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Investigating The Causes Of Contractor-Related Delays In Construction Projects And Mitigation Proposal

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Abstract – The study objective is to investigate construction contractor-related delay factors. In addition, the study aimed to identify the significant delay reasons related to the contractor as a major contributor to the delay in the execution of construction projects and propose mitigation strategies that contractors can implement. A literature review and PESTEL analysis were conducted on the studies published between 2020 and 2022. Thirty-five previous studies revealed twenty-five delay causes related to contractors. The identified causes were ranked according to the times they were reported in previous studies and further categorized into five management factors. In addition, this study proposes delay mitigation strategies to help contractors overcome delays related to their performance. Finally, the study recommends where future delay studies should focus on.

Keywords –

I. INTRODUCTION

Despite the active role of the construction sector in community development, several challenges need to be addressed. Delays in the execution of construction projects are considered a significant issue affecting the industry, economy, organizations, and people. The delay in the execution of the construction project was defined as slippage in the agreed delivery timing owing to several factors. Therefore, a construction project time overrun is a breach of a contract that can be remedied either by payment of liquidated damages or cancellation/termination of the contract, or both (Kebede & Zhang, 2020). In most instances, delays in construction projects lead to disputes that halt the entire project (Muhwezi et al., 2020).

Several causes leading to delays in projects include weather/climate conditions, poor communication, lack of coordination and conflicts between stakeholders, ineffective or improper planning, material shortages, financial problems, payment delays, equipment/plant shortages, and lack of experience/qualification/competence among project stakeholders, labor shortages, and poor site management (Durdyev & Hosseini, 2018). These factors lead to cost and schedule overruns, increased risk factors, client disappointment, and safety complications (Shaikh et al., 2020).

A study conducted by (Bajjou & Chafi, 2018) revealed that the top ten delay causes were delays in progress payment, lack of training for employees, lack of waste management strategy, unrealistic contract duration imposed by clients, rework due to construction errors, excessive subcontracting, delays in obtaining permits from governmental agencies, ineffective planning and scheduling, lack of collective planning, and unskilled workforce.

There is a relationship between causes of delay, firm size, and firm experience. (Maqsoom et al., 2019) argued that firm size and varied experience were associated with delays in communication and coordination, contract management, design and documentation, financial management, skilled labor, procurement management, and site operation-related factors. The study concluded that mature firms are more affected by financial issues than younger firms.

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Conversely, the delay was studied according to contributors such as clients, engineers, contractors, external factors, and environmental factors. The critical causes of delay related to the client were changes and variations in orders; contractor factors included ineffective execution plans and work programs; consultant factors concern late decisions, insufficient team for design work, and poor communication among parties; external factors included price fluctuation and unfavorable weather conditions (Gashahun, 2020). However, researchers have not agreed upon the influence of each delay contributor. However, studies have shown significant variations in this regard. (Elhusseiny et al., 2021) argued that the owner was responsible for three major causes of delay. (Abeysinghe & Jayathilaka, 2022) argued that contractor delays were the most essential factors. Moreover, the findings of the survey questionnaires on contractors, consultants, and clients showed that the contractor was the main source of delay. The study revealed that 47% of the delay factors were caused by the contractor, followed by delays caused by laborers and owners (Alshihri et al., 2022).

The literature also revealed that the delay causes were not shared or identical, but differed between countries and the nature of the projects. Rather, there was evidence of unfamiliar causes of delay in particular countries and regions (Fakunle & Fashina, 2020). This is another indication of disagreement among studies about delays in construction projects supported by (Welde & Bukkestein, 2022) where the root causes of delay are not general and differ among countries and sectors. These studies concluded that construction delays are shared globally, but their causes and effects vary with the region and context of the construction industry.

Therefore, the need for studies that investigate the delay factors of each contributor in more detail is crucial for the industry and the success of projects. This study investigated the contractor delay factors revealed in previous studies, in addition to the proposed mitigation plan that contractors can implement to avoid delays in their projects.

II. Study Objectives

The study objective was to investigate contractor-related delay factors in the construction sector. In addition, this study aimed to identify the significant delay causes related to the contractor as one of the main contributors to the delay factors and propose mitigation strategies that contractors can implement. The specified delay caused by contractors and the proposed mitigation will contribute to closing the literature gap related to construction contractor studies. This study contributes to providing a vision that helps improve the best practices of the construction sector in a more effective manner by understanding the delay factors and mitigation strategies.

III. Problem And The Study Hypothesis

This study focuses on the significant delay causes related to contractors and their rankings, which was concluded from previous studies. The study hypothesizes that the major contractors' delay causes are management-related.

IV. Theoretical Background

Generally, the delay in construction is defined as the extension of the time from the contract completion date. Construction contracts usually provide for the delay consequences that include the entitlement of an employer to remove parts of the contractor's scope of work, instruct the contractor to increase resources, impose delay penalties, demand delay damages, and/or terminate the contract and assign a new contractor to do the works (ALmonayyer, 2021). Therefore, delays can have negative economic consequences and create a bad image for a contractor. (Subedi & Joshi, 2020).

4.1- Delay in Construction Sector

There are several classifications of delay in the construction sector, as shown in figure No 1. They are classified according to their impact on the project completion date, the liability, and the occurrence, whether the delay is concurrent or not.

Critical and non-critical delay events: The delay that extends the contract completion date is the critical delay, opposite to non–critical delay, where the completion date is not affected. Any delay in critical activity will affect the critical path and lead to critical delay. The non-critical delay result from a delay in non-critical activity.

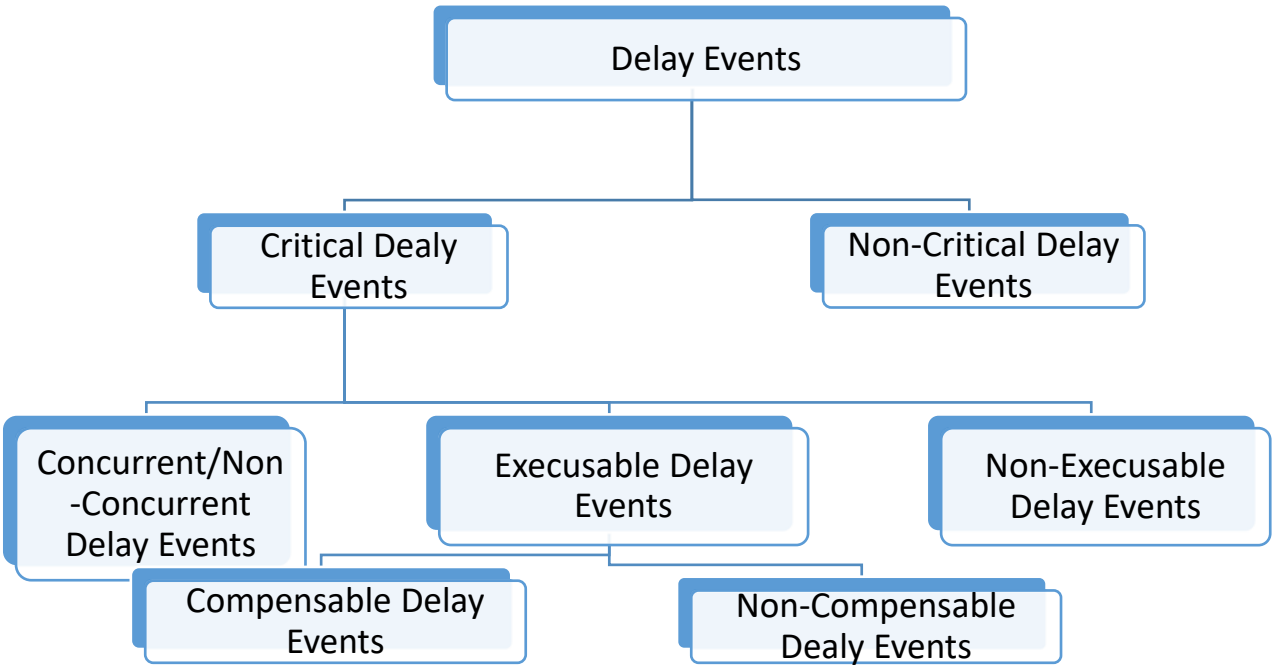
Excusable and non-excusable delay events: Any delay beyond the contractor's responsibility and from external factors, client representative, late client instructions, delay in site handing over, delay in issuing documents, or force major, is considered an excusable delay. In the excusable delay, the contractor has the right to compensate for any delay damage resulting from the

client, and, in such case, the delay is known as a compensable excusable delay. This compensation can be an extension of the contract completion date, cost compensation, or both. While any excusable delay not resulting from client action and beyond his control, such as unavailability of materials/labor, Acts of God, or COVID-19. In such case, this delay is not a compensable excusable delay, and the contractor has the right to time extension without cost compensation.

On the other side, the non-excusable delay is the contractor's responsibility. Generally, it results from a deficiency in the execution of the work or part of the work that leads to extending the project completion date with no presentable excuse. In such a case, the contractor has no rights for any kind of compensation and the client is entitled to compensation due to damage from the project delay. (Okereke et al., 2021) argued that the project's non-compensable delays are deficiency in management, insufficient time scheduling, faults and mistakes in construction, inefficient machinery and equipment, and conflicts and disputes among the project team.

