International Journal of Management and Commerce Innovations ISSN 2348-7585 (Online)
Vol. 10, Issue 2, pp: (316-325), Month: October 2022 - March 2023, Available at: www.researchpublish.com

Delay Analysis Techniques and Claim Assessment in Construction Projects

Amin Sherif[1], Ahmed Mohamed Abdelalim[2]

[1]Faculty of Engineering at Mataria, Helwan University, Cairo, Egypt.

[2]Associate Professor of Construction Management, Faculty of Engineering at Mataria, Helwan University.

DOI: https://doi.org/10.5281/zenodo.7509156

Published Date: 06-January-2023

Abstract: **The purpose of this research was to provide an understanding of what causes delays and claims in construction projects, along with the identification of multiple techniques that can be used for those issues causing delays. The true significance of this research lies in the bridging of gaps that were identified through a review of literature, along with the provision of essential findings based on a singular topic housing all of the associated variables so that every domain of related information could be explored and presented to the concerned people such as the construction management companies, project managers, and stakeholders of the construction project with better understanding on this topic. The methodology for this research revolved around the context of a quantitative approach, where a questionnaire was used for collecting data from more than 100 respondents in the dimension of multiple-choice questions so that a direct, and practical approach toward the understanding of said research topic could be developed. The results of this research revealed that most of the respondents viewed design, as well as consultant-related factors in the light of them being the highest impacting causes for delay and that the most probable technique which could be applied in the case of multiple delay causes was that of Time Impact Analysis or TIA. The construction stages through which these delay issues occur were also identified and listed individually for better understanding.**

Keywords: **Delay analysis, Delay analysis techniques, Construction projects, Claim assessment.**

I. INTRODUCTION

The world is progressing at a fast pace, which also shows the essence of the construction industry being developed through this change of time. According to Forbes & Ahmed (2010), new methods for managing, and ensuring the successful delivery of construction projects are also being both identified, as well as applied so that there can be an array of effective results that are gained in this context. Yet in this domain, authors Hwang & Ng (2013) also present the argument that advancements in the construction industry are now demanding more input and polished application of strategies from the end of project management groups as a pillar that provides support to a construction project.

In general terms of understanding, project management can be understood as the core, through which a construction project can be both effectively planned, managed, and delivered as well to the client. If the owners of a construction project are not effective project managers, the whole project will lack either timely delivery, or flawed structures and failed quality as per the client's demands, which will further result in the diminishing reputation of that construction company in the result (Mir & Pinnington, 2014). Yet there are some other issues that can arise if the domain of project management is not effective in the case of the construction industry, as claims which are made on the basis of project delays also make up a key area that should be managed and studied.

It has been found through surveys, and studies of documents from multiple sources that are available to the public, that the most common reason as to why construction projects face claims from the client is the domain of delays (Leach, 2014). For large-scale construction projects mainly, the timeline for delivery of the project is significantly different than for that which relates to small-scale projects. This is because, in large-scale construction projects, the deliverables are divided into different

segments which are presented to the client through mutually agreed multiple time stamps that lie within the total time for said project's submission (Mubarak, 2015). In constructive knowledge of the research topic and associated matter, it is critical to note that for large-scale construction projects, if even one deadline is missed, the whole chain of command and the final submission time for the project becomes impossible to meet.

When the context of delays in construction projects is discussed, it is essential to shedding light on the reasons because of why these delays mainly occur. According to a study conducted by authors Olawale & Sun (2010), the availability, and effectiveness of control techniques, as well as project management software of multiple kinds, is something that cannot be argued against, but even with these facilities at hand, many construction companies fail in delivering their project of various scales on times. This is not only applied to the context of large-scale projects, but also to those which are capable of being completed within a limited time and other associated resources.

It should also be mentioned here that since many construction projects face delays, the necessity of highlighting what caused them becomes equally essential for both existing, as well as future construction project orders (Ahsan & Gunawan, 2010). An alarming number of construction projects become delayed or compromised in terms of quality which is an issue that also stems mainly from a lack of adherence to the schedule and commitment made to the client that calls for quick management of the tasks and ineffective operations.

