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ENHANCING CONSTRUCTION SAFETY CULTURE: A SYSTEMATIC REVIEW OF FACTORS, PRACTICES FOR ERGONOMIC IMPROVEMENT AND PRACTICAL APPLICABILITY IN CONSTRUCTION INDUSTRY

Robin V. John Fernandes [1*], Dr. S.M Tauseef [2], and Dr. N. A Siddqui [3]

Abstract – Some of the major factors contributing to accidents in the construction industry are human behavior, intricate and distant work sites, labor-related complexities, hazardous safety cultures, the utilization of perilous machinery, and non-compliance. Notably, renowned databases, including Springer, Taylor & Francis, ScienceDirect, Research Gate, and Google Scholar, were all included in this systematic review (SR) that was completed following the PRISMA method. The goal is to investigate the relationship between safety culture and the effectiveness of safety measures on construction sites and for construction employees. In this systematic review, various keywords were selected, including "safety culture," safety performance, worker behavior," construction sites," "improved safety culture," and "ergonomic practices". Research published between 2016 and 2022 was considered, as were studies of safety culture in the construction industry that were linked to improved safety culture among construction employees. In this paper, the author examines the role of safety culture in the construction industry on the basis of 17 recent studies based on when the study was published, what technologies were used, and their relation to the construction industry. Researchers prefer proactive measures, which affect the safety culture and climate for construction employees. The study shows that more research is needed, especially in the areas of safety practices and the relationship between agronomic practices and the building industry, to figure out the complicated relationships between variables.

Keywords **–** Construction Accidents, Construction employees, Ergonomic practices, Safety culture, Improved safety culture, Worker behavior.

1. INTRODUCTION

A safety culture is established in a company or institution when its employees consistently prioritize safety and adhere to safety protocols. It's just how things are done here. During the Palaeolithic period (about 41,000 to 12,000 B.C.), when people lived in caves and other man-made dwellings on flat land, the construction industry emerged. When it comes to the building industry, the earliest known written documentation of safety management dates to 2200 B.C. When Hammurabi, king of Babylon, enacted his code of laws, he made it illegal for buildings to collapse and murder their occupants [1]. One of the world's most important contributors to global GDP and a major employer of the world's workforce is the construction industry (GDP). Construction activities make a significant contribution of 6% to the global economy. However, it also bears considerable responsibility for work-related injuries and illnesses, making up around one-third of reported incidents across all sectors.

With more than 5% of the nation's GDP and more than 78% of gross capital creation, the construction sector significantly boosts the economy of the nation. As a result, how the country is seen in terms of its capacity for innovation by the rest of the world is also influenced by the building

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sector [2]. One of the riskiest occupations for people to work in is frequently viewed as the construction industry. The statistics on the number of fatalities related to employment, the number of injuries, and worker's compensation reflect this. Employees are exposed to many, sometimes fatal threats because of the unique nature of construction labor [3]. Given the inherent uncertainties and risks involved, construction projects are inherently associated with some level of risk and unpredictability [4].

Construction plays a noteworthy role in the global economy, contributing 6% significantly. Based on recent statistical data (till 2020) (as shown in Figure 1), the construction industry exhibits a significantly higher rate of workplace injuries and illnesses compared to the average across all other sectors of the economy.

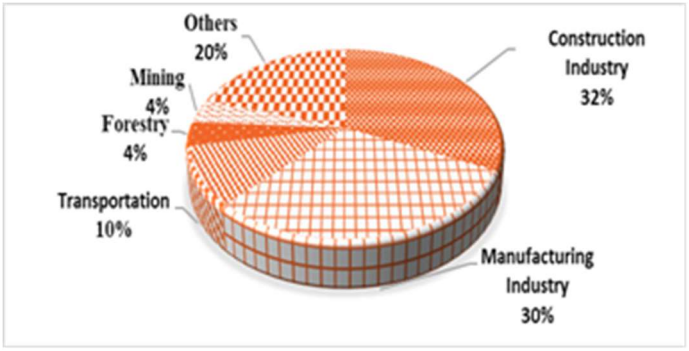

Figure 1: Rates of workplace accidents in various industries [5]

Additionally, Figure 2 presents a detailed analysis of workplace accidents in the construction industry, indicating that around 70% of these incidents take place on construction sites. Approximately 20% of accidents are related to external factors, such as traffic, while the remaining 10% occur in locations outside the typical work environment.

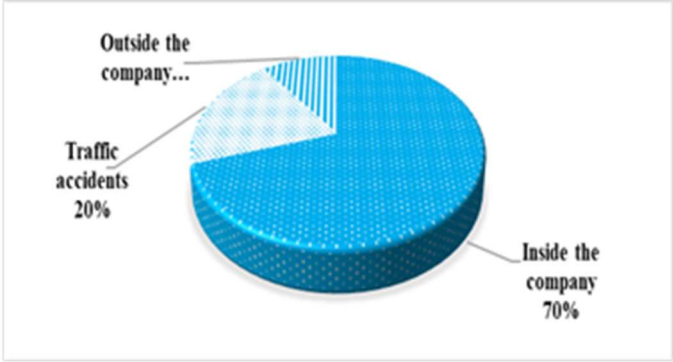

Figure 2: Percentage of workplace accidents by region [5]

Promoting a safety culture in the workplace has proven to be advantageous, leading to improved worker safety, incident prevention, and enhancing the industry's reputation [6]. The ergonomic outcomes of these changes can have various effects, ranging from negative to neutral or even positive. If there is a way to prioritize ergonomic considerations as a key focus in these interventions, it has the potential to significantly benefit worker health [7].

