CHAPTER II

LITERATURE REVIEW

Construction projects rely on skilled construction experts to bring them through to successful completion. Professional construction managers work on capital projects, which are typically lengthy, large-scale, complex, high budget undertakings. These projects are made up of three parties: the Owner, Architect, and General Contractor. Few owners have the skills or staff to pay close attention to all the details, so they turn to construction managers/project managers (CMs) to ensure success. The CM skillfully collaborates with and provides oversight to these three parties to deliver the project on time, at or under budget, and to the owner's expected standard of quality.

They typically do not perform the actual construction tasks themselves, but act as advisors to assuring the project progresses smoothly and achieves the owner's business objectives. The CM often leads a team of specialists to oversee different aspects of the project, such as scheduling, safety, cost estimating, design, quality assurance, value engineering, commissioning, construction inspection, risk management, and more. Reused and Recycle has been known as extraordinary compared to other answer for reuse the waste materials into reused substance and transform into usable materials. In Malaysia, there is a tremendous potential in reuse and reuse of development squander into elective materials that is usable in Malaysian Construction industry if executed effectively. In a significant number of the created nations, this has been achieved.

2.1 Important Elements of Worker Safety Practices

A safety and health management system (SHS) is a program designed to reduce the risk to health and safety in the workplace and reduce the likelihood of an injury by ensuring employees know how to work safely.

2.1.2 Work Safety

Work safety is important to avoid accident and risk. It is important to give the right communication to each worker and break their working time during construction site working. It is natural to want to get the job done quickly, but accidents can happen.

And these are some points that has to be conducted

1- Always wear personal protective equipment (PPE)
2- Limit crowd sizes in work areas.
3- Keep work areas clear.
4- Use best practices for scaffolding work.
5- Keep a communication device on hand.
6- Make sure to label and properly store all chemicals.
7- Create a culture of safety. (ST, 2020)

2.1.3 Human Resource

HRM is the process of managing people within an organisation. It is primarily concerned with ensuring that a project has sufficient human resources, with the correct skill-sets and experience, for the project to be successfully completed. HR managers must be able to identify and document project roles and responsibilities, and develop a plan to determine their human resource requirements.

HRM typically involves the following core activities:

1 providing safety managers

2 Role of safety specification.

3 Work safety planning.

2.2 Construction Project Management (Cpm)

Development venture administration is the specialty of coordinating and organizing human and material assets for the duration of an undertaking by utilizing present day administration methods to accomplish foreordained destinations. It involves arranging, coordination, and execution of a development venture, regardless of whether it is farming, private, business, institutional, mechanical, overwhelming common, or natural. It requires solid aptitudes in correspondence, profound learning of the building procedure and the capacity to issue comprehend. It is an overwhelming field, requiring information in a wide range of zones like back, intervention, law, business, and the sky is the limit from there.

Table 2.2 :Advantages and Disadvantages Of (Cpm)

Advantages of Construction Project Management	**Disadvantages of Construction Project Management**
• Focal points: In this course of action, the development chief expect the hazard, so it has a motivating force to act to the proprietor's advantage and to productively oversee costs, considering GMP overwhelms would be the duty of the director's organization.	•While Construction Management may be beneficial in some circumstances, owners should recognize that it might also have some disadvantages. •The most significant disadvantage of many Construction Management contracting arrangements is that significant portions of the total services for which the Construction Manager is remunerated are not subject to competitive bidding.

Source : (ukessay, 2022)

Construction Project Management (GMP) is beneficial in some circumstances, but it has some disadvantages. The most significant disadvantage is that significant portions of the total services for which the Construction Manager is remunerated are not subject to competitive bidding. This makes it much less likely that the Owner will be charged the lowest possible 'market rates' for these services. Additionally, the open-ended nature of many Constructions Management contractual arrangements exposes the Owner to the risk of unanticipated cost increases. Contractual arrangements that may have this effect should be avoided.

Alternatively, under CM as Constructor, and especially when no fast tracking is intended, these concerns can be mitigated by establishing a guaranteed maximum price or converting the Construction Management services contract to a stipulated price construction contract prior to the commencement of construction. However, this security comes at a price, as it may include a 'cushion' to cover risks which may or may not occur.

2.3 Construction Safety Division and Construction Work Section

The Construction Safety Division (CSD), DOSH Headquarters and Construction Work Section (CWS), DOSH States enforce safety, health and welfare legislations in the construction site. The CSD and CWS use regulatory interventions to influence, encourage and advise employers and prosecute those who have failed to fulfill their duties. These interventions are used to develop the Construction Industry's OSH Strategic Plan (CIOSP), taking into account other factors such as the industry's size and demographic, accident statistic and risk. The nine regulatory interventions are implemented at different phases, determined by the state of the risk.

