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The construction industry's health and safety factors: Identification and categorization

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C H R O N I C L E

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A B S T R A C T

This study seeks to examine the various attributes that impact health and safety in construction (HSIC) across different companies, stakeholders, and nations. The objective is to identify these attributes and organize them within a framework to facilitate a clearer understanding. The research identified common characteristics that promote the adoption of HSIC, yielding advantages for governmental, private, and public entities. The United Kingdom, the United States, Canada, Australia, and Hong Kong are considered the leading countries in terms of conducting research on HSIC attributes. There exists significant potential for enhancing the contributions of developing countries. The proposed framework acknowledges a comprehensive set of 61 attributes, which are categorized into four distinct groups: Corporate regulatory, Employee's self-supportive, Workplace regulatory, and Federal regulatory attributes. These attributes function as a framework for clients and policymakers to enhance the quality of HSIC. In forthcoming periods, it is recommended to prioritize the utilization of empirical surveys conducted across diverse locations in order to ascertain the attributes that are deemed of utmost importance and necessitate significant attention.

1. Introduction

In order to attain Health and Safety in Construction (HSIC), it is imperative to consistently enhance the factors that impact health and safety. The significance of categorizing these factors within the construction industry cannot be overstated (Patel & Malek, 2018; Upadhyaya & Malek, 2022). The construction industry is commonly recognized as a sector with a high incidence of accidents. In the United States, the fatality rate in this industry is five times higher compared to other industries (Jimmie et al., 2013). Similarly, in the United Kingdom, it ranks second in terms of fatal injuries (Executive HS, 2019). Furthermore, in China, the construction industry accounted for the highest proportion of work-related accidents in 2019, comprising 34% of all accidents across industries (*Work Accidents and Deaths in China Fall but Familiar Failings Remain*, 2019). On a global scale, the phenomenon under consideration leads to an annual fatality count exceeding 100,000, constituting a significant proportion of work-related deaths ranging from 30 to 40%. This data serves as evidence of its unsatisfactory outcomes (S. Alkilani et al., 2013). The limited identification and categorization of methods to enhance HSIC have hindered corporate firms' capacity to effectively develop application strategies that align with their objectives.

The primary aims of this study are as follows:

1. To determine the annual publication trend in the field of HSIC research,
2. To identify the countries of origin of authors and active participants involved in the exploration of HSIC application considerations, and
3. To delineate the attributes, consolidate them, and categorize them within a classification framework to facilitate accessibility and enhance comprehension.

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This paper aims to identify and classify attributes into four distinct categories. The four attributes under consideration are: corporate regulatory attributes, employee's self-supportive attributes, workplace regulatory attributes, and federal regulatory attributes. A novel framework has been developed to assess the global efficacy of HSIC, with potential implications for policymakers and practitioners seeking to implement HSIC for its anticipated advantages. Additionally, this may serve as an incentive for the government to formulate and implement appropriate policies that facilitate the successful implementation of HSIC.

2. Research methodology

The present study comprises three distinct phases aimed at formulating the constituent elements necessary for the implementation of HSIC. The comprehensive review process is outlined in Figure 1. The initial phase involved conducting a comprehensive literature search from scholarly journals pertaining to the field of construction management, as specified in the provided reference list (Wing, 1997). The search process of various renowned search engines, such as Scopus, Web of Science, Microsoft Academic, and Google Scholar, has garnered significant acclaim. During the second phase, an endeavor is undertaken to identify the most relevant articles pertaining to this study through a meticulous visual examination. During the final phase, the process of content analysis was conducted to identify attributes, which were subsequently categorized through frequency and mean analysis in order to enhance comprehension.

2.1 Papers Retrieval

The scholarly publications pertaining to construction management exhibit an average score exceeding 60% (Wing, 1997) on the ranking and were incorporated in the initial phase of the search process (Chan & Owusu, 2017). Following the selection of the journals, the virtual libraries associated with each respective journal were accessed. These virtual libraries include Science Direct, Taylor and Francis online, ASCE Library, and the Institution of Civil Engineer's virtual library. The purpose of accessing these virtual libraries was to retrieve papers related to the keywords "health," "safety," "construction," and either "attributes," "indicators," "parameters," or "variables." Following the initial search, a total of 90 publications were gathered from various academic journals. In addition to the journals that were ranked by (Wing, 1997) a few decades ago, prominent search engines such as Elsevier's Scopus, Web of Science, Microsoft Academic, and Google Scholar were utilized to facilitate the search process. It is worth noting that Wing's compilation did not include articles that contained either partial or complete explication of the subject matter, which were found in recent prospective journals. Therefore, employing generic search terms, a total of 85 additional articles were discovered, based on two significant criteria: 1) excluding journals already identified in the Wing's list, and 2) considering only valid papers that directly addressed HSIC, as illustrated in figure 1. The final count of publications amounted to a total of 175. The perspective expressed suggests that an adequate number of accessible resources were obtained, while important primary sources were disregarded, leading to a notable number of redundancies.

