# Causes For the Delay in Construction Offices Building: A Systematic Review

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ABSTRACT

*Analysing the literature related to construction delays, 74 papers that were published from 2018 to 2023 were reviewed. A comprehensive search was conducted thru numerous databases, including Scopus, Web of Science, and Google Scholar, using keywords such as " Buildings construction delay, "This key word was used to select the linked papers. The review concludes that past construction delay studies centred on 3 main causes of delay factors, namely Input Delay Factors (4 factors), Internal Delay Factors (18 factors), and External Factors (5 factors), and these studies have proposed improvement on techniques and frameworks. The methodology involved a systematic review procedure, concentrating on input, internal and external factors such as project management inefficiencies, financial constraints, labor lacks, material procurement problems, etc. The study noticed that construction internal and external delay factors issues were the most frequently cited cause of delays. This review provides valuable awareness into delay mitigation strategies for construction authorities and experts. Overall, this article contributes to the existing body of understanding on building construction delay by synthesising and studying the latest research from selected journals. The identified causes of delay and the improvement techniques and frameworks outlined in this study provide valuable insights for researchers, experts, and decision-makers involved in the construction industry, simplify informed decision-making and improve construction project to mitigate delays in building construction projects.*

*Keywords: Delay causes; construction delays; office buildings; systematic review; buildings construction*

## INTRODUCTION

Building construction contributes greatly to the economic growth of a country (Lu et al. 2018). A government's investment-led construction industry that prioritizes the development of buildings for health, transport and education is essential for the prosperity of any nation (Nguyen et al. 2020). However, high-profile project failure is regularly reported in the public domain (Boström-Einarsson et al. 2020; Hofmann et al. 2020; Liu & Zhang 2022).

Delays in construction projects are a widespread issue globally, impacting project outcomes in terms of cost, time, and quality. Among many construction areas, office building projects hold unique significance due to their role in supporting economic activities and accommodating evolving workplace demands. While the causes of delays in general construction projects have been extensively studied, the identifiable factors contributing to delays in office building projects still underexplored. Existing findings often focus on broader categories, such as residential, infrastructure, or industrial projects, which may not adequately capture the distinct descriptions and challenges associated with office construction(Al Saeedi & Karim 2022).

The current area of literature highlights several repeating causes of delays, including financial constraints, inadequate planning, resource shortages, and regulatory difficulties. However, the fragmented and context-specific

nature of these studies limits the ability to get comprehensive insights that can be globalized or fit to office construction projects. Furthermore, there is a lack of systematic reviews that consolidate evidence across multiple studies to identify patterns, rank delay factors, and suggest actions to mitigate strategies specific to office buildings projects.

This systematic review objects to bridge this gap by synthesizing current research on the causes of delays in office building construction. By critically analyzing the findings of earlier studies, this review seeks to identify key delay factors, emphasize trends, and recommend a structured framework for addressing these issues. The study's contribution lies in its focus on office buildings as a distinct category within construction projects, granting valuable insights for researchers, practitioners, and politicians to improve project delivery in this important sector (Shoar & Banaitis 2018).

Computerization and digital activities and processes, which include technologies such as artificial intelligence (AI), the internet of things (IoT), building information modelling (BIM) significantly impact the management of physical assets (Laghari et al. 2022). Data analytics and deep learning, for example, are utilized in various industries to increase production. As growth and development are enhanced through the utilization of technologies, economies assuredly thrive further. The construction industry plays an essential role in supporting the economic development of a country. It assists growth, links various industries and provides employment. It becomes the engine of growth, connecting services and goods to various businesses. Raising construction activities saves costs per capita and improve revenue, thus expands the economy. It is a fact that the construction industry links various business activities, forming a correlation that enables it to foresee complications to be encountered and identifies feasible actions to improve construction projects' performance. The issues in the construction (Bovkun & Korodyuk 2019). For many decades, companies throughout the world have invested on research to investigate declining productivity. Factors affecting the construction industry include measurement techniques, use of equipment, advancement of construction technology, development of models, and framework to improve construction. A delay in construction activity will affect construction work and may lead to failures (Durdyev et al. 2018). There are various levels of productivity measurement; the three main ones are industry or sector level, project level, and activity or process level measurement. However, construction entities prefer project-based productivity comparisons (case studies) because comparisons in case studies enable companies to identify improvement areas and therefore applied to their construction activities.

The growth of productivity in a country determines its economic wealth. Hence the increase in workers' wages and the profits and tax revenues of related agencies. Inconsistent productivity trends, such as variation in procedures of measurement, advancement strategies and recommended scheme of construction would delay successful completion of work. (Al Saeedi & Karim 2022) cited a few studies on building construction delay.

## METHODOLOGY

The methodology chosen for this study is an effective way to answer the research question and address the problem at hand. Based on (Snyder 2019) who suggests that research questions are the most appropriate methodology, and in this particular study, the focus is on "what" questions, of the study is an effective way to fulfil the aims of the study and address the problem at hand (Snyder 2019) Therefore, a survey strategy was chosen as the most appropriate approach to respond to the queries in the study.

The flowchart of the research methodology illustrates the sequential steps taken by the author to attain the aim of the research. The process begins with defining the research objectives and conducting a literature review to understand current knowledge in the field. Next is identifying the factors that delay oil and gas construction projects in Kuwait, drawing from previous studies by (Seddeeq et al. 2019) and (Ismael & Shealy 2018). The methodology is divided into five main stages. The first stage involves defining research objectives, reviewing the literature, and identifying delay factors. The second stage focuses on survey design, considering the specific research questions. The third stage includes the implementation of the survey strategy of data collection that are directly related to factors that hamper successful completion of construction work.

The collected data are then analyzed in the fourth stage using appropriate statistical techniques to identify patterns and relationships. Finally, in the fifth stage, the author interprets the results and draws conclusions based on the findings. By following this methodology, the researcher aims to effectively address the research questions and furnish existing knowledge with the outcome of the research.

The fifth phase also includes the framework for delay factors to be research further in the future, whereby the delay factors are analyzed and the reliability and validity of the questionnaire are checked, a pilot study is conducted and the eventual questionnaire is prepared (Aladwani et al. 2018). At this stage, the analysis of the pilot study, done by specialists and project managers with experience exceeding 15 years in Kuwaiti oil companies, including the feedback from the contributors were adopted to revise the questionnaire before submitting to the chosen respondents. Once the final questionnaire was ascertained, the study sample size was determined and copies the questionnaire were sent to participants, followed up by tracking the response (Hatta Antah et al. 2022).

