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IoT-Enabled Smart Building Safety: Bibliometric Mapping and Validation of Research Readiness in Indonesia

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Abstract: Building safety based on the Internet of Things (IoT) has become an increasingly important topic alongside the growing demand for smart building systems in Indonesia. This study aims to explore the direction of research development in this field and to assess the readiness of experts and practitioners for its implementation. The methods include a bibliometric analysis of international publications and a field survey using a questionnaire tested for validity and reliability. The validity test showed that 20 out of 23 items were valid, with an average correlation value of 0.56, while the reliability test obtained a Cronbach's Alpha of 0.884, indicating a high level of internal consistency. The bibliometric and VOSviewer mapping results reveal that studies on IoT, smart buildings, and safety systems remain weakly interconnected, forming separate clusters with limited thematic overlap. In contrast, most respondents demonstrated a good level of understanding and readiness to adopt IoT-based safety technologies, although practical implementation is still limited to specific projects. Cost, policy, and human resource constraints remain the main barriers. Overall, the findings indicate that conceptual and professional readiness for IoT-based building safety is strong; however, its integration into practice remains insufficient, underscoring the need for closer collaboration among researchers, policymakers, and industry to accelerate the effective implementation of intelligent safety systems in Indonesia.

Keywords: Bibliometric Mapping; Building Safety, Indonesia, Internet of Things; Smart Building; Validation

1. Introduction

Building safety has become an increasingly important concern as the size and complexity of modern buildings continue to grow. Traditional safety systems, such as manual inspections and routine checks, are still widely implemented; however, these methods are often too slow to respond to emergencies and less effective in identifying potential hazards at an early stage The use of IoT can enable continuous monitoring of working environments, helping companies to reduce the likelihood of accidents and improve overall safety performance [1].

Driven by these limitations, the concept of smart buildings has gained attention through the integration of digital technologies and automation to enhance operational efficiency and safety. The integration of the Internet of Things (IoT) with traditional Operational Technology (OT) systems has attracted significant interest; nevertheless, challenges persist due to differing operational methods, the absence of standardized protocols, proprietary systems, and isolated databases [2]. Among these innovations, IoT has become a key enabler for intelligent and safer building management. Real-time connected sensors can monitor parameters such as temperature, humidity, air quality, and occupancy levels, providing early warnings to prevent potential incidents. Consequently, IoT is expected to be an essential technology for maintenance, cost reduction, and safety enhancement within the built environment [3].

Despite notable opportunities, the literature highlights enduring implementation challenges. High installation costs, along with persistent concerns regarding data privacy, security, and interoperability, continue to limit large-scale IoT adoption. Most smart building systems still prioritize automation and energy efficiency, leaving safety mechanisms as secondary elements [4]. Current facility management (FM) research increasingly incorporates BIM-based FM, AI-driven predictive maintenance, real-time cyber-physical system integration, and lifecycle asset management; however, areas such as real-time asset prognostics, virtual infrastructure monitoring, and semantic data interoperability still demand further study [5]. Research also indicates that IoT deployment in building management faces significant barriers to system integration and operational reliability. Interoperability issues, data security, and high installation and maintenance costs restrict practical implementation, leaving many projects fragmented and confined to small-scale or experimental stages [7].

In Indonesia, similar issues are evident where the uneven distribution of internet infrastructure and inadequate digital facilities have become major obstacles to optimizing smart building systems. The limited network availability outside major cities prevents IoT devices from operating optimally, resulting in uneven progress of smart building implementation across regions [8]. This situation reflects the broader condition where the success of smart building implementation in Indonesia still relies heavily on adequate infrastructure, integrated intelligent systems, and sustainable material readiness [9]. Research on IoT-based building safety in Indonesia remains limited and fragmented. There is no comprehensive bibliometric study that maps global research trends, thematic developments, or collaboration networks in this field. Most studies lack visualization through tools such as VOSviewer, making it difficult to identify key themes and research directions. Moreover, empirical validation and readiness assessments are rarely conducted, leaving uncertainty about how global advances align with Indonesia's implementation capacity. These shortcomings indicate a clear research gap in both conceptual understanding and practical application.

This study conducts a bibliometric and VOSviewer based mapping to identify the direction and progress of global research on IoT-based building safety. It also includes a validation assessment to examine the readiness of experts and practitioners in Indonesia for implementing smart building concepts integrated with digital safety management systems. The findings are expected to reveal the gap between global research trends and local practices, providing a foundation for developing more intelligent and adaptive building safety systems in Indonesia.