Figure 1 Delay Categories

Sources: Modified from (Okereke, Zakariyau, & C. Eze, 2021)



Concurrent delay events: concurrent delay takes its name when two or more delay events happen simultaneously due to different causes. Concurrent delay causes can be excusable, non-excusable, compensable, or non-compensable, depending on the delay analysis results. The delay analysis will determine which party is entitled to compensation or an extension of time.

(Subedi & Joshi, 2020) mentioned that the courts determine the legal impact of concurrent delays by examining the responsibility for the concurrent delays and determining whether the parties are seeking compensation or an extension of time. There are many types of concurrent delays, and the contractor has the right to compensate for concurrent delays if the delays are caused by the client. Similarly, the client has the right to liquid damages if he succeeds in identifying the contractor's responsibility for concurrent delays. In the cases where concurrent excusable and inexcusable delays, the contractor has the right to an extension of the completion date. The contractor has a right to time extension without damage compensation in case compensatory, and non-compensatory delays are concurrent, but if the client is the source of compensatory delays, in this case, the contractor is entitled to compensate the damages.

(Subedi & Joshi, 2020) explained all the above in valuable equations as below:

Excusable + Non-Excusable = Time extension;

Concurrent (Compensatory + Non-compensatory) = Time extension only;

All compensatory delay solely by owner = Compensation +Time extension.

In many cases, concurrent delays were misused by clients and contractors where each party tried to collect damages compensation from another (Okereke et al., 2021). Thus, concurrent delays should be evaluated, documented, and reported during the occurrence timing to avoid disputes.

4.2- Delay Analysis Methods

Several delay analysis methods are available for quantifying project delays. Figure 2 shows the best-known delay analysis methods.

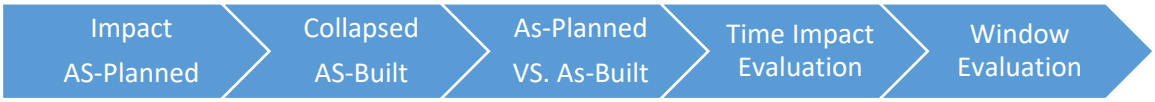


Figure 2 Delay Analysis Methods

Impacted As-Planned: This method includes the delay events into the baseline schedule to evaluate the impact of the events, and it is suitable for early use to determine the magnitude of the delay impact on future activities.

Collapsed As-Built: This method removes delay events from the as-built schedule and calculates the time extension from the delay events.

As-Planned Vs. As-Built: This method calculates the delay based on the difference between the baseline and the as-built schedules.

Time Impact Analysis: This method analyzes each delay event separately and chronologically to calculate the individual impact.

Windows Analysis; this method considers the project at different widows to compare the baseline schedule with the updated schedule over the time window being analyzed on the critical path only.

4.3- Impact of Delay

(Alenazi et al., 2022) investigated the influence of delays on projects and owners. Their study revealed that the Cost Performance Index (CPI) values ranged from 0.84 to 0.89, which indicates cost overruns and consequences on the client. Therefore, delays in construction projects affect the schedule and cause cost overruns leading to project abandonment and litigation (Rashid, 2020). Moreover, other delay factors that lead to project termination include Force Majeure provisions, liquidated damage, and other contractual terms during the pandemic (Yadeta & Pandey, 2020).

(Salih & Messaoudi, 2021) Identified the Ten most essential effects of delay, including time overrun, failure in achieving project objective/goal, cost increase, poor quality, negative impact on cities, loss of productivity, wastage, and underutilization of resources. Thus, project delay effects are not related to schedule and cost overruns but extend to people, organizations, communities, the environment, and national economies.

Therefore, identifying the causes of delays is essential for the contractor's success. Thus, understanding the causes of delay, identifying its types, using appropriate analysis methods, and realizing the impact of delay are the most critical steps for contractors to deal with delay as a serious matter to prevent projects from failing and improving their reputation.

V. Methodology And Data Source

5.1- Literature Review

The research method used for data collection was the literature review. Reviewing previous studies is beneficial for industry practitioners and scholars to provide comprehensive and valuable sources. It also provides a discussion, conclusions, and future research directions (Yap et al., 2021). Hence, the data collected from previous studies used Google Scholar (GS) and Research Gate as research engines. We used keywords to collect topics related to delays in construction projects, including time

extension, contractor delay, delay analysis, contracts and disputes, and delays in construction projects. The search focused only on the data published between 2020 and 2022. The first round of examinations revealed 17,000 topics on Google Scholar (GS). The selection criteria were as follows: The publication should be in English, published between 2020 and 2022, consisting of delay causes related to contractors, and be published in a scientific journal. After further checking, evaluating, and removing duplicate studies, 56 studies were identified.

Further reading of all 56 types of research revealed that 35 studies related to contractor delay causes were published from 2020 to 2022, while 21 studies were excluded. Although the excluded studies were delay causes in the construction projects, contractor related-delay was not investigated in these studies. Therefore, these were omitted from the analysis.

The Thirty-five selected studies (Appendix 1) were classified according to title, authors, year of publication, data source, participants, analysis methods, region of the study, and the construction project type. Moreover, Appendix 1 includes the causes of delay revealed by each study.

5.2- Effect of PESTEL Forces

PESTLE is an abbreviation for the six sources of impact: **political**, **economic**, **social**, **technological**, **environmental**, and **legal**. PESTEL analysis aims to identify and assess the critical macro-environmental factors that can affect the working conditions and performance of firms operating in an industry (Carruthers, 2009). Therefore, the construction industry can be characterized by the complex and diverse interrelations of various macro-environmental factors that directly or indirectly affect a company's operations (Turkyilmaz et al., 2019). Thus, the effect of PESTEL forces on the causes of contractor-related delays is tremendous, as revealed in previous studies.

Political Factors: This factor concerns the decisions, policies, and regulations of the government's interventions in the construction industry. (Rauzana & Dharma, 2022) Mentioned that a frequent cause of project delay is a political factor, namely, intervention by political leaders. Therefore, there are significant risks that may result from political decisions concerning the policies and regulations of the construction sector. These types of risks affect, in particular, infrastructure projects where this sector relies on governments and several authorities and agencies overlapping in policies or the decision processes.

Economic Factors: Economic fluctuations significantly influence contractor performance. Difficulties in project financing, high operational costs, low profit margins, and shortage of equipment are economic forces that affect contractors' performance and cause delays in construction projects.

Social Factors: Social factors, such as cultural aspects, population growth rate, and career attitudes, have a substantial impact on the construction workforce (Pan et al., 2019). Therefore, labor shortage, labor absenteeism rate, low labor productivity, and lack of workforce motivation were the major constraints on productivity and one of the significant delays caused by contractors.

Technological Factors: The absence of technological innovations in the construction industry prevents contractors from enhancing productivity, applying effective management tools and techniques, and using robotic technology in fabrication. Thus, the researchers identified delay causes, such as ineffective planning and scheduling of the project and lack of high-tech mechanical equipment as a technological force affecting contractors. Therefore, the use of BIM had the highest percentage saving of delay for factors related to the difficulty of coordination between different parties, errors/clashes in project documents, and ineffective planning and scheduling of projects (Elhusseiney et al., 2021).

Environmental Factors: Green buildings and sustainability have become essential requirements in the construction industry. Therefore, understanding international, national, and local environmental issues and regulations will help contractors to avoid this risk factor or minimize its impact. Although the environmental delay causes are not contractor-related, they are caused by weather, poor environmental safety, and geological problems. These were identified by (Rauzana & Dharma, 2021) as the environmental delay factors in construction projects.

Legal Factors: International and national legislation related to trading exchanges impact the supply chain. Legislations about workforce supply and their rights, wages, lifestyle, and pensions have a tremendous effect on project costs and productivity rates. Thus, delays such as labor shortages, unavailability of skilled manpower, labor disputes or strikes, and shortage of materials were legal factors affecting construction project progress.

The reviewed literature and PESTEL analysis of the previous 35 studies reveals five management factors which were explained in Chapter 6.