TABLE 1. Summary of the literature review

| Author(s)/Year | Country | Methodology | Limitations | Findings |
|---|---|---|---|---|
| (Abbasbhai & Patel 2020a) | India | Quantitative survey | Focused only on small to medium-sized projects. | Labors and materials shortages are essential delay factors in developing economies. |
| (Abebe & Germew 2021) | Ethiopia | Case study and interviews | Limited sample size from a single country context. | Financial issues and contractor performance significantly impacting delays in Ethiopia. |
| (Adeleke et al. 2018) | Malaysia | Survey and regression analysis | Lack of comparative studies with other countries. | Organizational culture and effective risk management minimize delays |
| (Akinosho et al. 2020) | South Africa | Statistical analysis of surveys | Limited focus on public infrastructure projects | Supply chain disruptions and insignificant scheduling impact timelines negatively. |
| (Al Saeedi & Karim 2022) | UAE | Survey-based study | Limited to office building projects in the Middle East. | Regulatory difficulty and design modifications cause delays in office building projects. |
| (Shoar & Banaitis 2018) | Lithuania | Quantitative analysis | Focuses on contractual factors; limited exploration of external variables. | Risk allocation in contracts correlates with project delays in construction phase. |
| (Alsuliman 2019) | Saudi Arabia | Questionnaire survey and case studies | discovering, ranking, and analyzing the causes of time delay of the public construction projects division in Saudi Arabia | Delay in providing financial rights to contractors by government agencies Ministries' poor information dissemination on infrastructure Inadequate plan by government entities. |
| (Umuhoza et al. 2019) | Somalia | Interview | | Causes of delay: work stoppage due to cash flow constraints, delay in design documents, change and orders approval, inspection, f physical plan confidentiality, price fluctuations Ineffective project planning, inadequate drawing details, unqualified labour, lack of materials on the market and dishonesty. |
| (Raden Risang Haryo et al. 2020) | Indonesia | Questionnaire and literature Studies | | There should be an implementation schedule to check proper stages of work and progress of each stage.  A change in scheduling of work can be made to accommodate any critical work delay. |

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|---|---|---|---|---|
| (Al Khatib et al. 2020) | Saudi Arabia | Questionnaire | | Three major factors that disrupt overall reconstruction project are: site restrictions and conditions, electrical and mechanical rerouting works, and design buildability and adjustment. |
| (A. Kassem et al. 2019) | Yemen | Questionnaires, expert assessment | | Validation test had shown that the risk factor model that had been developed had substantially able to explain the effect of risk factors on the success of oil and gas construction projects. |
| (Yap et al. 2021) | Malaysia | Pilot study Questionnaire | | This study provides the international construction community valuable insights into the reevaluation of delay factors and realignment of project management strategies to ensure project is delivered on time. These research findings provides both academics and construction specialists with extensive understanding into the core issues of schedule delays, . |
| (Fashina et al. 2021) | Somalia | Questionnaire | | The findings enhance the understanding of delay factors in the construction industry worldwide, and thus enabling global applications and spurring future studies. |

Table 1 shows that most researchers used Questionnaire as a tool for data collection. A few utilized expert assessment,

literature Studies, Interview, and case studies. Their findings are dissimilar and varied. (Fashina et al. 2021) found criteria that increase and improve the understanding of delay factors that are accepted internationally. (Yap et al. 2021) focused on research outcomes that contributes to the academic domain and construction experts with extensive understanding into the core issues of delayed works. Relying only on the "lowest price criteria" usually causes risks to a construction project, specifically time, cost, and quality. This study has limitations based on The Egyptian Federation for Construction and Building Contractors (EFCBC) First Grade companies (El-khalek et al. 2019); in particular limitations relating to identification, level and analysis of the causes of time delay in Saidi Arabia' s government construction projects (Alsuliman 2019). Other studies do not have limitations to their studies.

"Six authors used questionnaire in their methodology; one author used expert judgment, and one other author used interviews for his methodology." In general, all the information in the table is important but every author focuses on different angles which complement each other

consequently.

FIGURE 1. illustrates the systematic method for conducting a literature review on the topic of construction delays and building construction. It starts with the use of a search engine, in particular the Web of Science, to identify relevant research information using the keywords "construction delay" and "building construction." The method involves an initial filtering step where titles, abstracts, and keywords are checked, along with a visual test of publications like conference papers and book reviews. then this, data editing is carried out to select appropriate papers from the similar field. The output of this step concludes with eight publications deemed relevant to the study. A complete review and detailed reading of these final papers follow, focusing on understanding the motivation behind the research. after that, the causes and treatments of construction delays are organized for deeper analysis. Finally, the process concludes with summarising the findings and writing conclusions based on the reviewed literature.
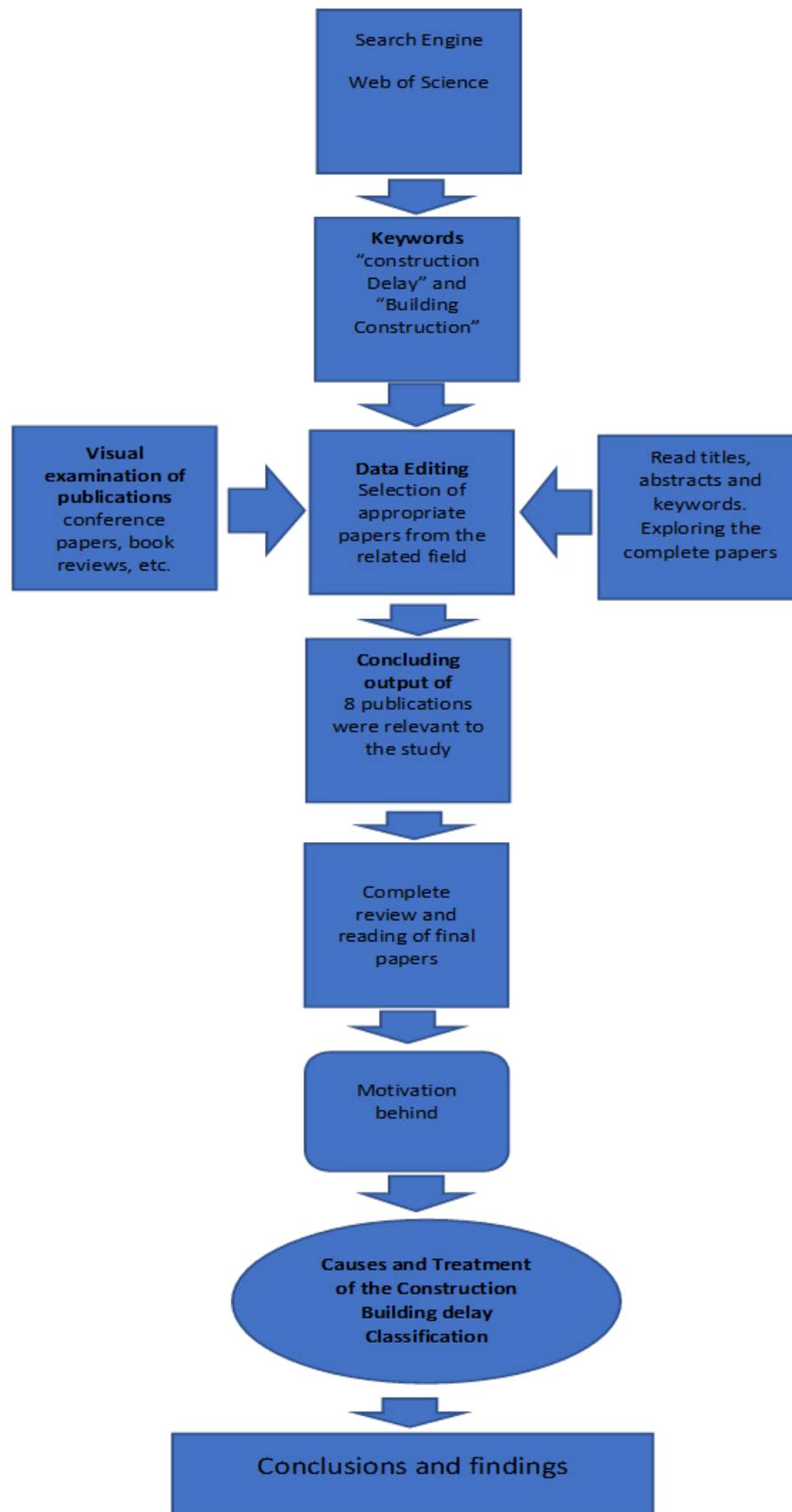
FIGURE 1. Research flow chart