As signified by Memon, Rahman & Hasan (2014), the context of delays should not only be understood in the scenario of them being a reason because which the company's client gets disturbed but also one which can have a lasting impact on the overall level of effectiveness, performance, as well as the credibility of that construction company within the respective industry. Because if it is found that the company cannot effectively manage a construction project in terms of delivery, it gives the impression that it does not adhere to promises and professionalism, and that it has a flawed system with which it cannot be trusted to complete a project on time.

Therefore, the realization of identifying delay causes within a construction project, and then assigning them to relative delay analysis techniques is an essential cure to this issue through which multiple organizations associated with the construction industry can learn, and progress through more manageable timelines, and trusted relationships with their clients as well.

II. LITERATURE REVIEW

The context of construction management cannot be discussed without the implication of highlighting the core reason which makes it highly essential. This relates to the domain of delays and claims in construction projects, a key area that needs to be understood, and created awareness, so that those who are both indirectly, as well as directly associated with this industry can provide better service and manage their duties to the best of their capabilities. Halpin (2010) also credits this by stating that various construction specialties and areas should be both identified, and then communicated to those who are associated with them if there is to be a realization of combined efforts through knowledge of what needs to be done for delivering a construction project on time. In recent times, many studies have been focusing on similar concepts because there is a widespread understanding of this matter and the heightened need for increased knowledge in this regard since the demand for bigger construction projects than the ones being managed before has also risen.

2.1. Theory of Construction Management

The theory of construction management was found to be one which presented with the understanding of specifics involving a construction project, including the domains of construction products, and processes, as well as the relationships that are established to effectively manage a construction project in general (De Valence, 2012). The research also highlighted the fact that since the construction industry is greatly evolving because of increased demands from the public and private sectors, it is essential to consider the developing impact of this theory as well, because it helps in better, and more effective implementation of policies and procedures through which an organization can successfully deliver a project on time.

2.2. Theory of Project Management

The theory of project management was found to be the one that relates to effective management practices leading to better monitoring, implementing, controlling, and delivering of any kind of project. The implementation of this theory in the context of a construction project can be signified in the way through which it pronounces the type of leadership which is required for managing a construction project (Walker, 2015). The theory was also found to be relevant in the case of stressing upon the planning phase for a construction project because it has the capability of defining the project's goals, and then listing them according to the stages at which they will be managed, and under which domains.

2.3. Stakeholder Theory

The stakeholder theory was found to be one which helps in the effective management and aligning of a project's policies and outtakes that can be implemented considering accordance, and mutual understanding gained from all the stakeholders involved. For any level of a construction project, it is known that the understanding, and aligning of all stakeholders to ensure they're on the same page with management is essential because even though the initial presentation of all demands might seemingly highlight a differentiating aspect, there is unanimity in the delivery of that construction project, which makes all of the stakeholder-based demands similar in general perspectives (Parmar et al., 2010). Through the understanding of this theory, the management group of a construction project can effectively manage all the stakeholders involved, while also ensuring that their individual, as well as group demands, are met.

In the context of the research, it can be said that the theories will significantly impact the overall understanding of the topic in a way through which they influence all of the variables which are involved. Here the stakeholder theory helps the construction company's management in better facilitating the needs and demands of its multiple stakeholders, and how it can align them through mutual understanding and trusting relationships to ensure that the construction project satisfies every party involved. Because there are multiple stakeholders involved within a single construction project such as contractors, design teams, clients, consultants, suppliers, workers, and vendors, it is essential to keep in mind their relevance when structuring the timelines, schedules, and resources for the project because all their demands need to be met at the same intensity for effective project completion.

On the other hand, the theories of construction and project management help in this domain by presenting a series of theoretical implications through which the construction company's management can more effectively complete and deliver a construction project. This is made possible through the understanding of risks, resources, and operations involved which are provided by these two theories and those that aid in the associative allocation of funds for structuring a construction project in a way through which it can avoid any instances of delay.

