



Identification of key Risks in Fast-Track Construction projects: A Literature Review

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Abstract

Fast-track construction projects have become more common in recent years as a response to increased demand. The sector was known for its high-risk and high-complexity features. Regardless of the degree of difficulty in construction projects, the construction industry has responded to requirements for faster project delivery deadlines to meet standards, emergency/disaster preservation, and time-to-market constraints. The purpose of this study was to clarify risk management's role in fast-track construction projects, evaluate how fast-track construction projects impact the construction time of such projects, and investigate risks that might occur from different levels of overlap. To achieve this, the paper undergone a comprehensive literature review on several 43 papers that have been published in Scopus. The researcher reviewed the literature for several studies, such as papers and books in this field from 2000 to 2021. The results were: identifying accelerated techniques and their classification; clarifying risks; risk management processes and their classification; and clarifying risks in fast-track construction projects because of an unfair risk distribution between the contractual parties because of specific or

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incorrect contract terms. This has led to a careful assessment of the scope of the work and how the project will be executed.

Keywords: Fast-track, Crashing, Risks, Risk Management, Construction projects.

1. Introduction

The Construction sector had a character for being high-risk and high complexity. The construction industry had responded to requirements for shorter project delivery timeframes to achieve requirements, and time-to-market limitations, regardless of the actual degree of challenge in construction projects. Techniques such as activity crashing, activity overlapping, and activity substitution can be used to shorten a regular project schedule. The activity overlapping method is used in the schedules of fast-track projects.

Fast-track projects may be tied to unique threats or risk characteristics because of overlapping activities, which might influence project schedule and cost and risk the fast-track strategy. This is true besides the risks associated with the construction industry. As a result, to create a more efficient risk management strategy for fast-track projects that minimizes project duration and cost overruns, the link between activity overlaps and risk must be evaluated.

Contractual issues arise in fast-track projects because of an unequal risk distribution between the contracting parties because of particular or unsuitable contract conditions. The purpose is to create effective contract agreements and strategies for fast and effectively tracking contracts. As a result, the contract's scope must be determined from the commencement of the project by bidding to carefully analyze the extent of the work and how the project will be implemented.

The objective of this paper is to clarify Risk management's action in fast-track construction projects, to achieve this objective, the researcher went through a literature review for several research in this direction during the period (2000-2021), The literature reviews' objectives are to identify accelerated techniques and their classification, clarify risks, risk management processes and their classification, and clarify the risks in fast-track construction projects.

2. Structure

As per Scopus, the research during the period (from 2000 to 2021) was reached using the search phrases "Fast-track projects", "construction projects", and "Risk Management". The statistics were clear that the number of research projects as shown in figure 1 and the countries where research is carried out as shown in figure 2.