# FINDINGS

The findings from the reviewed articles discover a variety of factors contributing to construction Buildings delays in different countries, each shaped by unique contexts and challenges. (El-khalek et al. 2019), conducting study on Egypt, identified poor project management, ineffective planning, and financial constraints as the main causes of delays. The study suggested adopting advanced project management tools and ensuring financial stability for construction projects to mitigate these problems.

In Saudi Arabia, (Alsuliman 2019) focused on contractor-related issues, such as insufficient skilled labor and material shortages, as a large contributor to delays. The research highlighted the need for improved contractor training and closer guidelines for resource management. Similarly, (Al Khatib et al. 2020) also studied Saudi Arabia's construction industry and found that ineffective communication and coordination among stakeholders were key factors causing delays. The study proposed the use of digital tools like Building Information Modeling (BIM) to improve collaboration and minimize disruptions.

(Umuhoza et al. 2019) and (Fashina et al. 2021) both examined the construction challenges in Somalia. (Umuhoza et al. 2019) focused on the impact of political instability and security challenges, highlighting the need for international support and policies to create a stable construction environment. (Fashina et al. 2021) shows that logistical challenges, a lack of skilled workforce, and poor risk management as main contributors to delays. The authors advised capacity-building programs and the development of risk assessment frameworks to address these concerns.

(Raden Risang Haryo et al. 2020) explored construction delays in Indonesia, point out environmental factors and regulatory hurdles as important causes. The study suggested streamlining regulatory processes and incorporating sustainable practices to mitigate these delays. Meanwhile, (Yap et al. 2021) examined the Malaysian construction industry and found that contractor inexperience and frequent design changes were key contributors to project delays. The study advised for better contractor selection processes and enhanced stakeholder engagement during the design phase.

In Yemen, (A. Kassem et al. 2019) highlighted the critical impact of political instability, economic challenges, and lack of infrastructure on construction delays. The study suggested enhancing international collaborations and developing governance structures to create a more environment helpful for construction projects.

Overall, these studies provide valuable visions into the causes of construction delays across several countries, emphasizing the importance of right solutions such as improved project management, stakeholder collaboration, and authority reforms to address these challenges efficiently.

By the end of this chapter, we aim to develop a practical framework that encompasses all the factors that may improve oil-related construction works. These factors are expected to be consistently present throughout the project life cycle. To achieve this objective, we will conduct a systematic study of historical literature, which is a crucial aspect of educational research (Bernardino et al. 2018). This approach will enable us to gather valuable insights from previous studies and contribute to the existing body of knowledge on delay factors in construction projects, specifically in the oil sector.

The researcher cited the construction project of the Government Primary School No. 027 in Samarinda Ulu District, Samarinda City, Indonesia, in fiscal year 2019, which recently witnessed changes because of scheduling methods that are erroneous. It is therefore appropriate to utilize draping methods with cost effective work. In measuring the 45 respondents' feedback through the questionnaire, factor analysis and multiple linear regression methods were used (i.e. counselors, contractors and related persons involved in the school project) based on the questionnaire provided . (Park & Holloway 2018). The elements causing the slow work in the construction of the Government Primary School no. 027 were due to the procedure of setting the work schedule and building construction delay. As for the work schedule, the value of the Geta laboratory is, and for the method of delaying construction, the value of the Geta laboratory. The above case is the result of an inappropriate work scheduling method with a coefficient of value (Raden Risang Haryo et al. 2020).

The frequent amendments in the different phases of the project will definitely affect the cost and time of the project as proposed in the contracts. Therefore, there must be a consensus that benefits both the client and the contractor on on the percentage of modifications and how to deal with them (Calvetti et al. 2020). The clients should not delay the contractor's progress payments according to the project duration, work progress, and available budget for the project. Engineers recruited should be competent and capable for their effective performance in the project. (Simanjuntak & Siagian 2023).

The staff should be provided with trainings, courses and workshops to disseminate the awareness of potential risks and appropriate corrective actions. A constant supply of materials is crucial to avoid late supply of materials that may interrupt the progress of the project(Chalhoub & Ayer 2018). A plan for risk assessment and response procedures should be prepared It is also crucial to pursue and update

design drawings, the extent of work, and coordination with the client to avoid faults during the implementation (Sitthiwha et al. 2013).

The consultants to oil and gas companies normally employs experienced and efficient workers for each project. In managing the project efficiently and professionally, they must be well-aware and receptive to project requirements and able to directly supervise work progress and identify possible risks factors. They should also constantly update drawings, designs, and ensure interaction cohesion between the client and contractor. It is also imperative for the consultants to provide regular reports that details progress of completion and probable delays (Bernardino et al. 2018).