2.4 The Role of a Project Manager In Construction Management

Project management planning, cost management, time management, Quality Management Contract Administration Safety management Construction management professional practices, safety professional develop and implement accident prevention programs, advise management on company policies and

governmental regulations, evaluate effectiveness of existing safety programs, train management in safety observation techniques, materials are checked off when they arrive, and house is set out correctly on the site. Modern operations processes have been implemented but are not fully formalized, suggesting that businesses are introducing these practices to keep up with competitors rather than push their own business objectives forward.

2.5 Class of Contractor In Malaysia

In Malaysia, all the contractors have been categorized to the limitation of their budget. The highest class would be class A contractor follows with B, C, D, E and the lowest one, which involves with maintaining project would be class E. Below is table 2.1 stated the project limits for each of the classes (dezan, 2020)

Table 2.3 : Class of Contractor in Malaysia.

Class	Project limit (RM)
A	More than RM 10,000,000
B	RM 5,000,001 to RM 10,000,000
C	RM 2,000,001 to RM 5,000,000
D	RM 500,001 to RM 2,000,000
E	RM 200,001 to RM 500,000
F	to RM 200,000

Source : (othman, 2021)

2.5.1 Class A Contractor

Class A is a contractor responsible for RM 10,000,000+ projects, such as the KLCC twin tower project. They must appoint an eligible engineer to be part of the team to ensure the design of the building is built well.

2.5.2 Class B Contractor

The contractor in Class B is a contractor that involves with projects is between RM 5,000,001 to RM 10,000,000 This contractor responsible on more to second high right building after class A , and general contractor license (othman, 2021)

2.5.3 Class C Contractor

The Class C License fee is between RM 2,000,001 to RM 5,000,000 There are no bonding or insurance requirements for licensing in the state of Selangor at this time, and A Class C Contractor is any contractor that has single contracts from RM or more but less than RM 10,000,000. (othman, 2021)

2.5.4 Class D Contractor

The class D license fee is between RM 500,001 to RM 2,000,000, and The Class D license entitles the licensee to contract for labor or for labor and materials involving only one trade. A Class D licensee may be licensed to perform more than one specialty. (othman, 2021)

2.5.5 Class E Contractor

A Class E general contractor license holder is authorized to perform any nonstructural alteration work to any building or structure in the City, including all work authorized by license types fee between RM 200,001 to RM 500,000. (othman, 2021)

2.5.6 Class F Contractor

Class F is In an effort to help the class F. contractor, the government has fixed that all government contract works amounting to. RM100,000 and below should be given to Class F contractors (othman, 2021)

2.6 The Safety in Construction (Malaysia)

In 1994, the Occupational Safety and Health Act (OSHA) was gazette in Malaysia to reduce industrial accident rates. This paper examines the poor safety record of

the construction industry due to a confluence of factors, including the presence of foreign workers. It highlights the confusing signals sent out to the industry by DOSH and the Construction Industry Development Board (CIDB) arising from conflicting instructions and initiatives. The paper draws upon some of the data compiled during a national study conducted in 1996–1997 that examined foreign and local site operatives in Malaysia. The employer has huge responsibilities under the law to manage the safety and health risks in a construction project, which resulted from his business activity. To do this, CSD and CWS use various regulatory interventions.

2.7 The Usage of Industrialiser Building System (Ibs)

The Integrated Building System (IBS) was deployed in Malaysia to accelerate the construction of housing projects and improve the quality and affordability of the projects. It is a construction technique in which components are manufactured in a controlled environment and transported, positioned and assembled into a structure with minimal site work. Despite the IBS being well-known and accepted by most construction firms, wet construction is still widely regarded as a conventional and safe option due to its higher costs and slower production rates.

2.8 Law During Construction Safety

This paper aims to identify and highlight the types of fall hazards that are most commonly found at construction sites today and the most effective solutions to overcome them. A study was conducted to investigate the root causes of fall hazards in construction site. The data was collected through questionnaire survey and analyzed using Likert scaling method. The finding was that most fall hazards are caused by roof falls and scaffolding falls, and workplace inspection is the most effective measure to reduce the fall hazards. This study aims to improve the problem of fall hazards in cyber jaya by establishing a safety and health committee.

The committee will keep track of measures taken to ensure safety and health of persons at the place of work, investigate any matter that a member of the

committee or a person employed thereat considers is not safe or is a risk to health, and attempt to resolve any matter referred to above. It also has the power to request the Director General to undertake an inspection of a place of work for that purpose, and if it is alleged that a person has contravened or failed to comply with a provision of the Act, the approved industry code of practice shall be admissible in evidence in the proceedings.