2.2 Relevant Paper Selection

The articles selected for this study were sourced from reputable journals in order to identify the most pertinent ones, as these journals are known for their high quality (Wallace & Wray, 2013). Following the selection process, the total number of papers that remained was 175. Subsequently, a comprehensive evaluation of all the abstracts and conclusions was conducted, and in cases where the derived information was deemed inconsequential, a thorough analysis of the complete text was undertaken (Chan et al., 2020). The study excluded articles that discussed HSIC but did not specifically focus on projects within the construction industry. The ultimate examination was derived from a cumulative of 38 scholarly articles. Table 1 illustrates the distribution of the final paper across the chosen academic journals.

3. Recognition Of The Hsic Attributes

In order to identify the characteristics of the chosen 38 publications, a four-step methodology was employed. Additionally, certain studies utilized tables and charts to enumerate the attributes, while others employed content analysis techniques.

Table 1
Search Suggestions for Pertinent Academic Articles

Sr. No.	Journals Considered	Publications found Initially	Publications Considered
1	Journal of Construction Engineering & Management (JCEM)	78	11
2	Safety Science (SS)	58	13
3	Journal of Management in Engineering (JME)	12	4
4	Journal of Safety Research (JSR)	11	2
5	International Journal of Construction Management (IJCM)	5	2
6	Journal of Civil Engineering & Management (JCEM)	6	1
7	KSCE Journal of Civil Engineering	1	1
8	Australasian Journal of Construction Economics	1	1
9	Journal of Construction in Developing Countries (JCDC)	1	1
10	ISRN Civil Engineering (ISRNCE)	1	1
11	Mediterranean Journal of Social Sciences (MJSS)	1	1
	Total	**175**	**38**

