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Benefits of Implementing Occupational Health and Safety Management Systems for the Sustainable Construction Industry: A Systematic Literature Review

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Abstract: Accidents are more prevalent in the construction industry compared to other economic sectors. Therefore, understanding the benefits of occupational health and safety management systems (OHSMSs) in terms of their sustainable implementation, management and performance, as well as the awareness of OHMSs and barriers to their implementation, are important for improving OHSMSs in the sustainability of the construction industry. Although there is considerable research on OHSMSs, further assessments are needed concerning other aspects of OHSMSs, particularly the benefits of OHSMSs. Thus, this review paper summarises the empirical state of the art of OHSMS activities. Scopus, Web of Science and other databases were searched using predefined standards. The query was limited to articles published from 1999 to 2023. Consequently, one hundred and four articles were selected and analysed. These articles present analyses of OHSMSs and their potential benefits concerning the implementation of OHSMSs and management, performance, awareness, and barriers in relation to OHSMSs. The results reveal that 12.50% of the reviewed studies assessed the implementation of OHSMSs in the construction industry, and 25.96% studied the management of OHSMSs. Analyses of the performance of OHSMSs in the construction industry accounted for 8.65%, analyses of the awareness of OHSMSs accounted for 4.81%, model-related analyses accounted for 13.46%, studies on the significance/benefits of OHSMSs accounted for 3.85%, studies on the barriers/challenges associated with OHSMSs accounted for 5.77%, analyses on the safety indicators of OHSMSs accounted for 2.88% and other types of studies accounted for 20.19%. This study further reveals that the implementation of OHSMSs is characterised by a dearth of proper communication, the non-utilisation of personal protective equipment (PPE), wrong postures and work activities, a dearth of training, physiological factors including burnout and stress, and a dearth of safety culture and orientation; in addition, matters relating to compliance with effective laws are significant safety challenges in the construction industry. However, the rationality for evaluating the benefits of OHSMSs, comprising their implementation, management and performance, as well as awareness of and barriers to OHSMSs, is challenging to authenticate because appropriate field, survey, organisational and clinical data concerning incident occurrences in the construction industry are lacking for comprehensive evaluations. Thus, this novel study presents our effort to narrow this gap by establishing a framework for increasing our understanding of the benefits of implementing OHSMSs and accident reduction.

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1. Introduction

Natural and human-caused fatalities are more pronounced in the construction industry than in other economic sectors worldwide due to a dearth of sustainably implemented occupational health and safety management systems (OHSMSs). For instance, from 1996 to 2005, 20% of the industrial accidents in Hong Kong, South Korea and Japan were associated with construction practices [1,2]. In Hong Kong alone, there were 3723 construction-related accidents in 2015, and 62% of the industrial death toll occurred in the construction industry [1,2]. The construction industry's high rates of accidents and fatalities can be associated with its dangerous working environment and quickly changing work practices [2,3]. The occupational health and safety management system (OHSMS) was introduced in the 1980s to lessen the dangerous conditions, curtail the risks of injury and reduce the wastage of materials in the building industry [3,4].

For example, the United Kingdom's Advisory Unit of Health and Safety Executive (HSE) approved an occupational and health safety law to authorise the SMS's introduction in 1989 [5]. Studies on the OHSMS indicated a significant reduction in the rate of accidents in the construction sector immediately after the adoption of OHSMSs in countries such as Hong Kong [2,6]. Thus, reviewing the factors influencing the successful adoption of OHSMSs and achieving sustainable improvement in the construction industry is essential.

The objective of the sustainable OHSMS is to limit the risks associated with occupational health and safety (OHS) and continuously improve these conditions in the organisation [7]. Based on the OHS Assessment Series, OHS involves the factors and conditions that may affect the health and safety of workers, visitors or other individuals on the construction site. Thus, an OHSMS can be a part of a company's more comprehensive management system. An OHSMS can be applied to establish and execute policies and manage occupational health and safety (OHS)-associated risks [7]. The 18001 standards of the Occupational health and Safety Assessment Series (OHSAS) offer requirements for OHS management in companies. The series was established via a selection of critical trade agencies, certification agencies and international standards to fill the gap concerning the dearth of international OHS criteria [7,8]. Generally, new studies concerning OHSMSs were limited to specific topics, including the certification process, its influence on organisational performance and workers' attitudes concerning risky behaviour and its impact on work-related accidents. For instance, Wanjiku [9] assessed the effectiveness of the OHSMS in the building industry. The study revealed that the dearth of safety rules was among the significant sources of health risks for casual construction workers. The study further revealed the positive impact of knowledge on health outcomes, though it was not significant. At the same time, practice, attitude and management prioritization significantly impact employee health. These studies did not focus on the benefits of OHSMSs. In addition, they mainly focused on small and medium enterprises (SMEs).

Additionally, these studies were limited in their geographical scopes since they focused mainly on individual countries. Regarding this research gap, this study was conducted to review the benefits of implementing OHSMSs in the construction industry. However, filling this gap requires understanding the factors contributing to the sustainability of OHSMSs. This study will enable the identification of the benefits of implementing OHSMSs.

Although there are rules, regulations, instructions and enforcements, improvements in occupational risk remain an unresolved challenge. Companies and their managers do not control the quality of OHS; thus, they wait for guidance on what to do concerning each risk. This paucity of control is drawn from international hazards which caused thousands of workers to lose their lives and the loss of properties worth billions of dollars. According to Oke et al. [10], these incidents include Oppa, Germany, 1921; Honkeiko Colliery, China,

1942; Texas City, USA, 1947; Cali, Colombia, 1956; Flixborough, UK 1974; Chasnala, India, 1975; Seveso, Italy, 1976; Novosibirsk, USSR, 1979, Alexander, Kielland, 1980, Mexico City, Mexico, 1984, Bhopal, India, 1984, Chornobyl, USSR, 1986, North Sea, 1988 and Rana Plaza, Bangladesh, 2013, which were attributed to poor OHS applications.

Likewise, different types of injuries, including musculoskeletal disorders, were encountered. These factors have contributed to the rise of OHSMS methodology, including the wider OHS reformations of the 1970s and 1980s [11,12]. Most advanced countries reviewed their regulations concerning health and safety in the 1970s [13,14]. There were three significant intervention guidelines created by the government which comprised the following factors: (i) a focus on the responsibility of companies with respect to OHS policy, (ii) the development of better standards and full legislation, which are still disjointed in many countries, to improve safety and health at work and impose better regulations, (iii) the stimulation of workers' participation in OSH rules [15,16]. Health and safety concerns include cancer, heart disease and physical fatigue [17]. Others comprise the increasing focus on novel problems, including stress and establishing an environmental framework of reference for analysing the relationship between humans and the environment [18].

Conversely, in many countries, workers' preoccupation with health and safety was vehemently expressed through industrial action [10], notably in Scandinavia, in a public-sector mining company in Northern Sweden (i.e., the LKAB clash). The development of the British Robens Report in 1972, with its implementation of the development of self-regulation, was likewise the primary facilitator of change [10]. The Scandinavian working environment reorganisations were instrumental in the institution of statute laws in most European countries and other countries, including Australia and Canada [10]. The OHSAS Project Group was established, and there was a subsequent increase in OHSMS certification in some nations, growing from 70 to 102 from 2003 to 2007, and the estimated OHSAS 18001 certifications increased from 3898 to 31,512 [10]. The global expansion of the supply and demand chains and occupation was strengthened via the increasing approval of OHSMSs by regulatory agencies [10]. Thus, if implemented, OHSMSs will support improvements in the quality of safety and health and legal conformity and will likewise increase the OSH performance of companies [10]. These factors have constituted some barriers to the development of OHSMSs and resulted in a limited understanding of the benefits of OHSMS implementation. Therefore, this study was conducted to fill this gap by confirming the benefits of OHSMSs with respect to employee safety and the indicators contained in the process of implementing OHSMSs in the construction industry.

The detection, measurement and categorisation of potential safety risks in the USA indicated that two factors are correlated with objectionable OHS risks in the United States' building sector. This type of finding is expected to offer benefits to safety experts, scholars, engineers and all stakeholders within the building sector by offering proof of how their selected sustainable designs may affect OHS on construction projects [1]. Studies in the USA further revealed a significant potential for workplaces to progress and increase their productivity with the incorporation of artificial intelligence (AI) tools and their application on project sites. However, there are significant OSH-related questions arising as AI in incorporated into project sites. Discrimination, stress, intensified precariousness, musculoskeletal conditions and the potential for job intensification and job losses are posing psychosocial risks, in addition to physical violence on computerised project sites [2]. These risks are increased when AI increases the use of high-tech tools which already exist or are freshly presented for project site design and management. Certainly, AI aggregates OHS risks for computerised project sites since it enables increases in anxiety and stress. AI emphases the imperative of giving more potential and credible authority to forecasting tools, robotics and algorithmic processes on the project site. Thus, the implementation of technologies creates positive and negative conditions [2].

Yap et al. [3] explained the immigrant health advantage concerning self-protection and selection with respect to health-related factors between five major groups of national origin in the United States. The results indicated a statistically strong self-selection, especially

between higher-skilled and lower-skilled undocumented male immigrants. The study further revealed strong and significant self-protection with respect to smoking for immigrant groups with robust relative social capital. OHS among hotel housekeepers in the United States was assessed by Khorasane et al. [4]. This study is among the few empirical studies to address the working conditions of housekeepers in the USA and their perception of the health problems they encounter. Hotel housekeepers comprise the industry's biggest workforce while facing challenging conditions, health risks and psychological stress. The studied housekeepers worked under considerable time pressure to handle unwarranted workloads and experienced biological and chemical exposures and psychosocial and physical strains. Additionally, poor working tools/inadequate supplies had adverse effects on the health of the hotel housekeepers, comprising heavy, wet towels and vacuum cleaners, which had considerable impacts on strains and sprains, and poor sanitary supplies, which had a considerable impact on chemical burns. All these issues might have some negative impacts on the sustainable implementation of an OHSMS and the workers' wellbeing.

The workers' expectation to be able to work effectively without encountering harm due to profit-generation activities is a sign of a responsible, mature, equitable and sustainable construction industry [1]. The international labour organisation (ILO) estimated that over 60,000 deadly accidents happen yearly on project sites around the world, signifying one deadly accident every 10 min [2,3]. Construction accounts for one-sixth of yearly fatal accidents recorded [4]. Additionally, the ILO estimated that the building sectors in advanced nations employ between six and ten percent of workers but account for twenty-five to forty percent of job-related deaths [5]. Correspondingly, the effect of work on the health of construction employees is important. The ILO estimates that 30% of construction employees in certain nations face back pain or other musculoskeletal ailments [6].

These are shocking revelations which indicate the need for a coordinated and determined effort to evaluate, develop and implement novel approaches to tackling these intractable problems [7]. The motivation for this review was the belief that policy makers, union groups, industry workers and scholars must pay more attention to interface and integrate issues in the management of occupational health and safety (OHS) in the building industry. This review was informed by the increasing recognition that addressing OHS as a single enterprise is no longer adequate to bring about significant and sustained improvement in OHS in the construction industry.

Building projects are organisationally and technologically complex. Traditional risk management approaches assume that work can be decomposed into its component parts [8]. Each of these component parts is then subjected to a risk evaluation, and suitable control measures are chosen. The problem with this technique is that the decomposition of composite systems is of narrow value when the system's components are in continuous, vigorous interaction with one another. It is not easy to forecast whether these interactions will create new OHS risks at the intersection between technologies, organisations, activities and components [9]. If undetected, these risks are uncontrolled. In construction, there is need to manage the influences and interests of multiple project stake holders and contributors who, either unconsciously or consciously, exert an influence on OHS [10].

Thus, coordinating the activities of various contributors to the construction and design of a facility can be difficult since each participant will be subject to their interactions with other participants in the project, though they each pursue their own organisational or individual business interests [11]. It is vital to ensure compatibility among the components that comprise a service and to warrant that the building and installation techniques implicit in the design of the parts do not yield unexpected risks or unacceptable hazards at their interfaces [12]. The activities of various working groups and trades require cautious management to warrant that work procedures are outlined to minimise the likelihood of adverse effects. The physical setting of the project site itself creates coordination challenges since workers, equipment and materials are continuously moving in the environment and the scenery changes every day [13]. The conditions for these tasks are the labour-intensive nature of building activities and a substantial dependence on subcontracting.