Hence, it is wise to prioritize safety and reduce potential hazards in construction projects. Nevertheless, despite the growing focus on ergonomics and an increasing understanding of

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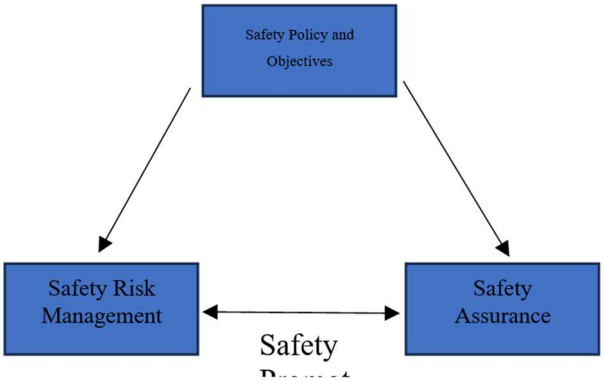
conventional ergonomic issues, the prevalence of musculoskeletal complaints in the workplace continues to be a significant concern [7]. As a result, there has been a push to implement safety systems that aim to decrease the likelihood of accidents while maximizing the efficient use of available resources [8].

1.1 Development of Safety Management

The manufacturing industry underwent a significant transformation during the latter part of the eighteenth century with the onset of the Industrial Revolution. Notably, there was a notable shift towards the widespread use of mechanical labour. This led to the establishment of large-scale manufacturing facilities, commonly referred to as factories, where workers could be directly supervised throughout the production process and effectively assigned specific roles [9]. However, the rapid expansion of the industrial revolution also brought an increase in workplace accidents and fatalities due to the implementation of hazardous manufacturing practices. Figure 3 represents the safety management system [10].



In the 20th century, as technology experienced rapid advancement, the associated risks also became more severe. The National Safety Council, a non-profit organization formed in response, is often credited with spawning the modern safety movement [11]. Later, with backing from businesses all around the globe, comparable non-governmental organizations emerged, such as the International Labor Organization (ILO) and the British Safety Council (BSC). Workers' compensation payments were a major focus in the subsequent stage. Over time, governments took on greater responsibility in ensuring the safety of numerous industries [12].

1.2 The Indian Construction Sector's Framework for Assessing Safety Performance

In 1998, a comprehensive survey was conducted across 175 countries to figure out the overall size of accidents worldwide. The survey revealed an annual occurrence of 264 million non-fatal work-related accidents, alongside 350,000 fatal accidents encompassing both the industrial and construction sectors [13]. The disparity in accident statistics between developed and underdeveloped countries is substantial. Nevertheless, the construction sector in emerging economies encounters difficulties in adjusting to rapid industrialization and struggles to effectively identify and mitigate potential hazards and risks in their projects [14].

During 2019, the construction sector in India was responsible for around 28.2% of all workplace fatalities that occurred throughout the year, resulting in the tragic loss of 48,000 lives. During the final quarter of 2018, the construction industry made a substantial contribution to the country's

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GDP, reaching a total of INR 2,535.88 billion. In India, despite significant endeavours to enhance and rigorously uphold safety protocols, such as the enactment of labour laws and safety regulations, the frequency of accidents is persistently escalating at a concerning rate [15]. Construction work in India is mostly manual, and a significant number of people are required to complete the task. The job's instability makes it a particularly difficult place to work. Most people working on construction sites are temporary, and they often must move around [16].

1.3 The nature of construction accidents

Accidents are the result of a confluence of many different factors, each of which has the potential to cause the incident. Many different characteristics affect two main classes of variables. Proximal factors consist of things like workers' attitudes, abilities, awareness, health, and fatigue levels, which can be influenced by industrial psychology's successes in the areas of communication, motivation, and training, as well as the workers' current health status and the site hazards that result from a lack of proper planning, management, and supervision, ultimately leading to an absence of an H&S culture. Second, 'distal factors' are those connected or tied to, such as design-related concerns like the selection of appropriate materials and tools as well as the design context in which they will be implemented. Active failures are the result of bad choices during the design and planning phases [17][18] [19].

Statistics on occupational fatalities, injuries, accidents, and their severity are among the indicators typically compiled, as stated [20]. The construction industry has the highest rate of accidents leading to serious injury or death compared to any other industry of work. The construction industry accounts for about 20% of all workplace fatalities in the United States due to the high number of accidents that occur there each year [21]. Accidents, as described by Anton (2017) [22] , are unanticipated and accidental occurrences that result in harm to people or damage to things that have worth in and of themselves. Large production expenses, poor efficiency, and long-term impacts like low staff morale and public disgrace can come from such mishaps, causing a company to lose a lot of money [23].