2.8.1 Electrocution

According to OSHA (2020) is occupational safety and health act electrocution injuries accounted for 82 construction worker deaths in 2016, which is 8.3% of the 991 fatalities caused by construction site hazards. Electrocution is death by electric shock caused by exposure to lethal amounts of electrical energy. Electrocutions most often happen when workers do not know about all of the energized power sources at their location.

And sometimes, workers are so focused on their tasks, they don't realize that they may be in danger of being crushed, squeezed, caught, compressed, or pinched between two or more pieces of equipment or machinery or against a wall or a floor. (msllegal, 2022)

2.8.2 Being Struck by Falling Objects

According to OSHA, "Struck" is defined as: injuries produced by forcible contact or impact between the injured person and an object or piece of equipment. Struck-by hazards in construction cause accidents such as the following: A construction worker was hoisting bricks in a bucket to the top of a building.

Trenches are often required on construction sites, and if a trench collapses with a construction worker inside, that worker could be injured by falling tools or even be buried alive in the surrounding soil.

Finally, an often-overlooked cause of construction site accidents is the physical condition and health of the construction workers themselves. (msllegal, 2022)

2.8.3 Trapped During Excavation

Construction workers are at risk of injury due to falls into a trench or excavation, tripping over equipment, sudden collapse of unsupported excavation walls, excavated material or other objects falling on workers, exposure to underground services or overhead electrical cables unstable nearby structures such as other buildings, mishandled or poorly placed materials, hazardous atmospheres (noxious gases/lack of oxygen) toxic, irritating or flammable and explosive gases, incidents involving vehicles and other mobile equipment. To assist with evacuation, it is important to study the emergency evacuation routes posted on all floors and have a backup or alternate path out of the building. Elevators and bridges should be avoided in emergencies and should not be used in the event of fire or earthquake. Know the location of the nearest manual fire alarm pull station in your building and how to activate it. Know if any co-workers, students, or visitors will require assistance in exiting the building and be prepared to provide whatever help is necessary. Persons with disability-related evacuation needs should discuss their needs with their Area Coordinator in advance. Emergency Refuge Areas are designated "safe havens" for people with mobility impairments and are typically located in stairwells of multi-storied buildings. Know where the emergency Assembly Point and Evacuation Areas are located, and the Evacuation Routes you should follow to reach them. Know how to turn off machinery and equipment at your worksite which if left running for an extended period may create additional safety hazards.

2.9 Advantage of (IBS)

The advantages of using industrialized building system Many researches have mentioned the advantages of using IBS system in there works. This study can list the advantages of IBS as follows:

Skilled workers with specific scope of works improve efficiencies and reduce errors due to controlled environment, better material selection, and mechanized technology.

The industrialized building systems can reduce boredom and monotony by reducing labor costs, minimizing waste material, and using components' moulds for different projects.

Time faster completion of projects due to advance off-site preparations and simplified installation process. Manageable construction schedule by planning control-estimated lead-time and forecasted down time. Off-site production can start while the construction site is under earthworks. Safety Promote safe and systematic factory working environment. Cleanness and neatness IBS provide cleaner sites.

1. Systematic components storage and timely material delivery (Just-in-Time principles).
2. Reduction of construction material at site.
3. Reduction of waste materials at site duo to casting in factory Minimizing the use of formworks and props at site because of casting in factory.

According to CIDB compares to conventional construction method, the industrialized building system has the following advantages:

1. Less construction time IBS requires less construction time because casting of precast element at factory and foundation work at site can occur simultaneously and the work at site is only the erection of IBS components. This leads to earlier occupation of the building.
2. Cost savings The formwork of IBS components are made of steel, aluminum or other materials that allows for repetitive use and this leads to considerable cost savings.
3. Saving in labor When the IBS components are produced in factory, higher degree of utilization of machine is permitted and the use of labor will be reduced and lead to saving in labor cost.
4. Less labor at site The use of IBS will reduce the construction process at site and consequently reduce the number of labor required at site.
5. Optimized use of material The utilization of machine during the production of IBS components lead to higher degree of precision and accuracy in the production and consequently reduce material wastage.

6. Higher quality and better finishes An IBS component have higher quality and better finishes due to the careful selection of materials, use of advanced technology, better and strict quality assurance control since production in factory is under sheltered environment. (ipm.my, 2020)

2.10 Disadvantages of (IBS)

IBS has many benefits, but its initial cost is high due to the cost of setting up the factory, standardizing the sizes, improving quality of the products, casting beds and support machinery. Adoption of IBS requires the governance of a specific organization, which is costly in terms of standardization of sizes, improving the building regulations, and improving the products.