These factors have formed conditions for the construction workforce in which occupations are modest and opportunities to become involved in collective bargaining and OHS training are inadequate [14]. Studies indicate that those at the bottom of the contractual chain suffer the most substantial effects when things go wrong.

This review presents a collection of thought-provoking research articles, each of which addresses the barriers and benefits of implementing occupational health and safety management systems in the sustainable construction industry. Several of the articles directly speak to the benefits of implementing an OHSMS at the interface between project participants and technologies [15–40]. A number of articles provide insight into how OHSMSs benefit and are understood by construction participants, and some of these articles described new and valuable ways of understanding the benefits of improved safety at project sites and the critical role of an OHSMS in meaningful communication and consultation among employees and managers [41–43]. Thus, the fundamental research question guiding this review asks, what are the benefits of implementing occupational health and safety management systems for the sustainable construction industry?

Sustainability is a well-adjusted methodology that assigns equal weights to the economy, society and the environment [44]. Employee safety and health are integral dimensions of social sustainability. The construction industry is the primary generator of environmental impact worldwide. It can add to large measures to achieve sustainability goals. However, most research studies in this area deal with sustainability with respect to the selection of construction materials and the enhancement of the operating phase of construction. When considering the sustainability of OHSMSs [45,46], the focus must be extended to occupational health and safety from the construction planning stage to project completion. The present review will contribute to the literature by identifying the benefits of implementing occupational and health safety management systems (OHSMSs) for the sustainable construction industry. It is against this background that this study seeks to identify the benefits of implementing occupational health and safety management systems for the sustainable construction industry.

2. Methods

The OHSMS comprises a set of interacting or interrelated factors used to develop OHS objectives and policy and to realise those objectives [47]. Applying the system approach to OSH management in the workplace guarantees that the levels of protection and prevention are evaluated continuously and maintained via timely and appropriate enhancements [48]. To establish and maintain healthy and safe working conditions and obey the OSH requirements set by international regulations and laws, companies are fortified to make suitable plans for developing an OSHMS [49]. The system should comprise the essential elements of planning, policy, organisation and implementation and assessment and action for enhancement, as illustrated in Figure 1. Conversely, scientific catalogues have stored vast amounts of literature on occupational health and safety management systems and their benefits concerning the construction industry [50]; reviewing all the works published on this subject is impossible. Therefore, a standard review method is needed to summarise the literature. The review methodology was adopted from the existing literature on OHSMS benefits [51]. Thus, the fundamental research question is as follows: *what are the benefits of implementing occupational and health safety management systems concerning the sustainable construction industry*?

Web of Science, Scopus and other databases (including Google Scholar, Pubmed, EBSCO and JSTOR) were searched on 17 February 2023, using the Policy–Organising–Planning–Implementation–Evaluation–Action–Improvement–Benefits (POPEAB) model modified from the International Labour Organisation (ILO), which is summarised in Figure 1 [51]. It was used for the formulation of search terms and the documentation of the literature. The search for the literature was limited to 1999–2023, and only papers published in English were analysed. Boolean positional operator searches ('ADJ00, 'WITH00, 'SAME00, 'AND00, '0R00) were employed to pertinently filter the literature docu-

mentation, following Wali and Alias [52]. The inclusion of articles required the confirmation of an OHSMS analysis. OHSMS studies, regardless of their geographical background, were considered suitable once occupational health and safety data were captured. A total of 150,000 academically related articles were identified, and this number was reduced to 934 based on the criteria defined in Figure 1. Finally, one hundred and four articles were selected and revised based on the criteria defined in Table 1 and Figure 2.

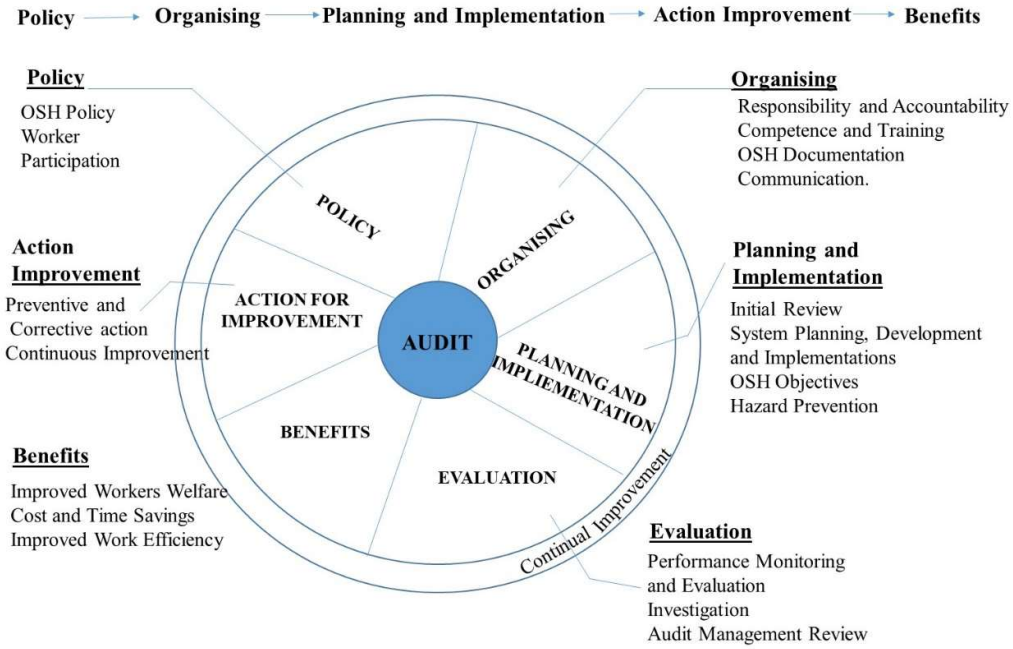

Figure 1. Phases for implementing OHSMSs in the sustainable construction industry.

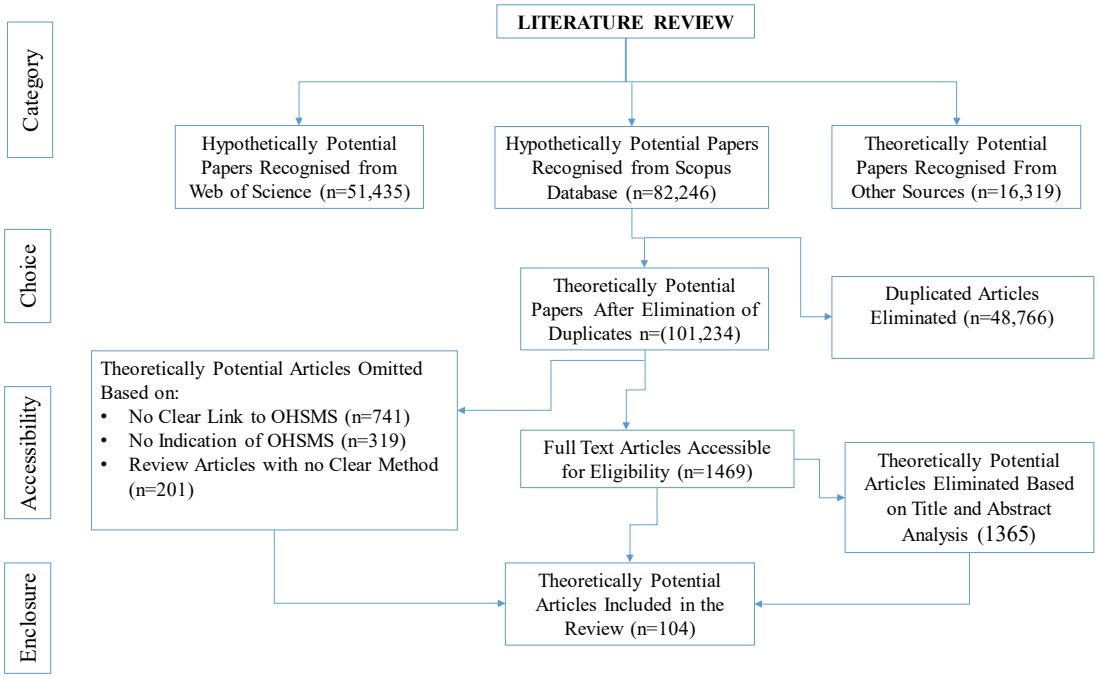

Figure 2. The methodical procedure applied in the present review included the results of the literature evaluation and documentation and the availability and ultimate inclusion of reviews [52]. After accomplishing the review procedure, 104 papers were included in the analysis, as summarised in Table 2 and Figure 2. These articles presented OHSMS analyses and their potential benefits concerning the implementation of OHSMSs and their management, performance and barriers.

Table 1. Search terms used to search databases and in resultant classification.

Terms Classification	Search Terms
Occupational and health safety management systems implementation; construction industry	Safety; health; accident; injury
Occupational and health safety management systems benefits; construction industry	Awareness; knowledge; education training
Occupational and health safety management systems barriers; construction industry	Barriers to OHSMS implementation

Table 2. Major characteristics of the reviewed studies on OHSMSs.

Major Characteristics of Reviewed Studies on OHSMSs	No. of Studies	Percentage (%)
Implementation	13	12.50
Management	27	25.96
Performance	9	8.65
Awareness	5	4.81
Model	14	13.46
Significance/Benefits	4	3.85
Barriers/Challenges	6	5.77
Safety Indicators	5	4.81
Others	21	20.19
Total	104	100

These studies present analyses concerning occupational health and safety management systems (OHSMSs). Based on the summary in Table 1, 12.50% of the reviewed studies assessed the implementation of OHSMSs in the construction industry and 25.96% studied the management of OHSMSs in the construction industry. Analyses of the performance of OHSMSs in the construction industry accounted for 8.65%, analyses of the awareness of OHSMSs accounted for 4.81%, model-related analyses accounted for 13.46%, studies on the significance/benefits of OHSMSs accounted for 3.85%, studies on the barriers/challenges to OHSMSs accounted for 5.77%, analyses of the safety indicators of OHSMSs accounted for 2.88% and other studies accounted for 20.19%. This is an indication that despite the established literature on OHSMSs, there is still a need for further assessments on the less-reported aspects of OHSMSs, particularly the benefits of OHSMSs (Figure 3).

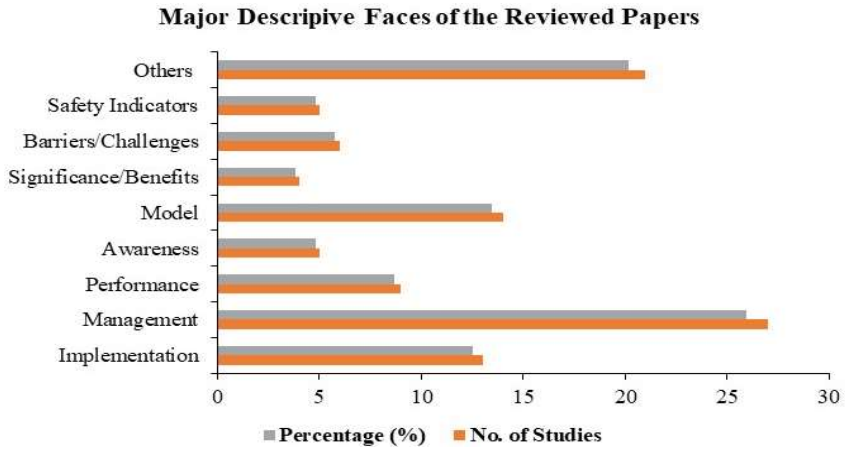

Figure 3. Major descriptive facets of the reviewed papers.

Although there is large amount of literature on aspects of the OHSMS, notably the modelling, implementation and management of OHSMSs, most of these studies are geographically and economically disproportionate (Figure 4). Additionally, most of these studies (61.54%) were conducted in developing countries, while 38.46% were conducted in

advanced nations. Based on these results, it is clear that more construction activities are being conducted in emerging countries and thus have attracted much attention from researchers.