1.4 Hazards and risks leading to accidents in construction industry

The term "risk" refers to both the likelihood that harm could occur from a specific danger and the severity of that harm. A hazard is anything that might endanger someone's safety. When thinking about construction H&S dangers and risks, it is important to keep in mind the five major categories mentioned previously as potential causes of construction accidents. Inhalation, absorption, and ingestion are obvious construction health hazards and risks; falls from heights, motor vehicle accidents, and being struck by are obvious construction security threats and threats; and work-related musculoskeletal disorders (WMSDs) or "body stressing" are obvious construct ergonomics hazards and risks.

The human body can absorb hazardous chemical substances (HCSs) through inhalation, skin absorption, or ingestion. Dusts, fumes, vapours, mists, and gases are only some of the airborne contaminants that can cause irritation to the eyes and respiratory system as well as more subtle harm to the organs over time if inhaled. Dust is produced during the construction industry's material handling and processing. Asbestosis, lung cancer, and pneumoconiosis (lung illness

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caused by breathing mineral or metallic dust over a long period of time) are all caused by inhaling extremely small dust particles, which might still enter the lungs despite the warnings of coughing and sneezing. breathing the complex fumes created by welding processes might induce metal-fume fever, while breathing solvents can cause respiratory problems and central nervous system damage [24][25][26][27]. Absorption describes the process by which HCSs enter the body through the skin. The usage of solvents, working with concrete (because to its alkaline and abrasive properties), and the handling of bitumen and similar items are all examples of occupations that put people at risk for skin diseases including dermatitis and acne [28] [29] [30] [31]. Accidental ingestion of HCSs is rare; most exposure occurs when people handle products containing HCSs and then proceed to eat without first washing their hands.

1.5 Ergonomics in construction

Ergonomics plays a crucial role in the construction industry, with the overarching goal of improving worker comfort, safety, and productivity through the improved design and arrangement of tools, equipment, workspaces, and tasks. Ergonomic factors are particularly important in the construction industry because of the high prevalence of physically demanding tasks and the high risk of workplace injuries. Construction firms can reduce the likelihood of injuries, increase worker morale, and improve project efficiency by adopting ergonomic principles like the use of well-designed tools and equipment, the proper sequencing of tasks, and sufficient breaks. The benefits of ergonomics in reducing fatigue and stress have been highlighted by a number of studies, including those conducted by Hignett et al. (2005) [32] and Jahncke et al. (2017) [33] , which have found that doing so can boost both productivity and attendance. Researchers Boyko and Cooper (2008) [34] stressed the importance of communication and cooperation between architects, engineers, project managers, and workers for the smooth implementation of ergonomic practices. Therefore, there is a strong correlation between a holistic approach to ergonomics in the construction industry and improved worker health and successful project completion.

1.6 Analysis of Accidents and Requirements for a Safety Culture

There is a pressing need to prioritize the enhancement of worker safety to reduce the frequency of accidents occurring on construction sites. Particularly in developing countries, the construction industry continues to present persistent risks to the health and well-being of its workforce [35]. Building companies worldwide are implementing various regulations and initiatives to address this issue. However, there are still gaps in the dissemination of safety-related information within the construction sector, resulting in ongoing challenges related to awareness of safety hazards, protocols, and practices. The nature of work, workers, and management structure all contribute to making these issues worse. One of the leading causes of workplace injuries and fatalities in the construction sector worldwide is a casual attitude toward safety [36]. Therefore, it is crucial to give priority to overseeing the safety culture at work to promote a secure working atmosphere and, in the end, reduce the frequency of accidents within the construction sector [37]. Apart from the adverse impacts on quality of life and potential loss of life, construction site accidents have far-reaching negative consequences. These include project delays, increased costs for materials and services, and heightened medical expenses [38].

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1.7 Leadership in Safety's Importance to Risk Management

The responsibility for workplace safety and cultivating a safety culture cannot solely rest on the workers. Behaviour is the determining factor in shaping culture, as it reflects and exemplifies the prevailing ideals. Extensive research on leadership underscores the vital role of risk management in organizational performance [39]. Assorted studies have also emphasized the detrimental impact of inadequate leadership support on the success of continuous health and safety enhancements. Scholars specializing in workplace health and safety management have underscored the pivotal role of leadership in establishing a secure work environment [40]. After examining the pertinent literature, researchers reached the consensus that senior management holds the ultimate responsibility for identifying the factors that impact safety performance within organizations [22]. For leaders to effectively manage safety at the same level as other business activities, it is essential to prove meaningful performance measurements that enable progress evaluation and strategic direction. Earlier safety research has examined and analyzed the existing policies and processes in organizations that have developed strong and positive safety cultures [41]. However, it is challenging for businesses to devise safety policies and procedures that account for every potential contingency. Since values ultimately shape behavior, regardless of the presence of regulations and procedures, understanding the underlying values driving the safety practices of companies praised for their exemplary safety cultures becomes imperative [42].

