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Integration of Health and Safety (H&S) into Construction Procurement System: A Systematic Review

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Abstract

The construction industry is a major contributor to the economy of many nations; however, the industry is bedevilled by poor health and safety (H&S) records, leading to significant human and economic losses. This study systematically reviews the integration of H&S into the construction procurement system, identifying key drivers and barriers. Using a systematic literature review approach, 71 articles were analysed out of 21,407 records that were retrieved from Scopus and Web of Science databases to uncover the drivers and barriers to H&S incorporation into the procurement system. The study discovered the ambivalent influence of procurement methods, digital technology, legislation, and project ecosystem on H&S integration. The findings reveal that traditional procurement methods, low technology adoption, inadequate legislation, and negative management actions are major barriers. Conversely, modern procurement methods, robust digital technologies, clear legislative frameworks, and positive management actions serve as drivers. The study highlights significant research gaps, including limited empirical evidence on the long-term impact of procurement methods on H&S outcomes, especially in developing countries, and proposes future research directions to enhance H&S integration in construction procurement. There is a need for the enactment and enforcement of robust legislative frameworks that mandate

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H&S considerations in the construction procurement system. Also, contractors need to adopt modern procurement methods and leverage digital technologies to enhance H&S.

Keywords: *Health and Safety (H&S), Construction Procurement System, Digital Technology, Legislative Framework, Project Ecosystem*

1. Introduction

The construction industry significantly drives socio-economic development and serves as a crucial employment multiplier in every country. Due to its high labour intensity, it is one of the largest employers and makes a substantial contribution to the economy. It is therefore not a gainsaying that the economic health of a nation depends on the success of the construction sector. For instance, in many developing countries, the construction industry accounts for up to 10% of GDP and employs approximately 10% of the formal workforce (Pheng and Hou, 2019). Similarly, in developed economies, the sector spans across primary, secondary, and tertiary industries, contributing not only through direct employment but also through its influence on infrastructure development, housing, and industrial growth (Olanrewaju, 2025). Meanwhile, numerous construction projects do not achieve the anticipated benchmarks of cost, quality and time (Rivera et al., 2016). One factor that influences such performance has been the poor health and safety (H&S) metrics within the construction sector. Umeokafor et al. (2023) opined that in many nations, the construction industry has reported more deaths and fatal injuries than in many sectors of the economy. Meanwhile, the cost of injury, such as compensation, medical bills, missed wages, and replacement training, which affect income and performance of projects, contributes to the spread of poverty and negatively impacts the achievement of the Sustainable Development Goals (SDGs) (Chigara and Smallwood, 2016). The adverse effects of H&S issues in the construction industry on society have raised significant concerns in recent years. Consequently, many nations have mandated that the construction sector protect the occupational health and safety of its workers and the public affected by its operations. This can be achieved by preventing and mitigating inherent H&S risks during the construction process and addressing hazards related to the intended activities of end users.

While numerous studies have identified various factors influencing H&S in construction, the procurement system is widely regarded as a major determinant (Umeokafor et al., 2023; Mosey, 2025). The construction procurement system, which involves activities such as identification of construction specifications, market procurement, tender selection, tender assessment, contract allocation, and management and evaluation of construction execution (Boadu et al., 20021), is perceived as a major determinant of the H&S in construction works. This is because the procurement system sets the tone for behaviours and practices that will continue through the building design, construction, occupation, and maintenance phase of a building project (Mosey, 2025). The quality of the construction procurement system is therefore related to the safety of the people's lives and property (Bu et al., 2020). How the construction procurement system is managed can determine the likelihood that a building is safe (Mosey, 2025). For instance, the Grenfell Tower disaster in the UK, where 70 people died and many others were injured, was largely attributed to the procurement practices that were adopted (Mosey, 2025). Adaku et al. (2021) argued that the seeds of fatality and ill health are often planted during the procurement stage of construction when H&S considerations are not integrated into the process. Again, Boadu et al. (2021) discovered that

the level of consideration given to H&S at the procurement stage influences H&S consideration at implementation and other stages of the construction. Meanwhile, Boadu et al. (2021; 2022) and Umeokafor et al. (2022; 2023) reported that H&S are usually not considered in the construction procurement process. While the overriding importance of human life and health ought to make H&S considerations more important than other construction project objectives, this is unfortunately not so in many construction projects (Donkoh et al., 2015; Umeokafor et al., 2023).