In Yemen, the success of O&G enhances the national economy, thus it is imperative that relevant infrastructure and facilities must be developed especially in the O&G region. Besides, related laws and work procedures were also developed to facilitate processes involved between the authority and O&G companies and to eliminate corruption in tenders related to O&G sector (N Alenezi ., 2020). There were also initiatives to facilitate & strengthened project decisions, budget and government supervision, security and coordination between responsible parties to minimalise risks and avoid project failures (Gebreyes et al. 2020)

Moreover, the coordination between O&G companies in training and developing local workers and preparing them to respond to potential risks were enhanced to ensure the future success of the O&G operation(Akinosho et al. 2020).

There has been little success to control and contain construction project delays, which has been a universal phenomena even though there has been a substantial academic attention to the problem. A Malaysian field survey investigated 20 construction delay causes, from the perspective of key stakeholders i.e. clients, contractors and consultants whereby each cause was given priority based on the importance index (IMP.I) which also include frequency of occurrence and degree of severity (Yap et al. 2021) The survey identified 5 main causes of delay: inefficient plan and schedule, inumerable change in plan and action, management and supervision weaknesses, incapable subcontractors and contractors' issue of finances. Based on Spearman's rank-order correlation (association between frequency, severity and importance) the survey results affirmed that contractor-related causes were the main reason for project delays (Seddeeq et al. 2019).

Ahamad et al. (2020) identified 5 major factors that could enhance effective project management: administrative competency, organising communication and coordination, administering finance issues, managing risks and operating work site.

These discoveries provide insights for academic researchers and construction practitioners into the basic causes of work delays, in particular, in Asian and African construction projects. (Aslan & Türkakın 2022) believed that stakeholders' awareness and understanding of delay causes would reduce delays and enable them to strategise project performance and guide the industry's future research.

The main aim of this study is to establish a model that clarifies significant factors affecting causes of construction delays (Elhusseiny et al. 2021). Construction delays adversely affect timing of construction completion, thus increasing the cost of projects. The analysis of delays in multi-storey building construction throughout the world should not be overlooked. The author revealed 4 delay factors in project developments: landlord problems, contractor problems, resource and material problems, and other related general problems (Sezer & Fredriksson 2021).
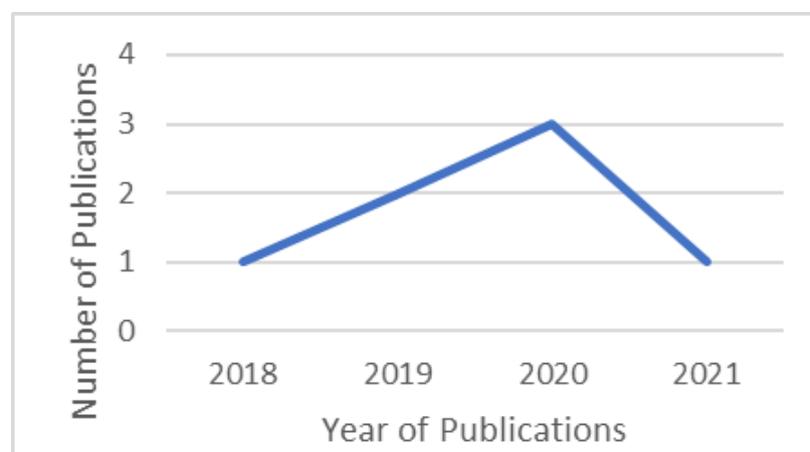


FIGURE 2. Number of relevant publications published annually from 2018 to 2023
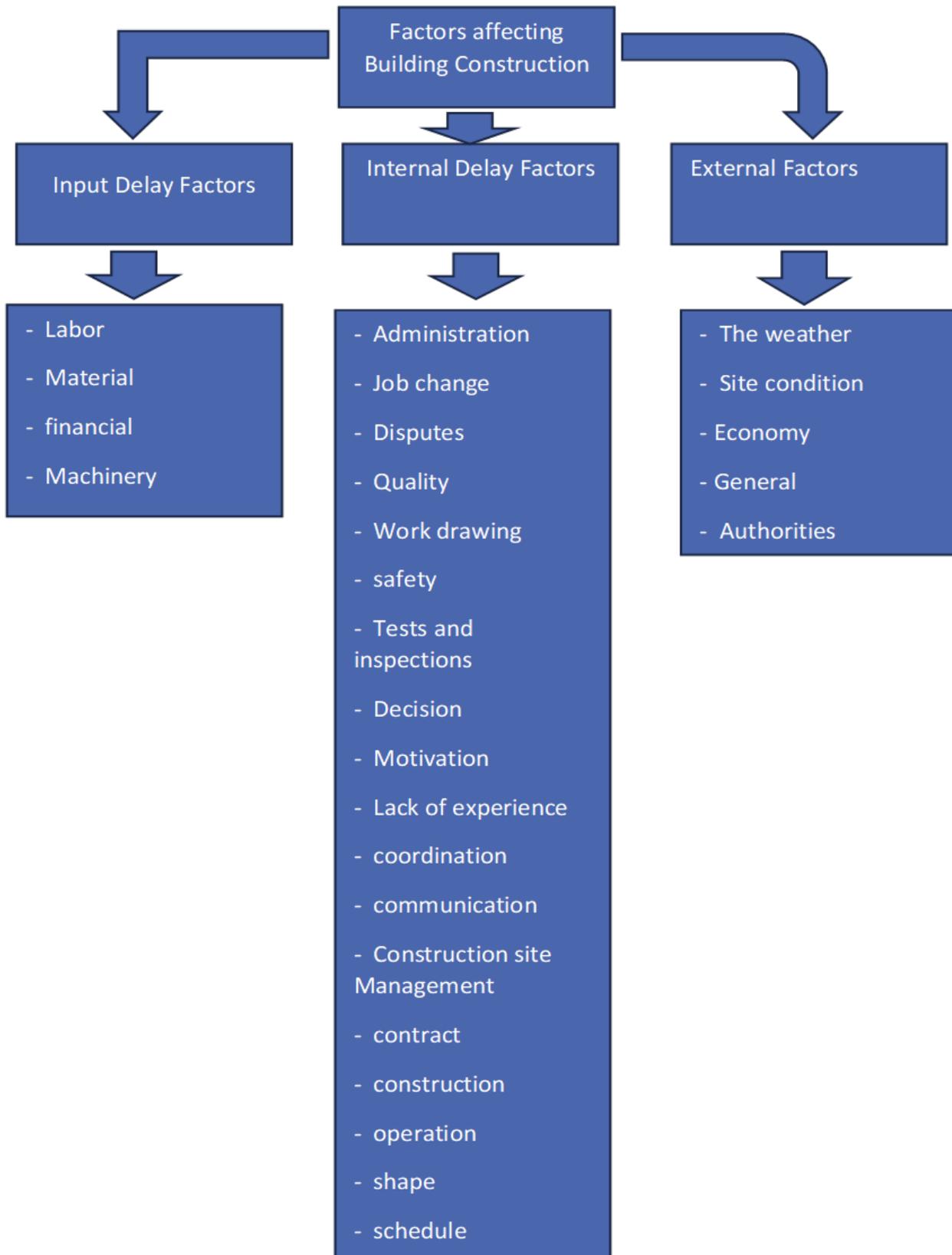
FIGURE 3. Conceptual Framework for Causes of Delay (Derwin ,1982)

The Conceptual Framework in Figure 3 is a structured and comprehensive model that identifies and categorises the various factors contributing to delays. This framework assists stakeholders to understand, analyse, and address the root causes of delays in the construction of buildings, , leading to better suprvision of work at construction sites and more efficient execution. Also, it discusses the key components of this conceptual framework.