The extra cost is needed to train foreign unskilled and semi-skilled laborers to do IBS construction work. However, if the worker decides not to stay in the country, it will be wasteful and only large projects can be cost effective. (Lim, P.C, 2006).

The Industrial Building System (IBS) has a high investment cost, leading to an unhealthy competition among small and medium industries. It also has a disadvantage in site accessibility, as the road surface must be in good condition and temporary site access must exist for heavy vehicles. These disadvantages make IBS a poor choice for public housing. Although there are a lot of advantages of IBS, however there are limitations for this system to be use too. Nothing in this world is perfect, so as using IBS. disadvantages of IBS are as follows:

High initial capital cost

- The initial capital cost of IBS is usually higher than conventional method.
- The initial cost is includes the casting beds, cost of constructing the factory and support machinery.

2.11 Review of Previous Researches

NO	Jurnal\Title	Author	Year	Findings
1	Article Complexity / A Social Network Study of Stakeholder Viewpoint on Metro Construction Safety Risk Factors	Ying Lu, Yu Zhang	2020	The urban ground system's traffic strain has been significantly reduced by the metro's rapid expansion,but the frequency of metro construction accidents is also rising year after year. Because to the intricate building process of the metro, whenever an accident happens, casualties and property loss are exceedingly serious. Accidents during the building phase of the metro were mostly caused by safety risk issues that were raised by various stakeholders. From a stakeholder's perspective, this study developed a social analysis network of safety risk elements in metro development the viewpoint. Six stakeholders and 25 safety risk variables were identified based on 42 accident incidents and relevant literature, and theconnections between stakeholders and safety risk factors were also established. A social network of safety risk variables in metro construction was built using social network analysis, and quantitative analysis was done using density, degree centrality, betweenness centrality, and cohesive subgroup

2	Springer Article / Design of building constructio n safety prediction model based on optimized BP neural network algorithm	Tao Shen, Yukari Nagai & Chan Gao	2019	The construction safety prediction model based on the improved BP neural network algorithm is proposed in this study to address the safety issue facing the construction sector. The traits of the construction business were examined first. Construction is a labor-intensive sector of the economy, and it is defined by a number of things, including high investment, protracted construction times, and challenging environmental conditions. Because of the growing significant security issue, society as a whole is becoming increasingly concerned. Second, a building construction safety prediction model based on a crude set-genetic-BP neural network was developed after a summary of the problem of managing building construction safety was made. Eventually, a mix of multiparty dialogue, empirical investigation, and model comparison served to validate the model. The findings demonstrated that the model successfully decreased casualties by correctly predicting the risk variables that would arise throughout the construction process. Hence, the model is practicable, effective and accurate.

3	The leadership position of the primary preventative management document on construction sites, according to Science Direct and Constructio's health and safety plan	M.N.González García, M.Segarra Cañamares, B.M.Villena Escribano, A.Romero Barriusod	2021	The strategic plan of the European Union aims to better safeguard the millions of its employees from diseases and accidents at work. The construction industry is the center of this study since it is one of the industries with the greatest accident rates, hardships, and risks. Its goal is to determine the efficacy of the primary management tool that construction works have, the Health and Safety Plan, based on the legislative framework that governs health and safety in the sector. In this research, the Autonomous Community of Castile-La Mancha, Spain, examined 3600 health and safety plans. The findings demonstrate that the Health and Safety Plans are papers that exhibit serious flaws and do not adhere to legal standards, endangering the management of prevention in the workplace and, as a result, the health and safety of its employees.

4	Causes of Accidents Involving Scaffolding at Building Sites, Journal of Technology Management and Business, Transportation Research Record	Nor Haslinda Abas, Muhammad Ridhwan Noridan, Muhamad Hanafi Rahmat, Nor Ain Abas, Nur Qamarin	2020	Accidents involving the use of scaffolding were one of the major categories of fatal accidents at construction sites, according to the Department of Occupational Safety and Health's (DOSH) reports on fatal accident cases. If activities involving working at height were involved, scaffolding was often employed. This research gives the examination of the key causes of accidents involving scaffolding at construction sites based on the perspectives of safety staff It was involved in distributing the questionnaire surveys to safety employees who were working at the building sites in Johor. The Average Mean Index and Relative Importance Index were used to examine the data (RII). According to the report, disobeying safety regulations, performing inadequate inspections, and having an unstable base are the leading causes of scaffolding accidents. The results of this study are planned to be used by construction employers as a guide in understanding the elements that lead to accidents using scaffolding. .

