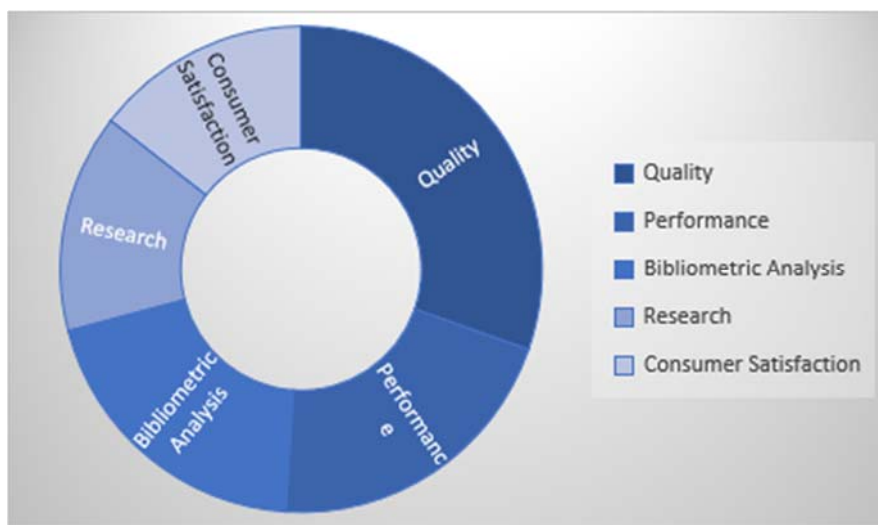


Figure (5): Numbers of citations for each keyword

Most Influential Documents

The study can elucidate the intellectual structure of the knowledge domain by examining the aspects of quantity and authority of the cited writings. Based on data from POP, processed into tabular form (Table 1),

the total number of citations ranges from 26,722 to 3,428. The top three most cited articles were written by Biggs et al. (2020), and Berger and Luckmann (2016), with citations totalling 13,361, 104,676.25, and 6925.5 per year, respectively (Table 1).

Table 1. Most influential documents, by number of citations

No.	Author (s)	Citations	TC per year
1	Biggs et al. (2020)	26722	13361
2	Berger & Luckmann (2016)	83810	10476.25
3	World Health Organization	13851	6925.5
4	Carver & Scheier (2024)	6165	6165
5	Kalnay et al. (2018)	35676	5946
6	Deming (2018)	31517	5252.83
7	Camp (2024)	4727	4727
8	Lockamy & Khurana (1995)	4721	4721
9	Chang & Lin (2011)	51657	3973.62
10	Aguinis et al. (2011)	3428	3428

Highest Research Productivity by Country

Our data-gathering strategy encompassed a wide range of building quality control research endeavours from different geographical areas and fields. This variety highlights the worldwide character of such research, with subjects covering diverse regions and

disciplines. Our approach utilized data based on countries to identify the locations where analogous research is most frequently discussed. Figure (6) depicts the countries involved in the research case studies visually.