From the perspective of Categorisation of Causes, Input Delay Factors, Internal Delay Factors, and External Factors, as mentioned in the initial list, the diverse reasons that can lead to delays during construction would be more organised and understood. From the view of Hierarchical Structure, the causes of delay can be arranged hierarchically to show their interrelationships and dependencies. For example, delays in obtaining permits from authorities (External Factor) might be caused by inefficient communication and coordination (Internal Delay Factor). From the angle of Cause-and-Effect Relationships, the framework should highlight the cause-and-effect relationships between the different factors. For instance, lack of experience (Internal Delay Factor) could lead to poor quality work, resulting in rework and time overruns. From Quantitative and Qualitative Assessment view, causes of delay can be assessed both quantitatively (measurable factors for example number of days delayed) and qualitatively (subjective factors like motivation levels). This helps in understanding the impact and severity of each cause.

This framework can incorporate lessons learned from past projects to improve accuracy and effectiveness. Analysing historical data enhances the identification of recurring causes of delay and therefore enabling strategies to be devised to prevent them in future projects. The conceptual framework should not be static but rather to be evolved over time as new insights and data emerge. It should be refined based on ongoing project experiences and research for Continuous Improvement. By using a well-structured Conceptual Framework for Causes of Delay, construction stakeholders can proactively address issues, implement appropriate mitigation measures, and enhance the overall efficiency and success of building construction projects.

## DISCUSSION AND CONCLUSION

A review of previous research revealed critical delay factors in construction projects differ from country to country due to differences in construction methodology, planning techniques used, and local laws in each country. Supervision, poor planning of work at the construction site,

slowness in giving instructions, poor qualification of the supervision staff of the consultant, and the extended waiting time for approval of drawings and testing of material samples (Bagherpour et al. 2020).

## INPUT FACTORS

The Figure (3) provided lists several frequent challenges or issues that can arise in a construction project. These challenges are classified into four categories: labor, material, financial, and machinery. Each category is further divided into subcategories, and under each subcategory, the specific challenges are listed. The references mentioned after each challenge indicate that these issues have been discussed in the papers authored by the respective researchers.

Labour shortage:. Labour shortage: This is a challenge that is related to the scarceness of skilled people to be recruited into the construction sector. The mentioned studies discuss the implications and potential solutions to address this issue. Strike: This challenge relates to labor strikes or work stoppages that can disrupt the development of any construction work (Shoar & Banaitis 2018). The mentioned studies explore the impact of strikes and potential strategies to manage them effectively. Labor productivity: This challenge refers to the efficiency and productivity of labor on a construction site. The studies investigate factors influencing labor productivity and propose methods to improve it. Labor skills: This challenge highlights the significance of having skilled workers in the construction activity. The mentioned studies discuss the skill gaps, training, and development of construction labour(Durdyev et al. 2018).

Material Lack in the market: This challenge pertains to the unavailability or insufficient materials for construction purposes in the market The studies explore the causes and potential solutions for this issue. Delay in receiving materials on-site: This challenge refers to any setback of time for the construction materials to arrive at the specific construction area(Karmakar et al. 2022). The impact of such delays was discussed in past research and strategies had been proposed to mitigate them Materials not following contract specifications: This challenge highlights the issue of materials not meeting the agreed requirements outlined in the construction contract. The mentioned studies discuss the consequences and potential remedies for such situations. Defect in materials that are acknowledged: This challenge refers to the acknowledgement of materials that have defects or quality issues. The mentioned studies discuss the implications and strategies to minimize the occurrence of such cases(N Alenezi .2020.).

Financial problems by the project owner: This challenge relates to financial difficulties faced by the project owner, such as insufficient funds or cash flow problems. The mentioned studies discuss the impact of these issues and potential solutions. Late payment for work done: This challenge refers to delays in payments to contractors for work already completed. The studies mentioned examine the impact and propose measures to alleviate this problem(Simanjuntak & Siagian 2023). Low project cost estimate: This challenge relates to underestimating the project costs, resulting in financial difficulties during its execution. The mentioned studies discuss the causes and potential ways to improve cost estimation correctness. Owner problem in obtaining bank finances: This challenge highlights the difficulty project owners may face in obtaining necessary financing from banks or financial institutions. The mentioned studies explore potential reasons and recommend measures to overcome them(Bernardino et al. 2018).

Machinery allocation problem: This challenge refers to issues related to allocating machinery realistically on a construction site. The studies mentioned discuss the impact and potential strategies for efficient machinery allocation. Machinery failure: This challenge pertains to the breakdown or malfunctioning of machinery through a construction project(Baduge et al. 2022).

## INTERNAL FACTORS

Administration: Disturbances of Project Owner: This refers to challenges or disruptions caused by the project owner, such as alterations in requirements, lack of clear communication, or delays in decision-making. Internal Administration Problems: These are issues that arise within the project team or organization, such as inadequate communication, inadequate coordination, or ineffective project management practices. Unskilled PMC (Project Management Consultant): If the project management consultant lacks the necessary skills or expertise, it can lead to difficulties in project execution and management (Mehrbod et al. 2019)

Disputes: Contract disputes and specifications: Disagreements or conflicts related to the interpretation of contract terms, specifications, or payment terms can lead to delays and disputes between project stakeholders. Environmental disputes: Disputes arising from environmental regulations, permits, or non-compliance issues can hinder project progress. Financial disputes: Issues related to project financing, payment delays, or disputes over cost allocations can interrupt project activities. Negotiation of other major disputes: This category encompasses any significant disputes or conflicts not covered by the previous subcontractors that may happen during the project (Zheng et al. 2021).

Too much quality-related documentation: Excessive documentation requirements can be time-consuming and difficult for project teams, potentially affecting project progress. Application of quality control based on specifications: Ensuring adherence to quality specifications and standards is highly critical for construction work to be completed successfully  (Mannino et al. 2021).