The exclusion or minimal consideration of H&S in the procurement of construction projects – often linked to poor H&S performance in the industry – may be a result of certain factors which either act as enablers or barriers to the incorporation of H&S into the construction procurement system. Although studies from Boadu et al. (2022), Chiagara et al. (2022), and Benviolent and Smallwood (2016) have explored aspects of health and safety (H&S) in construction procurement, these efforts are often fragmented and lack a comprehensive synthesis of the drivers and barriers. Moreover, there is limited systematic review research that consolidates findings across ambivalent factors. This study addresses this gap by providing a holistic and updated review using the PRISMA methodology by reviewing published articles between 2014 to 2025. The objective of the study is to analyse the drivers and barriers influencing the integration of H&S into the construction procurement system. The review also identifies potential areas for future research and direction. The remainder of this article is structured as follows: the next section outlines the research methodology. This is then followed by the findings section, where the results of the literature review are presented. Section four discusses the findings, and section five concludes the article.

2. Methodology

This study adopted the systematic literature review approach in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). The PRISMA methodology involves a structured process of identifying and retrieving relevant literature using appropriate databases, screening and selecting appropriate articles for review and synthesising and reporting on the findings (Page et al., 2021). Each of these steps, as applied in this study, is discussed in the following subsections.

2.1 Literature search

Web of Science and Scopus databases were used to search and identify relevant articles suitable for inclusion in the review. The choice of the two databases is a result of their wide coverage of Architecture, Engineering and Construction (AEC) research (Adebowale and Agumba, 2024). Search queries using the most frequent synonyms of the research concepts were utilised. Database protocols concerning the application of Boolean operators: AND, OR, and appropriate truncations (*) were employed. Specifically, the search query: TITLE-ABS-KEY ((("procurement") OR ("bid") OR ("tender*")) AND (("construct*")) AND (("Design for Safety") OR ("DfS") OR ("Safety in Design") OR ("SiD") OR ("Safety through Design") OR ("Prevention through Design") OR ("PtD") OR (“Health and Safety”))) was employed to search for Title, Abstract and Keywords form the two databases.

2.2 Article selection and eligibility criteria

Three inclusion criteria were employed to select appropriate articles from the databases. The criteria include articles published in peer-reviewed scientific journals that are in the English Language and published within the timeline of 2014 to 2025. Therefore, grey literature such as conference proceedings, theses, and policy briefs was excluded. Also, articles that were grouped in non-related fields to the subject of the research, such as articles indexed in subject areas like medicine, pharmacy, and agriculture, were excluded. The automation tools in the two databases were used to exclude articles that did not meet the inclusion criteria. In addition, duplicate papers from the two databases were removed.

2.3 Screening, retrieval, and review of relevant articles

The title, abstract and other details such as authors' names and affiliations, and year of publication of the eligible articles were exported as a Microsoft Excel spreadsheet from each of the databases. Afterwards, the screening was performed to select articles that applied to answering the study's research questions. The full text of the selected articles after screening was later retrieved. All the retrieved papers were carefully reviewed, and the necessary data from them were extracted and coded accordingly. The information extracted from the selected articles was organised into a narration to answer the study's research questions.

3. Results

Figure 1 shows the results from the literature search and the selection process. A total of 21,407 records were retrieved from the two databases: 352 and 21,055 from Scopus and Web of Science, respectively. The number of records was reduced from 21,407 to 239 after removing ineligible articles, including those that were not peer-reviewed articles in journals, not written in English or published before 2014. Additionally, 57 duplicate records from the two databases were removed, resulting in 197 articles eligible for screening. Out of the 197 records selected for screening, 125 were excluded based on their titles and abstracts, as they were not relevant to addressing the research questions of the study. This makes a total of 72 articles left for full-text retrieval. Out of this figure, only 1 article was not retrieved as a result of incomplete information provided in the database. Finally, 71 articles with full texts were retrieved and subjected to full article review, and necessary data were extracted and coded qualitatively. Specifically, information on the drivers and barriers to the incorporation of H&S into the construction procurement system was extracted from each article and analysed qualitatively using thematic analysis to inform the findings of the study. A total of 43 articles were ultimately included in the systematic review. The synthesis of the reviewed literature is presented in the next section as a discussion of the findings.