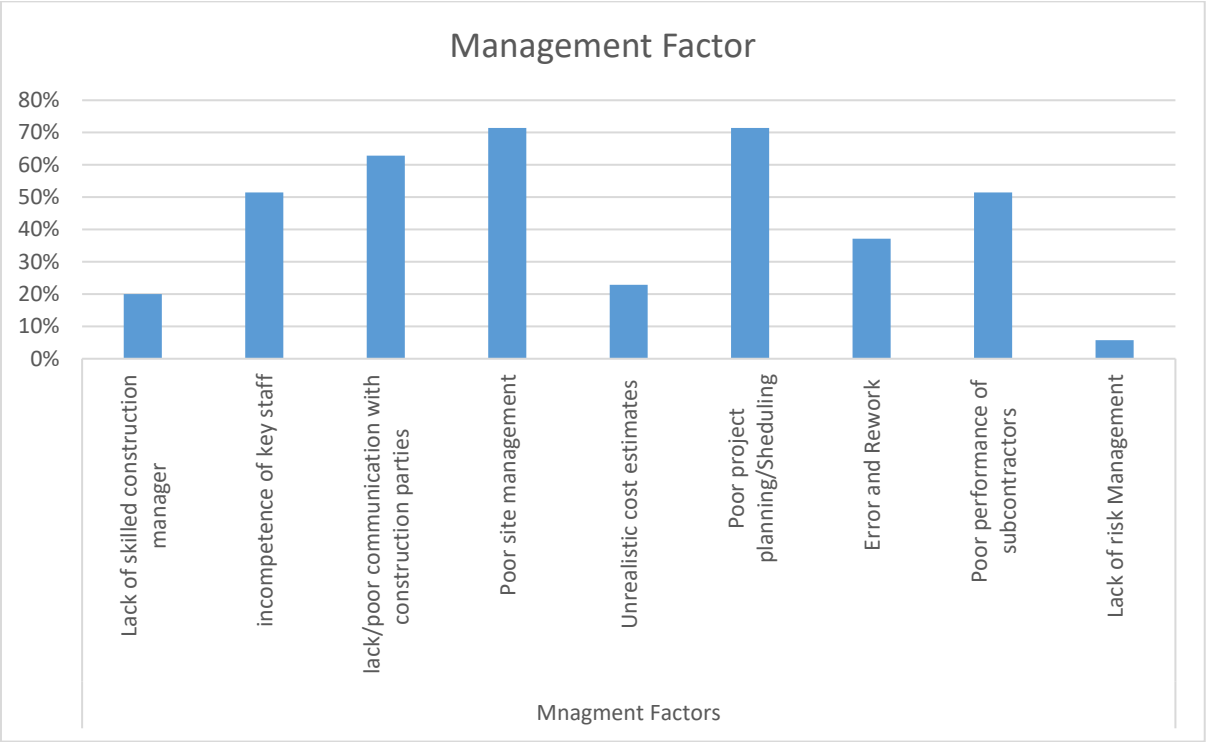
VI. Results And Findings

Appendix 1 includes the causes of delays related to the contractor revealed in previous studies and the PESTEL analysis. The causes were classified into five management factors, each with several causes of delay. These factors are; management, manpower management, material/supply management, equipment management, financial management, and other factors.

6.1- Management Factor

Delay causes related to contractors from previous studies revealed the major delay causes were; lack of skilled construction manager, incompetence key staff, lack/poor communication with construction parties, poor site management, unrealistic cost estimates, poor project planning/Scheduling, error and rework, the poor performance of subcontractors, lack of risk management. Appendix 2 and Figure 3 show the percentage of each delay cause mentioned in the 35 investigated studies.

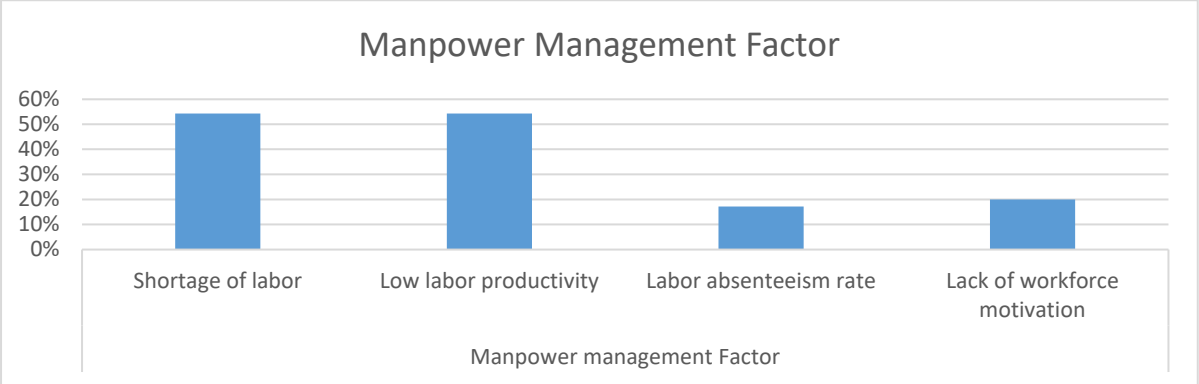
Figure 3 - Management Factor



6.2- Manpower management Factor

Delays due to low labor productivity, labor absenteeism rate, lack of workforce motivation, and labor shortage were the important causes of poor management of manpower by contractors. Appendix 2 and Figure 4 show the percentage of each delay cause mentioned in the previous studies.

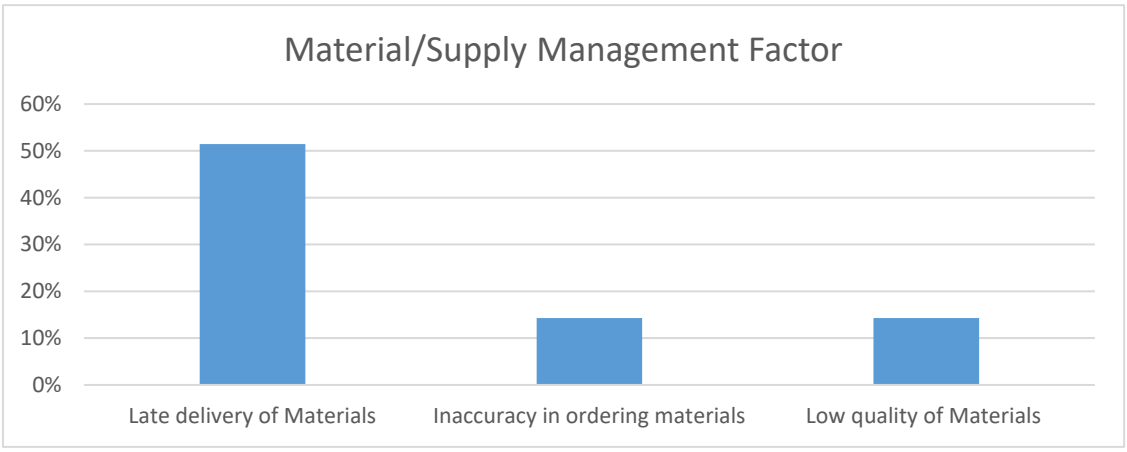
Figure 4 - Manpower management Factor



6.3- Material/Supply management Factor

Late delivery of materials, inaccuracy in ordering materials, and low quality of materials were the causes of delays related to contractors' poor supply management. Appendix 2 and Figure 5 show the percentage of each delay cause.

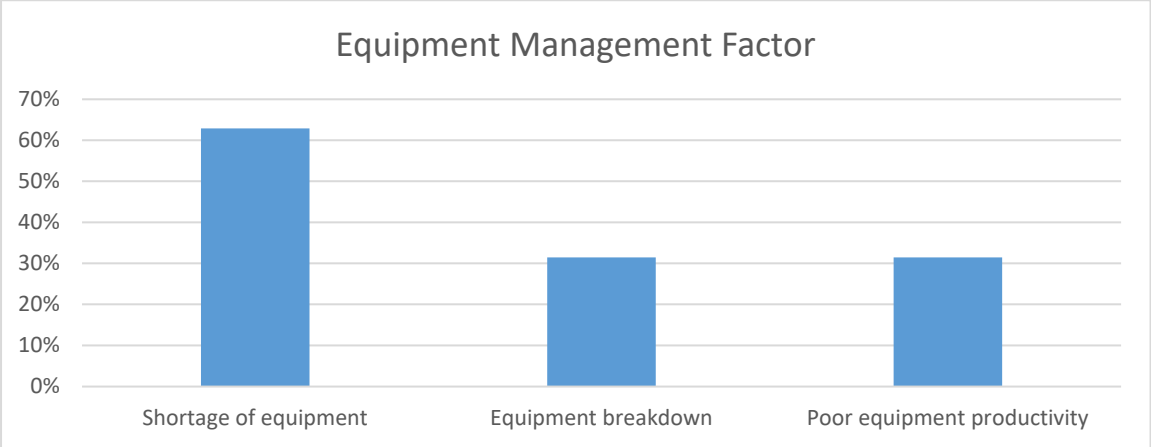
Figure 5 - Material/Supply management Factor



6.4- Equipment Management Factor

Three causes of delay related to the mismanagement of equipment were identified in 35 studies published between 2020 and 2022, including shortage of equipment, equipment breakdown, and poor equipment productivity, as shown in Appendix 2 and Figure 6.