Accidents during construction: Safety incidents or accidents can result in injuries, loss of productivity, and project delays. Lack of application of safety view: Failure to prioritize and enforce safety measures can jeopardize the well-being of workers and negatively impact project progress(Manzoor et al. 2022).

Lack of competent inspectors: Insufficient numbers or qualifications of inspectors can result in delays in conducting necessary tests and inspections.    Slow confirmation of testing and inspection: Delays in confirming the results of tests and inspections can delay work progress and postponement project milestones(Gebreyes et al. 2020).

Slow results from Project Owner: If the project owner is slow in offering necessary approvals or decisions, it can impede project progress and lead to delays. Late results from consultant: Delays in receiving crucial decisions or feedback from consultants can affect project timelines and decision-making procedures. Late decision from contractor: Contractors who are slow in making decisions related to construction activities can impact project schedules and progress. Approval Process: Delays in the approval process, whether related to approves, designs, or changes, can cause project delays and hinder whole progress (Banobi & Jung 2019).

Incentive for early work completed: Offering incentives to complete work before schedule can motivate contractors and teams to work more efficiently (Kurniawan & Ratnasih 2023).

Lack of Experience identifies three relevant parties: consultants, owners, and contractors. The lack of experience in any of these positions can contribute to project challenges and difficulties(A. Kassem et al. 2019).

Construction Site Management: addresses weaknesses in materials procurement planning, delays in document approval issuing, and the accuracy of documenting the bill of quantity works. Additionally, the role of the consultant project management team is also mentioned(Wang et al.

2020).

Contract is the factors discussed here include different types of bidding and awarding practices, late awarding of contracts, and high competition between bidders (Abebe & Germew 2021).Construction Factors under this category include delays in drawing preparation by contractors and unclear drawing details submitted by consultants (Luangcharoenrat et al. 2019).category includes factors such as work suspension, construction faults, delays of subcontractor work, incorrect construction methods, and work interruptions(El-khalek et al. 2019).The shape category highlights concerns related to complex designs, poor designs, and design faults(Liu & Zhang 2022). Schedule category covers factors such as project construction period, work program, and working plan.

This section addresses a range of internal factors that can effect construction projects, including weather conditions, site conditions such as soil condition and demolishing old buildings, economic factors such as increases in materials prices and labor salaries, general factors like construction activities during public events, force majeure events, limited construction areas, and the impact of government policies and law changes as well as delays in authorization by municipalities and workforce(Zhu et al. 2022). Late fines: Imposing penalties for late completion can incentivize contractors to adhere to project timelines and meet deadlines. Overall, the factors listed in the table reflect common challenges and issues encountered in construction projects. Understanding and addressing these factors can help project managers and stakeholders anticipate and mitigate potential problems, leading to more successful of project outcomes(Zheng et al. 2021).

## EXTERNAL FACTORS

The provided Figure (3) highlights different external factors that can impact construction projects. These factors are classified into various categories, including weather, site conditions, economy, general factors, and authorities. The authors mentioned in brackets have conducted studies that support the influence of these factors on construction projects.

The first category is weather, which is an essential consideration for construction projects(Luangcharoenrat et al. 2019). Bad weather can cause delays and disruptions in construction activities. The studies by (A. Kassem et al. 2019; El-khalek et al. 2019; Yap et al. 2021) and (Fashina et al. 2021) emphasise that weather condition is a crucial element in ensuring the continuity of construction work.

The second category is site conditions, specifically focusing on soil conditions and the demolition of old buildings. Understanding the soil composition is important for effective foundation design and construction (Park & Holloway 2018). The authors (Al Khatib et al. 2020; El-khalek et al. 2019; Yap et al. 2021) and (Fashina et al. 2021) highlight the consequences of soil conditions on construction work. Additionally, the demolition of old buildings can introduce complexities and potential delays, as stated by the same authors.

The third category is the economy, which encompasses two factors: the increase in material prices and the increase in labor salaries. Fluctuations in material prices can affect project budgets and costs, as discussed by (El-khalek et al. 2019; Raden Risang Haryo et al. 2020; Yap et al. 2021) and (Fashina et al. 2021). Similarly, changes in labor salaries can impact project expenses, as underlined by the same authors(Forcael et al. 2020).

TABLE 2. The Input, Internal, and External Delay factors and its overlap and influence one another.

| Reference | Input Factors | Internal Factors | External Factors | Methodology |
|---|---|---|---|---|
| (A. Kassem et al. 2019) | Risk management processes, project scheduling | Organizational culture, team capabilities | Environmental regulations, political instability | Case study analysis, qualitative research |
| (Abbasbhai & Patel 2020b) | Material availability, labor resources | Workforce skills, management practices | Market fluctuations, economic conditions | Survey, literature review |
| (Abebe & Germew 2021) | Project design quality, planning | Communication within teams, leadership | Legal frameworks, governmental policies | Survey, exploratory research |
| (Adeleke et al. 2018) | Resources allocation, construction methods | Company structure, employee training | Market demand, country-specific regulations | Quantitative analysis, survey |
| (Akinosho et al. 2020) | Data collection, planning systems | Project management tools, process optimization | Technological innovations, global trends | Literature review, qualitative analysis |
| (Al Saeedi & Karim 2022) | Cost estimation, resource allocation | Construction process, site management | Socio-economic factors, political environment | Critical review, case studies |

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| (Alsuliman 2019) | Design plans, contractor qualifications | Team coordination, project control measures | Legal issues, cultural differences | Survey, descriptive research |
|---|---|---|---|---|
| (Fashina et al. 2021) | Material handling, labor supply | Training programs, subcontractor performance | Market demand, inflation rates | Case study, qualitative research |
| (Shoar & Banaitis 2018) | Labor availability, safety measures | Labor productivity, task management | Local regulations, supply chain disruptions | Fuzzy fault tree analysis, qualitative analysis |
| (Yap et al. 2021) | Project complexity, technological requirements | Project schedule, resource optimization | External financial conditions, governmental regulations | Survey, regression analysis |

Table 2 showing up the Input Factors (such as resources, project design, and planning) essentially serve as the starting point and the work base for construction projects. These components influence internal and external factors through project completing.

Internal Factors (team performance, communication, project management) interact with both input and external factors. Internal factors often serve as moderators or mediators between input and external factors, involving how the project responds to external conditions.

External Factors (such as political, economic, and environmental conditions) endlessly influencing the project's development and can magnify or mitigate the impact of input and internal factors.

These factors often overlap and influence each other, creating a complicated environment where changes in one aspect can significantly impact the others. Each research emphasizes the importance of considering these factors in delay, project planning, and performing evaluation to ensure successful project results.