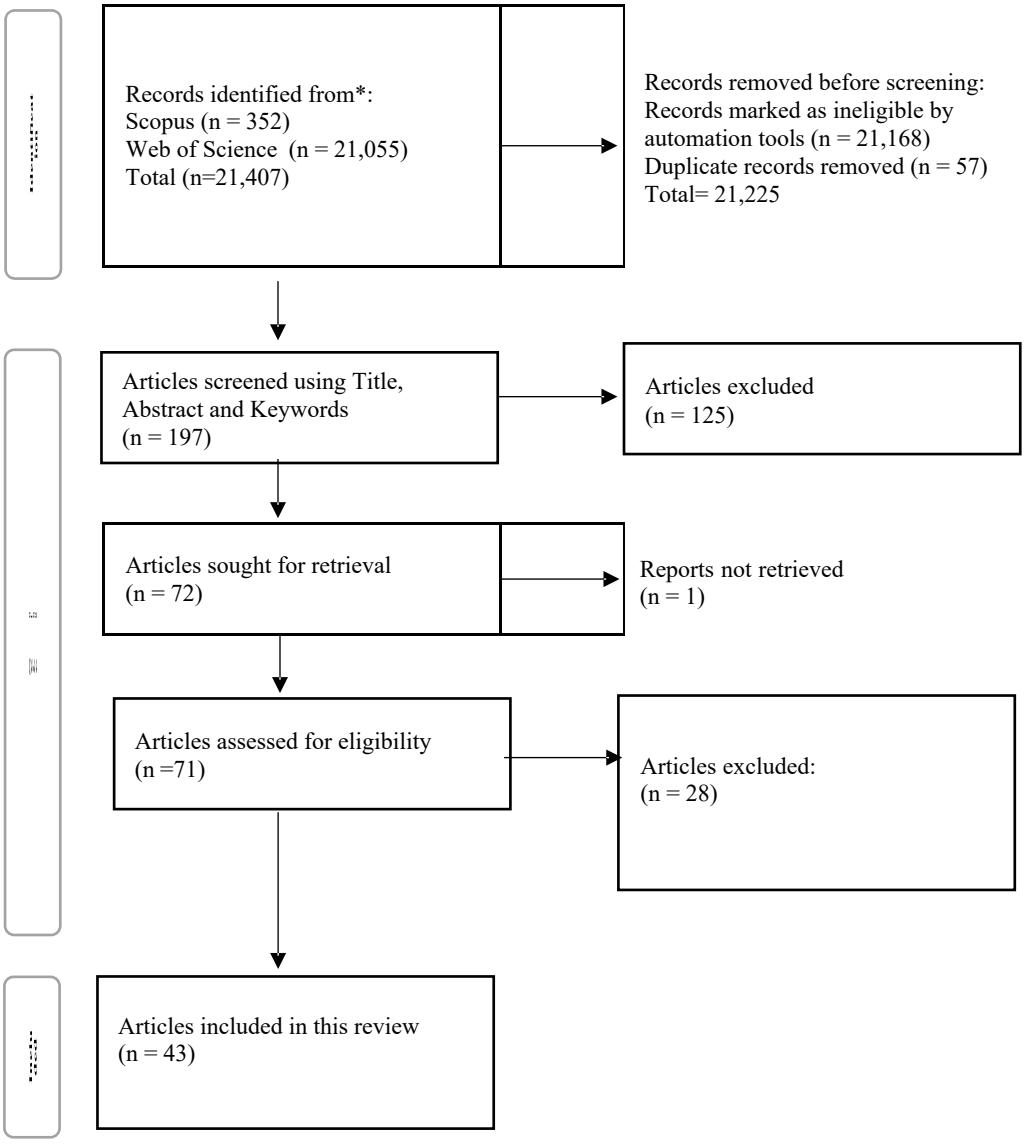

Figure 1: The results from the literature search and the selection process
Source: Author's diagram adapted from Page et al. (2021)

4. Discussion of findings

4.1 Drivers and barriers to the incorporation of H&S into the construction procurement system

From the review of the literature, the drivers and barriers to the incorporation of H&S into the construction procurement system can be categorised into four items: procurement method, digital technology, legislation and project ecosystem.