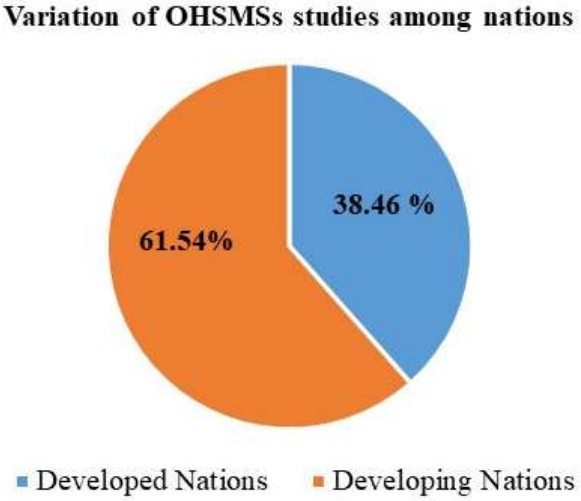

Figure 4. Geographical and economic aspects of OHSMS analyses among nations.

3. Results and Discussion

This study attempted to identify the benefits of implementing occupational health and safety management systems for the sustainable construction industry. The major descriptive facets of included studies are presented in the Supplementary Materials attached to this paper. Thus, the descriptive facets summarised in Table 1 and Figure 2 are described in this section. One hundred and four articles were analysed, and the prominent descriptive facets were derived from the current literature. These facets relate to occupational safety and health system management (OSHSM) and its relationship to construction activities. These facets comprised (1) implementation, (2) management, (3) performance, (4) awareness, (5) model-related analyses, (6) the significance and benefits of OHSMSs, (7) barriers and challenges, (8) safety indicators and (9) others (OHSMS framework, smart constructions, case studies, corporate social responsibility, OHSMS adoption in developing nations, safety prequalification, the development of multi-dimensional scale and validation, comparisons of safety plans, prevention and diagnosis, OHSMS proactivity, environmental safety, improving safety via Ir.4.0 and critiques of OHSMSs). This review is further divided into four sections as follows.

3.1. The Implementation and Management of OHSMSs in the Construction Industry

3.1.1. OHSMS Implementation

The implementation of a sustainable OHSMS was reported by 12.50% of the reviewed studies. Yiu et al. [2] studied the implementation of an SMS in the construction industry. The study assessed the success of the SMS in increasing the safety of construction and detecting factors that affect its application in Hong Kong. There was an observable commitment concerning the allocation cost and workforce and the competency of safety managers as significant drivers for implementing the SMS. Additionally, reduced rates and costs of accidents, a better organisational framework and enhanced safety audit ratings were recognised as significant benefits gained from the implementation of the SMS. The study's results are consistent with the existing literature and indicate the imminent development of safety management practices. However, tight working schedules, inadequate resources and a high rate of labour turnover were the significant challenges affecting the implementation of the SMS in Hong Kong. An examination of occupational health and safety systems (OHSs) in the construction industry concerning OHS management systems and Occupational Health and Safety Assessment Series (OHSAS) 18001 in the building industry by Zeng et al. [53] suggested that the integration of OHSAS 18001 into the ISO

quality management system is needed to rationalise the process. Due to the compatibility and similarity of the OHSAS 18001 and ISO 9001, an integrated management framework can be developed to avoid the duplication of efforts and lessen the resource inputs.

In addition, da Silva and Amaral [7] analysed critical success factors and barriers to the implementation of OHSMSs to evaluate issues concerning occupational safety and employee health concerns. The study revealed a greater emphasis on employee health issues. It also indicated the weaknesses of existing templates concerning the application of epidemiological indicators in OHS management. However, the indicators enable organisations to effectively manage events with their workers. The significance of the safety environment concerning the successful application of SMSs was studied to discover the interaction effects of safety management and the causes of a safe environment on safety performance. The study indicated that the implementation of SMSs significantly impacted safety performance. Likewise, the connections of safety incentives, safety accountability and the involvement of sub-contractors considerably impact safety performance [54]. Therefore, construction firms must provide safety incentives and link them to all components of their SMSs, involve sub-contractors in safety training and meetings and assign responsibility and ability to all individuals participating in the implementation of the building project(s).

Yiu et al. [2] studied the implementation of SMSs in the management of construction projects to investigate the significant benefits of implementing SMSs. The study identified four benefits of SMS implementation. These comprised (i) a safer operational environment, (ii) decreased risk for workers, (iii) the incorporation of safety management in project management and (iv) improved project management. Likewise, the study identified the following five challenges: (i) less prioritisation of safety due to cultural variations in companies, (ii) high rates of worker turnover, (iii) meagre working schedules, (iv) sub-contractors' obstructions and (v) the inactive participation of project members concerning the implementation of the SMS. These findings can improve the understanding of SMSs among participants and aid in improving SMS implementation in their respective projects. Factors affecting the implementation of SMSs on construction sites were analysed by Ismail et al. [55] to define the factors influencing safety with respect to the success of implementing SMSs on project sites. The study revealed that personal awareness and communication were the most influential factors concerning the implementation of SMSs on construction sites. Therefore, managers must help their workers become more aware and better educated with respect to safety matters for smooth OHSMS planning and implementation, as depicted in Figure 5 [56].

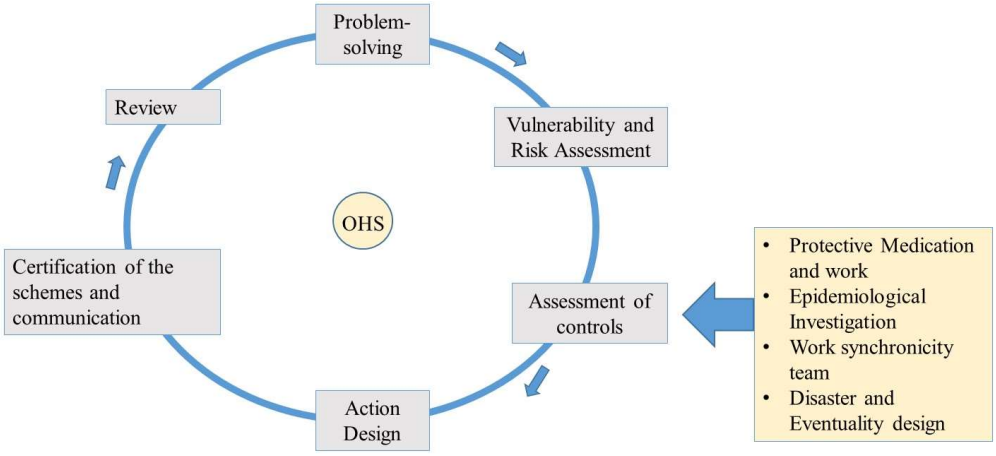

Figure 5. Occupational health and safety implementation process [56].

Buniya et al. [57] identified twelve barriers to implementing safety programs in the construction industry. These were grouped into the following four dimensions: poor governance, poor working environments, disobliging industry norms and a lack of safety awareness. It is noteworthy that rationale-level system governance can address these

barriers and enhance safety performance in the building industry. A study on the implementation of OHS management systems by Sutapa et al. [58] revealed an 80.45% rate of OHS implementation. The project implementers' commitment to the OHS can enhance the comfort and productivity of the employees.

Regarding supervision plans, a study examining behavioural changes in people and the implementation of safety management systems showed that workers' perspectives on safety became more positive after a supervision plan was implemented [59]. The study offered proof that a supervision plan is an operative tool. A study examining the implementation of OHSMSs and economic performance to quantify the influence of the implementation of OHSAS 18001 on a company's economic performance based on the company's labour productivity indicated that the company's labour productivity does not realise explicitly better values in the building industry. However, in the beginning, the correlation analysis showed that the chosen economic performance indicator relied on labour productivity. At this point, it is difficult to determine the influence of OHSAS certificate ownership on the company's economic performance. Therefore, OHSAS 18001 certificate ownership has a positive but insignificant impact on a company's economic performance.

The constraints on implementing OHSMSs in building projects were investigated using the analytical hierarchy process (AHP) method to identify their influence on OHSMSs based on the perceptions of OHS experts. The AHP results indicated that the most significant constraint was related to a lack of evaluation concerning OHS for employees, followed by little OHS culture and the lack of punishment for employees who do not observe OHS regulations, the lack of a particular unit to handle OHS, the absence of OHS training and the lack of budget concerning OHS in the building project. Few construction companies provide workers with correct and good OHSMS services [60].

Marhavilas et al. [61]'s assessment of the reinforcement of the implementation of OHMSMs in organisations indicated that the manufacturing and construction sectors have the highest proportion of OHSMS applications. However, not many published papers have focused on OHMSMS standards. Factors affecting the implementation of OHSAS 18001 in construction industries were analysed using interpretive structural modelling techniques to highlight the unsatisfactory safety performance of the construction industry. Safety training, employee morale, continual improvement and safety culture were significant variables influencing the implementation of OHSMSs. However, management commitment was the most significant factor driving safety policy [62].

The impact of the occupational health and safety management system (OHSMS) on work-related accidents and variations in awareness were analysed concerning the state of the art of the OHSMS and its effects on accident rates. There was a 67% reduction in the rate of accidents due to the implementation of OHSMSs, and fatal accidents were lessened by 10.3% between 2006 and 2011. Different levels of awareness were also observed among site and OHS managers. Variations were observed in enthusiasm for the development of the OHSMS, the outdoor support required to implement the OHSMS and the effectiveness and problems associated with OHSMS implementation [63]. Improving knowledge management with respect to OHS through collecting and classifying all safety requirements and significant problems and offering a specific toll for knowledge can facilitate the implementation of OHSMSs in the construction industry. Therefore, knowledge management software should be developed. Software for knowledge management was developed to support employee technical and training education. Fargnoli et al. [64]'s study established suitable techniques for preventing and managing risks that can be applied as intelligent agents for the implementation of the OHSs required by the construction industry. Kineber et al. [65] attempted an integral analysis of OHSMSs with respect to implementation based on OHSAS 18001. A lack of commitment and knowledge concerning safety was a significant challenge hindering the implementation of OHSMSs in the building industry. However, the essential strengths were the availability of OHS staff and the promotion of OHS by occupational risk administrators (ORAs). There is a need to propose

data alternatives to improve OHS, e.g., making more investments in contractors, enhancing organisational culture and implementing satisfactory monitoring by authorities.

3.1.2. OHSMS Management in the Construction Industry

Nearly twenty-five percent (25.96%) of the reviewed studies studied the management of OHSMSs in the construction industry, as illustrated in Table 2 and Figure 3. A standard for sustainable occupational health and safety management systems (OHSMSs) in the construction industry is required to establish OHSMSs for the OHS audit approach. Although companies' OHS management systems were highlighted, a post-audit analysis can lead to the development of an action plan for the implementation of an OHS management system in compliance with OHSS 18001: 2007 guidelines. Hence, construction companies can quickly adopt this approach to enhance OHS, reduce risk-related costs and increase productivity [66]. Contractors' levels of awareness concerning OSH management in the construction industry are essential since a high level of awareness among contractors with respect to the OHS management system can facilitate OHSMS management.

Therefore, an OHS management system should be implemented to achieve zero on-site deaths/accidents [67]. Construction safety management systems are critical in understanding how neural network procedures can be applied to study the correlation between safety performance and OSHMS elements and detect the key OSHMS element that influences the severity and occurrence of accidents [68]; three critical OSHMS elements comprised analysis, accident assessment, emergency readiness and group meetings. Learning from events with well-established emergency response strategies and efficient communication can reduce the chances and severity of accidents on construction sites [68].

In determining safety management in the context of a construction site, safety management in construction can be achieved by introducing a computer-based training (CBT) program within the organisation's academy. Thus, all trainees must be tested, and supervisors must be aware of and educated in first aid. These actions could help develop project managers and safety experts to make their sites safer [69]. Determining the priorities of the safety management system (SMS) can be essential in determining the priority processes defined in the BS8800 standard for OHSMSs for the building industry. Based on AHP rankings, the application of the analytical hierarchy process (AHP) revealed that safety training could be an issue between groups. These rankings could guide the implementation of the British Standard (BS8800) SMS in building companies [70].