2. Literature Review

The use of Internet of Things devices by workers in risky industries is not risk-free. Instead, they help managers cope with a range of hazards that could have been avoided. Through the use of the IoT, companies may monitor their employees' health and the safety of their working environment, both of which may help to lessen the occurrence of accidents [1]. Moreover, it is estimated that IoT will become a obligation technology for waste management, cost reduction of different construction activities, maintenance and repair, safety improvements, and requirement management for tenants [3]. In the implementation, connected sensors operating in real time allow continuous monitoring of parameters such as temperature, humidity, air quality, and occupancy levels. The collected data then able be used to provide early warnings before incidents occur that could cause significant damage [2][3].

The integration of Internet of Things (IoT) with traditional Operational Technology (OT) systems has garnered significant interest and attention in recent years. However, integrating IoT and OT systems or devices, or both, poses various challenges. These challenges encompass differences in operational methodologies between IoT and OT devices, the absence of standardized protocols, proprietary systems, isolated networks, and disparate databases [2].

Furthermore, the literature also identifies several persistent challenges. The installation cost of IoT systems remains relatively high, data security and privacy are still major concerns, and different devices are often incompatible [4]. Despite significant advancements in smart building technologies, still many existing systems are still predominantly focused on automation and energy management, with safety mechanisms often treated as secondary or standalone components. This fragmented approach can undermine the reliability and coherence of the building's overall management strategy [4]. Similarly, throughout the experiment, several challenges and issues were encountered. For example, compatibility issues between new and existing devices, problems with network connectivity, data management, and security vulnerabilities were identified [2].

Finally, the findings show that the current research of digital twin in facility management focuses on building information modeling-based FM, artificial intelligence-based predictive maintenance, real-time cyber–physical system data integration, and facility lifecycle asset management. However, several areas, such as AI-based real-time asset prognostics and health management, virtual-based intelligent infrastructure monitoring, and semantically rich data interoperability throughout the facility lifecycle, need to be further studied [5].

Several persistent challenges continue to hinder wider implementation, including the high costs of hardware and software, unstable digital infrastructure, and limited technical readiness among operators and facility managers. He also highlights that data security and privacy remain major concerns, and that successful IoT implementation will require stronger policy support, improved digital literacy, and investment in reliable network infrastructure [6]. And several global studies have discussed how IoT can support safer and smarter building systems. IoT helps improve efficiency and early detection through connected devices that monitor building conditions in real time [3]. The real-time data, artificial intelligence, and digital twin technology can support predictive maintenance and better asset management [5]. Meanwhile the adoption system is still not even across sectors, mainly due to data security issues, high implementation costs, and limited system compatibility [7].

In short, this literature review highlights two key points. First, IoT has strong potential to improve building safety through real-time and predictive systems. Second, the readiness still needs strengthening in terms of technology, infrastructure, and human resources. To assess this local readiness, this study uses a survey targeting professionals involved in various aspects of construction and safety. The respondents consist of architects, consultants, and engineers in planning or design; contractors, site engineers, and project managers involved in construction execution; occupational safety and health experts, safety engineers, and officers; research and development specialists including smart building experts; government officials or regulators such as the Ministry of Public Works and building inspectors; as well as academics, lecturers, and researchers. With this broad respondent base, the survey captures perceptions from various stakeholders who are directly or indirectly involved in building safety. The findings from this survey form the basis for combining global bibliometric analysis and local survey data to identify practical gaps and real world needs.

3. Research Method

This study adopts a mixed-method approach, combining bibliometric analysis and field surveys. This approach was chosen to provide a comprehensive picture of global trends in IoT-based building safety and local readiness in Indonesia. By integrating quantitative and qualitative data, the study aims to capture the phenomenon more holistically and deeply. Fig 1 shows the flowchart of the process.

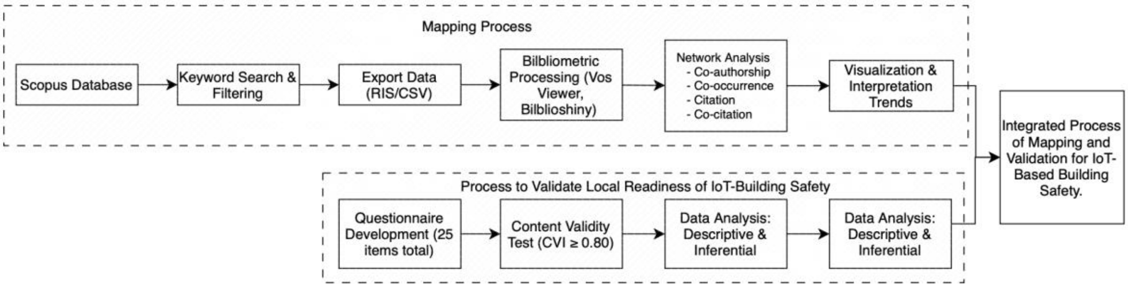

Fig. 1. Research flowchart combining bibliometric mapping and local readiness validation for IoT-based building safety.