4.1.1 Procurement method

Procurement is the process of acquiring the resources required for a project. Procurement methods are approaches used to obtain construction services and coordinate construction activities (Windapo et al., 2022). There are three procurement methods: traditional, integrated and management-oriented (Windapo et al., 2022). These can be categorised into traditional and modern procurement methods, with the latter encompassing both integrated and management-oriented approaches. The procurement method adopted for a construction project is determined by the integration of H&S into the procurement system. This connotes that the chosen procurement method can either be a driver or a barrier to the incorporation of H&S within the construction procurement system.

The results of the literature review revealed that the adoption of the traditional procurement method can serve as a barrier to the incorporation of H&S in the procurement system and throughout the construction process. Studies from Umeokafor et al. (2023), Boadu et al. (2021; 2022; 2023), Lestari et al. (2020), Dissanayake et al. (2022), Benviolent and Smallwood (2016) and Zavadskas et al. (2017) have confirmed that the traditional procurement method does not support H&S. This is because, in the traditional procurement approach, the functions of design and construction are separated (Windapo et al., 2022), which results in inadequate consideration of H&S. In this approach, the contractor and the designer have minimal or no influence on the design and construction processes, respectively. This separation has been recognised as having a detrimental impact on constructability and on the extent to which H&S can be integrated into the design (Boadu et al., 2022).

In contrast, modern procurement methods – such as integrated and management-oriented procurement methods – provide a single point of responsibility for both design and construction that enables more effective management of H&S throughout the design and construction phases compared to traditional methods (Lingard et al., 2018). When procurement processes are interconnected through the selected method, all project components work together in synergy to optimise the procurement processes. This leads to collaboration across all levels and improves H&S. The integration allows stakeholders to collaborate more effectively throughout the construction process (Zhang et al., 2022; Lingard et al., 2018). This strategy has been described as an integrated framework (Boadu et al., 2023), a holistic approach (Jain et al., 2024), an analytical network approach (Hasnain et al., 2018), and collaborative procurement (Zhang et al., 2022; Lingard et al., 2018).

Apart from the separation of design and construction in the traditional procurement approach, other issues can jeopardise H&S in the traditional procurement approach. For instance, Mosey (2025) contends that issues such as inadequate specifications, an excessive focus on cost, and adversarial contracting, because of the procurement model implemented, can make it difficult to consider H&S in building projects. Regarding cost, when a traditional procurement approach uses an arm's length single procurement approach, it can encourage inappropriate behaviours. This is because the emphasis often shifts toward meeting the minimum standards of materials and workmanship, thereby undermining H&S. This phenomenon, referred to as "race to the bottom" in Judith Hackitt's report, is detrimental to H&S outcomes (Mosey, 2025).

In addition, management-oriented procurement methods possess the capacity to integrate H&S more effectively than other methods because of the timely engagement of experts within the project team. According to Boadu et al. (2022), certain variants of this method are characterised by substantial overlap between project phases, which can introduce challenges. The collaboration of multiple consultants as a temporary management organisation may lead to conflicts arising from differing perspectives on H&S among the participating firms. The involvement of multiple layers of subcontractors in this procurement method may hinder the achievement of the project's H&S goals. As Boadu et al. (2021) noted, subcontracting in construction projects can compromise work quality and, in turn, negatively affect H&S protocols. Furthermore, the employment of labour-only subcontractors may result in insufficient training and education around H&S, thereby impeding the achievement of H&S objectives (Umeokafor et al., 2023).

Another issue associated with the traditional procurement system is the evaluation of tenders and the selection of contractors. While various criteria can be used in contractor selection, the traditional procurement approach tends to rely on price/cost attributes (Boadu et al., 2022). However, the lowest tender price does not inherently represent the best solution. Yao et al. (2022) discovered there is a relationship between low-price bids, general sub-contracting management and unsafe behaviours that compromise H&S. It can therefore be argued that clients should minimise the emphasis on traditional project objectives and instead prioritise H&S within the project. Securing a low tender price for the client could come at the expense of employee H&S (Mosey, 2025).