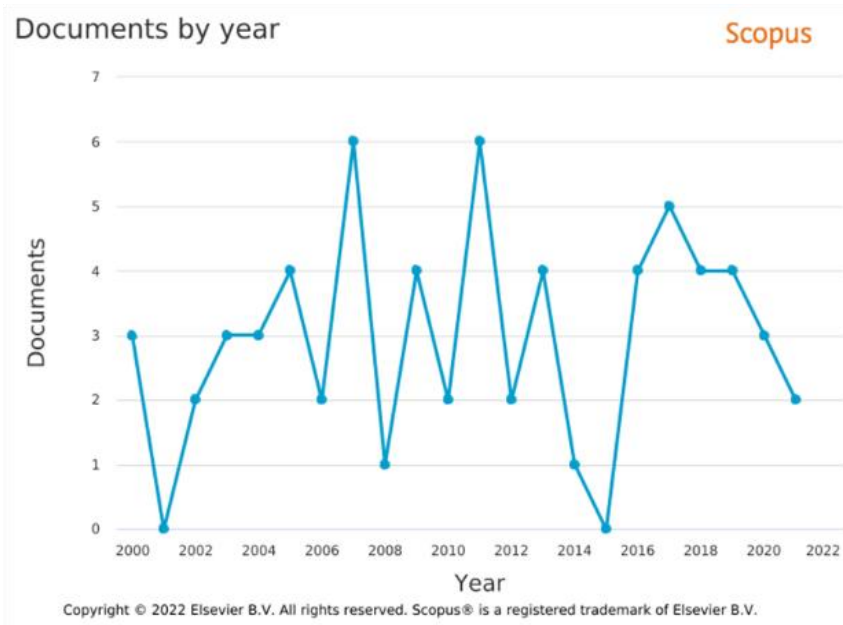


Figure 1: the number of research projects during 2000: 2021

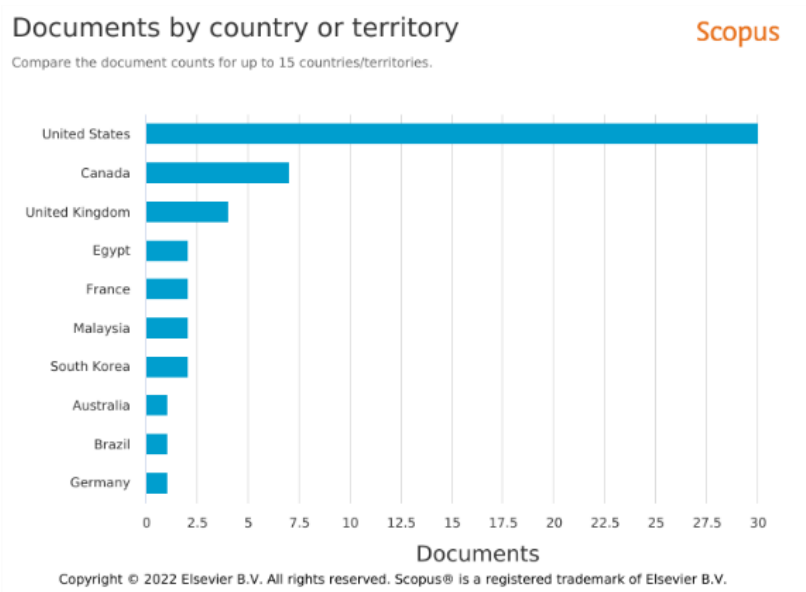


Figure 2: the countries where research is carried out during 2000: 2021

Research in the last 10 years, during the duration between 2011:2021, has discovered that the number of research projects during these years has increased, which means that risk management in accelerated construction projects has received attention for study, as shown in Figure 3.

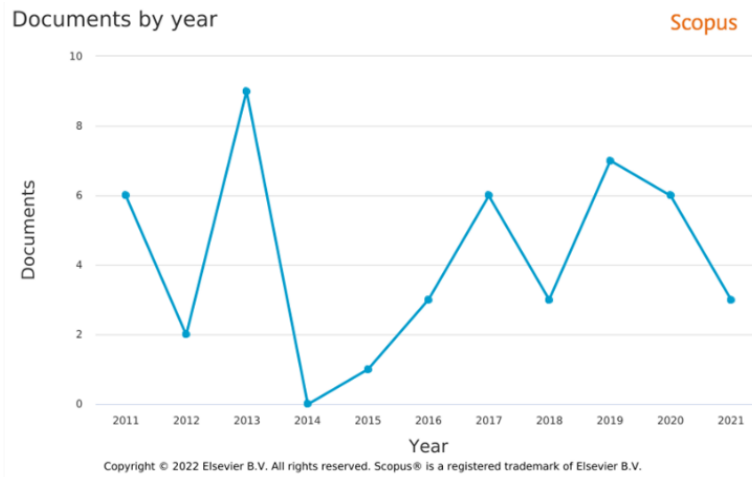


Figure 3: the number of research projects during 2011: 2021

Research has also discovered that in countries where research is carried out as shown in figure 4, such as the United States, Canada, and the United Kingdom, the number of research projects carried out in these countries has increased, which means the other countries need to pay attention to study.