The bibliometric analysis was conducted by reviewing scientific articles published over the last fifteen years in the Scopus database, Bibliometric analysis is a quantitative approach used to evaluate the development and structure of scientific research within a particular field. Bibliometrics is defined as *"the statistical analysis of books, articles, or other publications"* and is widely applied to measure research impact, identify influential authors, and visualize trends or relationships across disciplines [11].

The search was carried out using the keywords: "Smart Building" AND "Building Safety" AND "Internet of Things". The bibliometric approach in this study refers analyzed publication data using VOSviewer, a software developed by Van Eck and Waltman at Leiden University, which is specifically designed for constructing and visualizing bibliometric networks to visualize research networks, keyword co-occurrences, and thematic clusters. This technique enables the identification of dominant research topics, author collaborations, and emerging trends within the field [10] [12].

The search focused on publications related to IoT based building safety systems and smart buildings. The bibliometric results were analyzed to identify research trends, author collaborations, and dominant research areas. The analysis process was performed using VOSviewer to map the network relationships between authors, keywords, and citations.

The field survey was conducted to assess local readiness, targeting practitioners, stakeholders, and academics from various fields related to construction and building safety. Respondents were selected using a random sampling technique, with the total number of samples following practical guidelines ranging from 30 to 500 respondents, ensuring that each individual in the population had an equal chance of being chosen

The survey instrument consisted of a closed ended and open ended used a five-point Likert scale to measure participants' responses, balancing between detail and simplicity to ensure clarity and consistency in evaluating perceptions [13] consist of (six independent variables and twenty-three sub-variables) along with two open-ended questions. The Likert scale scores ranged from 1 to 5, representing the respondents' level of agreement: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree. Content validity was tested using the Content Validity Index (CVI) to ensure that each item was relevant to the study objectives and adequately represented the measured construct, CVI consists of two main forms, namely the Item-level CVI (I-CVI) and the Scale-level CVI (S-CVI). The S-CVI can be calculated using two approaches—S-CVI/Ave, which represents the average proportion of items rated as relevant by experts, and S-CVI/UA, which reflects the universal agreement among all experts in rating item relevance [12]. The CVI assessment was carried out by ten experts, consisting of building safety specialists, building design planners, and informatics experts. Each item was evaluated using a four-point relevance scale, where:

1 = not relevant,
2 = somewhat relevant,

3 = quite relevant,
4 = highly relevant.

Items rated 3 or 4 were considered relevant and included in the CVI calculation. The formula used is as follows:

$$\text{CVI} = \frac{\text{Number of Relevant Item}}{\text{Total Number of Item Evaluated}} \quad (1)$$

Explanation:

- "Number of relevant items" = items rated as relevant by expert evaluators
- Total number of items evaluated" = total items assessed in the validation process
- An item is considered valid if CVI ≥ 0.78

Item validity was tested using the Pearson Product Moment (r_{count}):

$$\text{r} = \frac{\sum(X_i - \bar{X})(Y_i - \bar{Y})}{\sum(X_i - \bar{X})^2 \sum(Y_i - \bar{Y})^2} \quad (2)$$

Explanation:

- Xi = score of item *i* from the respondent
- Yi = total score of the respondent excluding item *i*
- $\overline{X}$ and $\overline{Y}$ = r mean scores of each variable
- Item is considered valid if r count > r table

The reliability of the questionnaire was tested using Cronbach's alpha:

$$\text{r} = \frac{k}{k-1}\left(1 - \frac{\sum \sigma_i^2}{\sigma_{total}^2}\right) \quad (3)$$

Explanation**:**

- κ= number of questionnaire items
- σ_i^2 = variance of each item,
- σ_{total}^2= total score variance
- instrument is considered reliable if α ≥ 0,70

Survey data were analyzed descriptively to observe respondents' perceptions and inferentially to examine the relationships between variables. By combining bibliometric analysis and field survey data, this study provides a comprehensive overview of IoT implementation for building safety at both global and local levels.