Windapo et al (2022) argued that cost-saving approaches in contractor selection might be detrimental to the H&S objectives of the project. Similarly, Lestari et al. (2020) showed that an improved tendering process reduces hazards on construction site and improves H&S. Furthermore, Jain et al. (2024) noted that an effective contractor selection is crucial for successful execution and meeting the project objectives including H&S. The study recommended a holistic approach of contractor selection as a precursor to an effective contractor selection.

Further considerations regarding contractor selection include Hasnain et al's (2018) proposition for the use of an analytical network process as an alternative to traditional procurement strategies in order to enhance H&S in construction projects. Given the importance of tender evaluation and contractor selection to H&S performance, Wells and Hawkins (2011) advocated that one of the criteria for tender evaluation should be whether the contractor includes H&S items in the bill of quantities. They further argued that if these H&S items do not meet the client's requirements, the tender may be deemed non-conforming or invalid and subsequently rejected. The expense associated with fulfilling the project's H&S objective may be excluded from the competitive tendering process (Chan et al., 2010).

Another challenge is the consideration given to H&S in the traditional procurement approaches. For instance, Dissanayake et al. (2022) found that H&S ranked fifth among the criteria used for contractor selection. Similarly, Benviolent and Smallwood (2016) observed that in public construction project procurement, factors like bid amount, the contractor's financial status, and project delivery time are prioritised over H&S. In the same instance, Kukoyi et al. (2020) noted

that H&S is not viewed as a vital pre-qualification criterion for contractor selection in a public project within developing countries.

Collectively, these findings underscore that adequate weighting of H&S could be a factor affecting the integration of H&S into the construction procurement system. However, studies from Zavadskas et al. (2017) and Acheamfour et al. (2019) have shown that project success correlates more strongly with a contractor's technical ability, H&S record and management experience than the bid price.

Unlike the traditional procurement method, which focuses primarily on cost, a more robust approach can be used for contractor selection. Research by Ying et al. (2022) and Zubair et al. (2022) demonstrated that using the Best Value Procurement (BVP) results in better H&S performance than the traditional procurement approach based on using project cost. BVP is a procurement approach that evaluates vendors based on multiple criteria beyond just price, such as quality, reliability, and expertise. It incorporates both price and non-price attributes such as contractor qualifications, demonstrable experience and technological capability to improve the effectiveness and efficiency of the construction procurement (Ying et al., 2022). Therefore, the use of modern contractor selection approaches like BVP can be a driver of the integration of H&S into the construction procurement system.

4.1.2 Digital technology

Digital technology provides the golden thread that integrates design, construction and operation to support building safely (Mosey, 2025; Azmy and Mohd Zain, 2016). One digital technology that has been widely recommended is Building Information Modelling (BIM) (Pan and Zang, 2023; Zhang et al., 2022). BIM is characterised as a digital and virtual representation of a project within a unified virtual model, facilitating a collaborative environment among all project teams (Porwal and Hewage, 2012). The process entails developing a digital parametric model of a building alongside a database infrastructure that facilitates shared knowledge and decision-making throughout the building project's life cycle (Olapade and Ekemode, 2018). Some of the benefits BIM offers for construction procurement and H&S include risk identification and mitigation, enhanced communication (Nnaji and Karakhan, 2020), training and simulation (Abina et al., 2023), and automated safety check, real-time monitoring (Rane, 2023) and improved decision making (Brandel, 2024). Zhang et al. (2022) argued that BIM enables collaborative procurement, allowing stakeholders to access real-time data. Similarly, Collinge et al. (2022) demonstrated the use of digital tools and safety libraries to assist designers in addressing H&S within the BIM digital environment, thereby enhancing the integration of H&S into the procurement system.

Despite the enabling role and benefits that digital technology brings to the integration of H&S into the construction procurement system, its adoption within the construction industry remains relatively low (Agarwal et al., 2016; Nnaji and Karakhan, 2020). For instance, Nnaji and Karakhan (2020) noted that the construction industry is among the least digitalised industries in many countries. In addition to the low level of technology adoption, there are also technical challenges associated with the implementation of digital technologies. Compatibility issues across different platforms can impede the effectiveness of technology in supporting H&S objectives (Daniel et al., 2024). Furthermore, the performance of digital tools can be compromised due to poor internet

connectivity on construction sites, software bugs and hardware malfunctioning (Daniel et al., 2024; Nnaji and Karakhan, 2020). Collectively, these issues reinforce the argument that while digital technology holds great potential, it can also be a barrier to the integration of H&S into the construction procurement system.