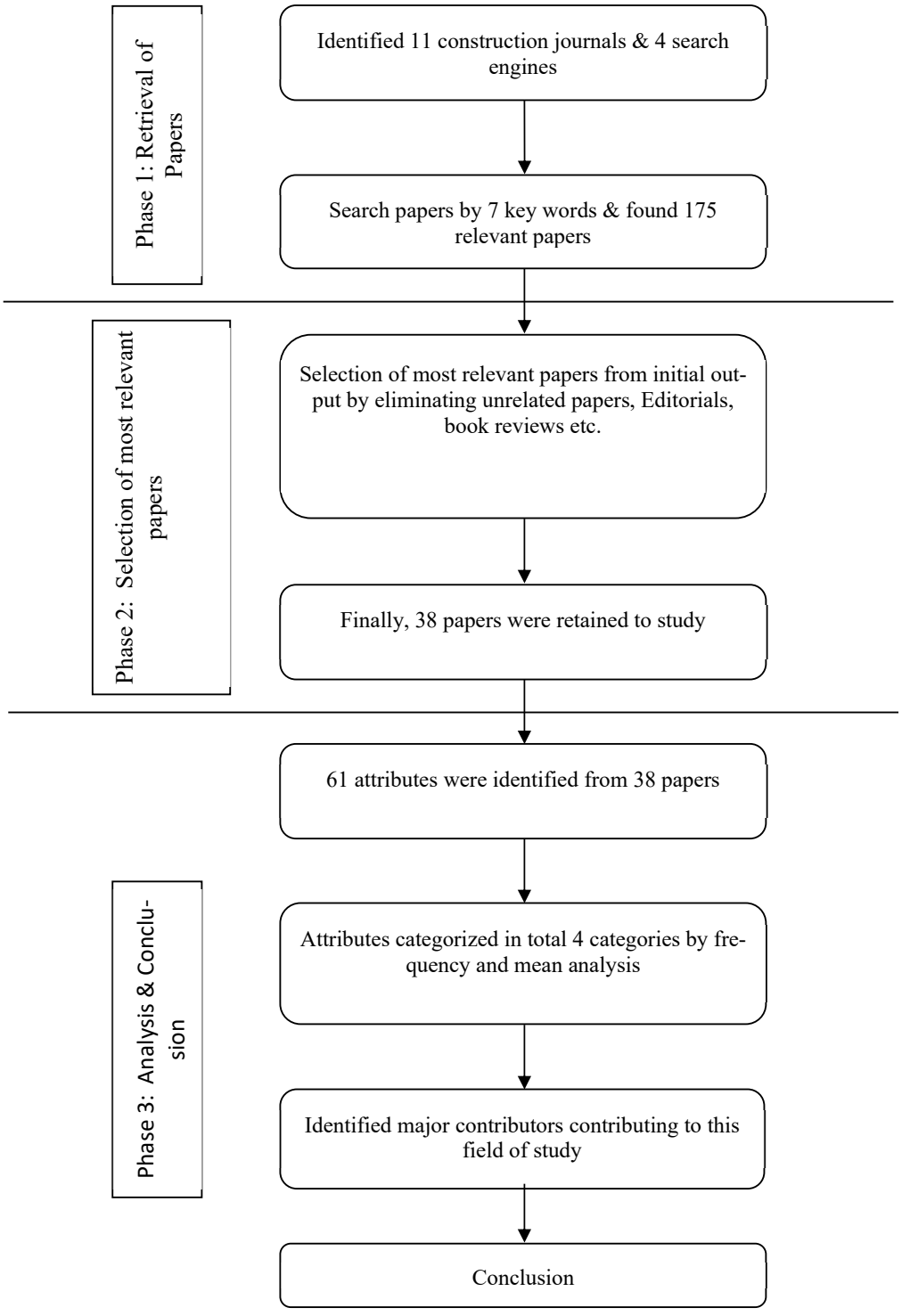

Fig. 1. Summary of article searching and study process

1. De-contextualization refers to the utilization of precise coding techniques that capture predetermined criteria in order to represent words, sentences, and phrases.
2. Re-contextualization refers to the method of assessing the significance of a study based on its consistency, as determined through the process of free coding.
3. The process of compilation and categorization involves the identification and extraction of individual topics based on the presence of key phrases within the content.

4. The evaluation of consistency involves comparing various judgments (Chan et al., 2020) in order to minimize internal subjectivity and significant discrepancies.
Following the completion of the entire procedure, a collective sum of 61 elements was successfully identified and shown with code in Table 2.

Table 2
Literature-Recognized Attributes for H&S in Construction

Code	Attributes for H&S in construction
1	Safety training & Safety related educational programs
2	Management commitment for H&S
3	Communication channels/systems
4	Safety incentives/Safety motivation /Safety promotional activities
5	Risk assessment/ Hazard identification/analysis/ Job safety analysis
6	Worker's/employee's involvement/participation in H&S aspects
7	Unsafe attitude/Behaviors
8	Accident investigation
9	Onsite safety meetings
10	Onsite toolbox talk
11	Housekeeping/ Drinking water/ Lines & Urinals/Sanitation/ Accommodation/ Drug & Alcohol testing/ Healthcare facilities & Canteen
12	H&S inspections
13	Safety budget
14	H&S performance monitoring system/evaluation/measurement/ assessment
15	H&S organization/Safety Committee
16	Safety policy
17	Supply of PPE for workers
18	Safety rules
19	Peer & Time pressure
20	Safety audits by outside auditors
21	H&S plan
22	Emergency plan
23	Accident reporting system
24	Safety awareness
25	Safety leadership
26	Working environment
27	Accident report analysis system
28	Instructional manuals for H&S
29	H&S lesion learning & sharing
30	Unsafe working conditions
31	Usage of PPE & Correct Method of Using PPE
32	Current H&S rules &regulations
33	Worker's suggestions & feedback
34	Workplace layout considering H&S aspects
35	Fire control measures/ Electrical safety precautions/Machine Guarding
36	Absence of safety provisions in contractual clauses
37	Records keeping
38	Provision of insurance for labour
39	Training for special operations
40	Worker's right to refuse potentially unsafe work & unhealthy conditions
41	Influence of drug/alcohol/injury on work efficiency
42	Risk-taking behaviors
43	PPE & other safety equipment inspection& maintenance policy
44	Teamwork of employees
45	Induction training programs
46	Lack of accident data management system
47	Extensive use of migrating labour
48	Shift pattern & timings
49	Contractor &Subcontractor selection criteria
50	Worker's age
51	Lack of certifying authority to the H&S management system
52	Lack of onsite inspections by government authorities
53	Insufficient penalties
54	Inadequate support for innovation, research & technology
55	Contractors' negligence toward safety
56	Safe operating procedures
57	Outdated procedures
58	Worker's education & skill
59	Identification of implementation of H&S legislation
60	Negligence of work due to simplicity & repetitiveness
61	Worker's sincerity & professionalism

Upon conducting a systematic examination of the studies, all acknowledged characteristics have been compiled and presented in Table 3.