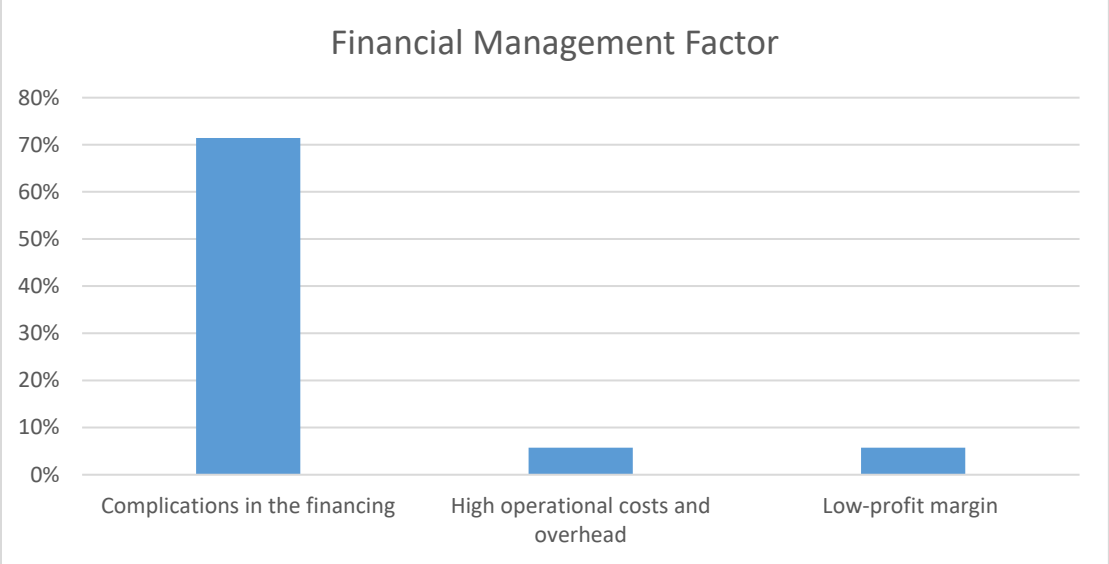
Figure 6 - Equipment Management Factor



6.5- Financial Management Factor

The contractor's financial status significantly influences his ability to complete the project on time, with an estimated building, and, as specified. Therefore, the complications in the financing, high operational costs and overhead, and low-profit margin were identified in the previous researches as major contractor-related delay causes. Their influence ranking is shown in Appendix 2 and Figure 7.

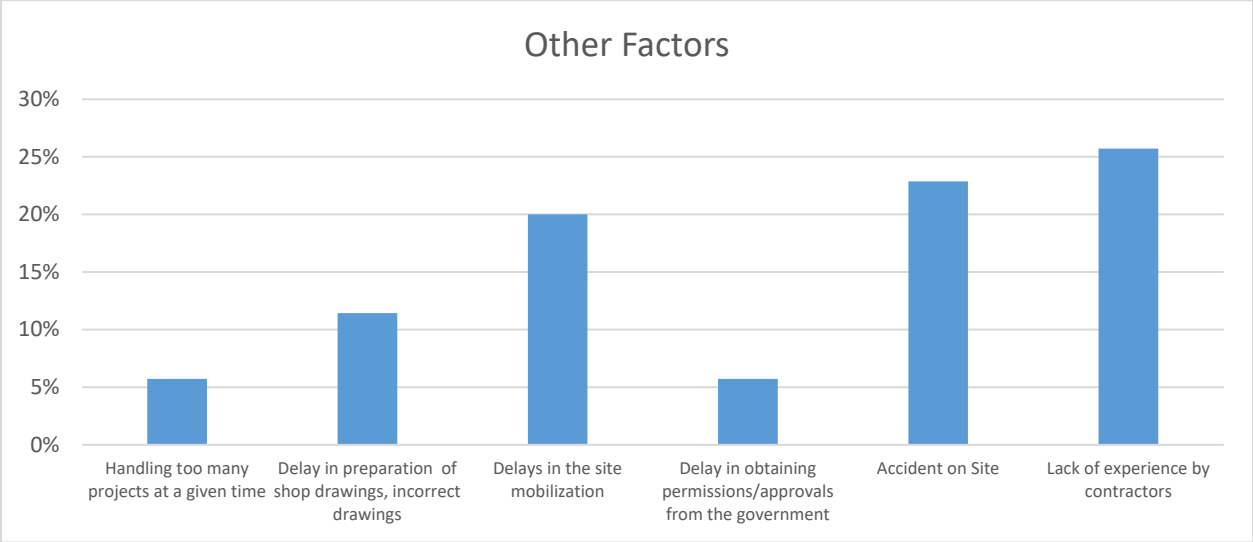
Figure 7 - Financial Management Factor



6.6- Other Factors

Other causes of delays related to the contractor were handling too many projects at a given time, delays in site mobilization, delays in obtaining permissions/approvals from the government, accidents on site, lack of experience by contractors, and delays in preparation of shop drawings and incorrect drawings. Appendix 2 and Figure 8 include their influence ranking among the investigated studies.

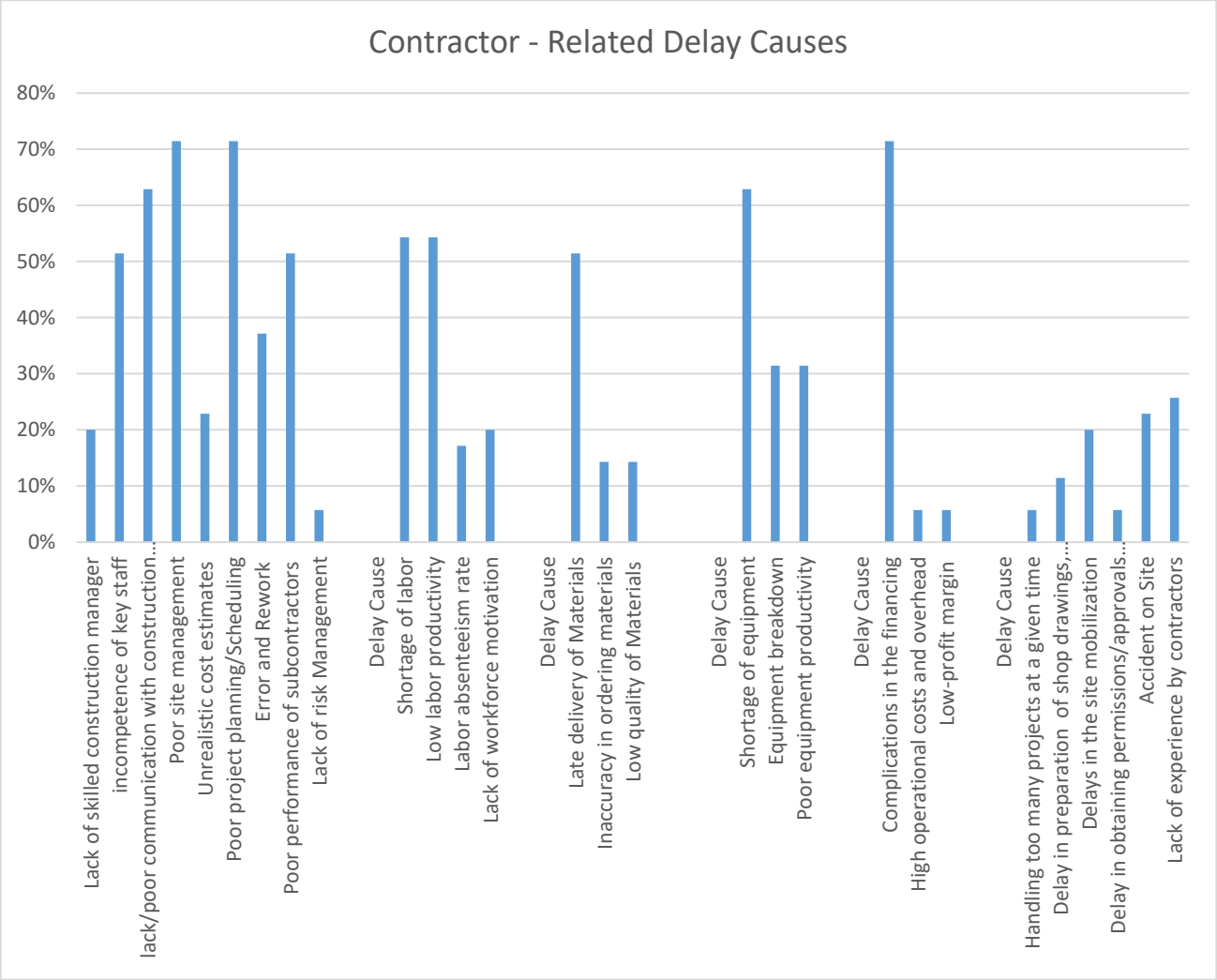
Figure 8 - Other Factors



6.7- Summary of Contractor–Related Delay Causes

Appendix 2 and Figure 9 show all contractor-related delay causes. Poor site management, poor project planning and scheduling, and financing complications represented the highest delay causes related to contractors (71 %). Lack/poor communication with construction parties and shortage of equipment were the second most common causes of delay (63 %). The third-ranking causes were shortages of labor (54 %), low labor productivity (54 %), incompetence of key staff (51 %), poor performance of subcontractors (51 %), and late delivery of materials (51 %). Errors during construction and reworks due to faults represented the fourth ranking of contractor-related delays. The summary of delay causes table in Appendix 2, shows the ranking of other causes of delays from the fifth to the tenth. Finally, the last ranking causes of delays revealed in the previous studies were lack of risk management (6 %), high operational costs and overhead (6 %), low profit margin (6 %), handling too many projects at a given time (6 %), and delay in obtaining permission and approvals from the government (6 %).