2.4. Delay in Construction Projects

The aspect of delays in construction projects was found to be one of the most critical reasons because of why projects fail in general. It was found through a review of literature that although other causes of construction projects' failures have also been evidentially proposed, the aspect regarding delays can be labeled as a consistent one which is seen throughout all kinds of projects (Islam, Trigunarsyah, Hassanain & Assaf, 2015). Through the case of said research, some delay causes which were mainly evident in common cases of construction project delays were identified and focused upon which are presented as follows;

a. Contractor-related factor: The contractor-related factor causes delays within construction projects through the domain of issues raised in lieu of the hired contractors and sub-contractor parties. If the contractor for a project is lacking in experience or has difficulties communicating with the other stakeholders of a project, there will be multiple delays across all stages of the construction project which can not only halt delivery timelines but also affect the level of efficiency needed to be shown on part of the contractor (Khoshgoftar, Bakar & Osman, 2010). Other issues which can arise if there are contractor-related problems include the lack of effective procedural implementations, which are not possible to manage if the contractor is inexperienced or has a lacking career to present.

b. Owner-related factor: The owner of a construction project is one who should be able to effectively manage all resources which are involved in this context. If the owner lacks experience about the management of a construction project and has ineffective leadership skills, then the financial resources of a construction project will also become compromised along with the project's deliverables (Kazaz, Ulubeyli & Tuncbilekli, 2012). Therefore, this factor should be closely ensured so that any delays from this domain cannot be presented which pose threat to the construction project's progress in any way.

c. Design-related factor: The design documents are one of the most critical assets for any construction project in general. This shows that their approval, as well as effective structuring, is a necessity for the project's success. If the design team is inexperienced, or if there are delays in approval of the design documents, the construction project can suffer large timelines of delay, and can also become compromised with respect to the safety and well-being of both its workers and clients in the long term (Kikwasi, 2012). Some other issues relating to this factor causing delays in projects to relate to the domains of ineffective design documents, lacking designs for a project, and delayed project design approvals.

d. Consultant-related factor: A consultant is a person who is responsible for providing ideas, and advice on how the construction project is managed. But if that consultant and his/her team are inexperienced, or have a faulty reputation, the

level of trust between them and the stakeholders of a construction project can become compromised (Fugar & Agyakwah-Baah, 2010). Some issues which were identified with respect to the domain concerning consultants related to that ineffective strategic suggestion, lack of communication between the consultant and other stakeholders of the project, as well as lack of expertise regarding the implementation, and understanding of design documents for a project which can have a significant impact on nature of the construction project.

2.5. The Delay Analysis Techniques

Through the review of the literature in the thesis, it was found that across the globe, there are multiple techniques for analyzing delays that are found to be applied in different contexts. But there is still a lack of understanding when it comes to identifying which analysis technique needs to be applied in the case of which delay cause, which results in ineffective implementations and lacking results in the end (Braimah, 2013). Some of the delay analysis techniques which were found to be more common across global contexts in the defining of construction project delays are highlighted as follows which will be further worked upon through gathering of questionnaire data in terms of their implementations;

- Time impact analysis
- Collapsed As-built
- As-planned vs. As-built
- Impacted As-planned
- Windows analysis

2.6. Factors Affecting the Selection, and Determination of Delay Analysis Techniques

It was identified through a review of the literature that to better understand the context of delay analysis techniques and when they should be applied, it is essential to highlight the domains within which each technique should be applied. But before this, there is another step which relates to the identification of the most commonly recurring delay-causing issues, which as per the research, related to the aspects of lack of commitment, lack of effective communication, accidents occurring at the site, mismanagement of financial resources, as well as an evident lack of support from the owner and management's side (Doloi, Sawhney, Iyer & Rentala, 2012). Apart from this, the study found that other factors affecting the selection and determination of a delay analysis technique can also be understood in the contexts of the stage at which the delay cause occurred, its impact, as well as the factor it was associated with.

2.7. Construction Staging

The understanding of which delay analysis technique should be applied in which context stems from the need to first allocate the understanding for multiple stages of a construction stage. Without this understanding, allocation of the right delay analysis technique is impossible, which can also lead to the ineffective selection of a technique (Volkov, Chelyshkov & Lysenko, 2016). In similar contexts, the various stages of a construction project as identified within the research are presented as follows to facilitate this awareness;

- *Mobilisation stage:* This is the first stage through which planning and main hiring of people needed for a project occur.
- *During construction stage:* This is the second stage through which the construction project is mainly conceptualized and carried out, involving different activities and jobs carried forward by the workers and involved personnel of the construction project.
- *Closeout stage:* This is the last stage of a construction project through which the closing of a project occurs. It is where the project is mainly wrapped for delivery to the client after its completion.