Table 3
Literature-Recognized Attributes for H&S in Construction

Code	References																																					Sum of References
	(Chan et al., 2017)	(Yiu et al., 2018)	(Alkilani et al., 2013)	(Cheah, 2007)	(Raja Prasad & Reghunath, 2011)	(Agumba & Haupt, 2012)	(Akroush & El-Adaway, 2017)	(Guo & Yiu, 2016)	(Wu et al., 2015)	(Wong, 2016)	(Gambatese et al., 2016)	(Namian et al., 2016)	(Nguyen et al., 2016)	(Marks, 2016)	(Gunduz et al., 2017)	(Guo et al., 2017)	(Gupta et al., 2018)	(Karakhan et al., 2018)	(Alruqi & Hallowell, 2019)	(Zhang et al., 2016)	(Pereira et al., 2018)	(Awwad et al., 2016)	(Guo et al., 2016)	(Jitwasinkul et al., 2016)	(Lingard et al., 2017)	(Mazlina Zaira & Hadikusumo, 2017)	(Saunders et al., 2017)	(Alruqi et al., 2018)	(Bavafa et al., 2018)	(Manu et al., 2018)	(Mohammadi et al., 2018)	(Tremblay & Badri, 2018)	(Xia et al., 2018)	(Stemn et al., 2019)	(Choudhry, 2017)	(Siew, 2015)	(Zahoor et al., 2016)	(Tong et al., 2018)	
1			√		√	√	√		√	√	√	√	√	√			√	√	√	√	√	√					√	√	√			√		√	√	√	23
2	√	√					√				√	√				√		√		√	√	√	√	√			√	√	√		√	√	√	√			√		20
3	√	√		√		√			√	√								√						√		√	√	√		√	√	√	√		√	√		18
4		√			√	√	√	√			√					√		√	√	√	√	√							√	√	√			√		√		17
5					√	√	√					√		√				√			√					√			√	√	√	√		√	√	√	√		16
6	√					√					√							√	√	√	√			√			√	√	√			√		√			√		14
7	√	√					√	√	√					√		√								√			√	√		√	√		√				√	14
8					√		√				√										√								√	√	√	√		√	√		√	12
9		√				√	√												√		√							√		√	√	√		√			√		11
10		√				√	√												√		√							√		√	√	√		√			√		11
11					√	√	√	√			√				√		√				√					√				√					√			√		11
12						√	√												√		√									√	√		√	√	√			√	10
13		√				√	√			√											√	√								√	√		√					√	10
14						√	√		√		√		√						√									√	√				√					√	10
15					√	√	√			√	√							√	√									√	√									√	10
16					√	√				√											√								√	√	√				√	√			9
17					√	√		√							√		√		√										√		√					√			9
18	√				√				√	√																	√	√	√	√						√			9
19	√								√											√			√				√	√	√		√					√			9
20						√	√											√			√					√			√					√		√			8
21						√	√												√										√	√		√		√			√		8
22					√		√														√								√		√				√	√			7
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24			√										√							√		√								√		√								7
25		√																√					√	√						√			√							6
26				√														√	√											√		√					√		6
27					√		√												√												√		√				√		6
28						√													√										√	√					√				5
29		√			√				√										√				√																5
30		√			√				√										√				√																5

Table 3
Literature-Recognized Attributes for H&S in Construction (Continued)

Code	References																																			Sum of References
	(Chan et al., 2017)	(Yiu et al., 2018)	(Alkilani et al., 2013)	(Cheah, 2007)	(Raja Prasad & Reghunath, 2011)	(Agumba & Haupt, 2012)	(Akroush & El-Adaway, 2017)	(Guo & Yiu, 2016)	(Wu et al., 2015)	(Wong, 2016)	(Gambatese et al., 2016)	(Namian et al., 2016)	(Nguyen et al., 2016)	(Marks, 2016)	(Gunduz et al., 2017)	(Guo et al., 2017)	(Gupta et al., 2018)	(Karakhan et al., 2018)	(Alruqi & Hallowell, 2019)	(Zhang et al., 2016)	(Pereira et al., 2018)	(Awwad et al., 2016)	(Guo et al., 2016)	(Jitwasinkul et al., 2016)	(Lingard et al., 2017)	(Mazlina Zaira & Hadikusumo, 2017)	(Saunders et al., 2017)	(Alruqi et al., 2018)	(Bavafa et al., 2018)	(Manu et al., 2018)	(Mohammadi et al., 2018)	(Tremblay & Badri, 2018)	(Xia et al., 2018)	(Stemn et al., 2019)	(Choudhry, 2017)	(Siew, 2015)	(Zahoor et al., 2016)	(Tong et al., 2018)	
31													√																		√			√		√		4
32			√	√																												√				√	4
33						√	√			√																							√				4
34					√	√											√						√														4
35					√		√								√																					√	4
36				√														√																	√		3
37							√												√																	√	3
38			√																										√						√		3
39					√																														√	√	3
40						√	√																√														3
41						√	√																√														3
42	√								√											√																	3
43					√		√																														2
44		√																√																			2
45					√																								√								2
46			√				√																														2
47			√																			√															2
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59				√																																	1
60					√																																1
61		√																																			1

4. Classification of the hsic attributes

The process of aggregating similar or dissimilar indicators into overarching higher-level categories is crucial for facilitating comprehension, enhancing clarity, enabling referencing, and promoting attribute simplicity.