4. Result

4.1 Scopus Database

The bibliometric analysis began with retrieving publication data from Scopus using the keywords *Smart Building AND Building Safety AND Internet of Things* for the years 2010–2025. The data were then filtered to include only journal articles with a final publication status. From an initial search result of 203 publications, data cleaning was performed to remove duplicates and irrelevant entries. The validated data were subsequently analyzed using bibliometric methods to identify annual publication trends, author contributions, institutions, countries, and major research topics. The results of this bibliometric analysis were then presented in tables and diagrams to facilitate interpretation. The bibliometric analysis aimed to understand global research trends related to the application of IoT in building safety. The search was conducted in the Scopus database using the following query:

TITLE-ABS-KEY ("Smart Building" AND "Building Safety" AND "Internet Of Things")
AND PUBYEAR > 2010 AND PUBYEAR < 2025
AND (LIMIT-TO (SRCTYPE , "j"))
AND (LIMIT-TO (PUBSTAGE , "final"))
AND (LIMIT-TO (DOCTYPE , "ar"))
AND (LIMIT-TO (LANGUAGE , "English"))

The extracted data from Scopus, which present the main information related to the analyzed publications, are displayed in Table 1. The data show that 56 journals contributed 87 documents during 2010–2025, with an average citation per document of 52.1. The total number of cited references reached 4,534, and the annual growth rate of publications was 1.09%. Keyword analysis produced 58 author keywords, while the total number of contributing authors reached 361, including 4 single-author papers. The average number of authors per document was 2.74, reflecting relatively high collaboration among researchers.

4.2 Bibliometric Analysis

Table 2 shows the results of the bibliometric filtering on publication sources related to Internet of Things (IoT)-based building safety. The table lists several relevant and influential journals, including the *IEEE Internet of Things Journal*, *Sensors*, and the *Journal of Building Engineering*, which have good publication volume and high H-index values. The SJR 2024 and Proxy Impact also show that studies about IoT and building safety are now more visible in reputable international journals that focus on technology integration, efficiency, and safety.

From the initial 56 journals found in the database, only five were kept after thematic and quality screening. The selected journals are those that regularly publish research about IoT applications in building safety and performance. The result shows that research in this area has become more mature and involves collaboration between different science.

Table 1. Main Information

Number of Journal	56
Document	87
Timespan	2010-2025
Average Citation per Doc	52,1
References	4534
Annual Growth Rate	1,09
Author Keyword	58
Author	361
Author of Single-Authered doc	4
Co-Authors per doc	274

Source: Scopus 2025

Table 2. Bibliometric Analysis of Filtered Source Journals on IoT-Based Building Safety Research

No	Journal	Articles	H-Index	SJR (2024)	Proxy Impact	Main Relevance
1	Journal of Building Engineering	4	186	1,636	46,5	Focuses on building performance, safety systems, and IoT-based fire safety applications.
2	Buildings	8	115	0,652	14,375	Covers building design, energy efficiency, and smart infrastructure for safety and sustainability.
3	Automation in Construction	6	230	2,67	63,2	Explores automation, predictive maintenance, and risk management through IoT integration.
4	Sustainability	5	155	0,89	18,4	Discusses IoT applications for sustainable and safe building environments.
5	Internet of Things	2	4	0,795	2	Focuses on IoT technologies, sensor networks, and data-driven safety monitoring systems.

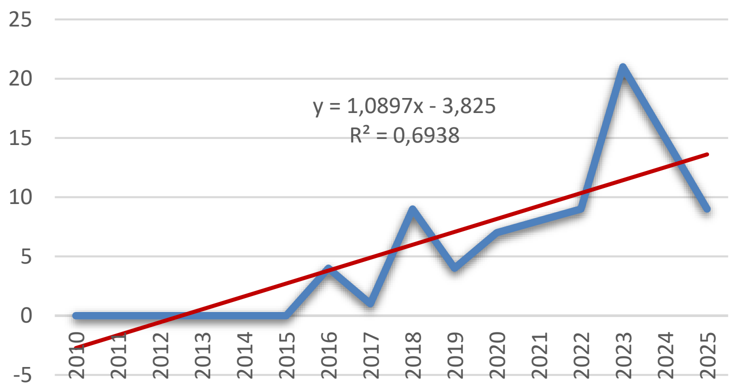

Fig. 2. Annual Growth Rate

Fig. 2 shows that the number of publications on IoT-based building safety has continued to increase from 2010 to 2025. Although minor fluctuations occurred in some years, the overall trend remains positive, following the regression equation $y = 1.0897x - 3.825$ with R^2 value of 0.6938. A significant rise in publications can be observed after 2017, reaching its peak in 2023, which indicates the growing interest of researchers in this topic.