We recommend that future researchers conduct further studies on the Building construction delays based on the findings from the reviewed studies, several paths for future research are recommended to develop the understanding of construction delays and their mitigation strategies. For example, (El-khalek et al. 2019) show up the financial and project management problems in Egypt. Future studies could increase the dataset to include a broader range of projects across different regions in Egypt, allowing for comparative analyses of urban and rural construction projects. In addition, applying advanced methodologies, such as machine learning models, could assistance to predict delays and improve planning precisely.

Alsuliman (2019) and (Al Khatib et al. 2020) study focused on contractor-related issues and stakeholder communication in Saudi Arabia. Upcoming research could investigate the integration of emerging digital technologies, like artificial intelligence and blockchain, to enhance collaboration and resource allocation. Additionally, studying how cultural and organizational factors influence stakeholder coordination could provide valuable insights into improving communication practices in the Saudi construction sector.

Finally, (A. Kassem et al. 2020) highlighted the challenges presented by political instability and economic needs in Yemen. Future studies could explore the role of public-private partnerships in mitigating these challenges, working on how innovative financing models could guarantee project continuity. In addition, further research could analyze the helpfulness of governance reforms and capacity-building programs in generating a sustainable construction environment in unstable economies.

The study focused on the key factors that cause delays in office building construction, aiming on the interaction between input, internal and external delay factors elements. However, limitations such as reliance on secondary data and lack of site works limited, depth and applicability of the findings. To overcome these limitations, upcoming research should incorporate primary data collection methods, such as stakeholder interviews and surveys from different areas, to validate and extend the study's insights and enhance its applied relevance.

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## DECLARATION OF COMPETING INTEREST

None.

## REFERENCES

A. Kassem, M., Khoiry, M.A. & Hamzah, N. 2019. Risk factors in oil and gas construction projects in developing countries: a case study. *International Journal of Energy Sector Management* 13(4): 846–861.

A. Kassem, M., Khoiry, M.A. & Hamzah, N. 2020. Using probability impact matrix (PIM) in analyzing risk factors affecting the success of oil and gas construction projects in Yemen. *International Journal of Energy Sector Management* 14(3): 527–546.

Abbasbhai, M.J. & Patel, A.S. 2020a. Factor Affecting Performance of Construction Projects. *International Research Journal of Engineering and Technology*.

Abbasbhai, M.J. & Patel, A.S. 2020b. Factor Affecting Performance of Construction Projects. *International Research Journal of Engineering and Technology*.

Abebe, M. & Germew, S. 2021. Investigation of significant industrial project delay factors and development of conceptual framework. *Cogent Engineering* 8(1).

Adeleke, A.Q., Bahaudin, A.Y. & Kamaruddeen, A.M. 2018. Organizational Internal Factors and Construction Risk Management among Nigerian Construction Companies. *Global Business Review* 19(4): 921–938.

Ahamad, N.B., Binti Mazlan, A.N., Zin, R.M. & Tukirin, S.A. 2020. Construction Procurement in Industrialised Building System. *IOP Conference Series: Materials Science and Engineering*, .

Akinosho, T.D., Oyedele, L.O., Bilal, M., Ajayi, A.O., Delgado, M.D., Akinade, O.O. & Ahmed, A.A. 2020. Deep learning in the construction industry: A review of present status and future innovations. *Journal of Building Engineering* 32.

Al Khatib, B., Poh, Y.S. & El-Shafie, A. 2020. Delay factors management and ranking for reconstruction and rehabilitation projects based on the Relative Importance Index (RII). *Sustainability (Switzerland)* 12(15).

Al Saeedi, A.S. & Karim, A.M. 2022. Major Factors of Delay in Developing Countries Construction Projects: Critical Review. *International Journal of Academic Research in Business and Social Sciences* 12(5).

Aladwani, M., Mollasalehi, S., Fleming, A., Aladwani, F. & Al-Adwani, M. 2018. A study of root causes of delays in the public-sector construction projects in Kuwait A study of root causes of delays in the publicsector construction projects in Kuwait Title A study of root causes of delays in the publicsector construction projects in Kuwait A Study of Root Causes of delays in the public-sector construction projects in Kuwait.

Alsuliman, J.A. 2019. Causes of delay in Saudi public construction projects. *Alexandria Engineering Journal* 58(2): 801–808.

Aslan, S. & Türkakın, O.H. 2022. A construction project scheduling methodology considering COVID-19 pandemic measures. *Journal of Safety Research* 80: 54–66.

Baduge, S.K., Thilakarathna, S., Perera, J.S., Arashpour, M., Sharafi, P., Teodosio, B., Shringi, A. & Mendis, P. 2022. Artificial intelligence and smart vision for building and construction 4.0: Machine and deep learning methods and applications. Elsevier B.V.

Bagherpour, M., Khaje Zadeh, M., Mahmoudi, A. & Deng, X. 2020. Interpretive structural modeling in earned value management. *Journal of Civil Engineering and Management* 26(6): 524–533.

Banobi, E.T. & Jung, W. 2019. Causes and mitigation strategies of delay in power construction projects: Gaps between owners and contractors in successful and unsuccessful projects. *Sustainability (Switzerland)* 11(21).

Bernardino, E.B., Serona, K.M., Cando, J.C., Acosta, I.C. & Malagapo, E.P. 2018. Strengthening Success Factors and Overcoming Profitability Barriers towards Sustainable Project Management Consultant Companies. *Business and Economic Research* 8(2): 230.

Boström-Einarsson, L., Babcock, R.C., Bayraktarov, E., Ceccarelli, D., Cook, N., Ferse, S.C.A., Hancock, B., Harrison, P., Hein, M., Shaver, E., Smith, A., Suggett, D., Stewart-Sinclair, P.J., Vardi, T. & McLeod, I.M. 2020. Coral restoration − A systematic review of current methods, successes, failures and future directions. *PLoS ONE* 15(1).

Bovkun, A. & Korodyuk, I. 2019. Analysis of the development of small innovative enterprises in the construction industry. *IOP Conference Series: Materials Science and Engineering*, .

Calvetti, D., Mêda, P., Gonçalves, M.C. & Sousa, H. 2020. Worker 4.0: The future of sensored construction sites. *Buildings* 10(10).

Chalhoub, J. & Ayer, S.K. 2018. Using Mixed Reality for electrical construction design communication. *Automation in Construction* 86: 1–10.

Durdyev, S., Ismail, S. & Kandymov, N. 2018. Structural Equation Model of the Factors Affecting Construction Labor Productivity. *Journal of Construction Engineering and Management* 144(4).

Elhusseiny, H.O., Nosair, I. & Ezeldin, A.S. 2021. Developing a user plug-in to assess delay causes' impact on construction projects in Egypt. *Ain Shams Engineering Journal* 12(4): 3553–3568.