2.8. Construction Claims

The domain of construction claims refers to the context in which the construction project's timelines and deliverables which were due are requested by the client to be completed and then submitted. Multiple claims on a construction project can showcase the fact that its client is not getting the deliverables as promised by the management of the project, while also showcasing a lack of efficiency on their part (Nasirzadeh, Carmichael, Jarban & Rostamnezhad, 2019). It was found through a review of literature that the most prominent types of claims stem from delays caused in construction projects deliverables, which shows the fact that this aspect needs to be managed with heightened care and caution so as to not tarnish the reputation of the construction company in the eyes of its client and stakeholders.

2.9. Project Schedule, Critical Path, and Project Float

The first domain of project schedule refers to the concept of defining a timeline through which the project's deliverables will be managed and sent to the client for review. This domain is usually referred to through a Gantt chart which proposes multiple activities and submission aspects according to a time-defining manner so that it is easier for the client, as well as the construction company to keep a record of what areas have been covered and which need to be further managed (Stok, 2020). For the aspect concerning critical path, it was found that it plays the role of a representation scheduling technique, but that it requires a vast number of resources to reach completion and to prove of any essence to the construction company in general (O'brien & Plotnick, 2016). Lastly, the domain of project float was highlighted, which can be seen in the light of defining a delay barrier till where the project does not get affected to a great extent. This is an essential domain because it signifies whether a certain delay cause will be impacting the scale of work done in a construction project along with the domain of how it can be managed effectively (Al Haj & El-Sayegh, 2015). This understanding of the three domains is essential to ensure because it helps in the effective management, and delivery of a construction project on time.

2.10. Gaps Identified Through Review of Literature

Some key gaps were identified through the review of literature related to the domain of lacking singularity with relevance to the presentation of all variables together. Although there was an abundance of literary sources available on the variables of this study individually, they were scarcely available in combination with one another, which presented a critical gap in the study of this research topic. Apart from this gap, it was found that the studies in his regard did not greatly focus on companies or countries from which cases of construction project failures through delay could be highlighted. This would have been a helpful find, as the case studies in this regard would have summated through the context of a real-life example of how delays occur in construction projects and what techniques can be utilized for better analyzing them as well.

III. METHODOLOGY

The methodology for this research was based on the core areas which are highlighted as follows.

3.1. Research Design:

The design for this research is shaped in the quantitative aspect, where the focus was on the gathering of data, and on associating it with literary sources-based information. A quantitative aspect was selected for this research because there was a need to present effective, and associated data that was related to the target population. The goal of this research was to generate primary data in accordance with the aspect of people who are directly involved in the construction industry, such as project management professionals, and people who have degrees and educational backgrounds in similar industrial aspects.

3.2. Data Collection Method and Tools:

The main method through which the data for this research was collected lies in the domain of it being a questionnaire, where most of the questions were related to allocating the aspect which causes delays caused at different stages of a construction project. The main method through which the data for this research was collected lies in the domain of it being a questionnaire, where most of the questions were related to allocating the aspect which causes delays caused at different stages of a construction project. Around 152 participants were involved in the research, because of which the data gathered could be concentrated enough to manage it through a statistical analysis approach. The questions which were presented within the format for gathering data from respondents were inspired by the individual variables that were identified within the theoretical framework of this research. These variables were highlighted in the context of them being either Dependent or Independent so that relationships between them could also be explored throughout the gathering of data and its associative analysis. The two main parts of the questionnaire included the domains of causes for the delay during construction projects, as well as the aspect of suitable delay analysis techniques. Furthermore, these domains were divided into the areas of the owner, contractor, consultant, and design-related factors that cause delays in relative construction projects.

3.3. Sample Selection:

The purposeful sampling approach was selected for this research because it deals with the management, and portrayal of information through a selection of a small sample size that is easier to manage as well. Here it is also essential to highlight that for the context of demographic-based data, the most commonly occurring factor which was present in almost all of the respondents were a direct, or indirect relation to the construction industry. This was reflected in the way through which some respondents related to the professions of either building contractors, project engineers, or project managers with an associative background in the industry of concern.