The impact of OHSMS management on functional indexes can be used to determine the impacts of implementing an OHSMS on health and safety performance indexes. A reflective descriptive analytical analysis by Karimi et al. [71] which was conducted over 5 years and comprised 21 departments of a casting site revealed a considerable decrease in occupational incidents after the implementation of the OHSAS 18001:2007. Likewise, the ergonomic and mechanical factors showed considerable improvements. The indexes of opening health files concerning personal protective gadgets, personnel, instructions, education, commitments, legal requirements and leadership were significantly improved; however, there were no considerable variations in physical and chemical factors. The implementation of an OHSMS effectively concerns the indexes requiring managerial control with little or no cost implications. However, it is ineffective at changing technical and engineering indexes that require more resources.

Incorporating information management into OHSs in the building industry is also critical to improving safety performance in the construction industry. Hence, designing specific KM tools for small and medium enterprises (SMEs) in the building industry can facilitate the management of OHSMSs. Consequently, Fargnoli et al. [72]'s study extended content and document management features, enabling users to make easy estimations from various sources. It also facilitated the establishment of corporate retention over various companies. Chountalas and Tepaskoualos [73] highlighted the discriminatory incorporation of management systems into the building industry to assess various factors influencing a company's decision to intentionally not incorporate its entire management

structure. Using case studies and interviews, the discrete execution of the systems enabled the organization to regulate the balance between its executives' powers and its capability to ascribe a special status to each of the following components: environment, quality, safety and health. These could further aid in the understanding that the selective incorporation of management systems is built on the idea that incorporation is a de facto desired goal, particularly if the cost/efficiency ratio calculated for non-assimilation is better than the ratio calculated for incorporation.

Tam et al. [74]'s non-organizational, fuzzy decision-backing scheme for assessing the safety of construction management systems with respect to the effectiveness of a non-fuzzy structural decision support system analysis in the building industry (NFSSDSS) indicated that establishing a structural framework for safety management system assessments is needed for effective OHSMS management in the construction industry. The NSFDSS is applied to simplify the process of making decisions for multi-objective tasks. The modified NSFDSS proposed in Tam et al. [74]'s study is suitable for evaluating compound construction tasks which enable appraisals built on pair-wise comparisons of alternatives through semantic workers, even in data-lacking circumstances. Thus, the study provides a framework for safety managers or contractors to efficiently determine their allocation of resources to various safety management systems. The model also offers an alternative method concerning decision making in building sites where multi-objective issues are regularly encountered.

It is necessary to manage risks in the construction industry to methodically assess general risk management factors to safeguard different project participants. A case study using a triangulation approach revealed that most project risks are of typical concern to participants in construction activities [75]. Thus, there is a shift by the industry from the transfer of risks to their reduction. Likewise, the present risk management systems are insufficient for supervising project risks. The absence of combined risk management systems is a critical barrier to effective risk management.

Consequently, there is a need to establish open-communication risk management mechanism to enable the commercial experience of all actors and improve the effective utilization of their judgement and knowledge. The management of safety and quality in construction can increase the understanding of contributors to successful safety and quality plans in construction [76]. Three fundamental barriers to the successful management of safety and quality in building projects are their sub-standard application, the type of building project and the company itself. Hence, academia must make a greater effort to enlighten the building industry and aid in the understanding that policy changes are required before the quality and safety of construction can be enhanced.

The analysis of safety management in the building industry is characterised by a dearth of dangerous behaviour monitoring and the application of safety situations to predict accidents, the obliviousness of a quantitative connection between company/project scale and construction safety, a dearth of research concerning construction safety at the project level, a high level of focus on construction projects and the building phase and a lack of applying innovative technology in building safety practices, factors which remain poorly explored [77]. Consequently, Gunduz and Laitinen [78] developed a five-step framework for analysing safety management in the construction industry. The multi-step framework for safety management in the construction industry can establish an OHSMS to create a methodical procedure for improving safety and health. The multi-process-based OHSMS model can offer a ten-step OHSMS framework for the building industry. A quantitative OHSMS indexing technique was also established. The framework can be applied by SMEs in the construction business.

An integrated management system (IMS) OHS can increase understanding with respect to the IMS's effects on the OHS risk management process in the construction industry. There is a significant improvement concerning the incidence of occupational accidents, and IMSs have created more connections between workers in risk management activities. However, their involvement has not yet attained the desired point [79]. However,

broader-scoped future analyses of various SMEs that have adopted IMS can be beneficial in confirming the significance of the participation of employees and the leadership roles in this process. The risk-based management of OSH in the building industry was studied to explain the high rate of accidents in the building industry. A quantitative model development (Monte Carlo Model) approach was attempted. The suggested model is capable of conducting cost-effective scrutiny for OSH risk management. The OSH-PRM allows for improved resource management to enhance OSH circumstances in the different activities and groups of employees participating in the implementation of the building project. Although there were significant improvements concerning OSH, accidents are still higher in the building industry. The literature has continuously reported similar results [80,81].

Kafel [82] argued that the roles of OHSMSs and integrated management systems (IMSs) are generally implemented after or simultaneously with the ISO 14001 and ISO 9001 standards. The management system standard (MSS) ranked second, and the subsequent round of implementation was shorter than that of the round of the first standards. Similarly, there was a high level of integration of the management standards implemented in firms in which one of the OHSMS standards was implemented, more so than in organisations without an OHSMS. Hence, the structures of safety management systems with other systems that enable firms to realise higher levels of integration and offer a potential pattern for the organisations to initiate the integration process are central to OHS management in the construction industry.

Behaviour-based safety management is central to assessing and implementing a behaviour-based safety management system in the building industry. Using a controlled experiment, the behaviour-based safety management approaches were determined to be very effective at facilitating increased performance with respect to site maintenance, though significant increases in access to heights were only noticed on a few sites [83]; however, no significant increases in the use of bamboo scaffolding during the experimental intervention were noted. Lingard and Rowlinson [83] further highlighted the limitations of all behaviour-based safety management procedures since employee behaviour, although necessary, is only one factor influencing industrial safety, and safe behaviour can only be realised where essential safety management is already in place and is supported by regulation (or an act). This is necessary for OHS administration (Figure 6).

Figure 6. Prerequisites for an occupational health and safety management system.

In analysing the maturity level concerning OHSMSs in construction and related industries, employee participation, training and operational activities were found to be the major advanced components, whilst performance and policy measurements require further advancement. Construction industries generally have adequately advanced levels of maturity concerning their OHSMSs. Based on an analysis of the contextual factors, organisational factors were found to be more correlated with the OHSMS level of maturity

than external factors. Therefore, inspections by public agencies exercise a disciplinary role, and the entire industry did not consider parliamentary pressure to be an essential factor in the development of OHS [84].

Based on a survey of the limitations and advantages of the most popular tools, providing an update for the software used in OHS risk management requires that those tools should be intended for application in chemical and construction processing, the industries in which OHS is the most seriously considered. These industries were found to hold promise as solutions to the problem of OHS risk management faced by different types of SMEs. These results could stimulate different stakeholders to experiment with software-based decision-making tools for OHS risk management that are designed for their specific industrial settings and thus bring about overall positive changes in accident prevention culture in their companies [85].

Proactive behaviour-based safety management can be essential to the development of behaviour-based safety (PBBS) for construction safety. Thus, the automatic quantification and observation of location-based behaviours are needed. Based on experiments, Li et al. [86] posited that PBBS management performed well in preventing construction accidents, and the safety index of the projects increased by 36.07% and 44.70% for the studied projects. PBBS management is efficient and can be implemented by construction firms. Divergences in safety culture between workers, supervisory and management groups were used to examine the relationship between peoples' perceptions and attitudes concerning safety culture. Eight testable aspects comprising organisational communication and commitment, the role of supervisor, line management commitment, personal role, the influence of workers, a hurdle to safe behaviour, risk-taking behaviour and accident reporting have stronger intercorrelations. The three respondent groups have different safety cultures [87]. These findings can offer an invaluable indication of the construction workers' increased understanding of safety culture.

Near-miss management system (NMS) design was assessed by applying lean thinking principles to define novel procedures for designing and managing an organisation and its resultant safety management system [88]. Consequently, a novel NMS based on the integration principles of lean management in job-related safety for a worldwide supplier company was designed. Since no baseline model had been previously established, many aspects were evaluated to effectively integrate occupational safety into the existing lean management system [88]. Novel features characterising the established model have potential for the entire application. Assessing employee health and environment standards improved the employees' wages in SMEs. Further, certified SMEs are more likely to offer their workers non-monetary benefits, e.g., paid sick leave, unemployment benefits, social and health benefits, accident insurance and formal contracts. The impact derives from greater profitability, more labour productivity, financial support from the government and a low level of competition when companies implement environmental standards [89].

The application of sustainable management system standards is needed to promote sustainability concepts among companies. Silva et al. [90] specified the management systems standard (MSS) requirements in each area, allocating different roles in the integration process as follows: efficient enablers, drivers, evaluators and pathways. The four roles promote the claimed integration in a systematic cyclical process, the plan–do–check–act (PDCA) process, to facilitate the management and consolidation of sustainability. The study reinforced the added value of the integrated management system. It also expanded its scope, aiding organisations in systematically and effectively implementing sustainability, leading to the development of theoretical sustainable management standards (SMSSs).

3.2. OHSMS Performance, Awareness and Model-Related Analysis

3.2.1. OHSMS Performance

Analyses of the performance of OHSMSs in the construction industry were conducted by 8.65% of the analysed studies, as shown in supplementary material and Figure 2. The quality of an OHSMS based on key performance indicators relating to OHSMS series

18001 specifications in certified organisations revealed that the performances of certified companies concerning OHSMS practices were significantly better than the performances of non-certified organisations [91]. OHSAS 18001-certified companies have better OHS levels, which supports the theory that OHSMSs play a critical, strategic role in health and safety at construction sites. Lin and Mills [92] assessed the OHS performance of building industries with respect to the manager's role in their construction facility's performance. The company size was the principal contributor to the OHS performance of building contractors. Thus, the company's size, its workers' commitment and its management are the key variables influencing OHS performance. However, small contractors tend to ignore the cost of OHS in their tenders, decreasing their capability to resolve potential issues.

Chang and Liang [93] attempted an HSMS performance evaluation to establish a model for assessing the performance of HSMSs via a factor analysis and an analytical hierarchy process. The framework developed in this work can be modified, generalized and applied to other industry sectors in the future. Companies' OHSMS performance showed a considerably high rate of adoption of OHSMSs by beverage and construction/building firms. However, recommendations concerning the adoption of OHSMSs must consider the local context to achieve optimal employee participation and management performance [94]. Hoque and Shahinuzzaman [95] examined the link between employee task performance and OHSMSs. The significant predictors of employee task performance are the OHS regulations, benchmarking, employee involvement, teaching, protective and preventive actions, emergency responses, communication, review and monitoring. These results are unique for considering the measurement of an employee's task performance from the OHS organisation's viewpoint.

Zahoor et al. [96] assessed OSH performance and stakeholders' perspectives to unveil overlooked OSH aspects and distinguish the differences in the construction stakeholders' perceptions. Stakeholders have diverse perceptions concerning three factors of OSH, including a commitment to OSH management, safety procedures/rules and OSH training and policies. Thus, it is recommended that regulatory authorities launch OSH awareness programs, announce incentives for safety, institutionalise OSH system certification and integrate safety credit points in the registration of contractors.

An integrated safety intervention model for assessing employee behaviour is required concerning safety intervention performance. It can be achieved using structural equation modelling (SEM) and an exploratory factor analysis (EFA)—technical interventions tend to have strong, positive impacts on human and management interventions [97]. Employee safety behaviour can be increased by concentrating on a technical intervention comprising five essential safety practices. These are personal protective equipment (PPE) programs, workplace safety inspections, the maintenance and availability of safety equipment, safety permits and safe work practices. These results can aid construction managers in identifying and selecting suitable safety practices with particular interventions to enhance the safety behaviour of their employees [97].