4.1.3 Legislation

Legislation plays a critical role in promoting H&S within construction projects. Martínez-Aires et al. (2016) highlighted the importance and positive influence of the EU Directive 92/57/EC on H&S in the project design phase. When legal frameworks recognise client and designer responsibility towards H&S practices, it impacts H&S specification (Boadu et al., 2022). Furthermore, Martínez-Aires et al. (2016) discovered that when H&S regulations explicitly assign roles and obligations to project stakeholders, it becomes easier to integrate H&S requirements into the construction procurement system. In this regard, Donkoh et al. (2015) advocated that clear H&S criteria should be embedded in tender assessments and bid pricing. However, in defective institutional environments, the risk of non-compliance increases (Lu et al., 2024). Umeokafor et al. (2023) noted that the lack of strong H&S legislation might be a barrier to client involvement in H&S.

In the same instance, Donkoh et al. (2015) noted that when procurement laws do not address H&S practices, these are unlikely to be factored into evaluating the tender and subsequent contractual requirements. The authors therefore recommended the inclusion of a non-ambiguous H&S requirement in the tender process and the pricing of H&S items into the Bill of Quantities (BoQ) to ensure their inclusion in the tender evaluation process.

Adebowale and Agumba (2024) further emphasised that the lack of a well-defined safety regulations framework is a key factor affecting the performance of H&S in construction projects across African countries. Moreover, Liu et al. (2022) stressed that even when regulations exist, inadequate enforcement mechanisms make it difficult to integrate H&S into the construction procurement system.

4.1.4 Project ecosystem

The factors categorised under the project ecosystem represent the comprehensive environment in which a construction project operates, encompassing all the interacting elements that influence the incorporation of H&S within the procurement system. These include management actions, attitudes toward H&S, project types and funding sources. As such, the project ecosystem can function either as a driver or barrier to the incorporation of H&S. For example, Boadu et al. (2022) contended that positive management actions – such as establishing clear H&S objectives, appointing qualified designers and including H&S practices in project estimates – can facilitate the integration of H&S into the construction procurement system. Conversely, negative management behaviours can be a barrier to this integration. For example, these can be poor attitudes (Boadu et al. 2023), failure to treat H&S as a vital contractual element (Kukoyi et al., 2022) and a lack of H&S knowledge (Boadu et al. 2023). Another aspect of the project ecosystem that could serve as either an enabler or barrier to the integration of H&S includes the client type and funding sources (Boadu et al., 2022; Onubi et al., 2022). Boadu et al. (2022) found in their study conducted in Ghana that the extent of H&S integration into the procurement process was

prioritised for public projects funded by international organisations but ignored for projects funded by the government.

4.2 Framework for integrating H&S into the construction procurement system

Considering the interdependence and ambivalent nature of the drivers and barriers to the integration of H&S into the procurement system, a visual conceptual framework is presented in Figure 2.