3.4. Data Analysis:

The main method of analyzing the data collected through the aspect of the questionnaire involved a statistical approach. This related to the application of an SPSS-based targeted approach which presented a descriptive summary of each question, further highlighting the selection percentages of each question's options. The options were presented in a multiple-choice aspect so that the respondents could select the answers which best suited their opinions and expertise. To ensure that the analysis software was updated, its 20th version was utilized for the purpose of analyzing this research's data gained through the questionnaire. This was further managed in three steps highlighted as follows;

- The first step related to the examination of demographic-based information of the respondents.
- The second step related to the application of Cronbach's alpha for evaluating the reliability aspect of each variable.
- The third step related to the performing of descriptive analysis to generate further descriptive statistics for every individual question so that they could be analyzed accordingly.

IV. RESULTS AND DISCUSSION

4.1. Literature Review-Based Findings

The findings gained through a review of the literature were based mainly on the individual understanding of all the variables involved, where the key focus was directed towards the domains of achieving better awareness on the matter of what causes a delay in construction projects, at what stages they occur, and how they can be effectively analyzed, as well as managed for ensuring successful delivery of the construction project. These findings also presented with theoretical implications on the research topic through the support of the stakeholder theory, as well as the theories of project, and construction management to summate the literary findings on this cause.

4.2. Questionnaire-Based Findings

The questionnaire-based findings gained through the direct mode of data collection are summarized as follows;

Table 01. The summarized version of findings from the questionnaire-based data.

S. No.	Factor	Associated Issues	Occurrence of Issue at the Respective stage of a Construction Project
1	Owner	1. Conflicts between joint ownership.	1. Construction Stage-Additional work.
		2. Delay in approving design documents.	2. Construction Stage-Additional work.
		3. Delay in progress payments.	3. Construction Stage-Complex issues.
		4. Lack of owner experience in construction projects.	4. Construction Stage-Additional work.
		5. Suspension, delay, or postponement of the project by the owner.	5. Construction Stage-Complex issues.
		6. Selecting inappropriate contractors.	6. Mobilization stage.
		7. Poor communication between owner and the other parties.	7. Construction Stage-Additional work.
		8. Delay in delivering site to the contractor.	8. Mobilization stage.
		9. Late in revising, and approving design documents by the owner.	9. Mobilization stage.
2	Contractor	1. Ineffective project planning and scheduling.	1. Mobilization stage.
		2. Poor site management and supervision.	2. Construction Stage-Complex issues.
		3. Errors committed due to lack of experience.	3. Construction Stage-Complex issues.
		4. Inadequate contractor experience.	4. Construction Stage-Complex issues.
		5. Inappropriate construction methods.	5. Construction Stage-Complex issues.
		6. Frequent change of sub-contractors because of their insufficient work.	6. Construction Stage-Complex issues.
		7. Poor communication and coordination by a contractor with other parties.	7. Construction Stage-Complex issues.
		8. Conflicts between contractor and other parties (Consultant and owner).	8. Construction Stage-Complex issues.

		9. Wrong allocation of equipment on site.	9. Construction Stage-Additional work.
		10. Incompetent contractor staff.	10. Construction Stage-Complex issues.
3	Consultant	1. Lack of consultant experience in construction projects.	1. Construction Stage-Complex issues.
		2. Conflicts between consultant and design engineer.	2. Construction Stage-Additional work.
		3. Delay in approving major changes in the scope of work by consultant.	3. Construction Stage-Additional work.
		4. Lack of experience of consultant in construction projects.	4. Construction Stage-Complex issues.
		5. Mistakes and discrepancies in design documents.	5. Construction Stage-Additional work.
		6. Lack of job security for the consultant team.	6. Mobilization stage.
		7. Bad past history and reputation of the consultant.	7. Construction Stage-Complex issues.
		8. Poor communication by a consultant with other construction parties.	8. Construction Stage-Complex issues.
		9. Conflicts between consultant and design engineer.	9. Construction Stage-Additional work.
		10. Delay in approving major changes in the scope of work by consultant.	10. Construction Stage-Additional work.
4	Design	1. The complexity of project design.	1. Mobilization stage.
		2. Design changes by the owner or his agent during construction.	2. Construction Stage-Additional work.
		3. Design errors and omissions made by the designer.	3. Construction Stage-Additional work.
		4. Insufficient data collection and survey before finalizing of the design.	4. Mobilization stage.
		5. Lack of design team's experience in construction projects.	5. Construction Stage-Complex issues.
		6. Mistakes and delays in producing design documents.	6. Construction Stage-Additional work and Complex issues equally.
		7. Poor use of advanced engineering design software.	7. Construction Stage-Complex issues.
		8. Misunderstanding of the owner's requirements by design engineer.	8. Mobilization stage.
		9. Unrealistic design duration imposed.	9. Construction Stage-Additional work.
		10. Poor design documentation and no detailed written procedures.	10. Mobilization stage.