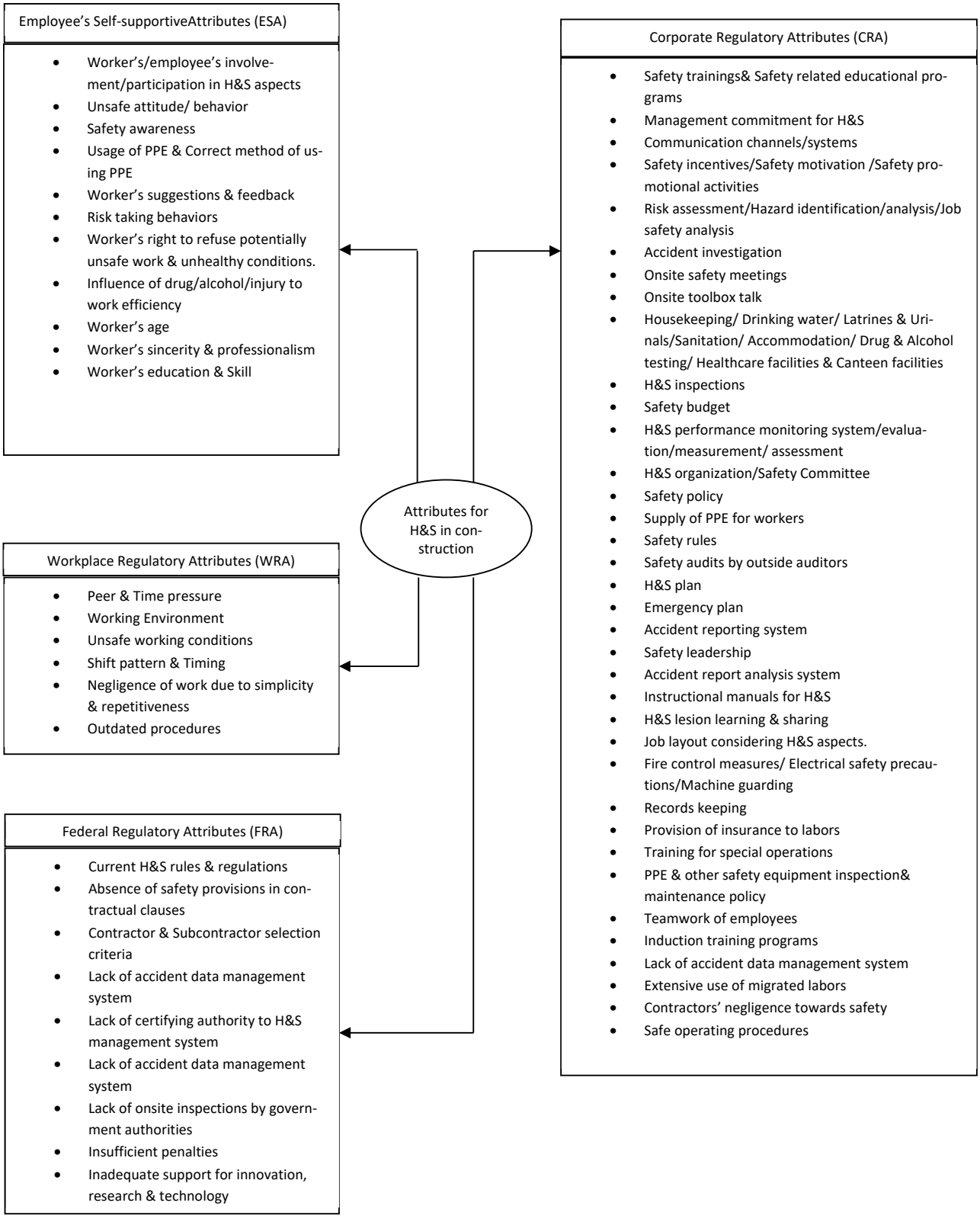

Fig. 2. A Conceptual Framework for H & S Attributes in Construction's Classification

The present study employed a classification approach to categorize the elements, drawing on four systematic reasoning methods (Chan et al., 2020). This approach distinguishes itself from previous research, which primarily organized the elements based on similarity in category or idea (Ghobadi, 2015). The study utilized this classification technique to construct a taxonomy framework for intelligence exchange attributes within programming groups, taking into account the perspective of institutional transformation.

The methodology encompasses the following steps:

1) In order to establish the interrelationships between authors, a comprehensive compilation of the identified attributes associated with each author was presented. 2) In order to assess the degree of similarity in attribute categorization, the obtained results were subjected to comparative analysis. 3) The outcomes were compared with previous studies that have classified certain attributes, thereby facilitating a contextual understanding. 4) A collective discussion among the central group was conducted to reach a consensus and finalize the attribute categorization.