The influence of total quality management (TQM) on OSH performance was evaluated to measure the level of application of (TQM) and OSH and the relationship between TQM behaviours and OSH performance [98]. TQM had a considerable influence on OSH performance in the companies studied. The fundamental TQM pillars and OSH practice components can be recognised as critical success factors and fundamental TQM adoption pillars in companies and for improving OSH performance [98]. Consequently, Lingard et al. [99] attempted to develop a hierarchical procedure for testing the project's OHS performance (Figure 7). The practical implications are that multiple indicators of OHS performance, including principal indicators and surveys of workers' perceptions and attitudes regarding OHS in construction projects, lay a solid foundation for developing targeted OHS enhancement strategies.

Hence, the future research implication relates to carefully evaluating the rationality of the safety index and the analysis of safety conditions in construction projects and the broader construction context [99]. The safety index of a project combines many leading

and lagging OHS performance indicators. These indicators are weighted based on their significance level in determining the total OHS performance score.

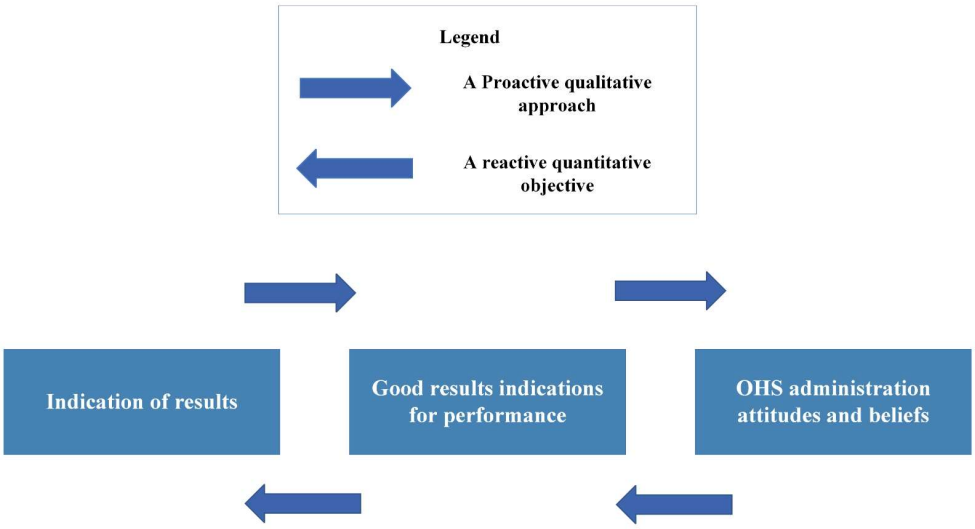

Figure 7. Hierarchical model for OHS performance measurement. Data from [99].

Since it comprises lagging and leading OHS performance indicators, this score presents a well-adjusted measurement of OHS performance quality in a project, facilitates the prompt detection of deficiencies and enables the rectification of OHS issues before illnesses or injuries occur. Table 3 displays the components of the safety index and their weightings. Establishing a basis for the uninterrupted assessment and enhancement of OHS matters in construction industries requires a framework for the continuous assessment of OHS in the construction industry. The following seven key elements were determined to be factors influencing the implementation of OHS management systems: commitment and leadership, strategic objectives and policy, resources, organisation, documentation, management and risk assessment, planning, implementation and monitoring, auditing, reviewing and measuring performance. The proposed framework can aid in achieving the improved implementation of OHS management systems [100]. Niu et al. [101] assessed SCO-enabled OHSMSs for the construction sector, aiming to establish an intelligent construction object (SCO)-enabled OHSMS. A generic SCO-OHS-enabled management framework was proposed. The SCO-OHSMS can detect conditions and autonomously respond to them. Smarter building via the integration of artificial intelligence is, in particular, a direction of significant promise with respect to improving OHS in the construction industry.

Table 3. Components of the safety index and their weightings. Data from [99].

S/N	Indicator(s)	Leading/Lagging	Weighting(s)
1	Community members injured	Lagging	0.350
2	Medically treatable injuries	Lagging	0.050
3	Occurrences of first aid	Lagging	0.050
4	Time taken for wound to heal	Lagging	0.300
5	Incidents/Near-miss incidents documented	Leading	0.050
6	Protection steps	Leading	0.050
7	Reflection of safety steps (prominent issues)	Lagging	0.050
8	Assessment of location safety achieved	Leading	0.030
9	Complications identfied via site safety assessment	Lagging	0.030
10	Estimations of safety	Leading	0.030
11	Recognised complications from safety evaluation	Lagging	0.030

3.2.2. OHSMS Awareness and Model-Related Analysis

The results indicate that awareness of OSHMS in the construction industry was reported in only 4.81% of the reviewed articles. Vigneshkumar et al. [102] studied the variations in OHSMS awareness between construction industries to measure the prevailing situation of sustainable OHSMSs. The study identified various OHSMS awareness levels between commercial and residential forms of construction. These variations mainly represent the success of OHSMSs and barriers to implementing OHSMSs, the external help needed to implement OHSMSs and the motivation for enlarging OHSMSs. These variations imply that further research requires an appropriate data set to guarantee additional future analysis. The level of awareness and the effective regulation of exposure to risks revealed a general absence of consciousness concerning essential health and safety aspects among construction workers in Nigeria [103]. In construction companies, there is an unwillingness and inability to pay sufficient attention to safety and health management. The general safety and health standard operating proficiency and corporate image of construction companies in Nigeria are poor. Possible reasons for this might include poor legal and institutional frameworks and knowledge transfer.

Duryan et al. [104] assessed OSH knowledge transfer. The factors that expedite OHS knowledge transfer within and between construction companies were examined using a thematic analysis and interpretive techniques. There were inconsistencies in OHS practices in building firms, hence the need to cultivate a positive safety culture to boost the transfer of lessons learned from good practices, near misses, incidents and failures among projects and from projects to programs and across supply chains. Safety and health regulations, guidelines and norms were not included in the government's potential safety regulations for various construction environments or addition to work contexts. Therefore, OHS programs must encourage workers to be conscious of incidents, near misses and failures from a no-blame perspective and to take suitable actions. This study laid the basis for encouraging project stakeholders to implement more socially oriented methodologies concerning the promotion of learning-rich organisational frameworks to overcome differences in the OHS and to go beyond the current level of safety data. These goals can be achieved by prioritising safety indicators in the construction industry. Figure 8 shows the significant elements of the construction industry's occupational health and safety awareness.

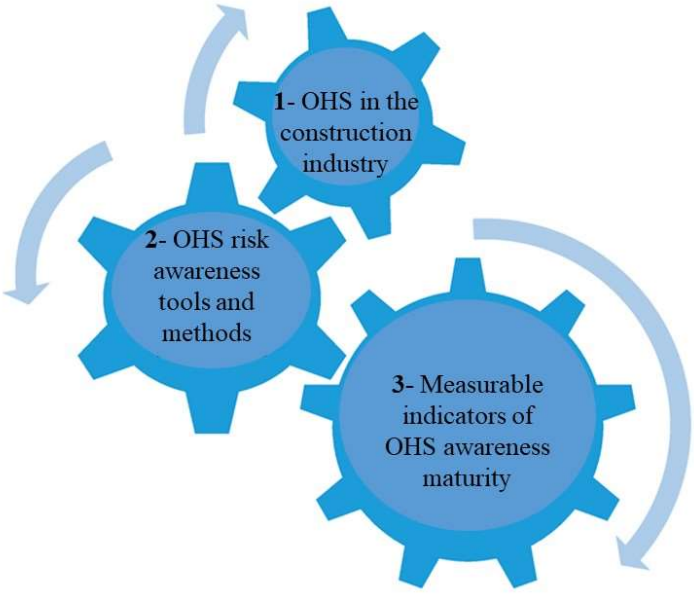

Figure 8. Major elements of occupational health and safety awareness in the construction industry. Modified from Kaassis and Badri [105].

Yarahmadi et al. [106] evaluated the prioritisation of health and safety indicators in the building industry to measure the prioritisation of safety and health indictors in large and small construction firms. The study employed indicators selected by experts, ranking and modelling the indicators using SMART criteria and the YTOPSIS approach. The results were derived using a fuzzy TOPSIS approach by measuring the priority of safety and health indicators in large and small building clusters, emphasising a diverse range of twenty-eight types of indicator priority which could be used to increase awareness among stakeholders in the construction industry. PPE and adjacent structures up to six floors have higher close rates. However, noise excavation, the use of trucks and safety scaffolding due to vertical spread, tall buildings in more prominent areas and six-floor structures had significant priorities. Shamsuddin et al. [107] argued that creating awareness among employees concerning different types of safety-related fortifications in the construction industry is vital since most accidents occur due to unsafe acts and conditions. Although it is impossible to recognise and eradicate all the hazards on project sites via efficient accident analyses, construction accidents can be avoided by identifying their root causes. In a project, the continuous consideration of safety, health and environment fortification on the project site could aid reduce the incidence of accidents.

The prioritisation of health and safety indicators based on the SMART criteria and fuzzy TOPSIS approach can be used as a professional method of increasing awareness of construction safety and reducing risk levels. Risk-level-based evaluations based on facility type, size and construction cost are needed to estimate risk levels in the construction industry [108]. Based on the type of facility, the project size and the total cost, it was confirmed that the total fatality rate might exceed the fatality rate corresponding to each type of facility and the size of the project [108], and applying the suggested approach enables the determination of the quantitative risk level based on particular construction industry features.

Additionally, model-related OHSMS analyses (13.46%) were reported frequently. Ligade and Thalange [109] proposed an OHMS model for the construction industry. They measured how applying the OHSMS could help achieve safety at construction sites, reduce risk and eliminate work hazards. The OHSMS model OHSAS: 18001 certification offers a path to continuous upgrading for an organisation by helping the organisation implement the OHSMS model in the building industry. The implementation of the OHSMS model ensures the financial and economic viability, acceptability and safety of projects.

Similarly, Ai Lin Teo and Yean Yng Ling [110] attempted to develop a model for assessing the effectiveness of safety management systems (SMS) at building locations. A multi-attribute value approach was used to establish a model, which was subjected to authentication. The construction safety index (CSI) was estimated using the established model. The CSI can act as an impartial tool for various sites for OHS appraisal and management purposes. Examining the factors concerning compliance and non-compliance with other health and safety management procedures in construction requires the development of a conceptual framework, which can be achieved through a critical literature review [111]. A conceptual framework was established for enhancing safety culture in the building industry to provide a safe operating environment, hence providing a promising and safe career [111]. Safety culture is a substitute for boosting competition at any step. The building industry must have a safety principle to curtail the frequency of injuries, fatalities and accidents involving properties and workers [111].

Correspondingly, Mohammadfam et al. [112] proposed a decision-making methodology to evaluate and stimulate OHSMSs and the effectiveness of the OHSAS 18001 principle. By merging two approaches, i.e., the analytical network process and the technique for order preference by similarity to ideal solution (TOPIS), they revealed that employee participation, management commitment, specifying the dissemination of OHS activities and results, specifying responsibilities and the allocation of financial resources are the key factors influencing the effectiveness and improvement of the OHSAS 18001 principles. The established method could be used to determine factors influencing the effectiveness of

OHSMSs. However, an integral diagnosis for OSHSMs might be needed for to improve awareness among construction industry stakeholders.

Suarez et al. [113]'s integral OSHM diagnosis was an attempt to conduct a broad-scale analysis of the adoption requirement (NTC-OHSAS) standards. It was apparent that a lack of knowledge and commitment concerning safety constituted a significant weakness in the adoption of OSHMSs; the main strengths comprised the promotion of OSHMSs by ORAs and the existence of OHS systems. Options for enhancing OHS were suggested, comprising more significant investments in contractors, improving organisational culture and the provision of adequate supervision by authorities.