Effective safety leadership could help reduce the number of accidents and injuries caused by human error. The United States Department of Labor's Occupational Safety and Health Administration (OSHA) acknowledges the need for excellent leadership and management in addressing workplace safety concerns. Figure 4 depicts some possible hazards are given that might arise when operating construction machines. In this manner, a future construction site's autonomous safety management system could be drafted.

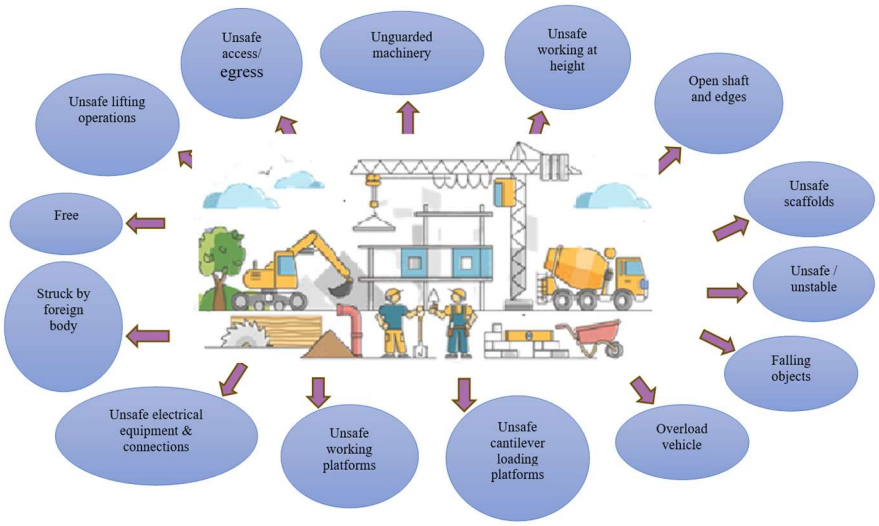

Figure 4: The idea for creating a safety management system[43].

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The Health and Safety Executive (HSE) has declared that strong safety performance cannot be achieved without competent leadership. That top management's commitment to safety is crucial to establishing a culture of safety was another point driven home by the Federal Safety Commissioner. Research on the leadership and self-reported protection conduct of senior managers in the field of package terminal operations is scant, with a few notable exceptions [44].

1.8 Safety Performance Enhancement

Once an organization has fully embraced a proactive safety culture, it effectively incorporates the principle of continuous improvement and utilizes it to elevate safety standards and performance [45]. Everyone in the company actively contributes to keep a safe work environment. Efforts to improve behavior are ongoing, and there is a widespread acknowledgment of the importance of addressing underlying issues related to attitudes and conduct Continuous and gradual improvement becomes the standard approach within the organization [46].

- The company adopts a forward-thinking approach in making strategic decisions, considering both present and future implications. It proactively finds potential issues and takes necessary actions to prevent their occurrence.
- Each decision is meticulously evaluated., considering its potential impact on the overall safety of the organization, encompassing all departments and operations.
- Enhanced understanding of the organization's operations among workers enables them to effectively support upper management in the efficient management of the firm.
- By encouraging internal and external learning, the organization fosters a culture of continual development. They use this skill to enhance productivity.
- Management and employees consider cultural aspects while making crucial choices. They promote a safety culture since it improves performance and finances.

The importance of valuing organizational learning and setting up mechanisms to capture and apply this knowledge is emphasized. It is crucial to recognize the connection between safety outcomes and the effects of operational processes [47].

1.9 Importance of Occupational Health and Safety (OHS)

The social, emotional, and physical well-being of people in the workplace, including those in offices and on construction sites, is included under occupational health and safety. To ensure the health and safety of construction workers, employers and experts in health and safety programs must work together [48]. They must also consider issues like occupational health, risk, remedies, cleanliness in the modern era, toxicology, education, construction site security, ergonomics, discovering the brain, and the construction safety management system [49]. Personal safety is prioritized in health and safety policies because of the assumption that a healthy workplace is also one that adequately protects its employees from harm. The most important thing is to make sure that every construction site is safe and healthy for everyone working there [50].

There are several wins for all stakeholders when it comes to occupational health and safety programs and practices in the workplace. Reasons why Occupational Health and Safety (OHS) in the workplace, whether inside or outside the office (construction sites), is important [51]:

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- Improved productivity and focus: When the workplace prioritizes safety, employees are likely to become more efficient and focused on achieving results.
- Reduced absenteeism: A safe and excellent work environment can lead to decreased absenteeism among employees.
- Professional image: A workplace that is safe, organized, and well-maintained reflects professionalism and contributes to a positive image for the company.
- Employee satisfaction and security: Ensuring a safe working environment contributes to the happiness and sense of security among staff members.

Keywords

1. How does safety culture impact ergonomics in construction industries?
2. Exploring the relationship between safety climate and ergonomic practices in construction industries
3. Analyzing the effect of safety performance on ergonomic strategies to prevent injuries on construction sites
4. Integrating ergonomic principles for enhancing safety on construction sites.
5. The role of safety culture in promoting ergonomic solutions for construction workers

- Cost savings: Workplace accidents might cost protection and insurance. OHS precautions and training can save firms money over time. This includes lowering personnel injuries, car, and construction damage claims and employee absences [52].