This process involved the participation of three scholars who have each published a minimum of two papers on the intriguing phenomenon. Subsequently, a total of 61 attributes were classified into four primary categories based on their respective impacts and definitions (Darko & Chan, 2017). Acquiring proficiency in management skills and advanced technological knowledge can significantly improve the operational effectiveness of construction enterprises, potentially yielding enduring implications for the overall development of the country. The classifications encompass various attributes pertaining to corporate regulations, attributes related to employees' self-support, attributes concerning workplace regulations, and attributes associated with federal regulations. Fig. 2 depicts the philosophical framework utilized in the categorization of HSIC components. This procedure enhanced the relevance of the philosophical framework, thereby ensuring the appropriate placement of the 61 attributes. The discussion primarily focused on the main categories, with limited attention given to their underlying variables due to constraints related to word count and spatial limitations.

The intensity of the variables, specifically the category means score, was adjusted according to the mean ranking analysis, as presented in Table 4. The calculation involved summing the frequencies of each factor isolated within each category and dividing it by the total number of factors "d" within the category, as described by Eq. (1) and Eq. (2).

$$\frac{\sum(WRA_1 + WRA_2 + WRA_3 + \cdots + WRA_6)}{d} \tag{1}$$

$$\frac{\sum(9+6+5+2+1+1)}{6} = 4 \tag{2}$$

Table 4
Attributes for H&S in the construction category rank

Number	Code	Category &Attributes	Frequency	Mean	Rank
1		**Corporate Regulatory Attributes (CRA)**		**7.972**	**1st**
1.1	Cra1	Safety training& Safety related educational programs	23		
1.2	Cra2	Management commitment for H&S	20		
1.3	Cra3	Communication channels/systems	18		
1.4	Cra4	Safety incentives/Safety motivation /Safety promotional activities	17		
1.5	Cra5	Risk assessment/ Hazard identification/analysis/ Job safety analysis	16		
1.6	Cra6	Accident investigation	12		
1.7	Cra7	Onsite safety meetings	11		
1.8	Cra8	Onsite toolbox talk	11		
1.9	Cra9	Housekeeping/ Drinking water/ Lines & Urinals/Sanitation/ Accommo-	11		
1.10	Cra10	H&S inspections	10		
1.11	Cra11	Safety budget	10		
1.12	Cra12	H&S performance monitoring system/evaluation/measurement/ assess-	10		
1.13	Cra13	H&S organization/Safety Committee	10		
1.14	Cra14	Safety policy	9		
1.15	Cra15	Supply of PPE for workers	9		
1.16	Cra16	Safety rules	9		
1.17	Cra17	Safety audits by outside auditors	8		
1.18	Cra18	H&S plan	8		
1.19	Cra19	Emergency plan	7		
1.20	Cra20	Accident reporting system	7		
1.21	Cra21	Safety leadership	6		
1.22	Cra22	Accident report analysis system	6		
1.23	Cra23	Instructional manuals for H&S	5		
1.24	Cra24	H&S lesion learning & sharing	5		
1.25	Cra25	Job layout considering H&S aspects	4		
1.26	Cra26	Fire control measures/ Electrical safety precautions/Machine Guarding	4		
1.27	Cra27	Records keeping	3		
1.28	Cra28	Provision of insurance for labour	3		
1.29	Cra29	Training for special operations	3		
1.30	Cra30	PPE & other safety equipment inspection& maintenance policy	2		
1.31	Cra31	Teamwork of employees	2		
1.32	Cra32	Induction training programs	2		
1.33	Cra33	Lack of accident data management system	2		
1.34	Cra34	Extensive use of migrated labour	2		
1.35	Cra35	Contractors' negligence toward safety	1		
1.36	Cra36	Safe operating procedures	1		

Table 4
Attributes for H&S in the construction category rank (Continued)

Number	Code	Category &Attributes	Frequency	Mean	Rank
2		**Employee's Self-supportive Attributes (ESA)**		**5.09**	**2nd**
2.1	Esa1	Worker's/employee's involvement/participation in H&S aspects	14		
2.2	Esa2	Unsafe attitude/ Behavior	14		
2.3	Esa3	Safety awareness	7		
2.4	Esa4	Usage of PPE & Correct Method of Using PPE	4		
2.5	Esa5	Worker's suggestions & feedback	4		
2.6	Esa6	Risk-taking behaviors	3		
2.7	Esa7	Worker's right to refuse potentially unsafe work with unhealthy condi-	3		
2.8	Esa8	Influence of drug/alcohol/injury on work efficiency	3		
2.9	Esa9	Worker's age	2		
2.10	Esa10	Worker's sincerity & professionalism	1		
2.11	Esa11	Worker's Education & Skill	1		
3		**Workplace Regulatory Attributes (WRA)**		**4**	**3rd**
3.1	Wra1	Peer & Time pressure	9		
3.2	Wra2	Working Environment	6		
3.3	Wra3	Unsafe working conditions	5		
3.4	Wra4	Shift pattern & Timing	2		
3.5	Wra5	Negligence of work due to simplicity & repetitiveness	1		
3.6	Wra6	Outdated Procedures	1		
4		**Federal Regulatory Attributes (FRA)**		**1.875**	**4th**
4.1	Fra1	Current H&S rules & regulations	4		
4.2	Fra2	Absence of safety provisions in contractual clauses	3		
4.3	Fra3	Contractor & Subcontractor selection criteria	2		
4.4	Fra4	Lack of accident data management system	2		
4.5	Fra5	Lack of certifying authority to H&S management system	1		
4.6	Fra6	Lack of onsite inspections by government authorities	1		
4.7	Fra7	Insufficient penalties	1		
4.8	Fra8	Inadequate support for innovation, research & technology	1		