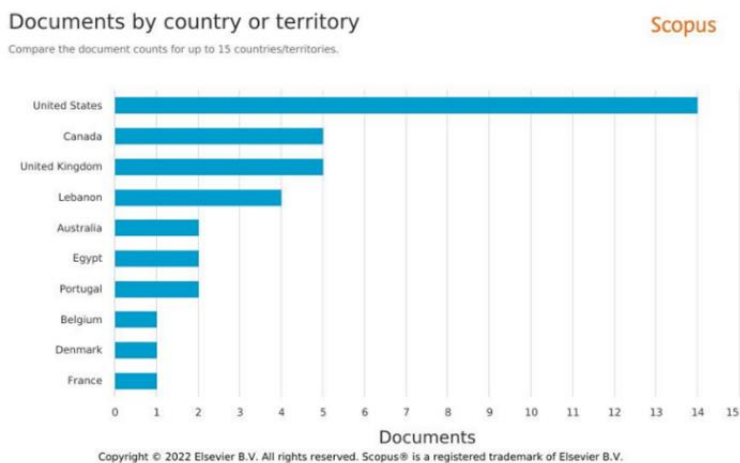


Figure 4: the countries where research is carried out during 2011: 2021

Findings were based on the analysis of the secondary data that has been explained throughout the paper during the period from 2000 to 2021, in this paper, literature studies discussed the keywords of this study that can be categorized as follows:

1. Accelerated Techniques (19 research)
2. Risk Management (10 research)
3. Risks in fast-track construction project (14 research)

According to the previous literature reviews, it is divided into 3 themes as shown in figure (5), which are related to fast-track projects and risk management, as shown in figure (1), The themes are studied by different methods as shown in figure (2) to achieve the aims and objectives of the studies.

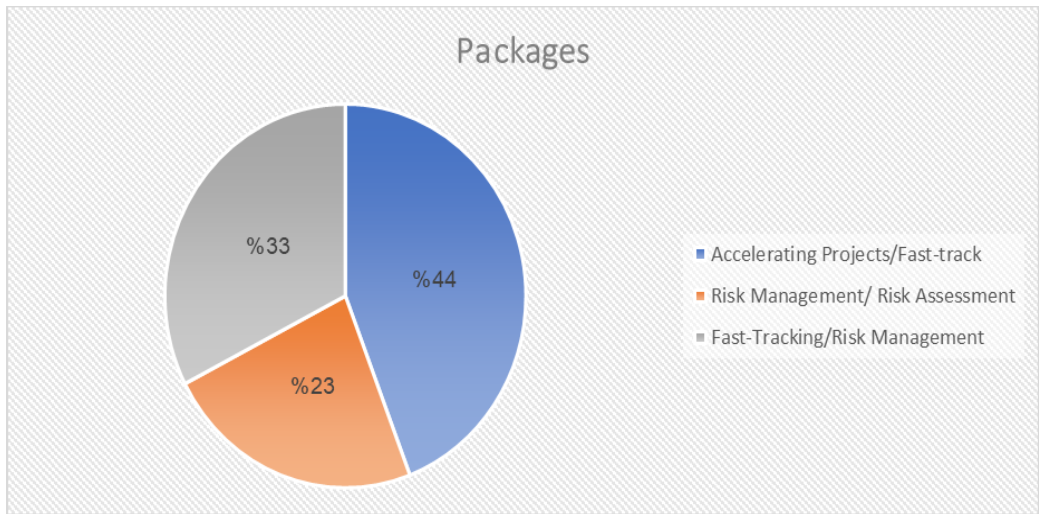


Figure 5: Division of themes

Many authors have been looking for fast-track projects, and much research has been done in various methods, as shown in figure 6.