Figure 9 - Contractor–Related Delay Causes



VII. MITIGATION PROPOSAL

Construction contractors need to invest adequate time and money in the investigation of projects, proper and well-defined risk-sharing mechanisms, and strong coordination within project groups and various interfaces (Shengea et al., 2020). They have to organize training/educational programs for workers to develop their expertise and profession (Alenez, 2020), (Kazemi et al., 2020), and (Zhang et al., 2020). Using BIM can lead to better coordination, minimal errors and design changes, as well as a smooth flow of information to reduce delays and cost overruns. Moreover, feeding BIM models with cost information (5D BIM) improves a project's financial representations and cost reliability (Elhusseiny et al., 2021).

Contractors need to perform value engineering to substitute for unavailable materials/equipment. Identifying critical outsourced materials/equipment for early purchase and stockpiling. Contractors should establish an applicable management system model for construction materials/equipment procurement, in which cost and time factors are considered. Cooperative efforts between project parties should be established to apply changes to the project and allow the use of alternative materials and equipment in case it is needed (Elhusseiney et al., 2021). Contractors should monitor the progress and productivity of activities using smart modern technologies for early warning in case there is reduced productivity or work progress. Realistic tender preparation must be conducted by contractors considering all real cost factors (Vacanas & s Danezis, 2021).

VIII. Conclusion And Recommendations

This study identified the contractor-related delay revealed from a review of previous studies and PESTLE analysis. This study identified 25 causes of delay related to the contractor. Poor site management, poor project planning and scheduling, and financing complications represented the highest delay causes related to contractors. However, lack of/poor communication with construction parties and shortage of equipment were the second-highest causes of delay.

Contractors can overcome delay challenges, and the proposed mitigation strategies include management training for key staff and performing value engineering. Another recommendation concerns the use of BIM and supporting its application by training and applying smart modern technology to measure and track project performance. Moreover, (Pan et al., 2019) suggested that the persistent constraints of high construction costs, severe labor shortages, and adverse weather conditions can only be overcome by a radical transformation of the conventional construction supply chain by adopting new technologies and prefabrications.

Although literature revealed that several studies have investigated delays in construction projects, only a few have investigated each contributor as a separate entity. Therefore, further studies are needed to investigate the causes of delay related to each party, such as the client, engineer, external influencers, and environment. Other studies are recommended to focus on each cause of delay for a deep investigation and to propose practical mitigation strategies. A further recommendation is that future studies should focus on case study research rather than questionnaires to avoid the subjective viewpoints of participants. The last suggestion is to study the causes of delay in construction projects by considering the PESTLE framework from a strategic perspective rather than an operational level.

References

[1] Abdullah, A., & Shonm, P. (2020). Delay in Construction Projects due to Lack of Procurement in Sulaimani. Polytechnic Journal, 11(1), 166-133. doi:10.25156/ptj.v11n1y2021.pp126-133

[2] Abeysinghe, N., & Jayathilaka, R. (2022). Factors Influencing The Timely Completion of Construction Projects in Sri Lanka. PLoS ONE, 17(12), 1-22. doi:https://doi.org/10.1371/journal

[3] Abu Salem, Z., & Suleiman, A. (2020). Risk Factors Causing Time Delay in the Jordanian Construction Sector. International Journal of Engineering Research and Technology, 13(2), 307-315. doi:10.37624/IJERT/13.2.2020.307-315

[4] Al Amri, T., & Marey-Pérez, M. (2020). Towards a sustainable construction industry: Delays and cost overrun causes in construction projects of Oman. Journal of Project Management, 5(2), 87-102. doi:10.5267/j.jpm.2020.1.001

[5] Alenazi, E., Adamu, Z., & Al-Otaibi, A. (2022). Exploring the Nature and Impact of Client-Related Delays on Contemporary Saudi Construction Projects. buildings, 12(880), 1-23. doi:10.3390/buildings12070880

[6] Alenez, T. (2020). Covid-19 Causes Of Delays On Construction Projects In Kuwait. International Journal of Engineering Research and General Science, 8(4), 35-39. Retrieved from https://www.scirp.org/(S(351jmbntvnsjt1aadkposzje))/reference/referencespapers.aspx?referenceid=3190624

[7] Aljawad, R., Mahmood, W., & Razzooqee, J. (n.d.). Evaluation Of The Reasons Of Delay For Construction Projects Under Terrorism Risk. Materials Science and Engineering, 1105. doi:10.1088/1757-899X/1105/1/012082 ALmonayyer, K. (2021, 11 18). MSc Dissertation. Retrieved from The British University in Dubai: https://bspace.buid.ac.ae/handle/1234/1991

[8] Alshihri, S., Al-Gahtani, K., & Almohsen, A. (2022). Risk Factors That Lead to Time and Cost Overruns of Building Projects in Saudi Arabia. buildings, 12(7), 1-27. doi:10.3390/buildings12070902

[9] Antoniou, F. (2021). Delay Risk Assessment Models for Road Projects. systems, 9(3), 1-17. doi:10.3390/systems9030070

[10] Bajjou, M., & Chafi, A. (2018). Empirical study of schedule delay in Moroccan construction projects. International Journal of Construction Management, 1-18. doi:10.1080/15623599.2018.1484859

[11] Carruthers, H. (2009). Using PEST Analysis to Improve Business Performance. Practice, 31(1), 37-39. doi:10.1136/inpract.31.1.37

[12] Carvalho, A., Maués, L., Moreira, F., & Reis, C. (2021). Study on The Factors of Delay In Construction Works. Ambiente Construído, Porto

[13] Alegre, 27(3), 27-46. doi:10.1590/s1678-86212021000300536

[14] Derakhshanalavijeh, R., & Teixeira, J. (2017). Cost Overrun in Construction Projects in Developing Countries, Gas-Oil Industry of Iran As A Case Study. Journal of Civil Engineering and Management, 23(1), 125-136. doi:doi.org/10.3846/13923730.2014.992467

[15] Dok, Y., & Odoom, J. (2020). Assessing the Significant Factors Contributing to Extension of Time in Road Construction Contracts in Ghana. Journal of Civil Engineering Research, 10(1), 1-9. doi:10.5923/j.jce.20201001.01

[16] Durdyev, s., & Hosseini, M. (2018). Causes of Delays on Construction Projects: A Comprehensive List. International Journal of Managing Projects in Business, 13(1), 1-27. doi:DOI 10.1108/IJMPB-09-2018-0178

[17] Dusso, N., & Bayeh, T. (2020). The Causes and Effects of Delay of Building Construction in Ethiopia, Southern Nation Nationalities of People Region in Gurage Zone (Case of Wolkite Town). Civil and Environmental Research, 12(1), 12-21. doi:10.7176/CER/12-1-02

[18] Egwim, C., Alaka, H., Toriola-Coker, L., Balogun, H., Ajayi, S., & Oseghale, R. (2021). Extraction of Underlying Factors Causing Construction Projects Delay in Nigeria. Journal of Engineering Design and Technology, 1-20. doi: 10.1108/JEDT-04-2021-0211

[19] Elhusseiney, H., Nosair, I., & Ezeldin, A. (2021). Developing A User Plug-In to Assest Delay Causes' Impact on Construction Project In Egypt. Ain Shams Engineering Journal, 12(4), 3553-3568. doi:10.1016/j.asej.2021.04.013

[20] Elhusseiny, H., Nosair, I., & Ezeldin, A. (2021). Systematic Processing Framework For Analyzing the Factors of Construction Projects' Delays in Egypt. Ain Shams Engineering Journal, 12, 1501-1511. doi:10.1016/j.asej.2020.10.016

[21] Fakunle, F., & Fashina, A. (2020). Major delays in construction projects: A global overview. PM World Journal, IX(V), 1-15. Retrieved from https://www.researchgate.net/publication/341852313_Major_delays_in_construction_projects_A_global_overview

[22] Fashina, A., Omar, M., Sheikh, A., & Fakunle, F. (2021). Exploring the significant factors that influence delays in construction projects in Hargeisa. Heliyon, 7(4), 1-9. doi:10.1016/j.heliyon.2021.e06826

[23] Gashahun, A. (2020). Causes and Effects of Delay on African Construction Projects: A State of the Art Review. Civil and Environmental Research, 12(5), 41-53. doi:10.7176/CER/12-5-04

[24] Ghaleh, R., Pourrostam, T., Sharifloo, N., Sardroud, J., & Safa, E. (2021). Delays in the Road Construction Projects from Risk Management Perspective. infrastructures, 6(135), 1-13. doi:10.3390/infrastructures6090135

[25] Heravi, G., & Mohammadian, M. (2017). Cost Overruns and Delay in Municipal Construction Projects in Developing Countries. AUT Journal of Civil Engineering, 1(1), 31-38.doi:10.22060/ceej.2017.12189.5163

[26] Kazemi, A., AKim, S., & Kazemi, H. (2020). Identifying and prioritizing delay factors in Iran's oil ran's oil Construction Prjects. International Journal of Energy Sector Management, 15(3), 476-495. doi:10.1108/IJESM-04-2020-0006

[27] Kebede, S., & Zhang, T. (2020). Enforcement of legal remedies against construction projects time overrun in Ethiopia: A critical appraisal. Heliyon, 6(10), 1-11. doi:doi.org/10.1016/j.heliyon.2020.e05126

[28] Kullaya, D., Alemu, M., & Yeom, C. (2022). An Analysis of the Main Causes of Delays in the Completion of Road Construction Projects: A Case Study of Tanzania. The Open Transportation Journal, 16, 1-9. doi:10.2174/18744478-v16-e2208190