5. Results and Discussion

As delineated in the following discussion, a total of 61 influencing attributes have been identified and subsequently classified into four distinct categories.

5.1 Corporate Regulatory Attributes

These regulations differ from legal or external regulations as they are more inherent and driven by internal motivations, thereby enticing construction companies to adopt HSIC. The determination of these fundamental attributes is frequently influenced by the physical environment in which the company is located. This particular category encompasses a total of 36 distinct attributes. This category achieved the highest ranking among the four options, with a mean value of 7.972. The primary attribute in this category is safety training and safety-related educational programs, which have the highest frequency of 23 among all attributes across all categories. This accounts for 60.52% of the total publications reviewed.

5.2 Employee's Self-supportive Attributes

Workers directly address the attributes of self-support exhibited by employees. Within this category, a total of eleven attributes were identified. Among these attributes, the involvement and participation of employees in health and safety aspects, as well as their unsafe attitude and behavior, emerged as the top two variables. These variables received high scores and were cited with equal frequency by individuals. This particular category ranked second out of four categories, with an average value of 5.09. This value was determined by calculating the mean frequency of citation for the main underpinning attributes, which accounted for more than 10% of the total number of articles analyzed for instance, the utilization of personal protective equipment (PPE) in conjunction with the appropriate protocols for its use, as well as the inclusion of worker suggestions and feedback, were identified as four out of a total of 38 diverse publications. These findings collectively accounted for slightly over 25% of the comprehensive review articles.

5.3 Workplace Regulatory Attributes

The aforementioned attributes are derived from the cultural framework of the organization. With a mean score of 4, this phenomenon was ranked third out of four categories, with Peer & Time pressure having the highest frequency of 9 occurrences, accounting for 23.68% of the total publications reviewed.

5.4 Federal Regulatory Attributes

One of the key characteristics of federal regulation is the active involvement of the government in the adoption of the Health and Safety Information Collection (HSIC) framework. A total of eight attributes were identified within this particular category. The highest frequency observed, accounting for 10% of the total publications reviewed, pertains to the topic of Current

Health and Safety rules and regulations.

6. Contributions in the study of attributes affecting HSIC

According to the data presented in Fig. 3 of the Scopus database, it is evident that the quantity of publications and studies pertaining to attributes for HSIC remained consistent in the years 2012 and 2013. Subsequently, there was a decline observed until the year 2016. However, from 2016 to 2021, there was an upward trend in the number of publications and studies. Nevertheless, in 2022, there was a subsequent decrease. It is now necessary to engage in extensive academic research in this particular field once more.

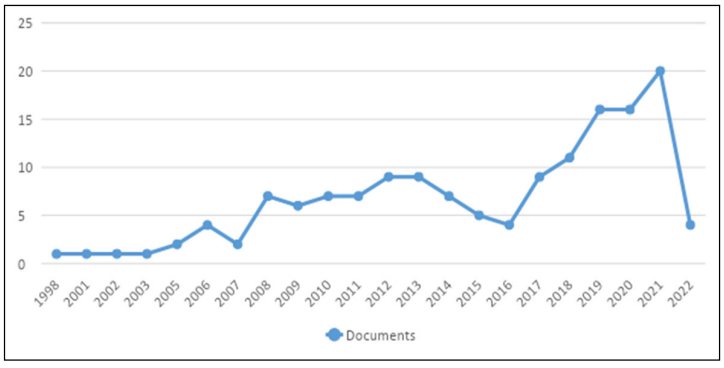

Fig. 3. Year-wise publications for attributes affecting HSIC

According to the data presented in Fig. 4 of the Scopus database, it is evident that the countries with the highest number of publications are predominantly developed nations such as the United Kingdom, United States, Australia, Canada, Hong Kong, Spain, and Turkey. These countries have contributed the highest percentages of publications, with the United Kingdom leading at 24%, followed by the United States at 13%, Australia at 12%, Canada at 7%, Hong Kong at 8%, Spain at 8%, and Turkey at 6%. Simultaneously, the developing nations of South Africa, China, and India made respective contributions of 12%, 7%, and 3% to the overall total.