5	Examining the Links Between Safety Climate and Worker Safety Behavior on Taiwanese Construction Sites, MDPI journal	Wei Tong Chen, Hew Cameron Merrett, Ying-Hua Huang, Theresia Avila Bria, Ying-Hsiu Lin	2021	Workers' inadequate understanding of how their activities affect safety on the building site is frequently blamed for occupational accidents in the construction industry. This study investigates the connection between the safety environment (SC) and personnel safety behavior (SB) of employees engaged in construction on Taiwanese building sites. The study found a strong correlation between SC and SB at Taiwanese construction sites, and that SC level had a favorable effect on SB participation and perceptions of general safety. The performance of SB was discovered to be better the greater the SC cognition of Taiwan's construction employees was. The factor that had the strongest correlation with SB was the "safety commitment and safety training" component. Safety education had a significant effect on SB's thinking as well. Therefore, the organizational culture and attitudes toward safety can effectively improve SC and worker SB on building construction sites in Taiwan along with the successful implementation of safety education and training, potentially reducing the impacts of the underlying organizational factors behind safety-related incidents.

6	Implementation difficulties of COVID-19 safety measures at South African building sites, Journal of Facilities Management	Christopher Amoah, Fredrick Simpeh	2021	The results show that there are many obstacles to implementing COVID-19 safety measures at the construction site, including worker ignorance of the regulation, poor personal protective equipment (PPE) provided by contractors, a lack of compliance, sanitizing construction materials, difficulty sharing tools and equipment, superstition (COVID-19 is for a specific group of people), and adhering to social distancing rules, among others. These problems have, therefore, impeded their endeavor to properly adhere to the safety procedures in line with the COVID-19 safety protocol at the project sites now under development.
7	Study of ergonomic risk factors in the construction sector, Materials Today Journal	G.K.Abinaya Ishwarya, D.Rajkumarb	2021	The engineer or managing person will organize the machinery, tools, skilled labor, and their surroundings to be in order and customary to execute the work in an efficient manner as a result of the ergonomics research. The necessity for effective communication between the management level and worker level should be there in order to increase the success rate of ergonomics implementation. Even with safety safeguards, employees in the construction industry nevertheless experience stress because of physical and psychological problems. The risk factors that influence the gap between top and bottom level in various psychological and administrative factors, analysis of ergonomics measurement in context with questionnaire survey carried out in five construction sites, the corrective measures, and difficulties in implementing ergonomics were discussed in this paper. The proposed flowchart for the construction industry incorporates the right use of ergonomics for both administration and employees.

8	Automation in Construction Journal / Deep learning for site safety: Real-time identification of personal protective equipment	Nipun D.Nath, Amir H.Behzadan, Stephanie G.Paala	2020	Traumatic brain injuries (caused by falls and electrocution) and collisions are the main reasons for construction-related fatalities (resulted from struck by objects). The U.S. Occupational Safety and Health Administration (OSHA) mandates that contractors enforce and continuously monitor the proper use of workers' personal protection equipment (PPE), such as hard hats and vests. This study provides three deep learning (DL) models built on the You-Only-Look-Once (YOLO) architecture to check employees' PPE compliance in real-time, such as whether they are wearing hard hats, vests, or bothIn the initial method, an algorithm identifies the workers, hats, and vests; then, a machine learning model (such as a neural network or decision tree) checks to see if each identified worker is correctly donning a hat or vest. In the second method, a single convolutional neural network (CNN) architecture is used by the algorithm to simultaneously identify specific workers and confirm PPE compliance. In the third method, the algorithm first isolates the workers from the background of the input image. These isolated employees are then cropped and identified using CNN-based classifiers (such as VGG-16, ResNet-50, and Xception) based on the presence of PPE clothing. The internal picture dataset, which was produced utilizing crowdsourcing and web mining, serves as the

				training ground for all models. The dataset Pictor-v3 includes 4,700 examples of employees wearing different PPE component combinations and 1,500 annotated photos. The second technique, which can process 11 frames per second (FPS) on a laptop, is shown to have the best performance, with a mean average precision (mAP) of 72.3% in real-world circumstances. This makes it appropriate for real-time detection and a strong contender for use with light-weight mobile devices. The third strategy, which combines the classifiers from VGG-16, ResNet-50, and Xception in a Bayesian framework, is the most competitive alternative in terms of performance (67.93% mAP). Yet, the first method processes at the fastest rate of 13 FPS with 63.1% mAP. To promote the development and evaluation of more cutting- edge applications for assessing safety compliance and advancing future research in automation in construction, the crowd-sourced Pictor-v3 dataset and all trained models are made accessible to the public.