2. Objectives of the Current Study

- To propose a distinct concept of building a company safety culture in comparison with the definitions of organizational safety culture that are already in use.
- The Safety Culture Interaction (SCI) Model presented in this study shows how a project's safety culture grows and how the owner, contractor, and subcontractors interact.
- To develop a safety culture for ergonomics professionals by providing a platform for experimentation with modified frameworks.
- To uncover elements that relate ergonomic consciousness to a culture of safety. These pieces could aid ergonomic consciousness and safety culture research.
- To manage emerging safety hazards and sustain excellent safety performance over time, a “safety culture" has been proposed. Examine how risk and safety culture impact construction project success in complicated projects.
- To characterize the shared assumptions, norms, and perspectives of an organization's members concerning safety.

3. Review Methodology

The methodology employed in this systematic review (SR) follows the guidelines outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statements. PRISMA provides a standardized framework for conducting and reporting systematic reviews and meta-analyses in the field of evidence-based research. PRISMA was created to standardize the reporting of studies that examine the efficacy of therapies, but it can be modified to record

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systematic reviews that focus on other topics, such as research methodology, theoretical framework construction, or hypothesis generation.

3.1 Search Strategy

The goal of an SLR (Systematic Literature Review) is to enhance the existing safety culture. Twelve primary academic literature collections were used to compile the research for "Using Ergonomic Tools in the Construction Industry", including Science Direct, IEEE, Springer, Academic, ASCE, MDPI, Ergonomics, Emerald Insight, Civil Engineering, Research Gate, Scimago Journal and IJOI. Researchers use SLRs to learn about previous studies that have addressed their research question or topic.

On November 7, 2022, a comprehensive search was conducted using various keywords to identify relevant academic materials. The search was performed in multiple databases, including Science Direct, without any limitations on publication date. Keywords in the abstract, title, and topic were used as part of the search criteria. Only specific document types such as articles, reviews, proceedings papers, bibliographies, and conference papers were considered. Table 1 presents the list of Science Direct and Near Perfect search terms utilized in the search. Additionally, different spellings of keywords were also explored. In total, twelve records were obtained in this search batch. The search strategy for keywords is outlined in Table 1.

Table 1: Keywords in the search strategy.

	Keywords
1.	How does safety culture impact ergonomics in construction industries?
2.	Exploring the relationship between safety climate and ergonomic practices in construction industries
3.	Analyzing the effect of safety performance on ergonomic strategies to prevent injuries on construction sites
4.	Integrating ergonomic principles for enhancing safety on construction sites.
5.	The role of safety culture in promoting ergonomic solutions for construction workers

3.1.1 Selected Brand for Research: Exploring the Chosen Brand for Study

On January 1, 2022, at previous studies to see how often the most prominent companies appeared. conducted a keyword search with no filtering for each inquiry. The findings were broken down into two groups: validation/reliability studies, and data collection studies. Two distinct audiences were pulled to find out which product line would work best. For companies with one of the top five bestselling goods in 2019 and 2020 or ten or more separate devices launched in the initial batch, researchers created a product keyword search. The papers' titles, abstracts, and methods sections were then removed from the final list. This was done to exclude irrelevant articles from the research and establish what other products were used in the trials. The author compiled a list of products like these and sent out new sets of inquiries, one for each item. In the end, eleven more people were included. In the outcomes section, the study's authors compiled a summary of their findings, including the keyword used to locate each item.

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3.2 Scrutinizing of paper for study

The selection process for the Primary Studies (PS) consists of four phases: detection, admissibility, inclusion, and multiple screening. In the first phase, a total of 6,407 potential studies were identified through a systematic search of various databases and sources, such as full-text articles, Science Direct, IEEE, Springer, Academic and Ergonomics, ASCE, MDPI, Scimago Journal, Ergonomics, Emerald Insight, Civil Engineering, Research Gate, and IJOI databases Xplore. Duplicate copies were removed, resulting in a pool of 195 studies. In the second stage, a preliminary assessment was done by reviewing the article's title, keywords, and abstract. There are still 6,540 data missing since they don't meet the inclusion criteria, mostly regarding the research scope and optimization topic. These two records, labeled “combined” and “unclear”, were forwarded for further examination. Figure 4 displays the assessment of the SR database, highlighting the progress made in the PS selection process. Among the 195 studies, 28% focused on construction safety practices, 17% examined the maturity of safety and health culture in the construction industry, and 33% involved investigative research on developing a safety culture for construction projects.

Additionally, a comprehensive review of relevant publications and review papers in the bibliography was conducted. Studies were selected for inclusion or exclusion based on the supplementary data and abstracts provided, following the criteria laid out in Table 2 for this systematic review.