4.3 VOSviewer mapping

The VOSviewer mapping results shown in Fig. 3 indicate that the *Internet of Things (IoT)* serves as the central point in the research network. IoT connects various fields such as *intelligent buildings, automation, information management, machine learning,* and *network security.* This position demonstrates that IoT plays a major role in integrating diverse areas of research, particularly those related to safety and efficiency in digitally managed buildings [3][5][10].

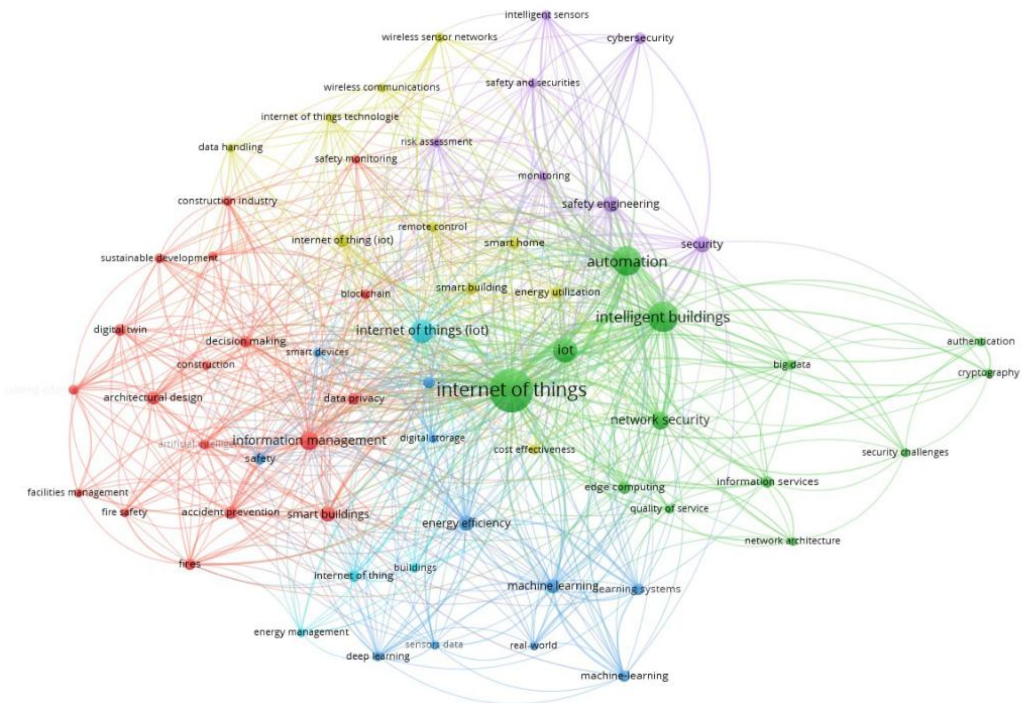

Fig. 3. Research Network Highlighting the Centrality of the Internet of Things (IoT)

When *smart building* is positioned as the central theme, the connetions between research topics form a strong network among technology, efficiency, and safety. Fig. 4 shows how *smart building* acts as a connector linking IoT, *automation, intelligent buildings, network security,* and *energy efficiency.* This confirms that smart-building research originates from IoT applications but has evolved toward integrating intelligent systems emphasizing energy efficiency and data protection [3][5][10].