9	Smart construction sites: A promising strategy to enhance on-site HSE management performance, Journal of Building Engineering	Maozeng Xu, Xiuying Nie, Heng Lic, Jack C.P. Cheng, Zhongya Mei	2022	ince they help to manage projects on-site in a way that is effective, efficient, and of the highest caliber, the development of smart construction sites using smart technologies for real-time interconnection, communication,and interaction has become a topic of interest for researchers and practitioners in the architecture, engineering, and construction industry. Nevertheless, therehasn't been much thought put into employing smart technology to manage all aspects of health, safety, and the environment (HSE). To close this gap, this study uses a systematic approach to find the papers (results = 325) related to the on-site use of smart technologies for HSE, and then conducts a quantitative and qualitative analysis ontheir research trend and interestsThe research status quo and trends are shown by a bibliometric analysis of publication numbers by year, nation and area, and journal, and the topic's interests are demonstrated by a keyword co-occurrence analysis. Several smart technologies, including approaches and gadgets, are grouped for on-site HSE management goals based on these interests. Additionally, a complete framework for smart technologies in HSE management and a plan for HSE-oriented smart construction site formation are put forward.

10	A risk assessment strategy for improving construction safety performance is published in the Safety Science .Journal	Muizz O.Sanni-Anibire, Abubakar S.Mahmoud, Mohammad A.Hassanain, Babatunde A.Salamic	2020	The number of fatal accidents and deaths in the construction sector each year makes it one of the most dangerous sectors in the world. Despite the establishment and implementation of safety initiatives in several nations, the problem does not appear to have been resolved. The goal of this research is to provide a risk assessment methodology that can be applied to improve construction project safety. For the study's risk ratings and weights for the various construction accidents, pair-wise comparisons and weighting-by-ranking surveys were used, and possible reasons behind them. On 15 sizable building sites spread across Saudi Arabia's Eastern Province, information was gathered from safety specialists. According to the study, "falling items" accidents have the greatest risk score, and the project site's extreme winds are their primary cause. An ongoing effort to build a parking lot using the developed technique. The results demonstrated that trips, slides, and falls performed the best in terms of safety. Also, according to six sigma evaluation, the average project safety performance was 2.33 sigma, meaning that 228,739 accidents may happen out of every million opportunities. The research also offered suggestions for enhancing the case study's safety performance.

11	Automatio nin constructio n / Evidence-driven sound detection for early warning and accident detection inthe constructio n industry	Yong-Cheol Lee, Moeid Shariatfar ,Abbas Rashidi, Hyun Woo Lee	2020	Safety has always been a top priority in the construction business due to the high risk of fatalities and huge financial damage brought on by accidents. In response, various research have sought to create novel methodologies and state-of-the-art technologies for conducting autonomous safety surveillance of construction work zones such as vision-based monitoring. Nevertheless, the technologies already in use and those that have been proposed, such as human inspection, are only capable of consistent, real-time monitoring and quick event detection of construction safetyhazards. Also, the health and safety dangers that come with building projects make it difficult for workers in the industry to be aware of potential risks and hazards in accordance with their daily schedules of work. This project comprises the creation of an audio-based event detection system to give daily safety concerns to workers and via the quick identification of construction accidents in order to fulfill the urgent demand of the industry to improve worker safety. The suggested framework, which is based on an evidence-driven methodology, integrates occupational injury and sickness manual data, which consists of historical construction accident data organized by different types of sources and occurrences. This paradigm was evidence-based and incorporated With a daily project schedule, it is possible to regularly contribute to improved construction safety monitoring through audio-based event detection and instantly notify construction employees of safety dangers at a relevant work zone. The framework can clearly categorize the condensed sound training data in accordance with a dailyproject plan and dynamically restrict sound classification kinds beforehand by utilizing a machine learning algorithm.

12	Virtual Reality (VR): A Review on its Use in Construction Safety, Turkish Journal of Computing and Mathematics Education (TURCOMAT)	Orlean G. Dela Cruz, et. al.	2021	Workplaces are now safer and more productive thanks to technology. We have been able to take on more difficult assignments and work more effectively together. Simulated 3D site models have a significant ability to enhance hazard detection and the cognition of worker danger, according to visualization technology application. One of the breakthroughs that is widely accepted and contributes to fewer workplace accidents is virtual reality (VR). Hence, this study thoroughly examines VR technology's contribution to construction safety through an analysis of its uses, advancements, and difficulties associated with its use. It is consistent with the goals of performing a thorough investigation of VR to close the knowledge gap that these cutting-edge technologies bring, such delivering sensitive information about its general conceptuseful uses, and potential restrictions. With any technical development, there are still a number of issues with the VR application that need to be resolved. Future research should take into account: 1) the inconsistency between the user's real movement and the virtual animation; 2) the study's narrow scope, which leaves out other important elements; 3) the study's labor-intensiveness, comparatively high cost, and upkeep; and 4) other relevant considerations technical complexity