El-khalek, H.A., Aziz, R.F. & Morgan, E.S. 2019. Identification of construction subcontractor prequalification evaluation criteria and their impact on project success. *Alexandria Engineering Journal* 58(1): 217–223.

Fashina, A.A., Omar, M.A., Sheikh, A.A. & Fakunle, F.F. 2021. Exploring the significant factors that influence delays in construction projects in Hargeisa. *Heliyon* 7(4).

Forcael, E., Ferrari, I., Opazo-Vega, A. & Pulido-Arcas, J.A. 2020. Construction 4.0: A literature review. MDPI.

Gebreyes, M., Bazzana, D., Simonetto, A., Müller-Mahn, D., Zaitchik, B., Gilioli, G. & Simane, B. 2020. Local perceptions of water-energy-food security: Livelihood consequences of dam construction in Ethiopia. *Sustainability (Switzerland)* 12(6).

Hatta Antah, F., Azry Khoiry, M., Nizam Abdul Maulud, K. & Nazrul Hakimi, A. 2022. Factors influencing the use of geospatial technology with 2 LiDAR for road design: Case of Malaysia.

Hofmann, P., Jöhnk, J., Protschky, D. & Urbach, N. (n.d.). Developing Purposeful AI Use Cases-A Structured Method and Its Application in Project Management.

Ismael, D. & Shealy, T. 2018. Sustainable construction risk perceptions in the Kuwaiti construction industry. *Sustainability (Switzerland)* 10(6).

Karmakar, A., Singh, A.R. & Kumar, V.S. 2022. Automated route planning for construction site utilizing building information modeling. *Journal of Information Technology in Construction* 27: 827–844.

Kurniawan, A. & Ratnasih, C. 2023. Job Satisfaction Through Motivation and Communication on Employee Performance (Case Construction Service Companies in Indonesia).

Laghari, A.A., Wu, K., Laghari, R.A., Ali, M. & Khan, A.A. 2022. A Review and State of Art of Internet of Things (IoT). Springer Science and Business Media B.V.

Liu, S. & Zhang, X. 2022. Fault Diagnosis and Maintenance Countermeasures of Transverse Drainage Pipe in Subway Tunnel Based on Fault Tree Analysis. *International Journal of Environmental Research and Public Health* 19(23).

Lu, H., Li, Y., Chen, M., Kim, H. & Serikawa, S. (n.d.). Brain Intelligence: Go Beyond Artificial Intelligence.

Luangcharoenrat, C., Intrachooto, S., Peansupap, V. & Sutthinarakorn, W. 2019. Factors influencing construction waste generation in building construction: Thailand's perspective. *Sustainability (Switzerland)* 11(13).

Mannino, A., Dejaco, M.C. & Re Cecconi, F. 2021. Building information modelling and internet of things integration for facility management-literature review and future needs. MDPI AG.

Manzoor, B., Othman, I. & Waheed, A. 2022. Accidental safety factors and prevention techniques for high-rise building projects – A review. Ain Shams University.

Mehrbod, S., Staub-French, S., Mahyar, N., Fellow, P. & Tory, M. 2019. BEYOND THE CLASH: INVESTIGATING BIM-BASED BUILDING DESIGN COORDINATION ISSUE REPRESENTATION AND RESOLUTION. *Journal of Information Technology in Construction (ITcon)*.

N Alenezi, T.A. (n.d.). Minimising The Delay Factors On Construction Projects: A Local Case Study In Kuwait City During Covid-19. *International Journal of Engineering Research and General Science* 8(5).

N Alenezi, T.A. (n.d.). The Impact Of Covid-19 On Construction Projects In Kuwait. *International Journal of Engineering Research and General Science* 8(4).

Nguyen, P.T., Likhitruangsilp, V. & Onishi, M. 2020. Success Factors for Public-Private Partnership Infrastructure Projects in Vietnam 10(2).

Park, S. & Holloway, S. 2018. Parental Involvement in Adolescents' Education: An Examination of the Interplay Among School Factors, Parental Role Construction, and Family Income. *School Community Journal*.

Raden Risang Haryo, C.D., Mulyadi, L. & Iskandar, T. 2020. Delay factors in building construction project of state elementary school. *Civil Engineering Journal (Iran)* 6(3): 523–530.

Seddeeq, A. Bin, Assaf, S., Abdallah, A. & Hassanain, M.A. 2019. Time and cost overrun in the Saudi Arabian oil and gas construction industry. *Buildings* 9(2).

Sezer, A.A. & Fredriksson, A. 2021. Environmental impact of construction transport and the effects of building certification schemes. *Resources, Conservation and Recycling* 172.

Shoar, S. & Banaitis, A. 2018. Application of fuzzy fault tree analysis to identify factors influencing construction labor productivity: A high-rise building case study. *Journal of Civil Engineering and Management* 25(1): 41–52.

Simanjuntak, A. & Siagian, H. 2023. The Role of Client-Contractor Relationship in Solving Financing Failure in Construction Project: Case Study 6(1): 10–19.

Sitthiwha, T., Timothy Ibironke, O., Olugbenga Oladinrin, T., Adeniyi, O. & Victor Eboreime, I. 2013. Analysis of Non-Excusable Delay Factors Influencing Contractors' Performance in Lagos State, Nigeria. *Journal of Construction in Developing Countries*.

Snyder, H. 2019. Literature review as a research methodology: An overview and guidelines. *Journal of Business Research* 104: 333–339.

Umuhoza, ), An & Sung-Hoon. 2019. Delay Factors in Building Construction Projects in Rwanda. *J. Korea Inst. Build. Constr* 19(5): 467–475.

Wang, M., Wang, C.C., Sepasgozar, S. & Zlatanova, S. 2020. A systematic review of digital technology adoption in off-site construction: Current status and future direction towards industry 4.0. MDPI AG.

Yap, J.B.H., Goay, P.L., Woon, Y.B. & Skitmore, M. 2021. Revisiting critical delay factors for construction: Analysing projects in Malaysia. *Alexandria Engineering Journal* 60(1): 1717–1729.

Zheng, X., Liu, Y., Jiang, J., Thomas, L.M. & Su, N. 2021. Predicting the litigation outcome of ppp project disputes between public authority and private partner using an ensemble model. *Journal of Business Economics and Management* 22(2): 320–345.

Zhu, L., Ma, H., Huang, Y., Liu, X., Xu, X. & Shi, Z. 2022. Analyzing construction workers' unsafe behaviors in hoisting operations of prefabricated buildings using HAZOP. *International Journal of Environmental Research and Public Health* 19(22).