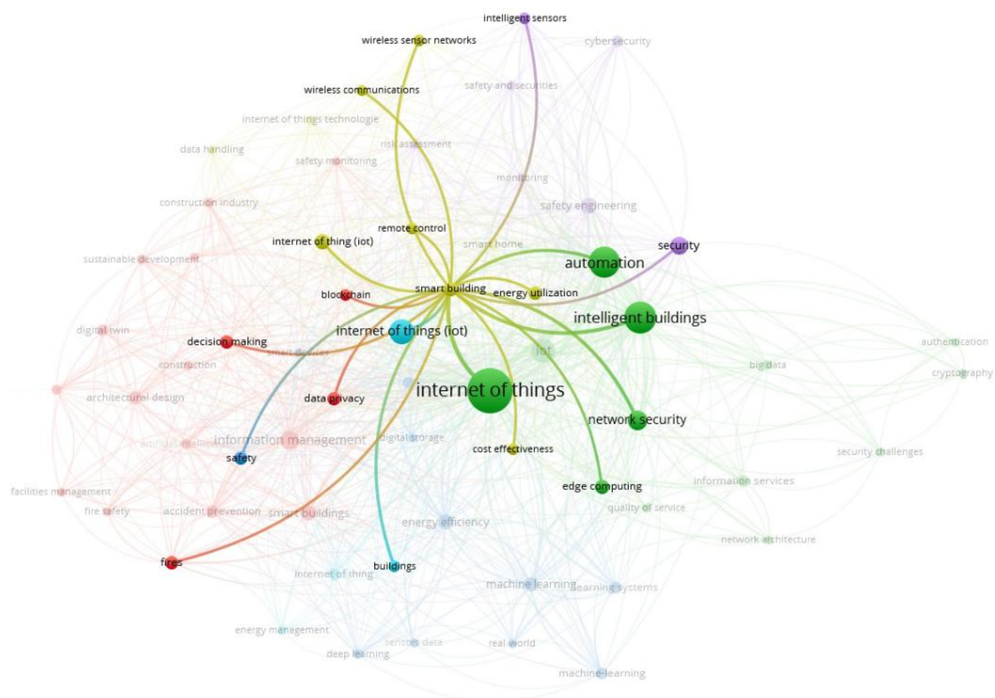

Fig. 4. Visualization of Research Network Centered on *Smart Building*

When the focus of analysis shifts to *safety engineering* and *safety monitoring,* the research network shows strong linkages between safety aspects and the application of IoT technologyin smart buildings. As shown in Fig. 5, both topics occupy strategy positions and are interconnected with IoT, *smart building,* and *automation.* This pattern reveals that research attention is not limited to technological development but also extends to how technology is used to enhance system security, enable real-time building monitoring, and prevent potential risks. In other words, safety engineering reinforces the role of IoT in supporting smart buildings that are safer, more adaptive, and sustainable [1][3][5].

By using VOSviewer, co-occurrence and citation maps were generated to reveal the structure of existing research and the relationships among keywords, authors, and publication sources. This combination of bibliometric analysis and visualization enables a deeper understanding of how the field of IoT-based building safety has evolved, as well as identifying research gaps and potential directions for future studies [10][11][12].

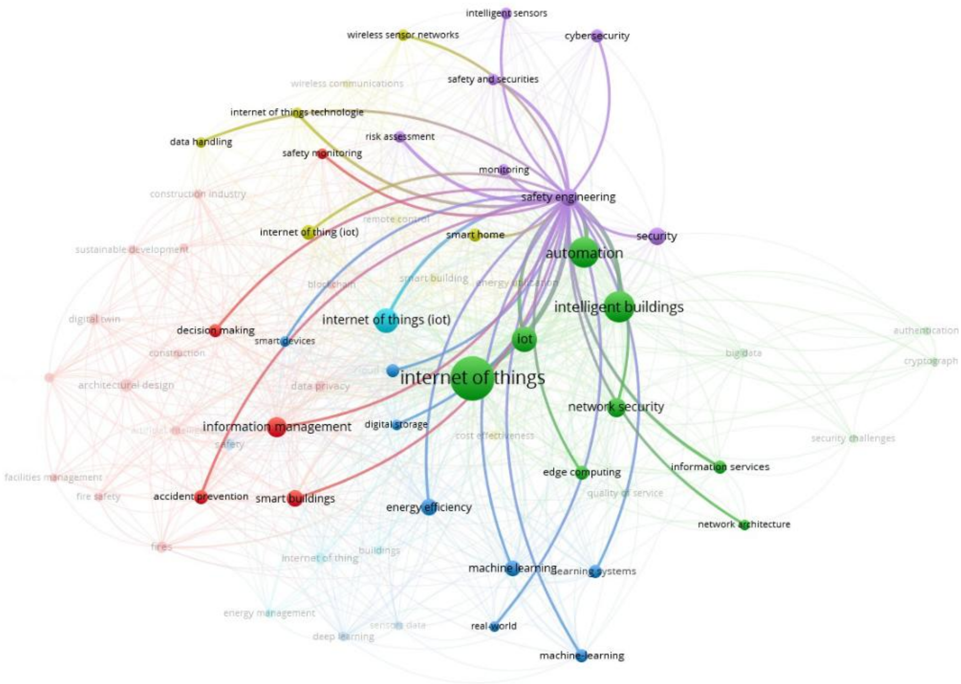

Fig. 5. Visualization of Research Connections between *Safety*, *IoT*, and *Smart Building*