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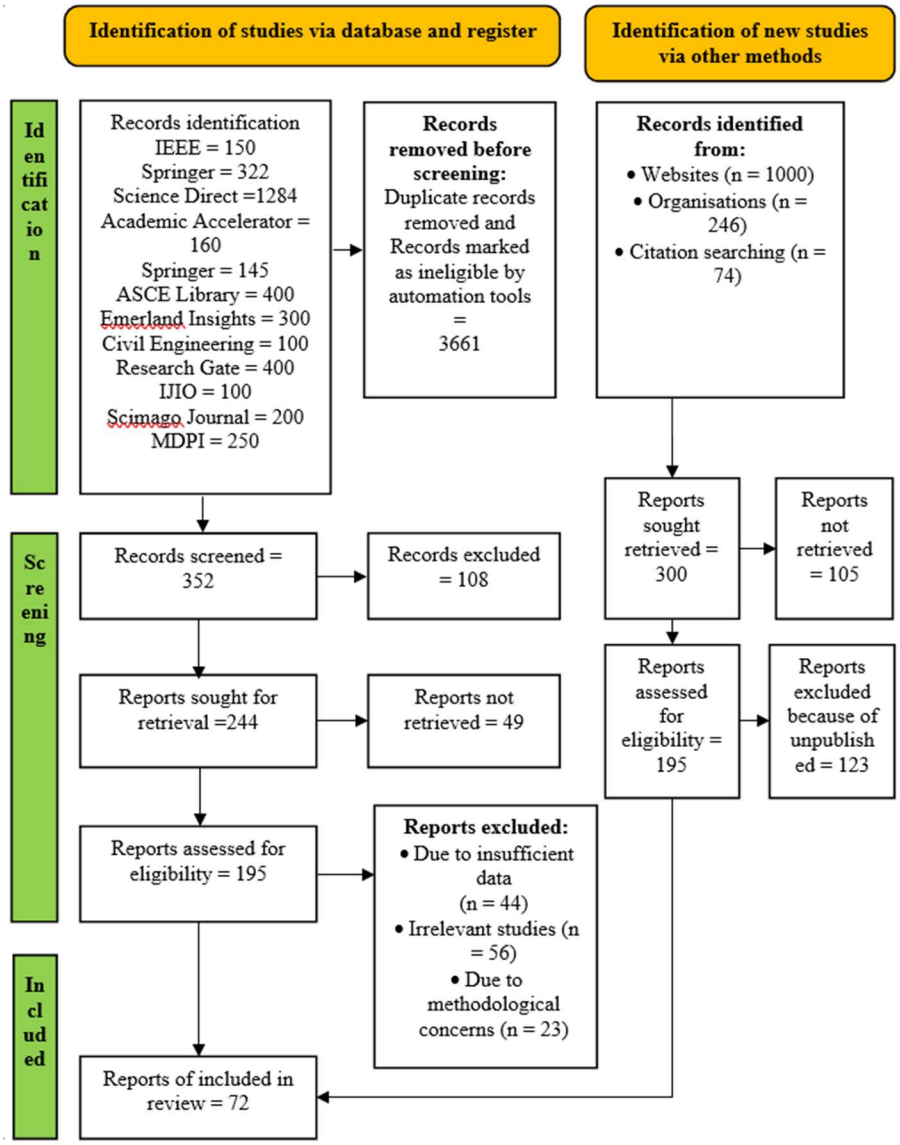

Figure 5: A PRISMA-based flowchart for systematic reviews of publications found in databases.

Figure 5: A PRISMA-based flowchart for systematic reviews of publications found in databases.

Table 2. Principles for SR's Exclusion and Inclusion

Inclusion criteria	Exclusion criteria
I1: Peer review must have been performed on the paper.	E1: Research papers that don't center on the effects of physical strain on the body.
I2: The language of the document is restricted to English.	E2: Grey literature sources.
I3: There is currently no estimated release date.	E3: Repeated study or publication.
I4: The paper needs to appear in a journal that publishes research or lengthy articles.	E4: Research papers, working papers, and final project reports.

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I5: The paper should meet the standard criteria for blind review, regardless of the impact factor	E5: The paper should not deviate from the specific focus and precision indicated in the given title.

4. Results

4.1 Study Selection

As seen in Table 3, several different writers have employed the method such as Delphi, EFA, PDO, PDCA, ANOVA, etc., and published their findings.

Table 3: Key findings from the studies on the Improvement of Safety Culture Using Ergonomic Tools in the Construction Industry.

Author	Title	Technique	Outcome	Total citation
Trinh and Feng [2022] [53]	"A Maturity Model for Resilient Safety Culture Development in Construction Companies."	Delphi	These findings suggest the model has the potential to serve as a useful resource for assessing and inspiring the advancement of companies' capacities to manage safety hazards.	2
Bhagwat and Kumar [2022] [54]	"Investigation of multi-level safety culture in the Indian construction industry: a multi-level employees' perception-based approach."	Plan Do Check Act (PDCA)	The results showed poor safety compliances and substantial (p 0.05) perception variations among workers across levels.	2
Buniya et al., [2021] [55]	"Barriers to safety program implementation in the construction industry."	Exploratory Factor Analysis (EFA)	The results demonstrate that the latent constructs to which they were allocated have loading indications that are greater than	73