[29] Maqsoom, A., Choudhry, R., Umer, M., & Mehmood, T. (2019). Influencing factors indicating time delay in construction projects: impact of irm size and experience. International Journal of Construction Management, 1-12. doi:10.1080/15623599.2019.1613206

[30] Maqsoom, A., Umer, M., Choudhry, R., Zahoor, H., & Basharat, M. (2020). Factors Causing the Time Delay in Projects: Empirical Evidence from Pakistani Construction Industry. ICCREM 2020 - Intelligent Construction and Sustainable Buildings (pp. 611-621). Stockholm: ASCE LIBARARY. doi:10.1061/9780784483237.072

[31] Mittal, Y., Paul, V., Rostami, A., Riley, M., & Sawhney, A. (n.d.). Delay Factors in Construction of Healthcare Infrastructure Projects: A Comparison amongst Developing Countries. Asian Journal of Civil Engineering, 21, 649-661. doi:10.1007/s42107-020-00227-1

[32] Mohamed, S., & Adam, O. (2020). Management of Delay Factors in Construction Projects in Sudan. FES Journal of Engineering Sciences, 9(3), 26-32. doi:10.52981/fjes.v9i3.692

[33] Muhwezi, L., Musiime, F., & Onyutha, C. (2020). Assessment of the Effects of Procurement Planning Processes on Performance of Construction Contracts in Local Govement in Uganda. Journal of Civil, Construction and Environmental Engineering, 5(6), 151-160. doi:doi.org/10.11648/j.jccee.20200506.12

[34] Okereke, R., Zakariyau, M., & C. Eze, E. (2021). Extension of Time (EoT) Claims Substabtial and Associated Issues In Complex-Multi Stakeholders' Building Connstruction Contracts. Journal of Engineering and Technology for Industrial Applications, 7(3), 23-31. doi:10.5935/jetia.v7i32.782

[35] Pan, W., Chen, L., & Zhan, W. (2019). PESTEL Analysis of Construction Productivity Enhancement Strategies: A Case Study of Three Economies. Journal of Management in Engineering, 35(1). doi:10.1061/(ASCE)ME.1943-5479.0000662

[36] Rashid, Y. (2020). Analysis of delay factors and their effects on construction projects. Management Science Letters, 10(6), 1197-1204. doi:10.5267/j.msl.2019.11.039

[37] Rauzana, A., & Dharma, W. (2022). Causes of delays in construction projects in the Province of Aceh, Indonesia. PLoS ONE, 17(1), 1-12. doi:10.1371/journal.pone.0263337

[38] Rivera, L., Baguec, H., & Yeom, C. (2020). A Study on Causes of Delay in Road Construction Projects across 25 Developing Countries. infrastructures, 5(10), 1-16. doi:10.3390/infrastructures5100084

[39] Salih, P., & Messaoudi, K. (2021). The Effects Of Dealy In Algerian Construction Projects: An Empirical Study. Civil and Environmental Engineering Reports, 31(2), 0218-0254. doi:10.2478/ceer-2021-0027

[40] Salman, K., & Abdulghafour, A. (2021). Stakeholders' Insight on the Delay of Constructions Projects in the Makkah Region - KSA. The Open Construction & Building Technology Journal, 15(1), 164-175. doi:10.2174/1874836802115010164

[41] Shaikh, H., Zainun, Y., & Khahro, H. (2020). Claims in Construction Projects: A Comprehensive Literature Review. IOP Conference Series: Earth and Environmental Science, 498(1), 1-7. doi:10.1088/1755-1315/498/1/012095

[42] Shengea, N., Misra, R., & Mishra, S. (2020). Construction Delay Analysis of Some Indian Hydropower Projects. Water and Energy International, 62, 61-67. Retrieved from https://www.researchgate.net/profile/Noah-Shengea-2/publication/339031342_Construction_Delay_Analysis_of_Some_Indian_Hydropower_Projects/links/5e39aa34458515072d80097e/Construction-Delay-Analysis-of-Some-Indian-Hydropower-Projects.pdf

[43] Sivarajah, T. (2021). Construction Projects delays in Sri Lanka. Journal of Research Technology & Engineering, 2(4), 25-29. Retrieved from https://www.researchgate.net/publication/355170739_Construction_Projects_delays_in_Sri_Lanka

[44] Subedi, D., & Joshi, B. (2020). Identification of Causes of Delay in Road Projects: Cases in Gandaki Province, Nepal. Saudi Journal of Engineering and Technology , 5(5), 231-243. doi:10.36348/sjet.2020.v05i05.004

[45] Turkyilmaz, A., Guney, M., Karaca, F., Bagdatkyzy, Z., Sandybayeva, A., & Sirenova, G. (2019). A Comprehensive Construction and Demolition Waste Management Model using PESTEL and 3R for Construction Companies Operating in Central Asia. Sustainability, 11(6), 1-16. doi:10.3390/su11061593

[46] Vacanas, Y., & s Danezis, C. (2021). Determination of Effective Delay-Avoidance Practices in Construction Projects. Journal of Legal Affairs and Dispute Resolution in Engineering and Construction , 13(1), 1-9. doi:10.1061/(ASCE)LA.1943-4170.0000438

[47] Welde, M., & Bukkestein, I. (2022). Over Time Or On Time? A Study of Delays In Large Government Projects. Procedia Computer Science, 196, 772-781. doi:10.1016/j.procs.2021.12.075

[48] Yadeta, A., & Pandey, D. (2020). Analysis of the Global Impact of the Pandemic (COVID-19) on Construction Industry: Possible Scenarios. Current Trends in Civil & Structural Engineering, 6(4), 1-8. doi:10.33552/CTCSE.2020.06.000641

[49] Yap, J., Goay, P., Woon, Y., & Skitmore, M. (2021). Revisiting critical delay factors for construction: Analysing projects in Malaysia. Alexandria Engineering Journal, 60, 1717-1729. doi:10.1016/j.aej.2020.11.021

[50] Yaseen, Z., Ali, Z., Salih, S., & Al-Ansari, N. (2020). Prediction of Risk Delay in Construction Projects Using a Hybrid Artificial Intelligence Model. Sustainability, 12(4), 1-14. doi:10.3390/su12041514

[51] Zhang, D., Zhang, H., & Cheng, T. (2020). Causes of Delay in the Construction Projects of Subway Tunnel. Hindawi Advances in Civil Engineering, 2020, 1-14. doi:10.1155/2020/8883683

APPENDIX 1

S	Study	Authors/ Year	Data Source	Partic-ipants	Analysis Method	Region	Project Type	Delay Causes
1	An Analysis of the Main Causes of Delays in the Completion of Road Construction Projects: A Case Study of Tanzania	(Kuliaya, Alemu, & Yeom, 2022)	questionnaire	experts and professionals	Relative Importance Index	Tanzania	Road	Financial problems, unwillingness or inability to maintain long-term unpaid payments, unrealistic project plans (project schedule), poor site management, unrealistic cost estimates (low bids), and poor project planning.
2	A Study on Causes of Delay in Road Construction Projects across 25 Developing Countries	(Rivera, Bagüec, & Yeom, 2020)	Literature	-	Simple Calculation Method	Developing Countries	Road	The most causes of delay related to the contractor were; Lack of an experienced construction manager, Inadequate planning/scheduling, Poor communication between construction parties, Shortage of equipment, Shortage of construction materials, and Poor labor productivity.
3	Analysis of delay factors and their effects on construction projects.	(Rashid, 2020)	questionnaires	professionals	multiple regression	Pakistan	Construction projects	Risks of error and rework, lack of communication and coordination, complications in the financing, and improper implementation of construction methods.
4	Causes of delays in construction projects in the Province of Aceh, Indonesia	(Rauzana & Dharma, 2022)	questionnaire	project managers from contractor companies	descriptive statistics	Indonesia Province of Aceh	construction projects	Delayed material arrival and poor calculation of material requirements. Equipment breakdown, Lack of equipment, and Poor equipment productivity. A poor financial condition during implementation, high operational costs, and overhead by contractors. Shortage of labor, Lack of awareness of project workers on occupational safety and health, Labor absenteeism rate, and Lack of workforce motivation. A weak time control system, the arrangement of the sequence of activities is not good, poor occupational health and safety management, and error in using execution method. Political factors, and Project manager factors. Delay in obtaining licenses.
5	Construction Projects delays in Sri Lanka	(Sivarajah, 2021)	questionnaires	professionals	Important Relative Index (RII)	Sri Lanka	building construction	Poor project planning & scheduling, Low-profit margin, Inadequate cash flow management, handling too many projects at a given time, incompetence of key staff, Poor decision-making by management, and Insufficient quality control.
6	Covid-19 Causes Of Delays On Construction Projects In Kuwait	(Alenez, 2020)	questionnaire	construction professionals	Important Relative Index (RII)	Kuwait	Construction Projects	Delay in delivery (i.e. materials, equipment, and documents, etc), Delay from subcontractors (i.e. Poor performance and Poor management), Poor site management and supervision, Poor scheduling and planning of the project, Poor communication with other parties, Low productivity of workers, Lack of construction materials, Lack of skilled labor, and Lack of construction equipment.