13	Analyzing the fundamental elements impacting safety performance in building construction Production Planning & Control Journal	Jeffrey Boon Hui Yap, Wen Kai Lee	2019	The Malaysian construction business is stigma-laden 'dangerous, filthy and demanding' (3 D) with a significant percentage of blue-collar migrant employees. The public's perspective is being weakened by subpar safety performance. The goal of this study is to assess the existing degree of safety consciousness in the construction industry, identify the key variables influencing safety performance, and assess prospective safety awareness-boosting solutions. A thorough literature analysis led to the first discovery of 27 causesA questionnaire survey was then used to assess how construction workers saw the elements that affected safety performance and potential solutions to raise knowledge of safety, where a lack of understanding of the hierarchy of controls still existed. Personal protective equipment (PPE), the working environment, employee attitudes, communication, and equipment maintenance are the key safety concerns. Eight fundamental components were then discovered via an exploratory factor analysis. Installing a fall prevention system, having excellent communication, and performing routine safety inspections are the most effective preventive measures. Lastly, correlation tests were used to determine the connections between the components and preventative actions.

14	Earth and environmental science IOP Conference Series: Study of Safety Hazards on the Construction Site	P Mesaros, M Spisakova and D Mackova	2019	Due to the fact that the construction business is among the most hazardous in many nations, safety in this sector is seen as being of utmost importance. 19.5% of all fatalities between 2000 and 2012 were related to the construction business. Construction safety management, and by extension construction project management, must include both safety variables influencing construction and techniques for assessing construction safety hazards. The plan of occupational safety and health, one of Slovakia's construction management papers, addresses the analysis, assessment, and removal of construction safety concerns. This study proposes a plan for occupational safety and health processing during the development of business centers. The input data is presented in one dimension of the building information model through the process of assessing safety risks, which should be a crucial component of integrated building design.

15	IOP Conference Series: Earth and Environmental Science / Malaysian construction site crane accidents: causes and consequences	Abdul Rahim Abdul Hamid, Ridzuan Azhari, Rozana Zakaria, Eeydzah Aminudin, Ramadhansyah Putra Jaya, Logeswaran Nagarajan, Khairulzan Yahya, Zaiton Haron and Riduan Yunus	2019	Regardless of the scale of the project, crane utilization is common and crucial in the construction business. The tower crane's effectiveness in tall structure construction is essential to a project's success. The crane operator must effectively manage the crane and adhere to all safety instructions. Consequences of improperly performing the standards and procedures for crane handling include loss of life, injury, and property losses. The awareness of the needto undertake this study in order to prevent this problem from occurring was raised by the rising frequency of crane accidents in Malaysia. In order to analyze the accident statistics involving cranes in Malaysian construction sites, this study was carried out. The Department of Occupational Safety and Health's official database of crane accident reports and document search was used in this study (DOSH). Two techniques, frequency analysis and content analysis, were used to analyze all of the data that had been gathered. The study's findings indicate that mobile cranes have the greatest number of crane accident cases—23—of any type of cranes. In Malaysia, structural collapse ranks first among the 28 causes of crane accidents as a major contributing factor. In an effort to reduce crane accidents

16	Is the Safe Working Cycle a Cure-All for Hong Kong's Problems with Building ?Site Safety	Daniel W. M. Chan and Dougla. Aghimien	2022	Construction accidents in Hong Kong continue to be more common than accidents in other sectors. Nevertheless, since the introduction of many safety programs, such as theSafe Working Cycle, accident rates within the sector have considerably dropped (SWC). In order to collect empirical information on the use of SWC in construction projects, the success of the safety initiative, and its advantages, a post-positivist philosophical approach was chosen in this study. A questionnaire survey was also initiated. Descriptive statistics, mean scores, Mann-Whitney U- Tests, Kendall's concordance analyses, Chi-square values, Spearman rank-order correlation tests, and exploratory factor analyses were used to analyze the data collected from 197 construction participants. The results showed that SWC has been widely adopted in Hong Kong's building sector. Additionally, this safety initiative is successful because of the daily, weekly, and monthly inspections and supervisions as well as the safety committee meetings. The safety of frontline employees and an improvement in the organization's commitment to and reputation for safety can be included under the advantages of implementing SWC. The theoretical foundation provided by this study is beneficial for future research on the SWC's applicability to the whole construction sector.