Table 02. Ranking of the delay-causing factors for construction projects.

Rank	Delay Factor
High impact needing primary attention.	Design-related factor.
High impact needing primary attention.	Consultant-related factor.
Moderate impact needing secondary attention.	Owner-related factor.
Moderate impact needing secondary attention.	Contractor-related factor.

4.3. Research Question-Based Discussion

4 3.1. Research Question 01:

The first research question was answered with respect to the dimension relating to causes of delays and claim submissions in construction projects, and the stages at which they occur. Through the review of literature, it was found that there are three critical stages of a construction project which include the Mobilization, Construction, and Closeout stages. Whereas the causes for delay in construction projects can be seen to occur in the four key dimensions of the contractor, owner, consultant, and design-related factors. Interpretation of data in this context also revealed that the most severe delay causes related to the design, and consultant-related factors. This is because these have the most plausible role in the definition of a project's success. Taking the example here of flawed design documents, it can be said that even if the project is completed on time, there can be health and safety hazards not only for the construction workers but also for the client over longer periods of time which can cause severe impacts.

4.3.2. Research Question 02:

For this research question, it was found that the most plausible difference between the delay analysis techniques that have been presented in the research relates to the domains of application and their implementations at different stages of a construction project. Through the interpretation of questionnaire-based data, it was revealed that Time impact analysis or TIA was the most plausible technique which could be applied in the case of most delay causes and issues, as it was more closely aligned in the context of a forward-looking, and apprehensive perspective on the matter.

4.3.3. Research Question 03:

The answer to this research question was related to the context of realizing and understanding how different delay causes occur at different stages of a construction project while having different levels of severity and impact as well. To answer this aspect, a key recommendation was made further in the study that addressed the need for establishing a framework that represents the core idea of all causes contributing towards project delays so that a high level of awareness amongst all those concerned can be ensured.

4.4. Theoretical Implications

The main idea behind the inclusion of the three theories, namely stakeholder, project management, as well as construction management theories was to highlight through theoretical understanding the role of a construction company's management and its stakeholders in ensuring that the construction project is delivered on time and with efficient attention to the detailed demands of the client. Since it was found that most construction projects are managed on a large scale, it is essential to address these theoretical findings so that further studies can also be inspired in the right direction where they can facilitate the people of this industry to better manage all associated activities and delay causes in general.

V. CONCLUSION

The base of this research paper lies in presenting the key findings from the thesis conducted on the topic of Delay analysis techniques and claim assessments in the case of construction projects. Although there was no reference to a specific country or construction company, the research was directed through the selective interpretation of questionnaire-based data which was collected from people who were directly linked to the construction industry. These respondents included the contractors, consultants, and project managers, as well as those who were pursuing their degree in construction management so that a more concentrated data set could be achieved.

Through the study, it was found that there are three prominent stages during which delay causes within a construction project occurring, including the mobilization stage, the construction stage, as well as the closeout stage. It was also found through the study that there are multiple delay analysis techniques, but for every delay cause occurring at a different stage within a construction project, the probability of each analysis technique's application changes dramatically. From both review of the literature and the interpretation of questionnaire-based data, it was identified that the Time impact analysis or TIA-based delay analysis technique was the most plausible one in the application case for most of the delay issues occurring at various levels. The reason why this delay analysis technique was mainly selected relates to the aspect of it being forward-looking, as it is responsible for determining the true impact of a delay caused on the respective construction project.

The core causes were also identified through the study which included the contractor, consultant, owner, and design team-related factors which give way to delays within construction projects. Here they were also labeled in terms of severity with regards to delay, where the causes related to the factors of design and consultant domain because delays through these contexts can cause great harm to a construction project as opposed to the other two factors.