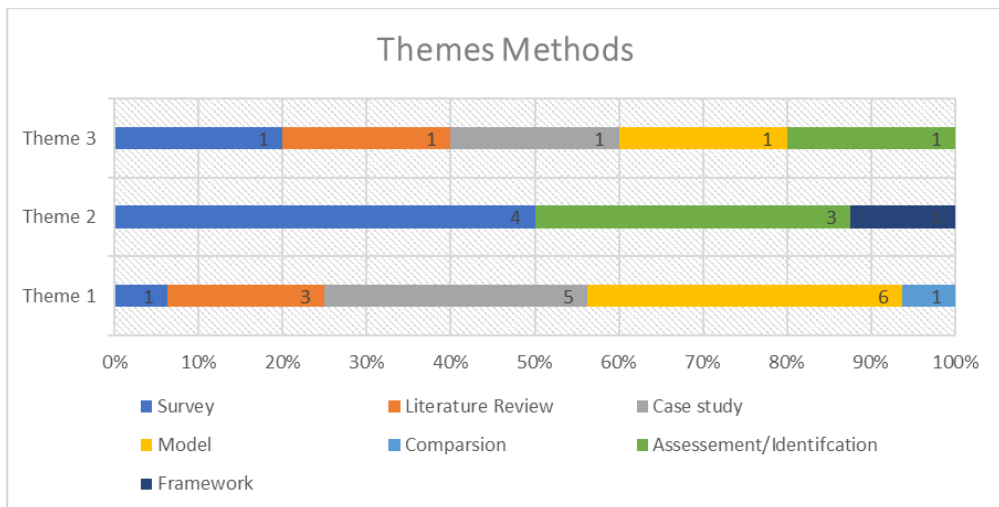


Figure 6: Division of themes as per method of research

Accordingly, previous literature was analyzed, to find the key risks that were carried out during the accelerating techniques.

3. Time and Cost Performance in Construction Projects

The construction sector is known for bad poor business practices in terms of budget overruns and schedule delays, both of which have serious consequences for projects [1] [2]. Expense overrun is defined as "extra cost beyond the project's estimated financing cost," while time delay is defined as "additional time beyond the construction project's completion deadline" [3]. Construction time delays and cost overruns in construction projects are not usual. As a result, the attention of construction practitioners, consultants, and academics has been drawn to these issues, which may be unavoidable in most building projects across the world [4].

On one hand, these projects are sometimes regarded as extremely difficult to execute on time. On the other side, the construction managers are very particular about according to the contract's deadlines. Also, Construction project managers were provided with a hard challenge: they had to meet safety standards while executing within very short timelines. Because there are any scheduled risks, the management process becomes more difficult. Traditional techniques and technologies for handling difficult problems, such as the Critical Path Method (CPM), Precedence Diagramming Method (PDM), Linear Scheduling Method (LSM), and Program Evaluation and Review Technique (PERT), are unproductive [5].

3.1. Accelerated Control Techniques

When a project problem happens, it must be accelerated; otherwise, the project will be delivered later than expected. the question that occurs is about how to accelerate up a project? there are three techniques to accelerate up a project:

3.1.1. Crashing

The first method of project acceleration to be investigated is crashing. Crashing occurs when more resources are allocated to an activity than were originally planned. Additional resources represent more cost when an activity crash. Rework is expected when activities overlap, which increases the cost. The implementation of the substitute activity in activity substitution requires unexpected purchasing cost [6].

3.1.2. Fast track

“A schedule compression technique in which activities or phases normally done in sequence are performed in parallel for at least a portion of their duration “as (PMBOK® Guide) - Sixth Edition defines fast-tracking [7], Fast tracking is one of the three commonly used schedule compression techniques. A fast-tracking schedule includes partial overlap of important activities, which is to carry out sequential multiple tasks, disregarding their initial arrangement, to shorten the project's overall duration. However, unlike crashing and substitution, which results in a direct cost increase for the project.

Fast-Track is a planning approach for reducing the overall duration of projects by overlapping activities that would otherwise be completed under a traditional contract. By overlapping the design and construction processes, the most time may be saved [8]. Because of the project's complexity, most project managers focus on traditional tool to plan, schedule,

and control project progress. Projects that require constant time, cost, and performance management can be executed on schedule, with good quality, and under budget. Matt Loveless discovered in 2017 that implementing the fast-track approach is more than just rushing; it is a totally different systematic approach than the usual method for achieving project objectives [9].

3.1.3. Substitution

Substitution occurs when one activity or a sequence of activities in a series is replaced by another activity, such as when a different technology is used than in the original design [6]. The introduction of a superstructure including activity crashing and substitution has been used to represent the substitution of activities in a project [10]. They estimated a minimum cost for project acceleration using the related mixed-integer linear programming model. The use of a different technology to achieve the same objective is referred to as activity substitution. One example is the use of a digital numerical control machine to substitute a manual mode of fabrication [6].

4. Risk Management in construction projects

It is difficult to avoid risk in this world of rising globalization, which has become an inescapable part of everyday life. Every area of our lives is highly risk. One of these areas is the construction industry, which is loaded with risk. Effective risk management does not mean the avoidance of risk, which seemed to be the most cost-effective choice. This alternative is worthless from an economic point since what is potentially profitable is risky, and activities that do not pose a risk are not economically beneficial, and so do not provide tangible advantages [11].