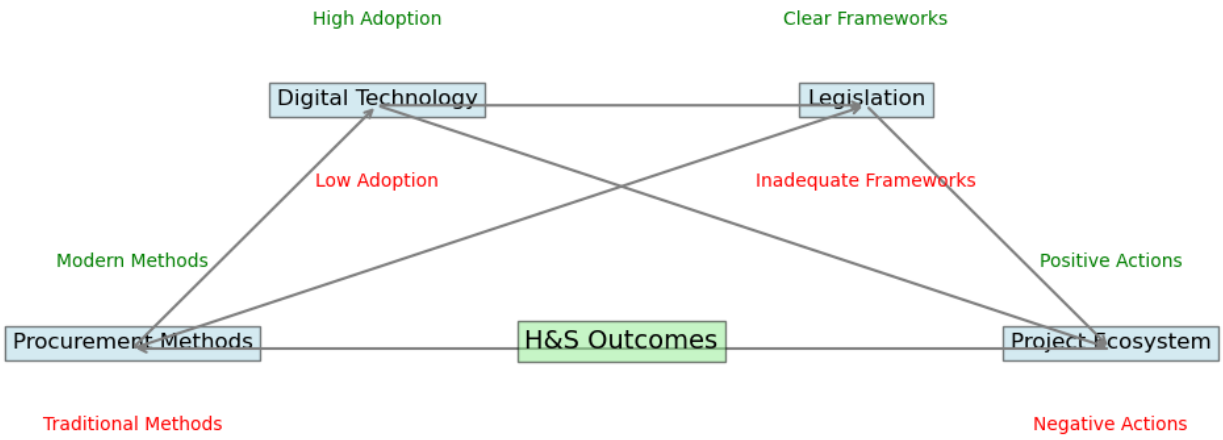

Figure 2. A multi-dimensional framework for integrating health and safety into construction procurement systems

Figure 2 illustrates the interdependencies among the four key dimensions: procurement method, digital technology, legislation, and project ecosystem. The framework emphasises that improvements in one dimension can reinforce progress in others, thereby contributing to positive H&S outcomes. For instance, the adoption of modern procurement methods, widespread use of digital technologies, the presence of a clear legislative framework, and proactive management practices within the project ecosystem can collectively enhance H&S's performance. Conversely, reliance on traditional procurement approaches, low levels of technology adoption, inadequate legislative provisions, and negative organisational behaviours can lead to poor H&S outcomes. These interconnections highlight the criticality to adopting a holistic and integrated approach that simultaneously strengthens all four dimensions to ensure sustainable and effective H&S integration within construction procurement systems.

5. Conclusion

This study presented a comprehensive review of the integration of H&S into the construction procurement system, identifying key drivers and barriers. The findings indicated that traditional procurement methods, low technology adoption, inadequate legislative support, and negative management actions are significant barriers to H&S integration. In contrast, modern procurement

methods, the adoption of robust digital technologies, the introduction of clear legislative frameworks, and positive management actions serve as drivers. This study advances the existing body of knowledge by synthesising the literature into a four-dimensional framework that categorises the drivers and barriers influencing H&S integration. Unlike previous studies that examined these factors in isolation, this review revealed the interconnections between procurement methods, digital technologies, legislative frameworks, and project ecosystem dynamics.

The study underscores the critical role of procurement methods in shaping H&S outcomes in the construction industry. Traditional procurement methods, marked by the separation of design and construction phases, often fail to effectively integrate H&S considerations. In contrast, modern procurement methods, such as integrated and management-oriented approaches, facilitate better collaboration and centralise responsibility, thereby enhancing H&S performance. In addition, digital technologies, particularly BIM, offer significant potential to improve H&S integration within construction procurement processes. However, low levels of technology adoption across the construction industry, coupled with technical challenges such as compatibility issues and poor internet connectivity, remain significant barriers. Legislation also plays a vital role in promoting H&S in construction projects. Clear and enforceable legislative frameworks that embed H&S considerations in procurement processes can drive better H&S outcomes. However, in many regions, the lack of well-defined safety regulations and inadequate enforcement mechanisms hinders effective H&S integration. Finally, management practices within the project life cycle are important: positive and informed management actions can drive H&S outcomes, while negative management actions, such as poor attitude and lack of H&S knowledge, can act as barriers.

Furthermore, the findings of this study carry significant implications for policy, practice, and research. For policymakers, the results highlighted the need for robust legislative frameworks that mandate H&S considerations in construction procurement, supported by clear regulations and enforcement mechanisms. For industry practitioners, the adoption of modern procurement methods and digital technologies is essential, alongside investments in training and capacity building. For researchers, the study identified critical areas for further investigation, including the impact of procurement methods, digital technologies, legislative frameworks, and management actions on H&S outcomes. These insights can inform the development of targeted interventions and policy reforms, such as integrating H&S metrics into contractor selection and offering incentives for technology adoption.

While this study offers a comprehensive synthesis of the literature on H&S integration in construction procurement, several research gaps remain. There is a need for more empirical and longitudinal studies to assess the long-term, individual and combined effects of procurement methods, legislative frameworks, digital technologies, and project ecosystem dynamics on H&S performance. Additionally, although this study employed the PRISMA methodology to consolidate fragmented evidence, it did not include a bibliometric analysis to examine publication trends across regions or over time. Future research could complement this work by mapping scholarly output, identifying influential contributors, and exploring regional or temporal trends in H&S-related procurement research.

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