4.4 Content Validity Indeks (CVI)

The Content Validity Index (CVI) analysis, conducted by ten experts, is presented in Table 3. The panel consisted of Building Safety Experts, Building Planning Experts, and Informatics Experts. The evaluation covered 25 statement items using a relevance scale to assess the suitability of each indicator with the research constructs. Based on the calculation results, the Item-CVI (I-CVI) values ranged from 0.80 to 1.00, indicating that all items were considered relevant by the majority of experts. A total of 21 items achieved universal agreement among all experts, while four items received slightly lower scores but were still within the acceptable range. The Scale-CVI/Average (S-CVI/Ave) value was 0.976, and the Scale-CVI/Universal Agreement (S-CVI/UA) value was 0.84, both exceeding the minimum eligibility threshold (≥ 0.80), calculated using "Eq.(1)" These findings confirm that all items in the instrument are valid and appropriate for use, with a very high level of expert agreement regarding the relevance of the research indicators.

Tabel 3. Result of CVI (Content Validity Indeks)

Indicator	Range of I-CVI	Items with Universal Agreement	S-CVI/Ave	S-CVI/UA	Category	Description
25 items (Q1–Q25)	0.80 – 1.00	21 of 25	0.976	0.84	Accepted	All items are considered relevant and valid

Table 4. Summary of Respondents' Evaluation on IoT-Based Building Safety Questionnaire (Q1–Q23)

Variable	Code	Unvalid Code	Number of Items	Mean (Average)
Knowledge of Building Safety	[Q1],[Q2],[Q3],[Q4]	-	4	4.156
Understanding of Smart Building Concepts	[Q5],[Q6],[Q7]	[Q8]	4	3.943
Knowledge of IoT in Buildings	[Q9],[Q10],[Q11],[Q12]	-	4	3.980
Perception of Smart-Building and Safety Integration	[Q13],[Q14],[Q15],[Q16]	-	4	4.125
Implementation Barriers and Challenges	[Q19],[Q20]	[Q17],[Q18]	4	3.887
Readiness and Expectations toward IoT Adoption	[Q21],[Q22],[Q23]	-	3	3.975

Table 4 presents a summary of the assessment results from 40 respondents for 25 statement items (Q1–Q25), covering aspects of understanding, readiness, and perception toward IoT-based building safety and smart building integration. The mean scores of each item range from 3,575 to 4,325, indicating generally positive responses from all participants. Most indicators fall under the "Good" to "Very Good" categories, suggesting that respondents possess high levels of understanding and awareness regarding the application of digital technology in building safety.

Overall, the interpretation shows that respondents comprising experts and practitioners in building safety, architectural planning, and informatics demonstrate good readiness in implementing IoT technologies and smart building concepts to enhance building safety. Items related to system integration and practical implementation (Q21–Q23) also show relatively high mean scores, reflecting a positive perception of the potential and benefits of applying these technologies in professional practice.

These findings indicate that both research and practical implementation of smart building technologies integrated with IoT have strong support and readiness among professionals. This suggests that the development of such systems could serve as a strategic direction for improving building safety in the future [5][6][7].

Table 5 presents the results of the validity and reliability tests of the research instrument, which consisted of six variables and twenty-five questions. Of these, twenty-three items used a five-point Likert scale, while two were open-ended questions designed to obtain qualitative responses. The validity test results showed that twenty items had correlation values higher than the r-table ($r > 0.312$), and therefore were considered valid, while three items did not meet this threshold. The reliability test produced a Cronbach's Alpha value of 0.884, indicating a high level of internal consistency and confirming that the instrument is suitable for further research applications.

Table 5. Summary of Validity and Reliability Analysis of the Questionnaire

Aspect	Description	Result	Interpretation
Number of Items Tested	Total closed-ended questionnaire items analyzed	23	
Valid Items (r > 0.312)	Number of items exceeding the minimum r-table value	20 valid, 3 invalid [Q8, Q17, Q18]	Most items are valid; three items did not meet the threshold
Average r-value (Corrected Item–Total Correlation)	Mean of all item–total correlation coefficients		Indicates good construct validity
σ_i^2 (Total Variance)	Total variance of each item. Shown at "Eq. (3)"	8,159	
σ_{total}^2(Total Score Variance)	Total score variance Shown at "Eq. (3)"	52,892	
Cronbach's Alpha	Reliability coefficient of the instrument	0,884	High reliability
Overall Interpretation	–	–	The instrument demonstrates good validity and excellent internal consistency

5. Discussion

The bibliometric mapping shows that research topics related to the Internet of Things (IoT), smart buildings, and building safety are still developing on their own paths. The connection between these themes has not yet been fully established, both in research and in practice. This suggests that the integration of IoT-based systems into building safety is still an area with growing potential rather than a field that has reached maturity.