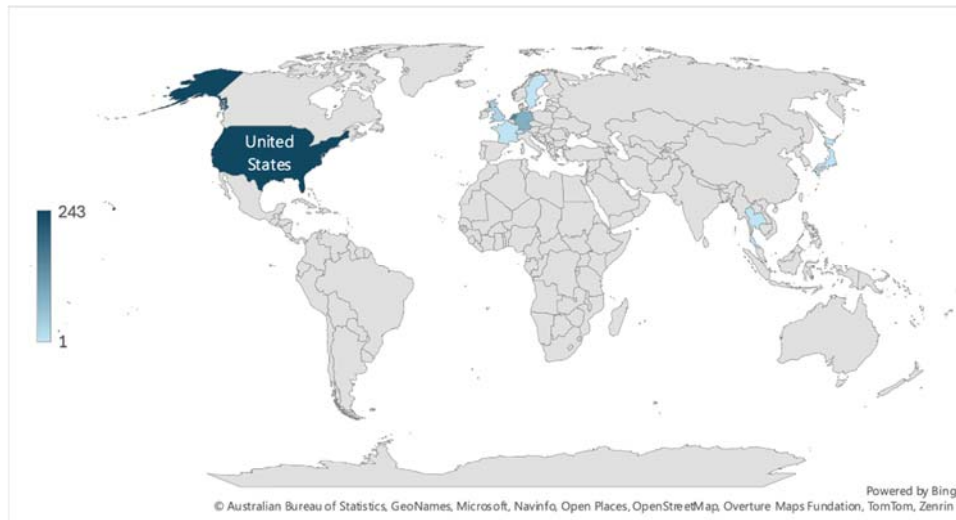


Figure (6): Research distribution map by country

The map displayed above illustrates each country’s research contribution. The deeper the blue hue, the more significant the country’s contribution. The USA stands out with the highest contribution, shown by its dark blue shade. Numerous European nations, including the Netherlands, Germany, and the UK, also demonstrated considerable contributions, represented by lighter blue shades. In contrast, countries like Switzerland, Japan, France, Sweden, and Thailand showed significantly lower contribution levels.

Table 2. Research distribution table by country

Country	Number of Studies
USA	243
Netherlands	152
Germany	83
UK	27
Switzerland	3
Japan	2
France	2
Sweden	1
Thailand	1

The map chart in Figure (6) illustrates the

distribution of research in the USA and across various countries. According to the data, the USA has the highest number of recorded case studies, totalling 243, underscoring its significant role in research dialogues. The Netherlands follows closely, with 152 studies reflecting a robust regional research impact. Germany has 83 studies to its credit, followed by the UK with 27 studies. Notably, Switzerland, Japan, France, Sweden, and Thailand show minimal contributions, with Japan and France reporting three studies each and Sweden and Thailand documenting just one study each. This highlights the necessity of establishing quality control as a critical area for improving construction practices and ensuring consumer satisfaction on a global scale. The evolving and interconnected nature of research in this sector accentuates the ongoing development of best practices and innovative strategies for quality control within the construction industry.

Research Distribution by Year

Figure (7) presents a graph that illustrates the distribution of research years derived from data processed in Microsoft Excel using POP. This graphical representation of research years helps improve the comprehension and analysis of trends and patterns in

research on a specific subject. A visual depiction of research data can efficiently demonstrate the trends and

patterns in research progression over a defined timeframe: in this case, from 2000 to 2024.

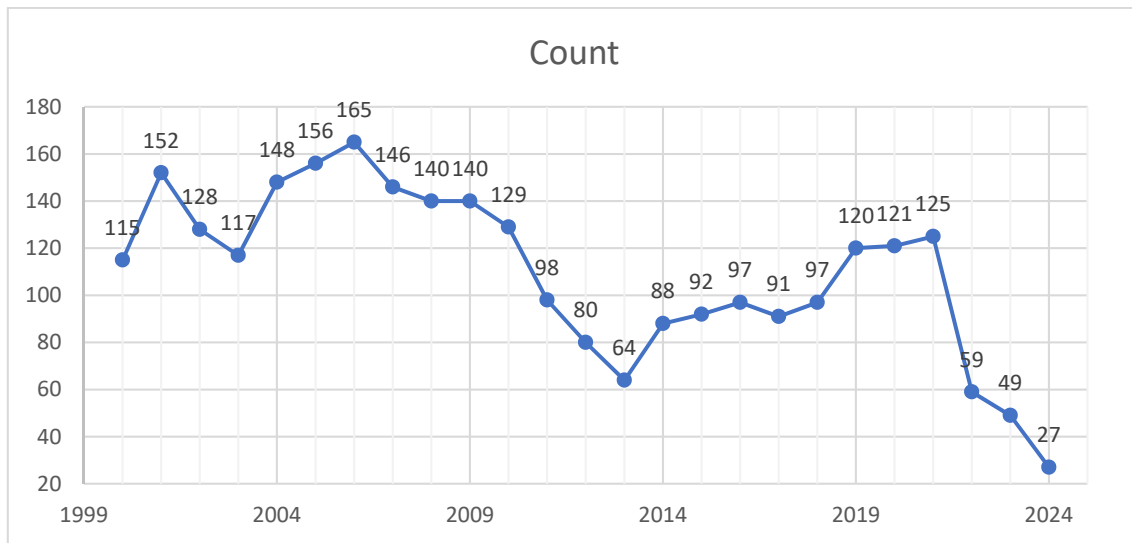


Figure (7): Research distribution by year

The graph illustrates the distribution of 1,000 studies conducted between 2000 and 2024. The data shows a notable shift from 2004 to 2006, suggesting a significant transformation in research trends or methodologies. The year 2006 witnessed the highest number of studies related to quality control, bibliometrics, customer satisfaction, performance measurement, and quality improvement, totalling 165. Research publications are constantly evolving, with journals consistently adjusting to discoveries and trends.