A constructivist multi-criteria model analysis was utilised to create a model to support the management of the risk of accidents on construction sites by Ensslin et al. [114]. The study identified strategic objectives and examined the criteria scales, including performance profiles, and proposed vulnerability improvement activities. Professionals and managers contribute by using instruments in the legitimate contexts of their values, standouts and concerns. Researchers contribute to resolving the challenges of improving their generic models by understanding personalized models. In a continuation of the process of knowledge construction initiated by researchers, future research must develop a risk management model using the multi-criteria methodology for a decision-aiding constructivist (MCDA-C) approach involving more training on or learning about OSHSMs. The model suggested by Endroyo et al. [115] was more operational than the existing learning model. Hence, the model can be utilised in the training/learning of OSH in the building industry for more real results via the construction and evaluation of the model's framework (Figure 9).

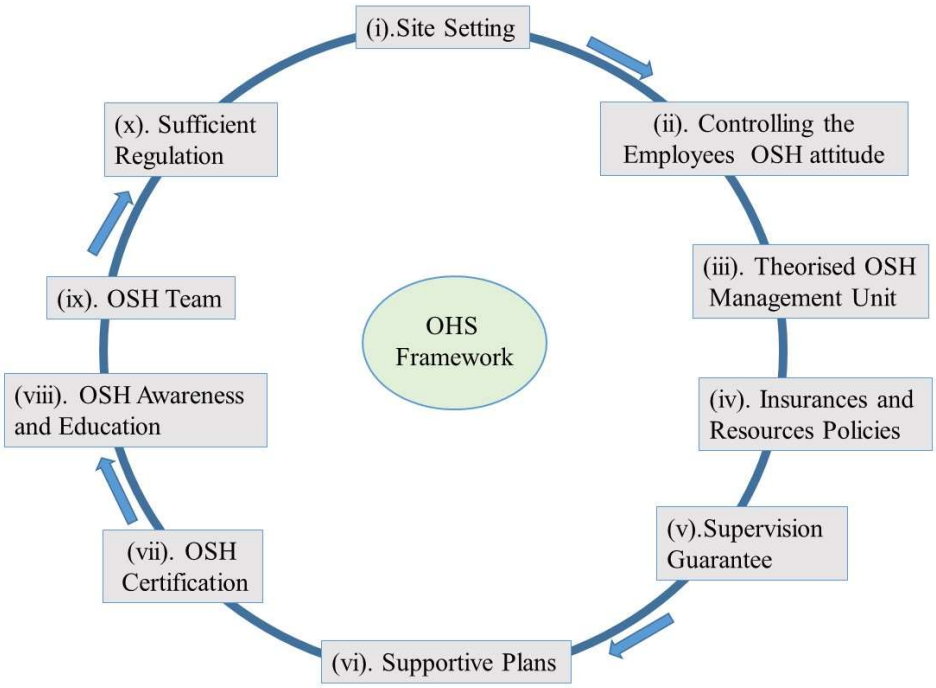

Figure 9. Occupational safety and health framework. Data from [116].

Consequently, Priyadarshani et al. [117] developed a construction safety evaluation framework for developing countries. The study used a questionnaire survey. They argued that building industry benchmarks must be adopted in six significant aspects: management measures, management commitment, the nature of the project, economic investment and individual involvement. Management commitments were the major influential factor concerning construction safety which comprised implementing organisational safety policies and allocating responsibilities at all levels. The established management framework could facilitate initiatives and a benchmarking process to improve construction safety performance in emerging nations.

However, this might require a multiple-attribute decision framework or model. İnan et al. [118] compared a companies' perceptions of OHSM using a multiple-attribute decision model (MAM). The model's ranking shows each company's level of consciousness with respect to OHSMSs against its rivals. The significance of each criterion (OHSAS requirements) was determined using VIKOR and Simos' procedure, which ranks companies with respect to a consultant's quality assessment. The study offers MADM as a potential approach for comparing firms' perceptions of OHSMSs. Conversely, Pauliková et al. [119] presented a cluster modelling approach to supporting OHSMS integration to analyse the documented data and requirements of two management system standards: OHSMSs based on ISO 45001 and environmental management systems (EMS) based on 14001. A combination of clustering analysis, content methods and a ToughGraph Navigator was used. The integrated implementation was accompanied by several benefits, such as reductions in the cost of management and bureaucracy, a simplified certification process, enhanced internal management and the acceleration of continuous upgrading. Managers and auditors could utilise these findings to implement integrated management systems during the review and monitoring process and articulate recommendations for improvements in their management systems. These could be achieved by establishing a global model for OHSMSs.

Kajiki et al. [120] proposed an international OHSMS model and tried developing a model hypothesis formalised for its international introduction. The model comprised site and headquarters roles. The roles comprised OHS and functioned well. However, two problems were identified, i.e., the desire to establish a reporting system for head office and the desire to back the enhancement of specialised human resources. The international OHSMS model was built on applying approaches and specialised workforces relevant to each continent and their shared goals and assessing indicators based on the minimum requests of the organisations' head offices. However, the experiment must be extended worldwide to verify the model's efficiency.

Thus, Su et al. [121] presented an integrated methodology for improving voluntary OHSMS protection programs to assess voluntary compliance and protection programs for OHS management. A secondary data (VPP) analysis of 724 construction sites was used. The results indicated that the VPP worksites had a 49% lower frequency rate than all industries over three years. During the same period, the severity rate reduction was 80%. To foster a culture of safety, there is a need to employ a plan–do–check–act management cycle to continuously pursue improvement with respect to the safety culture. The findings further indicated that an employer VPP is a possibility for emerging nations through proper model design.

An OHSMS model was designed by Teo et al. [110] to address critical gaps in the literature by co-designing a model OHSMS comprising an employee who works from home, focusing on psychological risks. A system approach utilizing a co-design focus group was also used. The research acknowledged the need for designing tools to support workers and managers in fostering mentally safe conditions for working from home. Working from home challenged perceptions of OHS obligations, including entry rights. Hence, the hazard management barriers comprised a lack of understanding of mental risks.

Thus, measures are needed to improve remote workers' participation in OHS by establishing a suitable framework to support health and safety [122]. This enables the establishment of an integrated framework for optimising safety and health in the construction industry. Although safety and health laws are enforced, they are neither universal nor standardised. Additionally, the study revealed that no single entity was responsible for implementing health and safety standards. Thus, an innovative and precise framework for establishing an authority to regulate safety and health standards is required. Setyorini and Latief [123] proposed a conceptual model of an integrated OHSMS, using experts' surveys and company case studies. Based on the results obtained, a monitoring and evaluation method was established. The application of this method can lead to improvements in company performance.

3.3. Benefits of OHSMS Implementation in the Construction Industry

3.3.1. Benefits of OHSMS Implementation

The results reveal that the significance/benefits of OHSMSs are poorly reported in the literature (3.85%). A few studies addressed this issue, including the study by Kim et al. [54], who assessed the interaction effects of safety management and the factors of a safe environment on safety performance using the partial least squares (PLS) method. The implementation of SMSs had a significant impact on safety performance. Likewise, the connections of safety incentives, safety accountability and sub-contractor involvement considerably impact safety performance. Therefore, construction firms must provide safety incentives and link them to all components of their SMSs, involve sub-contractors in safety training and meetings, and assign responsibility and ability to all participating in the building project(s) to obtain experiential benefits.

The experiential benefits of executing a pay-for-safety scheme (PFSS) in the building industry are critical for assessing the level of adoption of PFSSs, especially in public work contracts. Most of the benefits obtained from the adoption of a PFSS comprised amplified safety training, improved safety awareness, the encouragement of the development of a safety management system (MS) and enhanced safety commitments [124]. However, the broader application of PFSSs should be encouraged to achieve better safety performance in the building industry, which confirms the main benefits of the application of OHSMSs in the construction industry. It is necessary to determine stakeholders' perception of the benefits of applying an OHSMS since the prevention of work-related accidents and improved workplace conditions were the leading benefits of applying OHSMSs. Thus, the adoption and incorporation of OHSMSs into safety and health regulations should be mandatory. It will strengthen OHS and improve the construction industry's performance [125]. It is equally important to demonstrate the significance of integrating OHS practice sin managing systems and possibly avert, reduce or eliminate work-related risks in building activities. The integration of OSH processes into management systems is beneficial in enhancing the building industry's move toward sustainable design and thus improves the workers' well-being [126].

Work is an economic pillar of any nation. Therefore, workers must be regarded as the most treasured asset for an organisation. An injury, accident or work-related illness directly affects the economy and burdens society and families considerably [127]. The implementation of an OHS system in an organisation benefits the workers and the company. Some benefits for organisations comprised the prevention and lessening of accidents, leading to increased financial savings concerning unplanned costs, insurance, health care, compensations and fines; improvements in organisations' reputations and brands; and the high returns of investments made in occupational safety. Additionally, workers are motivated and healthy, creating a multiplier impact within the work environment and their individual lives to reduce poverty [127]. Figure 10 summarises the benefits to workers and companies of implementing OSH systems.

3.3.2. Barriers/Challenges to OHSMS Implementation

A significant number of reports concern barriers to the implementation of OHSMSs in the construction industry (5.77%). It is essential to assess the factors of poor construction safety to improve the status of safety management in the building industry, discover the risk-prone activities on project sites and detect the elements influencing safety on project sites [128]. Contractors' behaviour concerning safety management is of critical concern, comprising the delivery of personal protection devices, regular safety briefings and training. Major elements influencing safety performance comprised the poor safety awareness of top management, a dearth of training, a dearth of safety awareness from project managers, a lack of investing in safety and careless operations. Therefore, authorities must play a more significant role concerning law enforcement and the organisation of safety-teaching programs.

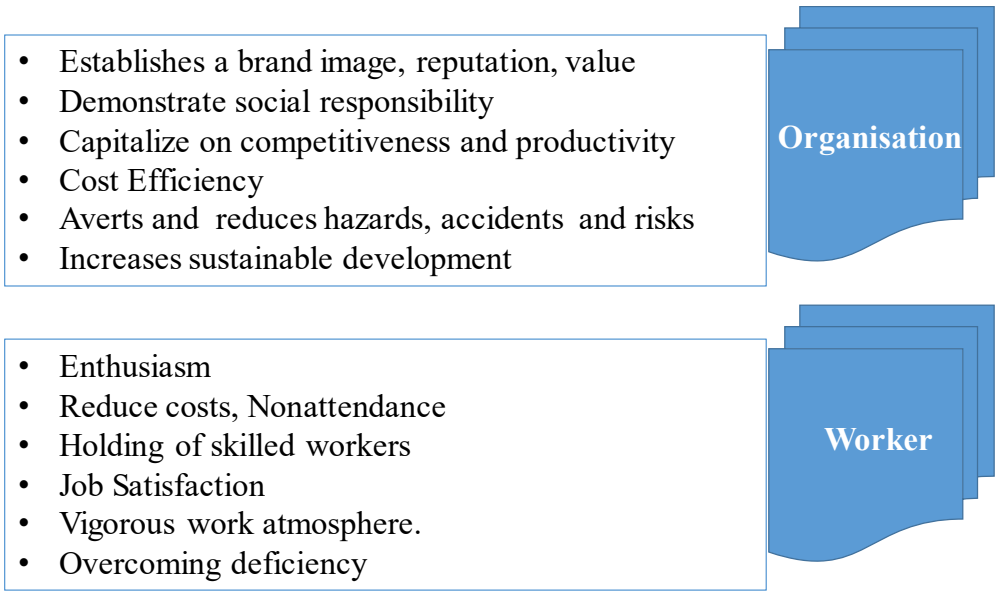

Figure 10. Benefits of occupational health and safety implementation. Data from [127].

Establishing an intelligent data analysis (IDA) to support the assessment of factors influencing OHSMSs. Many related-OHSMSs influential factors must be considered carefully to facilitate the adoption of the OHSMSs method [129]. The established IDA procedure/model could be an effective computer-based tool to be considered by organisations/companies and OHS professionals for improving the efficiency and management of adopting OHSM systems [129]. However, there are many challenges to enforcing OHS in the building industry. Boadu et al. [130]'s study presented a broader perspective of the challenges hindering effective OHS law enforcement. Thus, substantial measures are needed to ensure effective OHS law enforcement in the building industry.