7	Delay factors in the construction of healthcare infrastructure projects: a comparison amongst developing countries	(Mittal, Paul, Rostami, Riley, & Sawhney)	Interviews	project managers, architects, site engineers, service consultants, and	Content Analysis	India	Healthcare Infrastructure Projects	Delay in issuing and revising drawings, incorrect drawings, lack of data collection and survey drawings, slow progress by sub-contractors, missing services in drawings, and preparation of erroneous bill of quantities. Material procurement issues, shortage of skilled laborers, and labor facilities. Equipment breakdown, unavailability of specialized equipment, and accident during construction. A lack of communication and coordination among the stakeholders.
8	Delays in the Road Construction Projects from Risk Management Perspective	(Ghaleh, Pourrostam, Sharifloo,	Interviews	Construction Experts	analytical hierarchy process (AHP)	Iran	Road	The lack of Machinery and the financial capacity of the contractor. Contractors who have fewer financial capacities and do not provide sufficient machinery to the project increase the project time.
9	Determination of Effective Delay-Avoidance Practices in Construction Projects	(Vacanas & s Danezis, 2021)	questionnaire	leading professionals	Relative Importance Index	Cyprus	Construction Projects	Inadequate programming of works, Low productivity by the contractor, Problems between the contractors and their subcontractors, Problems between contractors and their suppliers, Bad communication between contractor and the other parties, Low productivity of labor, non-availability/breakdowns of machinery/plant, and Low productivity of plant/machinery.
10	Exploring the significant factors that influence delays in construction projects in Hargeisa	(Fashina, Omar, Sheikh, & Fakunle, 2021)	questionnaire	construction stakeholders	Relative Importance Index (RII)	Somaliland, Hargeisa	Road and Building projects	Underestimation or overestimation of the project cost, Difficulties in project financing, Delays in subcontractor's work, Errors during construction, Improper planning and preparation during the construction project, Poor site management and coordination, Conflicts between the contractor and other parties, Delays in the mobilization of workers, Regular change of sub-contractors technical staff, Conflicts in sub-contractor's schedule in the execution of the project, and Underestimation of the project durations

11	Extraction of Underlying Factors Causing Construction Projects Delay in Nigeria	(Egwim, et al., 2021)	Literature	-	systematic review	Nigeria	CONSTRUCTION PROJECTS	Late delivery of materials by supplier, Site accident, Late deliveries of equipment, ineffective or poor communication among stakeholders, Labor dispute or strikes, Equipment breakdown, Contractors' financial difficulties, and slow/poor decision-making by the contractor.
12	Factors influencing the timely completion of construction projects in Sri Lanka	(Abeysinghe & Jayathilaka, 2022)	questionnaire	Civil Engineers	Relative Importance Index (RII)	Sri Lanka	Construction Projects	Poor planning and scheduling, Shortage of skilled subcontractors/suppliers, Delay of delivering materials to the site, Inadequate numbers of equipment, Financial difficulties of contractors, Disagreements between the contractor and other parties, Poor site management, monitoring, and control, Errors during construction, Underestimating the project duration, Regular changes in the subcontractor's staff, and Delay in obtaining permissions/approvals from the government.
13	Revisiting critical delay factors for construction: Analyzing projects in Malaysia	(Yap, Goay, Woon, & Skitmore, 2021)	Literature	-	Meta-Analysis	Malaysia	Construction projects	Lack of proper planning and scheduling, Incompetent site management and supervision, Incompetent sub-contractors, Financial problems of contractors, Ineffective communication with others, Construction mistakes and defective works, Inadequately skilled labor, Low productivity, Material shortages, Improper or insufficient equipment selection.
14	Systematic processing framework for analyzing the factors of construction projects' delays in Egypt	(Elhusseiny, Nosair, & Ezeldin, 2021)	questionnaire	Key parties in Construction	Relative Importance Index RII	Egypt	Construction projects	Slow decision making, Difficulty of coordination between the different parties, Poor site management and supervision, Delays in subcontractor's work, Difficulties in financing projects by contractor, Ineffective planning and scheduling of the project, Unavailability / slow delivery of construction materials and equipment, Poor productivity level of labors, and delay related to shop- drawings and material samples.

15	Towards a sustainable construction industry: Delays and cost overrun causes in construction projects of Oman	(Al Amri & Marey-Pérez, 2020)	Questionnaires	Project Managers	Frequency distributions	Oman	construction projects	Poor contract management, lack of experienced workers, Late delivery of materials, Shortage of workers, Poor site management, Delayed payment of suppliers and sub-contractors, and Problem with sub-contractors.
16	Causes and Effects of Delay on African Construction Projects: A State of the Art Review	(Gashahun, 2020)	Literature	-	Content Analysis	Africa	construction projects	Infective project planning, scheduling, Poor site management, Rework, Inadequate contractor experience, Poor communication between the parties, Cash flow problems, Inappropriate construction method, Frequent change of subcontractors, Delay in site mobilization, Late delivery of material, Obsolete technology, Supplying poor-quality material. Poor health and safety. Unavailability of equipment, Low productivity of labor, Shortage of skilled labor, Shortage of recent technology equipment, Absenteeism and strikes, and Unqualified/inadequate experienced labor. Delay in material delivery, Poor quality of construction materials, Change in materials type and specifications during construction, Delay in manufacturing materials, Damage of delivered materials/Poor material management, and Unreliable suppliers

17	Causes of Delay in the Construction Projects of Subway Tunnel	(Zhang, Zhang, & Cheng, 2020)	questionnaire surveys	Consultants and Contractors	Severity Index	China	Subway Tunnel	Ineffective scheduling of the project by the contractor, Conflict between the contractor and other parties, Difficulties in financing the project by the contractor, Poor communication by the contractor with other construction parties, Rework because of errors during construction, Improper construction method, Poor site supervision by the contractor, and Poor resource management. Low productivity of laborers, Insufficient laborers, Low skill level of equipment operator, Personal conflicts among laborers, and Conflict between laborers and management team. Shortage of large advanced equipment, Lack of equipment efficiency, Changes in material types and specifications during construction, Serious damage to the equipment, and Material loss in the process of transportation.
18	Assessing the Significant Factors Contributing to Extension of Time in Road Construction Contracts in Ghana	(Dok & Odoom, 2020)	questionnaire	quantity surveyors, contract managers and [illegible]	Relative Importance Index, the mean score and One-Sample test	Ghana	Road	Unavailable or shortage of equipment, Labor shortages, Slow delivery of materials due to longer haulage distances, Lack of experience by contractors, Poor site management by contractor's staff, Lack of communication between parties, Labor disputes and strikes, and Accidents on site.
19	Construction Delay Analysis of Some Indian Hydropower Projects	(Shengea, Misra, & Mishra, 2020)	Interviews & questionnaire	senior professionals in the construction	Importance Index and Fuzzy Risk Assessment	India	Hydropower Projects	Equipment breakdowns, Deployment of old machinery at the Site, Difficulties in financing projects by contractor, Shortage of equipment, Shortage of labor, Delay in site mobilization, Unreasonable claims and demands of contractor during construction, and Ineffective scheduling by contractor.
20	Delay Factors in Construction of Healthcare Infrastructure Projects: A Comparison amongst Developing Countries	(Mittal, Paul, Rostami, Riley, & Sawhney)	Interviews	PMs & Engineers	content analysis	India	construction of hospitals	The slow progress of subcontractors, Material procurement, Shortage of skilled laborers, Equipment breakdown, Unavailable specialized equipment, Accident during construction, and Lack of coordination between different parties

21	Delay in Construction Projects due to Lack of Procurement in Sulaimani	(Abdullah & Shonm, 2020)	questionnaire	Professional Managers	Relative Important Index (RII)	Sulaimani/Iraq	Construction Projects	Lack of management, poor Contractor Experience, Materials late delivery, Subcontractors' problems, Suppliers' faults, and Equipment shortage & breakdown.
22	Delay Risk Assessment Models for Road Projects	(Antoniou, 2021)	literature	-	Relative Important Index (RII)	Greek	Road	Contractor's underestimation of project cost, Low markups/profit margins, Contractor's financial difficulties, Insolvency/liquidity, High overhead expenses, Inadequate contractor experience, Contractors' delay in mobilization, Ineffective construction schedule and/or cost planning, Contractor's work overload with many concurrent projects, Poor site management by the contractor, Inappropriate site logistics, Delay in the preparation of shop drawings, Inefficient construction methods, Rework due to defective materials, Rework due to poor workmanship, On site accidents, Poor communication by the contractor with other parties, Retention of technology advantage, Poor resource procurement procedures, Unavailability of necessary equipment or machinery, Inefficient equipment or machinery, Low productivity of workers, Unavailability of skilled equipment or machinery operators, Unavailability of sufficiently skilled workers, Poor qualifications of the contractor's engineers, Personal conflicts between laborers and management, Labor disputes and/or strikes, and Delay in sub-contractors' work.