4.1. Risk management

Risk is described as an occurrence that affects objectives, has the potential to have a good or negative influence, and takes place in macro, meso, and micro contexts. A risk is an unexpected phenomenon that, if it occurs, might have a negative impact on the project's progress and goals. A positive risk is one that has a positive impact on your project, whereas a negative risk has a negative impact. As a result, it is important to recognize between positive and negative risks, with negative risks often requiring major decrease and management. One of the key goals of addressing risks that are considered as negative risks is to reduce their negative effect and ensure that the project's objectives are met without delay or expense escalation. Risk may be expected, and actions can be prepared ahead of time, but certain risks are unknown, which means project and risk managers must remain vigilant since they are able to reduce the risk or its impacts [12].

4.2. Classification of Risk

The most popular risk classification is based on the probability of occurrence and the magnitude of the impact. The division is as follows in general terms: (probability, the scope of the impact, and Risks is identified between the risk types) [13].

4.3. Risk management cycle

Strategic and careful risk management improves the chances that a project will succeed by maximizing the impact of positive events and minimizing the consequences of bad ones. A well-executed scheme also gives investors important information on what steps to take and which scheme to utilize to get the best results with the least amount of "negative" risk. Four main steps make up an example risk management cycle: (Risk Identification, Risk Analysis, Risk Responding, and Risk Monitoring and Control) [13].

5. Fast Track Construction Project and Risks

Fast-track projects have a higher risk profile than typical projects, which requires a close inspection of their level of risk. The key to successfully managing this complexity is to have a better understanding of project risks as linked variables rather than isolated events [14], as well as to build a systematic risk management strategy tailored to fast-track projects [15].

Project acceleration with incomplete design information, on the other hand, adds another dimension to the project, increasing project risks such as multiple change orders, design mistakes, and rework [16] [17] [18].

the most effective methods for minimizing and managing various forms of risk. The following are the risk management's goals [19]:

- To identify risks in construction projects so that they may be managed while the project is still on track to meet its goals.
- To identify the most common risk management strategies used in the construction industry, Technological and Economic Development of Economy.
- To effectively manage risks, assess risk rating and client and contractor obligations connected to risk.
- To find out how successful risk management approaches are in helping managers manage risks more effectively.

5.1. Reasons for Fast-Track Project Delay

According to BABA, it was clarified that Project delays are caused by a variety of factors, including the following [12]:

- Requirements for large scale and high quality.
- International consultants and contractors are involved.
- Traditional Procurement Methodology Adoption.
- Many small contractors are present.
- Construction firms' extreme commitment.

- International Staffing.
- A shortage of skilled labor and qualified specialists.
- Language may be a huge key barrier.
- Inaccurate time estimates for activities.
- Communication with the client.
- Local Customs and Regulations.

5.2. Risk and Uncertainty in Fast Track projects:

Even though there is a relevant difference between risk and uncertainty, many project members incorrectly believe that risk management is the same. They will be able to identify and determine the exact difference between risk and uncertainty in a project environment, where a variety of difficulties might possibly aid in developing project progress.

A risk, Unknown risks often occur during the project's execution stage and are not possible of being accepted during the identification process. A project risk team would commonly know to develop a contingency plan for known risks, and a contingency reserve can be prepared and used in this regard. However, unknown risks would have to be mitigated through alternatives, and teams would have to depend on management reserves to properly mitigate these risks. Unknown and unexpected risks are typically difficult to manage, resulting in delays and a loss of efficiency for any project, including a fast-track project [20].

An uncertainty, in opposition to risks, uncertainty refers to the lack of assurance in executing out or implementing a plan and its outcomes. In many scenarios, the consequences are completely unknown, and project teams must estimate which technique is the best. Because there may be a lack of knowledge to some extent, the outcomes can be risky. Uncertainty, on the other hand, cannot be considered like unknown risks. The background information is available in the case of unknown risk, but the risk cannot be predicted during the identification process. However, in the situation of Uncertainty, the team is completely without knowledge, although the event has been identified [21].

5.2.1. the Difference between Risk and Uncertainty:

The following are some of the differences according to BABA [12]:

- While the outcome of a risk may be expected, the outcome of an unclear situation cannot be predicted due to a lack of knowledge.
- Risk can be managed by suitable mitigation measures, but uncertainty is difficult to manage since its scope and impact are unknown.
- The risk team can analyze and quantify risk, but uncertainty cannot be fully assessed or quantified.