			the cross-loading of all other constructs.	
Stiles [2021] [56]	"Developing a safety culture maturity tool for the construction sector."	Project Delivery Organisations (PDO)	Using a tool like the Maturity Matrix would allow them to establish a standardized method of evaluating the culture of their projects and identifying where they can make the most progress.	1
MD et al., [2021] [57]	"Influence of knowledge-based safety culture in the construction industry: a stakeholder's perspective."	Factor Analysis Technique	The findings indicate that the construction industry, as a collective, demonstrates a limited understanding of the High Occupancy Construction (HOC) concept.	5
Yap and Lee [2020] [58]	"Analysing the underlying factors affecting safety performance in building construction."	Hypothesis Testing Method	Management, foremen, professionals, and front-line employees all had safety culture measuring ratings of 78.8, 77.6, and 77.4, respectively, contributing to an aggregate level of 77.4 for all businesses evaluated.	43

Williams et al., [2020] [59]	"Assessment of health and safety culture maturity in the construction industry in developing economies."	Kaiser–Meyer–Olkin (KMO)	The findings suggest that the suggested instrument might be a reliable, valid, and sensitive tool for studying how the construction industry's safety culture affects the knowledge dimension.	35
MD et al., [2019] [60]	"Developing a knowledge-based safety culture instrument for construction industry: Reliability and validity assessment in Indian context."	ANOVA	The study's findings provide useful information for construction industry leaders to evaluate and improve current safety practices.	31
Tehrani et al., [2019] [61]	"Investigating factors of safety culture assessment in construction industry projects."	Simple Random Sampling (SRS)	Results suggest Ghana's construction sector culture of safety and health is pathological., Even while Ghanaian contractors have safety rules and standards of conduct, safety isn't a critical business risk.	17
Al-Bayati et al., [2019] [62]	"Construction safety culture and climate: Satisfying necessity for an industry framework."	Bootstrapping Technique	Management commitment, evaluation of work dangers, supportive atmosphere, and communication had	49

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			the largest influence on contractors' safety culture in the analyzed projects, whereas job stress had the least.	
Hola and Nowobilski [2019] [63]	"Analysis of the influence of socio-economic factors on occupational safety in the construction industry."	EFA	According to the results, construction safety culture is represented by the MS factor, while the construction safety environment is characterized by the SS factor.	29
Feng and Trinh [2019] [64]	"Developing resilient safety culture for construction projects."	Machine Learning (ML)	The data demonstrate that each of these variables has a unique impact on the total number of workplace injuries.	41
Aburumman et al., (2019) [65]	"Evaluating the effectiveness of workplace interventions in improving safety culture: A systematic review"	Standard Review	The majority of studies improved safety culture overall. Safety-focused, leadership-oriented, and behavior-monitoring interventions proved to be the most effective overall.	87
Chen et al., [2018] [66]	"The impact of safety culture on safety performance-	SEM	The findings suggest that construction	18

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	a case study of taiwan's construction industry."		businesses might create a resilient and adaptive safety culture by methodically responding to typical dangers, rare threats, and unforeseen events.	
Guo et al., [2018] [67]	"A system dynamics view of a behavior-based safety program in the construction industry."	SEM	There is no statistically significant correlation between safety commitment and attendance.	126
Abdullah et al., [2016] [68]	"Safety Culture Behaviour in Electronics Manufacturing Sector (EMS) in Malaysia: The Case of Flextronics."	Standard Review	The proposed research framework has an R2 of 0.227. In other words, the proposed framework accounts for 22.7% of the observed variance in the dependent variable.	37

5. Discussion

5.1 Enhancing Health and Safety in the Industry Through Ergonomics

Worker exposure to potentially harmful ergonomic problems seems to be expanding in tandem with the complexity of the construction process. When considering the prevalence of Work-Related Musculoskeletal Disorders (WMSDs), the construction business stands out as one of the highest-risk fields. Implementing appropriate measures during the hiring process to ensure that job demands align with the physical capabilities of workers, scheduling regular breaks for meals and rest, and transitioning operations towards automation or semi-automation are fundamental strategies to mitigate ergonomic concerns.

The main purpose of this study was to create a multifaceted ergonomic intervention plan consisting of three different approaches: training workshops, participatory ergonomics (PE), and workstation redesign. The purpose of this research was to determine whether or not this model contributed to the prevalence of unhealthy postures in the workplace at an Iranian steel production complex. The focus was on eliminating work postures that were found to contribute to work-related

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musculoskeletal disorders (WMSDs) by reducing the risk factors identified by the workers directly involved in the study.

In broad terms, this research aimed to accomplish the following objectives:

- The aim was to develop a comprehensive and tailored ergonomic intervention program that can be effectively implemented within the specific workplace setting.
- The objective of this study was to enhance working conditions by implementing participatory interventions.
- The purpose of this research was to determine if a cascade training intervention program could reduce the incidence of work-related musculoskeletal disorders (WMSDs).
- This project aims to implement practical ergonomics knowledge within the industry to institutionalize workstation redesign and improvements [69].