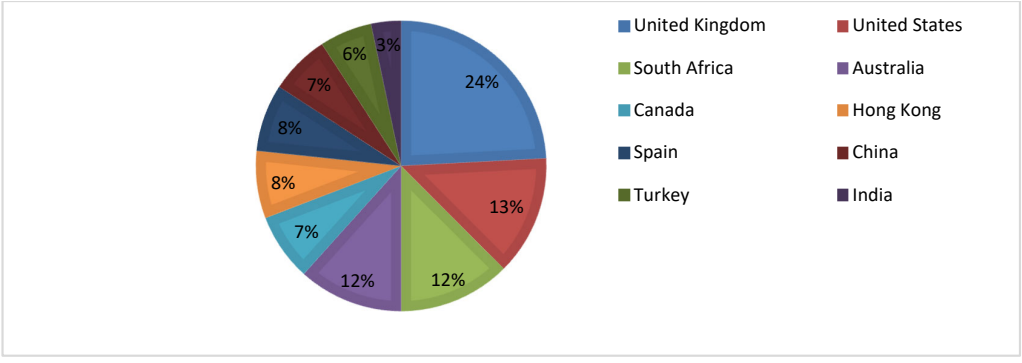

Fig. 4. Country-wise contribution to the study of attributes affecting HSIC

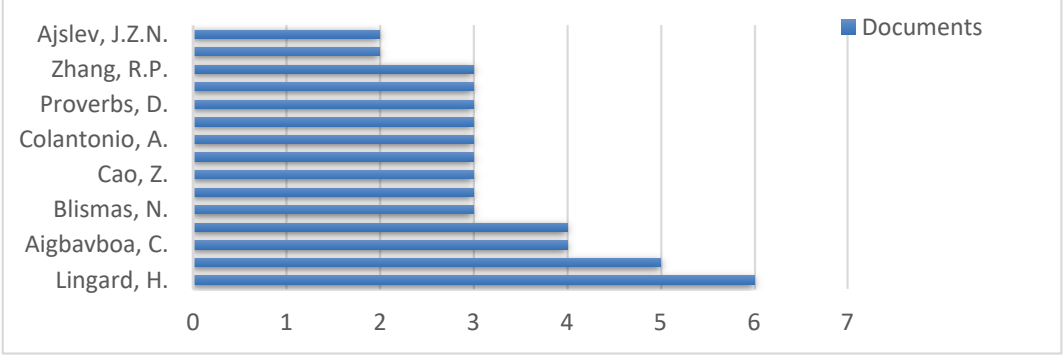

Fig. 5. Author-wise contribution to the study of attributes affecting HSIC

According to the data presented in Fig. 5 of the Scopus database, an analysis of the top fifteen authors and their respective publication counts can be conducted to examine the factors influencing HSIC. It can be asserted that the leading authors in the field of attributes influencing HSIC are Lingard, H., who has published six papers, Haput, T.C., who has published five papers, Aigbavboa, C., and Chan, A.P.C., both of whom have contributed four research papers.

7. Conclusions

In order to effectively implement strategies and make progress toward their objectives, it is imperative for both stakeholders and policymakers to possess a comprehensive understanding of the factors that promote the adoption of Health Information Systems and Communications (HSIC). This study conducted a comprehensive review and produced substantial research on the application of HSIC. Incorporating the entirety of HSIC publications into a singular study may prove to be a laborious task in terms of time allocation. A comprehensive bibliographic review was conducted on a total of 38 scholarly papers that have been published in refereed journals. It can be inferred that authors hailing from developed nations, specifically the United Kingdom, United States, Australia, Canada, Hong Kong, Spain, and Turkey, have exerted a significant influence on the exploration of HSIC attributes. South Africa, China, and India are classified as developing countries that actively contribute to research in the field of HSIC. When incorporating the Hilbert-Schmidt Independence Criterion (HSIC), the framework provides a thorough and inclusive examination and can serve as a guiding principle.

Our proposal for a conceptual framework identifies a total of 61 influencing attributes, which are primarily categorized into four groups: corporate regulatory attributes, employee's self-supportive attributes, workplace regulatory attributes, and federal regulatory attributes. The aforementioned attributes are subsequently refined and incorporated into the proposed framework. The evaluation of success and failure outcomes can be conducted at more frequent intervals, thereby enabling a higher frequency of assessments. This framework can provide a valuable structure for decision-making regarding the promotion of HSIC.

8. Future research and implications

Further investigation using case studies is necessary due to the subjective nature of the attributes identified, which predominantly rely on the researcher's perspective. The majority of empirical studies are typically carried out in developed nations. In light of this matter, it is imperative for researchers to shift their attention toward the advancement of developing nations. In relation to future research, it is recommended that greater emphasis be placed on conducting empirical surveys across multiple locations in order to ascertain the most significant attributes that necessitate careful consideration.

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