- Risk events can be assigned a probability once they are known, but uncertain events cannot be assigned a probability since the project teams have no information about them.

5.2.2. Managing Risk and Uncertainty

When compared to uncertainty management, risk management is simpler. This is because risk can be identified and its impact determined, allowing the project team to plan for it. Contingency plans can be made to mitigate the harmful effects. Managing uncertainty, on the other hand, is challenging since nothing is known about it and no contingency plans can be implemented. The only thing the management can do is keep the team aware. Uncertainties are difficult to mitigate since there might be too many factors, and it's impossible to know which one will affect the results with confidence. As a result, results are impossible to forecast with assurance, and teams are afraid. However, even when formal methods of preventing uncertainty are not possible, the project team must be extremely careful, proactive, and open-minded to manage risk and uncertainty [12] [22].

5.3. Risks in Fast Track Project

The decision to expedite a project is critical, and contractors should be aware of the risks. A review of fast-track construction projects showed that, despite the apparent advantages, not all projects supported the successful use of the fast-track technique. Although there is generally risk associated with construction projects, overlapping project activities might result in the development of brand-new risks or changes to the probability and effect of already-identified issues. As a result, the relationship between activity overlap and risk must be identified in order providing tools for better management of fast project schedules and short duration delays [23]. Positive changes may be made to risky projects if the risks are identified early, thoroughly studied, and mitigation strategies are implemented, monitored, and updated to achieve the goals with little cost and quality variance [24].

There is Factors influencing fast-track project such as, High levels of uncertainty in design and scope create various risks in fast-track projects, and scheduling accelerates the influence of these factors, causing the project objectives to be deformed [15]. Projects become extremely unstable and complicated because of overlapping activities, resulting in non-value-adding implementations [25]. According to Garrido Martins, 80 % of the risks were caused by four categories of risk, and the impact on project cost was greater than the impact on project time, however risk mitigation at no cost could greatly reduce project overall risk [26].

5.4. Risk Management Control in Fast track Construction project

To assess and analyze risks as linked systems, scientific and methodical methods and methodologies are required. A series of interviews with experienced construction experts revealed that among the variables that affect how sensitive construction activities are to upstream design modifications are the level of transformation, lead time, modifiability, and the connection of constructed components. Whether it's disaster risk reduction, supply chain management, construction projects, or banking and finance, risk identification and assessment are critical steps in the risk management process [27] [28].

According to Project Management Institute, there are two types of risk: single risk and total project risk. Construction risk management methods, on the other hand, still only handle the first level of risk, with no information on how to address the total risk [7]. According to recent research, linear risk assessment is a huge issue in complicated project risk management [28]. Risks are typically labelled as linear cause-effect connections [29]. They are collected on a risk registry, analyzed, and dealt with separately. This method, however, fails to reflect the actual risk situation in complex systems. Chain reactions lead unusual or unexpected systems to fail in complicated projects. One failure might have a generator impact on other highly linked systems [30].

Previous literature findings address the fact that managing the relationship between design and construction is critical to project success. The risks involved of fast-tracking projects include:

- The failure of financial benefits due to the cost of changes and claims.
- The failure of expected time savings due to schedule delays.
- The failure of project cost control due to the early elimination of commonly used design options, incomplete tender specifications, and overlapped construction work.

5.4.1. The differences between Internal and External Risks in Construction Projects

Risks might occur from outside the team, project scope, or business, as well as from within. These risks must be identified and classified for the project to proceed without delay.

It is important to note that, while internal risk is easier to reduce and manage, risk managers must focus on both types of risks to ensure that the project is completed on time and under budget. Because delays in fast-track projects can be dangerous, accurately estimating the risks is critical to successful risk reduction.

A risk breakdown structure must be in place after the necessary risks have been identified for successful management of both types of risks in a fast-track project. Risks may be assigned to specific areas of the project using this risk breakdown structure, and only then can the linkages between the sources of risks and project elements be correctly analyzed and accounted for in the project plan [31].