23	Identifying and prioritizing delay factors in Iran's oil construction projects	(Kazemi, AKim, & Kazemi, 2020)	literature	-	fuzzy Delphi method (FDM) & best-worst method (BWM)	Iran	Oil Construction Projects	Problems with subcontractors, Financial problems, Inadequate experience, Ineffective project planning, and scheduling, Poor site management and supervision, Inappropriate construction methods, Rework to correct undesirable work, Poor communication and coordination with other parties, Poor qualification of the contractors' technical staff, Weak project management and Contractor Improper pricing by contractors to win the bid. Shortage of equipment, Frequent failure of equipment, Low efficiency of equipment, Lack of high-tech mechanical equipment, Slow mobilization of equipment, and Inappropriate selection of equipment and faulty equipment. Shortage of labor, Low productivity, and Low Motivation Personal, Delay in delivery of materials, Low-quality materials, Changes in the type and characteristics of materials, and Damage of stored materials.
24	Developing a user plug-in to assess delay causes' impact on construction project in Egypt	(Elhusseiney, Nosair, & Ezeldin, 2021)	Literature	-	BIM	Egypt	Construction Project	The poor productivity level of labor, Unavailability / slow delivery of construction materials and equipment, Slow decision making, and Difficulty of coordination between the different parties. Poor site management and supervision, Ineffective planning and scheduling of the project, Delay in subcontractor's work, Difficulties in financing project by the contractor, and Delay related to shop drawings and material samples

25	Enforcement of legal remedies against construction projects time overrun in Ethiopia: A critical appraisal	(Kebede & Zhang, 2020)	Literature/interview	Construction experts	Extract from literature	Ethiopia	Road & Building	Poor work management by the contractor, Contractors lack of experience, Delay in thoroughly undertaking investigations for potential sources of construction materials, Shortage of skilled manpower at the site, Unsatisfactory resource management and site organization, Significant reduction in construction equipment, Lack of close follow up of the daily output of the available critical equipment, Contractor's poor Site Management, and Contractors poor planning of the works. Very poor performance of subcontracted works and Problems of cash flow,
26	Evaluation of the reasons of delay for construction projects under terrorism risk	(Aljawad, Mahmood, & Razzooqee)	questionnaire	Chi Square & Relative Importance Index (RII)	Construction engineers	Iran	Construction Projects	The contractor's poor planning of the work, Poor financial management of the project contractor, Financial problems of payment with secondary contractors, Poor of the contractor's project's time estimation, and lack of commitment of the project progress schedule
27	Factors Causing the Time Delay in Projects: Empirical Evidence from Pakistani Construction Industry	(Maqsoom, Umer, Choudhry, Zahoor, & Basharat, 2020)	questionnaire	Simple calculations	construction experts	Pakistan	Construction Projects	Poor project management, Contractor lack of project type experience, Lack of cost planning or monitoring, Financial difficulties to the contractor, and Inaccurate estimation of time and cost
28	Identification of Causes of Delay in Road Projects: Cases in Gandaki Province, Nepal	(Subedi & Joshi, 2020)	Questionnaire & Reports	Relative Importance Index (RII)	Client, Consultant & Contractors	Nepal		poor communication and coordination between the participants, poor experience in estimating activity duration and resources required for construction, shortage of equipment, and improper project document management
29	Management of Delay Factors in Construction Projects in Sudan	(Mohamed & Adam, 2020)	questionnaire	Average Index	Client, Consultant & Contractor	Sudan	Construction Projects	Low productivity rate of labor and equipment, Unavailability of skilled laborers, and Personal relationship between owner and Contractor could negatively affect the management of the project.

30	Prediction of Risk Delay in Construction Projects Using a Hybrid Artificial Intelligence Model	(Yaseen, Ali, Salih, & Al-Ansari, 2020)	Literature, Interview, & questionnaire	Construction experts	genetic algorithm	Divala city, Iraq	Construction Projects	Ineffective project planning, Financial contractor difficulties, Inadequacy of contractor, Rework due to defects in executed work, Ineffective supervision and site management, and Many changes in subcontractor parties. Delay in supplying materials, Ineffective quality of materials, and Poor storage of materials. Poor efficiency of equipment and Unsuitable type of equipment. Poor labor productivity and Inadequacy of workforce skills.
31	Risk Factors Causing Time Delay in the Jordanian Construction Sector	(Abu Salem & Suleiman, 2020)	questionnaire	construction professionals	Risk Matrix	Jordan		Insufficient labor, Rework from poor material quality, Rework from poor workmanship, and Unavailable construction materials. Unreasonable project time frame, Poor resource management, Improper construction method, Poor communication between construction parties, and Late submission of nominated materials. The financial status of the contractor.
32	Risk Factors That Lead to Time and Cost Overruns of Building Projects in Saudi Arabia	(Alshihri, Al-Gahtani, & Almohsen, 2022)	questionnaire	clients, designers, consultants, and contractors.	Relative Importance Index (RII), and Risk Importance (RI)	Saudi Arabia	Building Projects	Contractor's financial difficulties (ineffective cash flow management), Ineffective planning and scheduling of project by contractor, Rework and wastage on site, due to errors or quality of work (poor quality of workmanship), Contractor's poor site management and supervision, Inadequate contractor experience (lack of experience, and managerial skills), Delays in sub-contractors' work or suppliers, Accidents on site, and Conflict between contractor and consultant. Shortage of manpower (skilled, semi-skilled, unskilled), Unqualified/inexperienced workers, Low productivity level of manpower, High turnover of personnel, Labor strikes, and Delayed salary payments to staff by the contractor

33	Stakeholders' Insight on the Delay of Construction Projects in the Makkah Region - KSA	(Salman & Abdulghafour, 2021)	questionnaire	Client, Consultant, & Contractor	Relative Importance Index (RII)	Saudi Arabia	Construction Projects	Delays related to works performed by subcontractors, Delay due to improper estimate of task duration, Lack of risk evaluation, Delay to inadequate site management and improper task duration, Lack of training and adopting new techniques, Inadequate crew size, Lack of skills of project manager, Difficulties in financing the project, Deficiency in planning and scheduling the project, and Low productivity of labor.
34	Study on the factors of delay in construction works	(Carvalho, Maués, Moreira, & Reis, 2021)	Questionnaires and interviews	construction industry professionals	Relative Importance Index (RII) & ABC Curve	Brasil	Construction Projects	Delay in materials delivery (inefficiency of the purchasing sector) and Rework due to errors during construction. Delays in labor works, Lack of workforce commitment, and Low level of labor productivity. Delivery of incomplete projects and Difficulties in obtaining funding for the project
35	The Causes and Effects of Delay of Building Construction in Ethiopia, Southern Nation Nationalities of People Region in Gurage Zone (Case of Wolkite Town)	(Dusso & Bayeh, 2020)	Questionnaire & focus group	clients, contractors and consultants	severity index frequency, Importance index, & importance index	Ethiopia	Building	time overrun of the project, slow decision making, improper planning, lack of fund to finance the project completion, Variation of work, Failure of plan of work application, Lack of cash during construction, delay in site mobilization, and late delivery of material and equipment.

APPENDIX 2

Management Factor

Delay Factor	Delay Cause	Percentage
Management Factor	Poor site management	71 %
	Poor project planning/Scheduling	71 %
	lack/poor communication with construction parties	63 %
	incompetence of key staff	51 %
	Poor performance of subcontractors	51%
	Error and Rework	37 %
	Unrealistic cost estimates	23 %
	Lack of skilled construction manager	20 %
	Lack of risk Management	6 %

Manpower management Factor

Delay Factor	Delay Cause	Percentage
Manpower management Factor	Shortage of labor	51 %
	Low labor productivity	51 %
	Lack of workforce motivation	14 %
	Labor absenteeism rate	14 %

Equipment Management Factor

Delay Factor	Delay Cause	Percentage
Equipment Management Factor	Shortage of equipment	63 %
	Equipment breakdown	31 %
	Poor equipment productivity	31 %

Financial Management Factor

Delay Factor	Delay Cause	Percentage
Financial Management Factor	Complications in the financing	71 %
	High operational costs and overhead	6 %
	Low-profit margin	6 %

Other Factors

Delay Factor	Delay Cause	Ranking
Other Factors	Lack of experience by contractors	26 %
	Accident on Site	23 %
	Delays in the site mobilization by contractor	20 %
	Delay in preparation of shop drawings, incorrect drawings	11 %
	Handling too many projects at a given time	6 %
	Delay in obtaining permissions/approvals from the	6 %

Summary of Delay Causes

Delay Cause	Rank
Poor site management	1
Poor project planning/Scheduling	1
Complications in the financing	1
lack/poor communication with construction parties	2
Shortage of equipment	2
incompetence of key staff	3
Poor performance of subcontractors	3
Shortage of labor	3
Low labor productivity	3
Error and Rework	4
Equipment breakdown	5
Poor equipment productivity	5
Lack of experience by contractors	6
Unrealistic cost estimates	7
Accident on Site	7
Lack of skilled construction manager	8
Delays in the site mobilization by contractor	8
Lack of workforce motivation	9
Labor absenteeism rate	9
Delay in preparation of shop drawings, incorrect drawings	10
Lack of risk Management	11
High operational costs and overhead	11
Low-profit margin	11
Handling too many projects at a given time	11
Delay in obtaining permissions/approvals from the	11