Theoretical Framework and Conceptual Framework

The theoretical and conceptual frameworks form the essential basis for this study, providing a thorough interpretation of the theories, principles, and concepts relevant to the research topic (Varpio et al., 2020). The theoretical framework links this research to established knowledge, ensuring that the study is organized and firmly rooted in solid theoretical foundations. On the other hand, the conceptual framework establishes the connections among key variables, providing a coherent structure to elucidate the focus and direction of the research (Jabareen, 2008). Integrating these two frameworks connects theory with practice, validating the research and enhancing its relevance.

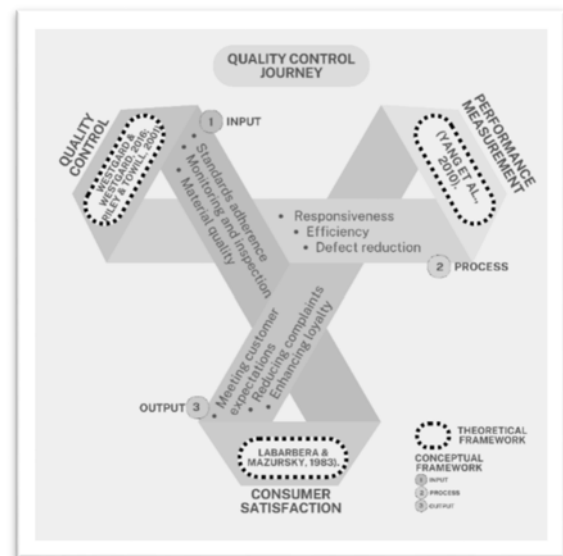


Figure (8): A theoretical framework encompassing the elements influencing customer satisfaction: Quality control, performance measurement, and consumer satisfaction

Figure (8) presents a visual representation of the theoretical framework underlying this research. The figure depicts the quality control journey as a diagram that explains the relationship between the theoretical and conceptual frameworks through three main stages: Quality control as input (Riley & Towill, 2001; Westgard & Westgard, 2016), performance

measurement as a process (Yang et al., 2010), and consumer satisfaction as output (LaBarbera & Mazursky, 1983). This diagram illustrates the interrelationship between these stages to ensure adequate quality management, from initial control to customer satisfaction.

Quality control protocols should be established to maintain elevated standards. The key components of this phase involve compliance with standards, inspection of materials, and assessment of material quality. This phase is a critical foundation to ensure that initial materials and processes align with pre-determined specifications, laying a robust groundwork for the project's success.

The performance measurement Journey evaluates performance using responsiveness, efficiency, and defect reduction metrics. This approach aims to assess the effectiveness of the measures implemented throughout the project, ensuring that every phase progresses smoothly and effectively while delivering high-quality results.

Consumer satisfaction emphasizes the need to meet customers' expectations (Kirby et al., 2025). Key indicators of satisfaction include fulfilling customer needs, minimizing complaints, and boosting loyalty. At this stage, the primary goal is to ensure that the finished product meets technical specifications and delivers high levels of consumer satisfaction.

The framework will assist construction project managers in coordinating quality control strategies with performance objectives to achieve consumer satisfaction

while providing a systematic method for identifying deficiencies in quality and performance. Furthermore, it lays the groundwork for subsequent research to investigate specific connections, such as the role of performance metrics in mediating the relationship between quality control and satisfaction, allowing researchers to test further and validate the framework.

CONCLUSION

This bibliometric analysis highlights the importance of quality control in improving consumer satisfaction within the construction sector (Bukari et al., 2023). The results indicate that proper quality control enhances consumer satisfaction by elevating building standards, aligning with customer expectations, and building trust. The prevalence of keywords like "quality" and "satisfaction" in the research domain emphasizes their importance.

Future research should investigate the long-term effects of quality control on consumer satisfaction, particularly in diverse cultural and industrial contexts. Additionally, leveraging innovative technologies for real-time quality assessment and executing localized pilot initiatives could address existing gaps and offer targeted solutions. Focusing on quality control and consumer satisfaction will support sustainable growth and competitiveness in the global marketplace as the construction sector advances.

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