5.4.2. Some of the risks related with fast-track projects according to BABA, the following are [12]:

- Stockholders' Risk
- Design Risk
- Risk (contractor side)
- Suppliers Risk
- Economic factors
- Environment and natural factors
- Social and other factors

5.5. Potential Negative Risks in fast-track Projects

A fast-track project has few times for design optimization, resulting in overdesign in some project components, the risk of rework when the system is overmatched or unable to operate as designed, and the risk of material waste when attempting to maximize the use of labor, which is more expensive than material. Some material wasting was reduced to increase the use of labor, which is more expensive than material. Bogus S., noted the dangers of rework and the resulting increased costs and resources, as well as a rise in change orders, a lack of design optimization, and rework [32] [33].

Trouble points have been discovered because of Previous literature study and additional recent studies on problem fast-track construction projects. Fast-tracking a project usually resulted in unexpected additional costs and does not always result in a shorter project duration. rework is the most risk [23].

5.6. Contractual Risk in Fast-Track project

Fast-track projects now face shortages contractual and clauses in published contract forms that fairly distribute risks among contracting parties. Inequitable risk allocation between contractual parties because of limited contract terms and unsuitable contract types is the most common source of legal risks. Few studies have looked at the contractual issues that come with using a fast-tracking technique. the contractual problems that lead to conflicts, claims, and legal concerns in fast-track projects [33]. Fast-tracking a project may have a negative impact on the project's goals since it introduces new risks. Some of these risks will result in serious legal consequences. fast-track projects are delayed by a lack of a contractual structure tailored to their needs. As a result of this issue, each contractual party transfers project risks inequitably to the other parties by using exculpatory terms in the contract wording. Inequitable risk transfer may result in legal fighting. However, by aligning the contract type with fast-tracking qualities, legal concerns can be avoided [23].

The most important contractual risks in a fast-track project are, according to Moazzami, Dehghan, & Ruwanpura [33]:

- cost overruns and inaccurate cost estimating.
- design errors and omissions.
- delay damages.
- numerous change orders.
- construction rework and modifications.
- overlooked work (assigned to no party).

Fast-track projects raise special legal issues due to a lack of a contractual framework and an incorrect distribution of risk among contracting parties. The most frequent reasons for risks in fast-tracking are incomplete scope of work and design package at the bidding stage. The problems in quick-turnaround projects are as follows [33]:

- Responsibility for inaccurate cost estimating and cost overrun risks.

- Responsibility for design errors and omissions.
- Delay damages,
- Numerous change orders,
- Construction rework and modifications,
- Risk Responsibility of overlooked work (assigned to no party),

6. Discussion

Theme (1): Accelerating Projects/Fast-track

From the study of the first theme, which analyses accelerated projects, the conclusions were summarized as follows:

The construction sector faces a problem with material excesses and schedule delays, which leads to many consequences such as unsuccessful profiting or breaking the economic situation. On the other hand, investors want their investments to succeed as quickly as possible. They prefer to set short but inflexible schedules, which the project faces many unexpected difficulties. The reasons for the time lag, such as poor management, contracts, funding, and lack of resources, are due to the above reasons for cost overruns as well. Despite these problems, all projects need to reduce the duration of the project while meeting all requirements by crashing, overlapping and substitution.

Project managers have difficulty implementing a fixed-term project in the final contract, while meeting safety standards during implementation within short periods of time, so they must choose the time allocated for each stage of the project with a cost assessment over various time periods and choose a schedule that meets all project demands in the shortest possible time with an expected profitable return so that investors can repay bank loans.

On the other hand, acceleration leads to an additional cost, so managers should know the activities and the type of acceleration method suitable for each activity so that the project manager can reduce the additional costs. There are three approaches to accelerate the project as follows:

- Crashing occurs when the number of resources increases, increases direct costs, and reduces indirect costs.
- Fast track occurs when activities are placed in sequence in parallel with the activities for a minimum period and may cause a direct cost to the project with the possibility of rework due to overlapping activities. Project managers use this approach many by identifying the critical path when planning to focus on activities that must be achieved in parallel to reduce the duration of time with the lowest possible cost.
- Substitution occurs when replacing one activity or a series of activities in another activity chain, such as the use of new technology to be replaced by manual manufacturing with cost control.

Theme (2): Risk Management in Fast-Track Project

From the study of the second theme, which analyses risk management in fast-track construction project, the conclusions were summarized as follows:

Project delays, it was stated, are caused by a range of causes, including: large-scale and high-quality requirements, International consultants and contractors are involved, Traditional Procurement Methodology selection, Many small contractors are present, Construction firms' extreme commitment, International Staffing, a shortage of skilled labor and qualified specialists, Language may be a huge barrier, Inaccurate time estimates for activities, Communication with the client, and Local Customs and Regulations are all factors to consider.