The top three challenges hindering OHS law enforcement are inadequate OHS regulations, policies and standards, a dearth of OHS education and campaigns and a dearth of instances of prosecution or sanctions for breaching OHS regulations. Therefore, practical strategies for public agencies, professionals and OHS inspectors within the building business are desperately required to improve the enforcement of OHS rules, especially in emerging nations, which requires tackling barriers to the development of OHSMSs in the construction industry. Kamoli et al. [10] posited that a lack of commitment by public authorities, poor regulatory agencies and a dearth of knowledge about OHS activities are the critical barriers to the development of OHSMSs. Hence, collaborative efforts by the construction firms, construction experts and employees need to support the government concerning the implementation of OHSMSs in the construction industry.

Using a fuzzy, synthetic evaluation, Oni et al. [131] assessed the factors influencing safety and health behaviour for improved health and safety practices. Insufficient safety planning was the highest critical value, followed by management failure, poor safety promotion, poor enforcement and supervision, safety ignorance, unexpected behaviour concerning safety and a lack of experience. Overall, the criticality factors are high in the building industry and must be addressed to improve safety and healthy practices. Oni et al. [131]'s research presented a universal approach to the factors influencing health and safety behaviour in the building industry. These results could furnish policymakers with practical methodologies to adjust and reinforce health and safety approaches in the construction industry. Risk factors influencing construction safety must be identified concerning causes of construction accidents to ensure the safety of construction sites and reduce accidents. Generally, six latent variables (material and human factors, geological assessment design, safety and technical management and natural settings) have influenced construction significantly. The natural setting has the most significant influence,

followed by human factors and safety management. Special attention must be paid to safety management, training and education barriers for improving OHS in the construction industry [132].

In establishing a basis for a safety management system framework, it is clear that efficient safety performance can only be achieved via the actual implementation of (i) safety laws, (ii) safety planning, (iii) leadership, (iv) safety compliance, (v) performance evaluation, (vi) risk evaluation, (vii) safety monitoring and (viii) safety culture [133]. These elements are interrelated and thus cannot be isolated. However, it is essential to significantly enhance the safety performance target of building projects. Hence, there is a need to re-balance and re-align the priorities allotted to the factors affecting safety performance in the construction industry [133]. Figure 11 summarises the critical factors influencing health and safety performance in the construction industry.

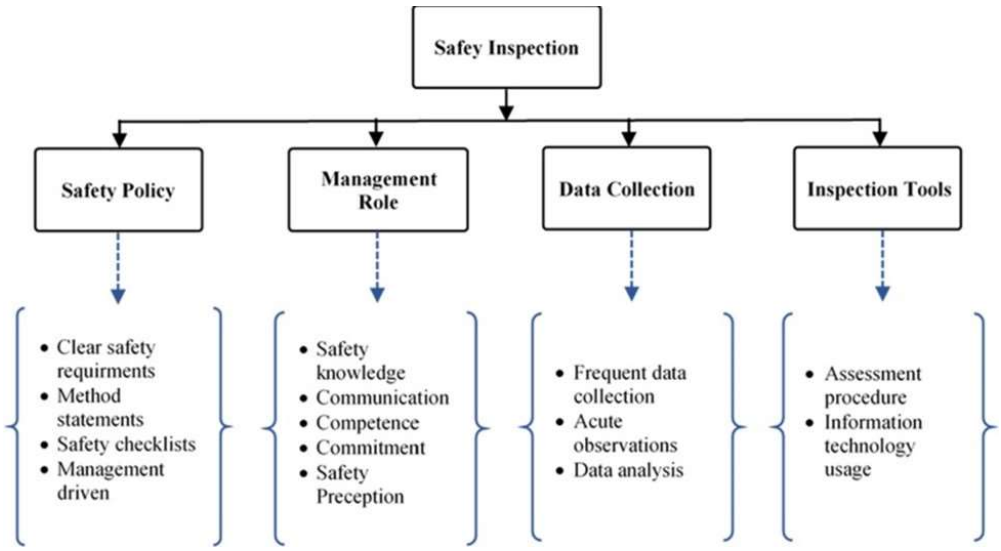

Figure 11. Critical factors influencing health and safety performance in the construction industry.

3.4. Other OHSMS Elements in the Construction Industry

Other OHSMS elements in the construction industry constituted 20.19% of the reviewed literature. These elements accounted for less than 1% of the analysed literature and are deemed significant for further discussion. However, these elements represent areas that need further exploration. Thus, further analysis concerning these elements could narrow the existing gaps concerning OHSMSs in the construction industry. For instance, Tepaskoualos and Chountalas [134]'s case study attempted a detailed integration of the OHSAS 18001 and ISO 14001 systems. The company's effort towards realising the essential factors and the identical structures of the two studied systems have enabled their successful integration.

In contrast, this does not spontaneously imply that the organisation adopted the concept of total assimilation. Instead, the maximum benefits of the integration and exclusion of related difficulties were attained via the organisation's mindful choice to proceed with fractional integration, possessing discrete policies, manuals, and risk management methods for each system. This finding can help us understand that fractional integration is an impeccably realistic and acceptable solution that, under some conditions, might be more cost-effective than total assimilation.

The factors contributing to the severity of accidents in construction were studied by Soltanzadeh et al. [135], who examined the factors causing and contributing to the severity of accidents rates (SARs) between construction companies. The system connected to HSE and HSE risk management accounted for 41.8%and 18.4%. Likewise, the organisational and individual factors, HSE training and risk management system factors were significantly connected to the ASR. The causal factors and components of the ASR can be used in the

planning and execution of a wide-ranging HSE risk management system to lessen the ASR. Evaluating the behavioural safety compliance of workers is necessary for identifying the factors of worker compliance with behavioural safety. There is an excellent opportunity for enhancement since there is an understanding that good conduct can improve behavioural safety compliance with OHS enhancements in the building industry. The study's results led to the establishment of the continuous analysis currently being conducted by the researchers which requires an analysis of the workers' behavioural safety compliance regarding OHS enhancement in the building industry [136].

HSMSs and building companies are critical for assessing the HMSMSs in construction companies. Mavroulidis et al. [137]'s study revealed variations among three health and safety (HS) management types, with insufficiencies identified in three out of the fourteen HS management dimensions over the three types of HSMSs. The three dimensions comprised employee training and competence, subcontractor management, and incentives and accountability for worker participation. The study's quantification of the variations in three HS management dimensions will aid contractor firms in improving their HSMSs.

Simukonda et al. [138] attempted an analysis of OHSMSs in developing nations to identify and unravel issues of OHSMS adoption that require attention. OSH implementation is low among contractors, especially concerning organising, policy, reviewing, measuring and auditing OSH management. The size of a firm is associated with the adoption of about 50% of the OSH practices. A firm's OHSAS 18001:2007 standard certification is correlated with the adoption of fewer activities [53]. Efforts made towards improving OSH management should concentrate on factors such as the poor implementation of activities and comprise solutions which focus on aiding SMEs in enhancing their OHS management systems. OHSAS 18001:2007 standard certifications might not translate into higher rates of adoption of OSH management activities in developing nations [53].

A safety prequalification survey used in the building industry must recognise methods that incorporate leading indicators of employee safety performance. Elements of safety management, including control and prevention, program improvement and evaluation, communication and coordination, were, remarkably, available in only 10% of the surveys. Regulatory or employer guideline initiatives intended to require prequalification safety procedures for building contractors or the delivery of construction permits must incorporate more principal indicators into their contractors' assessments [139]. The selection and ranking of OS indicators can be used to present the factors, performance and indicators of OS. Janackovic et al. [140]'s case study indicated that organisational factors dominated OHSMSs in road construction firms. The analysis was based on a fuzzy AHP; hence, generalisations could be vague.

Some studies are concerned with OHS regulations, assessing the efficiency of OHS regulations and laws and detecting influential factors. This might involve direct interviews with stakeholders. The existing regulatory and legal OHS structure is barely futile, as revealed by Eyiah et al. [141]. The study laid a foundational strategic basis for intervention and improving OHS regulations and laws in developing nations. Gyi et al. [142] explored how accident and health data quality concern high-profile construction engineering organisations via interviewing senior managers. Although the companies prioritised safety, health had not been provided a similar level of concern, particularly with respect to subcontracted labour. The validity of using accident data as a safety measure remained a major limitation, there is a need for an integrated and consistent approach to measuring safety and health performance.

Fernández-Muñiz et al. [143] were concerned with developing and validating a multidimensional scale and establishing a measurement scale operationalising the concept of the safety management system. The safety management system scale was developed using confirmatory and exploratory factor analyses. The established scale offers companies a tool for assessing their condition with respect to safety management and identifies areas needing attention to curtail work-related accidents. The developed scale could be applied

to assess the organisational factors that limit or favour the adoption of safety management systems in companies.

A comparison of site safety plans was conducted by Ho Derrick Chong et al. [144] to relate different site safety plans from excellent building and civil contractors. Building firms are now considering OHS as a requirement for all site activities. The entire safety program must be reviewed to determine its weaknesses and strengths. However, Samanta and Gochhayat [145] attempted a critique of OSH to identify significant issues, challenges and possible solutions using expert surveys. A dearth of proper communication, the non-utilisation of PPE, wrong postures and work activities, a dearth of training, physiological factors including burnout and stress, a dearth of safety culture and orientation and matters relating to compliance with effective laws are significant safety challenges in construction industry. These findings will guide public and organisational authorities and supervisors of projects sites to increase occupational safety.

The impacts of organisational safety workers' proactivity with respect to OHSMSs were studied by proposing a structural model to examine the components of OHSMSs: POSS, POSF and proactivity behaviours. POSF and POSS correlated positively with enhancing the identification of safety hazards and procedures via proactive safety behaviours. Thus, the study provided a novel perspective on organisational safety for enhancing OHSMSs in the construction industry and extended the application of proactive safety behaviours [146]. Nikulin and Nikulina [147] assessed the effectiveness of occupational health and safety to develop a system-based approach to OHS for the implementation of new technologies and equipment. A standard was established for assessing the current effectiveness of the safety management system deployed, and a statistical review was presented. Proactive measures of priority to any detected violations were recommended.

Kalatpour and Khavaji [148] examined hospital registries and performed data mining on work-related injury data to provide an overall representation of work-related injuries in the construction industry. The results revealed a fivefold increase from 12% to 57% in injuries over three years. Many reported injuries (73.6%) were treated without additional follow-up. However, 1.7% of the reported injuries led to death, and 0.3% of injuries led to permanent incapacities/disabilities. For a better understanding of construction injuries, it is essential to analyse the related variables. The analysis is a vital input for prevention programs or even aiding in decision making.

Rodríguez-Martín et al. [149] attempted to establish a novel approach to engineering courses. They aimed to establish consultation systems for employees following the suggestions of the global standard ISO 45001. Experiments with mechanical engineering scholars revealed that the scholars considered the activity helpful for learning, exciting and adjusted to reality, creating a significant challenge that might have facilitated intrinsic motivation when participating in learning management systems. Measures are required to enhance the participation of remote workers in OHS. Improving health and safety through the industrial revolution 4.0 is needed to analyse the use of IR-4.0-associated technologies for enhancing the safety and health concerns of the construction industry. Based on matrix multiplication, the greatest significance between the alternatives and criteria was found for BIM, wireless monitoring and sensors. BIM and integrated systems have the highest potential as advanced technologies which can be applied to lessen the barriers to the benefits of implementing OHSMSs in the construction industry. When introducing BIM in the construction industry, it must be prioritised to enhance safety and health performance [150]. Therefore, understanding the barriers to the implementation of OHMSMSs and their associated benefits is needed to facilitate the adoption of OHSMSs.