17	An integrated managemen t of constructio n and demolition waste for resource recovery is published in the Journal of Cleaner Production article "Pathways to Circular Constructio ".n	Seyed Hamidrez a Ghaffar, Matthew Burman Nuhu Braimah	2020	The UK government has acknowledged the difficulties of sustainable building, the necessity of industrial growth, and the problems of resource efficiency, and these issues are now at the forefront of strategy and policy. The management of construction and demolition waste (C&DW) is a key aspect of the government's sustainability plans. An investigation of existing C&DW management methods and knowledge of the circular construction (re- use, recycling, and recovery of materials) concept in the UK was conducted in this study using a mixed method approach Relevant construction industry stakeholders (from the contracting, demolition, and C&DW organizations) were chosen, and their opinions on circular construction-related issues were sought out to assist create shared visions and further promote sustainable behavior in the industry. According to the study, government regulation of the minimum level of reuse and recycling for each new project may significantly enhance circularity in the built environment. More precisely, attention should be paid to cost-effective process optimization and smart building demolition. This will allow for fair competition among the many parties involved and eventually result in investments in cutting-edge methods for resource recovery from C&DW.

18	Impacts of COVID-19 pandemic on municipal solid waste management: Opportunities and Challenges Science of The Whole Environment Journal	Bhargavi N.Kulkarni, V.Anantharama	2020	The COVID-19 epidemic has sparked a worldwide crisis and generated social and economic challenges that will eventually affect the environment. The current study assesses existing municipal solid waste (MSW) management procedures in the context of this natural experiment, with a focus on MSW treatment and disposal facilities in a few industrialized and developing nations. The data and information utilized in this study were gathered from a number of academic research papers from various fields, government and multinational agency publications, and news stories. Considering the paucity of research on the management of MSW during such pandemics, This essay covers several facets of managing MSW against a global backdrop of the COVID-19 pandemic. The criteria of disease transmission through solid waste management are identified, as well as the effects of an increase in medical waste on the existing municipal waste treatment and disposal systems. Moreover, based on earlier research on pandemic and catastrophe waste management, this paper also outlines difficulties and potential in the wake of the current epidemic

19	Artificial intelligence' s roles in constructio n engineering and managemen t: A critical analysis and emerging tendencies	Yue Pan, Limao Zhang	2021	Construction engineering and management (CEM) is undergoing a quick digital revolution as a result of the widespread usage of artificial intelligence (AI). As AI- based CEM solutions are the current area of study, a thorough understanding is required. In order to explain the current state of AI adoption in the context of CEM and analyze its future research prospects, this study offers a systematic evaluation under both scientometric and qualitative analysis. First, a scientometric evaluation of 4,473 journal articles from 1997 to 2020 is conducted to investigate the features of keywords, journals, and clusters. The number of pertinent articles has increased dramatically, especially over the last ten years as the popularity of keywords has shifted from expert systems to building information modeling (BIM), digital twins, and other topics. Following that, a quick explanation of CEM is given, which may profit from the new AI trend in terms of automation, risk mitigation, high efficiency, digitization, and computer vision. Six popular research areas that significantly increase the benefit of AI in CEM have received particular attention: knowledge representation and reasoning, information fusion, computer vision, natural language processing, intelligence optimization, and process mining. These themes aim to data-drivenly model, forecast, and optimize problems over the course of the whole complicated project lifecycle. Six important future research directions—smart robotics, cloud virtual and augmented reality (cloud VR/AR), artificial intelligence of things (AIoT), digital twins, 4D printing, and blockchains—are highlighted to continually facilitate the automation and intelligence in CEM. This will help to further close the gap between AI and CEM.

20	Risk evaluation and identification in UAE sustainable building projects, International Journal of Construction Manageme nt	Sameh M. El-Sayegh, Solair Manjikian, Ahmed Ibrahim, Ahmed Abouelyo usr & Raed Jabbour	2018	In the United Arab Emirates, there is a significant trend toward environmentally friendly building initiatives (UAE). Construction projects that are sustainable carry higher risk than conventional projects. This study aims to identify and evaluate the hazards associated with green building initiatives in the United Arab Emirates. This will make it easier for project participants to handle these risks effectively. Based on a review of the literature, a list of thirty dangers was created. Management, technical, green teams, green materials, and regulatory/economic risks were divided into five categories. After that, a survey was created and distributed to UAE professionals. The respondents assessed each risk based on its likelihood of happening and its consequences. There were 44 replies gathered. Based on the risk severity, the thirty dangers were graded (probability multiplied by impact). The top five hazards include a lack of money from the client, incomplete or inaccurate information about sustainable design, changes in design, an unreasonable tight deadline for sustainable construction, and a lack of a clear scope definition for sustainable building. An essential component of project risk management is risk identification and evaluation. This makes it possible to plan and regulate risk .responses appropriately