Strategic recommendations were also suggested in the ending parts of the research so as to facilitate those who are associated with the construction, and project management industry by better equipping them with the knowledge of delay causes and claim assessments and how they can be analyzed for the successful delivery of a construction project in general. These included the areas of ensuring realistic work schedules and timelines, improving workforce resources through training programs, hiring contractors having better work experience, improving site conditions to ensure safety, approving the design associated documents in the early stages of the project, as well as the assessment of funds for a construction project in its early stages.

VI. RECOMMENDATIONS

6.1. Ensuring Realistic Work Schedules as Well as Timelines for Delivery

This domain of ensuring realistic work schedules and the timeline for delivery is a key recommendation because it can greatly facilitate the avoidance of any kind of delay within a construction project (Offia Ibem, Anosike, Azuh & Mosaku, 2011). The main motivation behind this change and realistic approach should be to facilitate the construction workers and to make space in the case of any uncalled-for situations because of which the construction project can get disturbed or halted.

6.2. Improving Workforce's Resources Through Training Programs

This recommendation is a key role player when it comes to the domain of preventing any causes for delay within the construction project. It is understandable that a trained, and skilled workforce is something that is required by any type of project management group, because ensuring this aspect guarantees that the efficiency-related dimension is covered (Li, Lu, Hsu, Gray & Huang, 2015). Therefore, construction project management groups should realize the importance of training programs and the general impact they have on increasing the efficiency of the overall project.

6.3. Hiring Contractors Having Better Work Experience

To ensure that the delays causes with regards to contractor-related factors are avoided, there should be an essence of realizing the importance of hiring a contractor with effective work experience (Agrawal, Horton, Lacetera & Lyons, 2015). If the contractor has a lacking experience or one that is marred by failed jobs, then the project's management should refrain from hiring him/her as this would compromise the project's success in more ways than one, with delays being the heightened cause through which the project becomes ineffective.

6.4. Improving Site Conditions to Ensure Safety

The state of site conditions is a key domain that should be addressed by every construction project's management group (Kines et al., 2010). When it comes to the discussion of this recommendation, it can be said that the practice of ensuring construction workers' and employees' health and safety/well-being is a critical one that can lead to the successful delivery of a construction project.

6.5. Approving Design Associated Documents Early

The approval of design-associated documents should be managed in the early stage of the construction project, because this is one of the critical aspects because of which a construction project is either successful or unsuccessful (Doloi, 2013). Here the domain regarding the design documents should also be associated with the construction project's stakeholders, because they make key decisions in this context, and because there is a heightened need for them to associate themselves with the activities that are managed in the construction project.

6.6. Assessing Funds for the Project in the Early Stages

The management of funds is a necessary domain that should be managed effectively, especially in the early stages of a construction project so that any issues regarding this perspective are not able to cause delays of any kind. According to Smith, Merna & Jobling (2014), the management of funds for a project in its early stages is highly crucial, because it leads to the successful management of risks which are involved, such as those which cause delays within a construction project.

REFERENCES

[1] Agrawal, A., Horton, J., Lacetera, N., & Lyons, E. (2015). Digitization and the contract labor market: A research agenda. *Economic analysis of the digital economy*, 219-250.

[2] Ahsan, K., & Gunawan, I. (2010). Analysis of cost and schedule performance of international development projects. *International journal of project management*, *28*(1), 68-78.

[3] Al Haj, R. A., & El-Sayegh, S. M. (2015). Time–cost optimization model considering float-consumption impact. *Journal of Construction Engineering and Management*, *141*(5), 04015001.

[4] Braimah, N. (2013). Construction delay analysis techniques—A review of application issues and improvement needs. *Buildings*, *3*(3), 506-531.

[5] De Valence, G. (2012). A theory of construction management. *Australasian Journal of Construction Economics and Building, The*, *12*(3), 95-100.

[6] Doloi, H. (2013). Cost overruns and failure in project management: Understanding the roles of key stakeholders in construction projects. *Journal of construction engineering and management*, *139*(3), 267-279.

[7] Doloi, H., Sawhney, A., Iyer, K. C., & Rentala, S. (2012). Analysing factors affecting delays in Indian construction projects. *International journal of project management*, *30*(4), 479-489.