Survey results from Indonesia indicate that experts and practitioners already have a high level of readiness to apply these concepts. Most respondents agreed that smart building and digital safety systems are necessary, and they believe they can adapt to such innovations. The open ended responses (Q24 and Q25) give a clearer picture of how things work in reality. Many respondents said that implementing smart building and safety systems is actually possible, as long as there is support from all sides, especially in funding, regulations, and human resource preparation. Some mentioned that it is easier to apply smart systems when they are included from the beginning of a project, while those introduced midway often face technical and financial challenges.

Interestingly, three items in the questionnaire were found to be invalid based on the validity test results, namely Q8 (*Understanding of data monitoring and automation in building safety*), Q17 (*Perception of high cost as a barrier to building safety implementation*), and Q18 (*Perception of limited experts as a main challenge in building safety implementation*). Their corrected item–total correlation values were below 0.312, which means these statements did not correlate well with the overall construct. When viewed in context, this finding seems relevant to the discussion: respondents may already understand the general idea of IoT-based safety but still have different perceptions about its cost and technical challenges. In other words, while conceptual awareness is high, the practical understanding of automation and resource constraints is still uneven among participants.

Several respondents also pointed out that smart building adoption in Indonesia mostly happens in large or government projects. Private project owners often consider these systems non essential, and the level of digital literacy among field workers is still limited. Another issue raised was the lack of attention to maintenance once the project is completed, mainly because of limited budgets and technical expertise. One respondent summed it up simply: "easy to apply but hard to maintain." This phrase reflects the gap between conceptual readiness and practical reality.

Some respondents expressed optimism, saying that the direction of development is becoming clearer. They referred to projects in Ibu Kota Nusantara (IKN) that have started to adopt smart building principles more completely. This shows that progress in Indonesia is underway, although its implementation across regions remains uneven. The adoption of smart building systems in Indonesia faces several major challenges, including high initial investment costs, limited digital infrastructure, and uneven public understanding of smart technologies. Furthermore, the distribution of technology use is still concentrated in urban areas, while many regions have yet to adopt smart building practices, highlighting the need for stronger policy support and public awareness [8]. Thus, in accordance with the statement that the realization of smart buildings in Indonesia is feasible but depends heavily on the adequacy of supporting infrastructure, seamless integration of intelligent systems, and sustainable material use [9].

In general, the results reveal a gap between theoretical readiness and what happens in practice. Experts and practitioners are aware of and ready for digital integration, but the actual implementation is still hindered by cost, regulation, and technical capacity. Strengthening the link between research, policy, and field implementation will be important to support wider adoption of smart building technologies in Indonesia.

6. Conclusion

This study shows that global research on IoT-based building safety continues to expand; however, bibliometric and VOSviewer analyses reveal that studies on smart buildings and safety systems remain weakly interconnected, forming separate clusters with limited thematic overlap. This fragmentation indicates that the integration between smart building technologies and safety management remains insufficient. Meanwhile, research in Indonesia has begun to follow this direction but still requires stronger support in terms of policy, standardization, and technological advancement.The validation and assessment results strengthen these findings. The Content Validity Index (CVI) from ten experts covering building safety, planning, and informatics shows high agreement by 0.84, confirming the relevance of all indicators. The instrument validity and reliability tests, consisting of six variables and twenty-five items, further indicate robustness 20 items were valid ($r > 0.312$) and the Cronbach's Alpha value was 0.884, signifying high internal consistency. In addition, a survey of 40 respondents on understanding, readiness, and perception of IoT-based building safety produced mean scores between 3.575 and 4.325, categorized as "Good" to "Very Good." These results demonstrate strong awareness and positive attitudes toward digital safety implementation. However, adoption remains constrained by high costs, limited skilled professionals, and insufficient policy support. Therefore, stronger collaboration among researchers, government, and industry is needed to accelerate the effective integration of intelligent systems into building safety management.

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