3.5. Barriers to the Benefits of the Development of OHSMSs by the Construction Industry

There are several barriers to the development of an OHSMS, as shown in Table 4. Despite several barriers to the implementation of OHSMSs, a detailed discussion concerning the significance of OHSMS activities in the sustainable construction industry context is lacking [7,23]. Thus, the current study argues that construction companies approach

OHSMSs as a matter of compliance with legislation instead of as an effective method for enhancing the company itself [24,25], with a particular focus on numerous activity sectors, including the construction industry. In contrast, the literature becomes bare when the attention shifts to the consciousness of this type of industry concerning the benefits that implementing a system able to regulate health and safety based on standard practices could have on their economic performance and safety [26].

Table 4. Barriers to the benefits of OHSMS implementation in the construction industry.

S/no	Barriers to OHSMS Implementation Benefits	Reference
1	Knowledge/awareness	[27]
2	Lack of analysis of accidents and injuries	[7]
3	A dearth of assurance from the government	[28]
4	Ineffective controlling bodies	[29]
5	A dearth of proficiency in OHS activities	[30]
6	A dearth of leadership commitment in the companies/organisations.	[31]
7	A dearth of management strategies concerning OHS practices	[32]
8	Prioritising production over safety and health	[33]
9	A dearth of safety and health awareness	[32]
10	Short-term thinking	[34]
11	Ineffective communication or an absence of communication between stakeholders	[32]
12	Economic pressure	[33]
13	Failure to begin small	[35]
14	Insufficient resources allocation to safety and health	[36]
15	Insufficient policy on OHS	[30]
16	A dearth of knowledge concerning the impact of the interventions	[37]
17	Bureaucracy	[38]
18	Complexity in the relationships with external organisations	[30]
19	Trouble in preparing OHS activities	[30]

This barrier can be studied on various scales based on the themes, some of which are discussed in the existing literature and some of which are irrelevant to the construction industry. Knowledge concerning the existence of systems (e.g., OHSMSs) is among the key barriers to implementing OHSMSs itself. This refers to a company's dearth of economic and informative resources for understanding and implementing this system [26]. Construction companies consider management systems capital-intensive, ineffective and time-wasting [39]. Standard OHSMSs, including ISO 45001/OHSAS 18001, are designed for large, homogeneous companies and may not match the entire construction industry's inhomogeneity [40] since various studies have reported that national legislations and standards treat this category of industry as a whole and do not focus on the infinite details that differentiate one construction industry from another of perhaps similar size and category. Thus, this leads to a lack of interest from the construction industry concerning this topic, which transforms into a dearth of data concerning OHS and its associated benefits, especially in developing countries [41,42].

The inability of the construction industry to analyse injuries and accidents is another critical area. Based on the existing literature, it has been proven that construction industries have higher rates of accident risks than other industries. However, on the other hand, due to the large numbers of employees in these firms, the frequency of accidents is relatively

high [43]. Owing to this, owners may overestimate the risks in their construction firms, and this might lead to a general decrease in safety and health in the construction industry. Notwithstanding the list of barriers and the paucity of space and time to discuss every barrier, this study has employed a systematic approach to the selection and discussion of the literature concerning the benefits of implementing occupational and health safety management systems for a sustainable construction industry.

Conversely, it is noteworthy to estimate the financial benefits of employers' OHS expenditures. Although company expenditures on OHS in developed countries (e.g., USA, Germany and Japan) can be significant, the monetary benefits of these expenditures have not been fully explored. A transparent approach was applied to measuring the financial overrun to companies from OHS expenditures [1]. They combined estimates of monetary benefits with real monetary benefits arising from the aversion of disabling job-associated illnesses and injuries and real monetary benefits relating to improved worker morale and retention, improved production quality and reinforced company reputation. Applying these reasonable hypotheses, the average return on OHS costs varied around the estimated average return on investment values. The estimates of average monetary return between big companies ranged from 1.24 to 2.14. Thus it was an estimates of average monetary return are consistent with the existing literature [1]. Thus, it is essential to establish an OHS framework for reducing accidents in the construction sector with continual improvement using a systems approach (Figure 12).

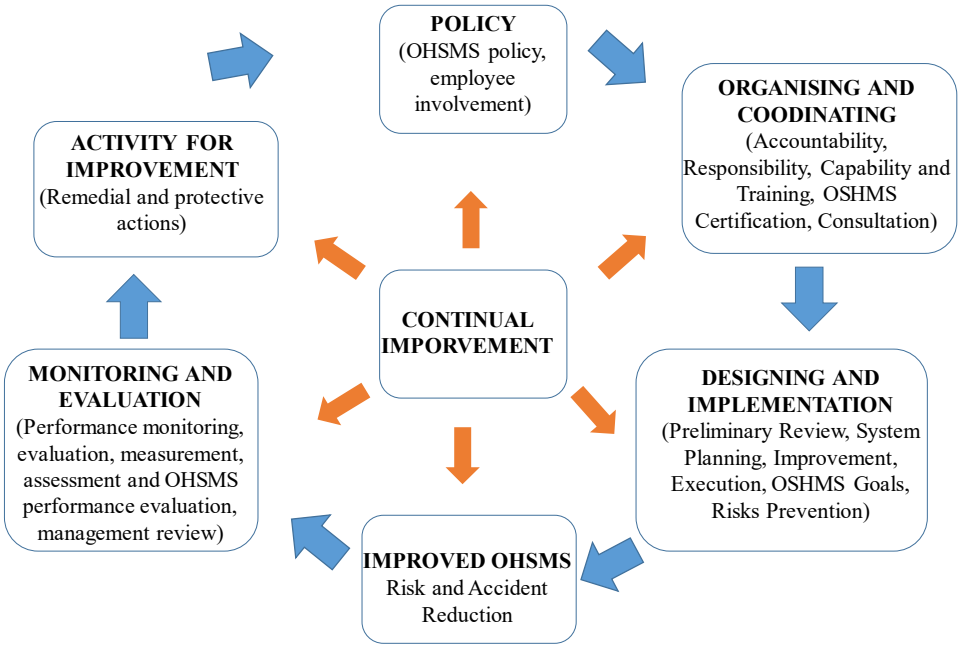

Figure 12. A framework for OHSMS management and accident reduction.

A systems approach to OHSMS services and management in various construction sector occupations have been increasingly internationally recognised. In addition to different sectors of occupation, the large, international workforce comprising the construction industry, amounting to hundreds of thousands of people, is grossly deprived of full access to OHSMS services. This influence illuminates the key features of OHSMSs in various international sectoral models. It examines the challenges and effectiveness of the systems in the different areas of occupation, including construction. Further, different OHSMS schemes and models were elaborated with sector-specific applicability in various countries.. As illustrated in Figure 12, policy formulation is fundamental to the implementation of OHSMSs through the phases of improving the OHSMS and reducing accidents.

3.6. Knowledge Gaps and Future Research Directions

This paper reviews occupational health and safety management systems (OHSMSs) from articles accessed via online databases through some defined principles of choice and incorporation. Using this standard, it is clear that OHSMSs are well researched. However, discrepancies exist concerning the scope, depths and types of problems or concepts being investigated. For example, the implementation and performance of OHSMSs were deeply examined. Similarly, the awareness of OHSMSs among workers and construction managers has been studied well. Despite the established literature on the benefits of OHSMSs, this concept was poorly reported. Additionally, this review identified the following grey areas which require more research:

- The fractional integration of OHSMSs;
- Worker behavioural safety compliance;
- Low rates of OHS implementation among contractors;
- Regulations and law enforcement;
- Comparisons of site safety plans;
- Proactive measures of priority to identify violations.

Finally, this review revealed the following factors that compromise the implementation of OHSMSs:

- A lack of proper communication and the non-utilisation of PPE;
- Erroneous postures and work activities;
- A dearth of training;
- Physiological factors, including burnout and stress;
- A dearth of safety culture and orientation;
- Matters relating to compliance with effective laws are significant safety challenges in the construction industry.

4. Conclusions

This study reviewed the benefits of implementing occupational health and safety management systems for the sustainable construction industry. The review has demonstrated our novel efforts to increase our understanding of the benefits of implementing sustainable occupational and health safety management systems for the sustainable construction industry. Generally, new studies concerning OHSMSs were limited to specific topics, including the certification process, its influence on organisational performance and workers' attitudes concerning risky behaviour and their impact on work-related accidents. This review began with an attempt to summarise the empirical state of the art and identify the most pressing viewpoint regarding future research based on the prospective employee and company benefits of implementing OHSMSs in the construction industry. Although it might be challenging to infer the benefits of OHSMSs among different construction companies, the financial, safety and health benefits are apparent once construction firms enhance OHSMSs.

Large scientific databases have stored large amounts of literature concerning OHSMSs in the construction industry. Thus, reviewing all these publications is challenging due to time constraints. Hence a systematic procedure must be employed. Web of Science, Scopus and other databases were searched using predefined standards. Therefore, one hundred and four articles were selected and examined. These studies present OHSMSs and related analyses and measurements concerning the implementation of OHSMSs and their performance, awareness, benefits and challenges in the construction industry. The results are summarised below:

- This study reveals that 12.50% of the reviewed studies assessed the implementation of OHSMSs in the construction industry, and 25.96% studied the management of OHSMSs in the construction industry.
- Analyses of the performance of OHSMSs in the construction industry accounted for 8.65%, analyses of the awareness of OHSMSs accounted for 4.81%, model-related analyses accounted for 13.46%, analyses of the significance/benefits of OHSMSs

accounted for 3.85%, analyses of the barriers/challenges to OHSMSs accounted for 5.77%, analyses of OHSMS safety indicators accounted for 2.88% and other studies accounted for 20.19%.

- Conversely, most of these studies (61.54%) were conducted in developing countries, while 38.46% were conducted in advanced nations. Based on these results, it is clear that more construction activities are being conducted in emerging countries and thus have attracted much attention from researchers.
- Concerning the implementation of OHSMSs, there is an observable commitment concerning the allocation cost and workforce and safety manager competency as significant drivers for implementing SMSs. Additionally, reductions in the rates and cost of accidents, better organisational frameworks and enhanced safety audit ratings were recognised as significant benefits for the implementation of SMSs.
- However, the results pointed to the weaknesses of the existing templates concerning the application of epidemiological indicators in OHS management. The connections of safety incentives, safety accountability and sub-constructor involvement considerably impact safety performance.
- Managing risks in the construction industry is necessary to methodically assess general risk management factors for safeguarding different project participants. The management of safety and quality during construction can increase the understanding of contributors to successful safety and quality plans in construction.
- The major elements influencing safety performance comprised the poor safety awareness of top management, a dearth of training, project managers' dearth of safety awareness, a lack of investment in safety and careless operations. Therefore, authorities must play a more significant role in law enforcement and organising safety teaching programs.
- Other OHSMS elements in the construction industry constituted 20.19% of the reviewed literature. These elements accounted for less than 1% of the analysed literature and are deemed significant for further discussion. These elements represent areas that need further exploration.

There is evidence concerning the sustainable benefits of exploring the neglected areas of OHSMSs mentioned above, which could further enhance occupational health and safety in the construction industry. The dearth of extensive analyses concerning these areas can be attributed to challenges including OHSMS standards, regulations or laws between countries, especially developing countries. This is evidenced in the proportion of OHSMS studies conducted. Additionally, providing an answer as to why standard certifications might not translate into higher rates of OHS implementation among construction industries, especially in developing countries, remains a significant challenge that has yet to be fully addressed. Therefore, further research is needed to explore these areas and provide an answer to the question above. Consequently, the rationality for evaluating the benefits of an OHSMS, comprising its implementation, management, performance, awareness and barriers, is challenging to authenticate since appropriate field, survey, organisational and clinical data concerning the occurrence of incidents in the construction industry are lacking for a comprehensive evaluation. Hence, the current review was conducted within the context of prevailing state-of-the-art knowledge about the benefits of implementing OHSMSs and the consistently essential application of acceptable standards in the literature.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/su151712697/s1. References [151–158] are cited in the supplementary materials.

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A.F.K., M.F.A.-A., F.E., A.M.A.Z., M.A. and T.J.O.Q.; writing—review and editing, A.F.K., M.F.A.-A., F.E., A.M.A.Z., M.A. and T.J.O.Q. All authors have read and agreed to the published version of the manuscript.

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