Musculoskeletal disorders (MSDs) continue to be the most common kind of work-related illness, prompting a look into why previous attempts to control the issue have been less successful. Musculoskeletal disorders are the most prevalent kind of illness caused by employment. About one-quarter of employees in EU nations have back discomfort, while another 23% say they have muscle problems on the job. In the United States, MSDs account for the bulk of workers' absences. Musculoskeletal trauma, including sprains and strains, accounts for most work-related injuries that do not prove fatal in the United States. Worker complaints in Brazil were comparable to those in other countries. The most prevalent areas affected were the shoulders (49%), necks (47%), and backs (39%). In 2005, WMSDs accounted for nearly 69% of all work-related injuries reported in Sweden, affecting more than one in five construction employees (reference missing). Developing nations are the worst impacted. Injury and accident rates in Nigeria, Thailand, and Tanzania were greater than in Europe. Every construction worker will be temporarily unsuitable to work at some point due to moderate injuries or health concerns. However, it seems that almost all construction-related accidents and illnesses are avoidable since safety and health issues are intrinsically linked to how construction projects are organized, and manual labor is performed. Inadequate site information, communication, and measurement technologies could account for most construction industry risks. Knowing and understanding High-Level Structure (HLS) allows construction companies to avoid these risks and injuries. Workers in the construction industry need to be cognizant of the risks they face on the job. Consequently, the construction industry's safety and health performance could be greatly enhanced if adequate information regarding workplaces, manual tasks, and ongoing training and education were provided.

5.2 Methods for Minimizing Ergonomic Risks in the Industry

This study aims to address four key aspects of ergonomic risks and proposes preliminary adjustments to work practices to reduce these risks. As a result, there are a wide variety of elements that could be adjusted to facilitate the introduction of ergonomics and the mitigation of ergonomics-related risks on the job site. To better apply ergonomics in the workplace and lower risk factors, several methods, and measures could be implemented, including, but not limited to, better communication, management control, ergonomic design considerations, training and education, and formalized ergonomics programs [70]. This framework offers several benefits,

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including personalized ergonomic assessments for each workstation, identification of ergonomic risks, and the provision of modified work to mitigate those risks. The overarching objective is to proactively reduce employee claims and injuries, as well as minimize industry costs associated with workers' compensation [71].

Opting for a suitable design is the most efficient and preferred approach to address the root causes of workplace stress. Emphasizing the ergonomic aspects of workplace design should be prioritized from the outset and regarded as a crucial factor in constructing a conducive work environment.

6. Conclusion

In conclusion, this paper focuses on the important parts of safety culture in the construction industry and how it affects safety measures and outcomes for construction workers. When looking at the many things that can lead to accidents, such as human behaviour, complicated work sites, hard work, and not following rules, it becomes clear how important it is to understand and address safety culture in this setting. Using a systematic review method, this study pulls from a wide range of well-known databases. The use of different keywords and strict selection criteria helped make sure that the collection of research studies was representative and up-to-date.

The combination of 17 recent studies has shed light on the complicated relationship between a construction site's safety culture and how well safety measures work. By looking at many different aspects of safety culture, this study goes beyond simple numbers and gives a more complete picture. Also, taking ergonomics into account in the context of safety culture gives the results more depth and makes them easier to use in real life. Ergonomics experts who want to improve their organizations' safety culture can take advantage of the fact that an updated framework can be made to fit specific study environments. But, despite what this review has added, it is clear that safety culture in the construction industry is still a complicated and multifaceted topic. In the paper's conclusion, the need for more research is brought up, especially in the areas of safety practices and how ergonomics and the construction industry work together. The fact that 72 different studies were considered using the PRISMA technique shows how thorough this study is, but it also shows how much more there is to learn from the following studies which are from following databases:

Science Direct = 14, Taylor & Francis = 4, Inder Science = 2, ASCE = 3, IEEE = 1, Emerald Insight = 3, Civil Engineering = 1, Research gate = 5, IJOI = 2, MDPI = 3, Books google =1, Government office for science = 1, Sabinet = 3, IJCESEN = 1, IJPM = 1, Shodhganga = 2, CIDB = 1, Makshi = 1, CORE = 1, virtual Library = 1, IOP = 2, Ergonomic = 3, HSE = 1, JEP = 1, Sciendo =1, NTH = 1, Springer = 1, Safety Research =2, IJOSE = 1, Safety Science = 3, IJOHFE = 2, Environmental Psychology = 1, Google search= 2

The total number of research taken = 72. (Reference has a total of 72 numbers)

In the end, this paper will be helpful in learning more about how safety culture affects safety in the construction industry. As the construction industry continues to change because of new technology and methods, this study's findings can help both researchers and people who work in the field create safer and more efficient workplaces. Still, the road to a full understanding of safety culture is still long, and researchers need to keep looking into the complexities of this important concept to improve the safety and health of all construction workers.

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This paper has the potential to enhance the practical applicability of safety culture for ergonomics practitioners by developing an updated framework that can be customized to specific study environments through exploratory research. To determine whether or whether this evaluation tool can be used by ergonomists and individuals in a variety of business settings, more study is required.

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