Risk management is less complicated than uncertainty management. Because risk can be identified and its impact determined, the project team can plan accordingly. Contingency plans can be put in place to help limit the negative consequences. Managing uncertainty, on the other hand, is difficult since no one knows what will happen and no contingency measures can be put in place. Uncertainties are difficult to reduce since there may be too many variables to consider, and it's difficult to foresee which ones will have the most impact on the outcome. To manage risk and uncertainty, the project team must be extremely selective, proactive, and open-minded, even when formal methods of preventing uncertainty are not available.

For successful management of internal and external types of risks in a fast-track project, a risk breakdown structure must be in place after the relevant risks have been identified. Using this risk breakdown structure, risks may be allocated to specific project areas, and only then can the relationships between risk sources and project components be properly analyzed and accounted for in the project plan.

Fast-track projects face contractual problems also, due to the unfair distribution of risks between the contracting parties, due to specific or inappropriate contract terms. There are some of the difficulties with fast-track projects as follows: responsibility for incorrect cost estimates and the danger of cost overruns risk liability for incomplete work, design errors and omissions, delay damages, numerous change orders, construction rework and changes, and risk responsibility for unfinished work (assigned to no one). The goal is to develop effective contract documents and techniques for tracking contracts quickly and accurately. So, the scope of the contract from the beginning of the project must be determined by bidding to carefully consider the scope of the work and how the project will be implemented. Designers and contractors typically add extra contingency and insurance to their bid prices because of unequal risk assignment, which increases the final project budget. Contract papers that outline the design-build delivery strategy are used to accomplish the bulk of fast-track projects. On the other side, design-build contract documents aren't really appropriate for accelerating.

In the context of the above, there remain gaps that the literature review cannot fill to find the following solutions:

- There are critical problems still when the activities are overlapping and there is no focus on risk assessment analysis.
- In developing countries, risk management approaches are used with expensive and limited techniques, so they must be systematic and up to date.

- Most accelerated projects are carried out using a design-build approach, which is defined by the contractual documents, the design-build contractual documents, on the other hand, are not exactly good for acceleration.
- The literature has also missed important points and gaps, such as accelerated projects in Egypt from 2019 to 2022 under COVID-19 conditions.

7. Conclusion

According to literature review evaluations, it is divided into three themes, which are relevant to fast-track projects and risk management, 19 papers were discovered and evaluated using the search phrases “accelerated projects”, “fast-track project”, 10 papers were reached and evaluated using the search phrases “risk management “, “risk assessment”, and 14 papers were discovered and evaluated using the search phrases “Risk in fast-tracking”.

The previous research has been conducted on previous projects to minimize the risks to them during all stages of construction from the initial stages to the completion of implementation. The literature reviews briefly as follows:

- Discussion between time and cost performance in construction projects,
- The techniques that can deal with the delays in time and overrun costs, such as crashing, fast-tracking, and substitution.
- Discussion of risk management and the procedures to mitigate the risks that happen in fast-track construction projects.
- It has been made clear that managing risk in a project extends further than just documenting all the positives and negatives or classifying each exciting and upsetting event as a "negative risk".
- Management is a difficult, complex, and continuous process that starts well before the investment and can continue even after it is finished.
- Managing risk doesn't mean avoiding it; rather, it means correctly identifying it and understanding the opportunities and threats it presents.

Although the previous research has investigated some aspects of fast-tracking, or overlapping, and it is commonly recognized that a fast-track method might face greater risks, there remains a gap in risk assessment in a fast-track project. Identifying and studying risks in Egyptian construction projects, especially under the COVID-19 conditions, on the other hand, has received insufficient attention in previous studies, although some of these risks have a negative impact on the life cycle of the project, so it is necessary to identify the risks and their impact, whether negative or positive, to be dealt with at no additional cost on the project budget or a further delay in the schedule.

The limitation of this study is that it was theoretical through literature reviews and will be practical in the future by implementing some suggestions for the future, such as making a survey and studying a case study for a project during the recent five years, considering the COVID-19 conditions.

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