[8] Forbes, L. H., & Ahmed, S. M. (2010). *Modern construction: lean project delivery and integrated practices*. CRC press.

[9] Fugar, F. D., & Agyakwah-Baah, A. B. (2010). Delays in building construction projects in Ghana. *Australasian Journal of Construction Economics and Building, The*, *10*(1/2), 128-141.

[10] Halpin, D. W. (2010). *Construction management*. John Wiley & Sons.

[11] Hwang, B. G., & Ng, W. J. (2013). Project management knowledge and skills for green construction: Overcoming challenges. *International journal of project management*, *31*(2), 272-284.

[12] Islam, M. S., Trigunarsyah, B., Hassanain, M., & Assaf, S. (2015). Causes of delay in construction projects in Bangladesh. In *The 6th International Conference on Construction Engineering and Project Management, Busan, Korea* (pp. 82-86).

[13] Kazaz, A., Ulubeyli, S., & Tuncbilekli, N. A. (2012). Causes of delays in construction projects in Turkey. *Journal of civil Engineering and Management*, *18*(3), 426-435.

[14] Khoshgoftar, M., Bakar, A. H. A., & Osman, O. (2010). Causes of delays in Iranian construction projects. *International Journal of Construction Management*, *10*(2), 53-69.

[15] Kikwasi, G. (2012). Causes and effects of delays and disruptions in construction projects in Tanzania. In *Australasian Journal of Construction Economics and Building-Conference Series* (Vol. 1, No. 2, pp. 52-59).

[16] Kines, P., Andersen, L. P., Spangenberg, S., Mikkelsen, K. L., Dyreborg, J., & Zohar, D. (2010). Improving construction site safety through leader-based verbal safety communication. *Journal of safety research*, *41*(5), 399-406.

[17] Leach, L. P. (2014). *Critical chain project management*. Artech House.

[18] Li, H., Lu, M., Hsu, S. C., Gray, M., & Huang, T. (2015). Proactive behavior-based safety management for construction safety improvement. *Safety science*, *75*, 107-117.

[19] Memon, A. H., Rahman, I. A., & Hasan, M. F. A. (2014). Significant causes and effects of variation orders in construction projects. *Research Journal of Applied Sciences, Engineering and Technology*, *7*(21), 4494-4502.

[20] Mir, F. A., & Pinnington, A. H. (2014). Exploring the value of project management: linking project management performance and project success. *International journal of project management*, *32*(2), 202-217.

[21] Mubarak, S. A. (2015). *Construction project scheduling and control*. John Wiley & Sons.

[22] Nasirzadeh, F., Carmichael, D. G., Jarban, M. J., & Rostamnezhad, M. (2019). Hybrid fuzzy-system dynamics approach for quantification of the impacts of construction claims. *Engineering, construction and architectural management*.

[23] O'brien, J. J., & Plotnick, F. L. (2016). CPM in construction management. McGraw-Hill Education. , 8th ed.; McGraw-Hill Education: New York, NY, USA, 2016; pp. 635–700.

[24] Offia Ibem, E., Anosike, M. N., Azuh, D. E., & Mosaku, T. O. (2011). Work stress among professionals in the building construction industry in Nigeria. *Australasian Journal of Construction Economics and Building, The*, *11*(3), 45-57.

[25] Olawale, Y. A., & Sun, M. (2010). Cost and time control of construction projects: inhibiting factors and mitigating measures in practice. *Construction management and economics*, *28*(5), 509-526.

[26] Parmar, B.L., Freeman, R.E., Harrison, J.S., Wicks, A.C., Purnell, L. and De Colle, S., 2010. Stakeholder theory: The state of the art. *Academy of Management Annals*, *4*(1), pp.403-445.

[27] Smith, N. J., Merna, T., & Jobling, P. (2014). *Managing risk in construction projects*. John Wiley & Sons.

[28] Stok, A. J. (2020). *Decreasing the delay of Project X* (Bachelor's thesis, University of Twente).

[29] Volkov, A., Chelyshkov, P., & Lysenko, D. (2016). Information management in the application of bim in construction. stages of construction. *Procedia engineering*, *153*, 833-837.

[30] Walker, A., 2015. *Project management in construction*. John Wiley & Sons.