Al-Azhar Engineering 16th International Conference

Vol. 19, No. 72, July 2024, 538 - 557

PREDICTING POTENTIAL RISKS ASSOCIATED WITH FAST-TRACK PROJECTS

Amr M. Afify*, Khaled M. Khorshid, Adel A. Radwan

Architectural Engineering Department, Faculty of Engineering, Al-Azhar University –Cairo- Egypt.

*Correspondence: amrafify@azhar.edu.eg

Citation:

A.M. Afify , K.M. Khorshid and A.A. Radwan, "Predicting Potential risks associated with fast-track projects ", Journal of Al-Azhar University Engineering Sector, vol. 1, pp. 538 - 557, 2024.

Received: 30 January 2024

Revised: 15 February 2024

Accepted: 02 March 2024

DOI: 10.21608/auej.2024.269209.1625

ABSTRACT

Risk management in traditional projects involves identifying potential risks that may arise during the project lifecycle, analyzing them, and responding to them to ensure the project stays on track and is capable of achieving its objectives. However, in the case of desiring to accelerate project implementation without understanding the prominent risks associated with this acceleration, it can lead to unforeseen consequences that may impact the desired project goals.

To make an informed decision about adopting an acceleration approach, it was necessary to predict the risks associated with following this path. Therefore, this study addressed the potential risks that hinder the path of project acceleration by reviewing relevant studies on accelerated projects and the resulting effects of project acceleration. This includes risks that hinder achieving the desired acceleration as well as cost and quality variations that impede project objectives.

Based on the examined case study and other previously analyzed fast-track projects, areas of concern requiring special attention were described within five main categories of potential risks. Recommendations were provided regarding the establishment of a clear scientific mechanism to achieve acceleration by leveraging those risks.

It was also found that unless significant attention is given to problem areas before embarking on the project path, such an accelerated technique can result in unexpected project delays.

KEYWORDS: Fast-track, Risk, Construction projects, Quality, Cost, Scope.

التنبؤ بالمخاطر المحتملة المرتبطة بالتسارع في تنفيذ المشروعات

عمرو محمد عفيفي علي*، خالد مصطفى السيد خورشيد، عادل عبدالحميد رضوان

قسم هندسة العمارة، كلية الهندسة، جامعة الازهر، القاهرة ، مصر

***البريد الإليكتروني للباحث الرئيسي:** amrafify@azhar.edu.eg

الملخص

تتضمن إدارة المخاطر في المشاريع التقليدية تحديد أي مخاطر محتملة قد تنشأ خلال دورة حياة المشروع وتحليلها والاستجابة لها للتأكد من بقاء المشروع على المسار الصحيح وقادر على تحقيق أهدافه. ومع ذلك، في حالة الرغبة في التسارع في تنفيذ المشروع دون التعرف على أبرز المخاطر التي تواجه هذا التسارع، فإن ذلك سيؤدي إلى عواقب غير مدروسة قد يكون لها أثر على الأهداف المرجوة من المشروع. ومن أجل اتخاذ قرار واضح بشأن اعتماد نهج التسارع من عدمه، كان من الضروري

التنبؤ بالمخاطر المرتبطة باتباع هذا المسار. لذلك تناولت هذه الدراسة المخاطر المحتملة التي تعيق مسار تسريع المشاريع من خلال مراجعة الدراسات ذات الصلة بالمشاريع المعجلة والآثار الناتجة عن تسريع المشاريع، بما في ذلك المخاطر التي تعيق تحقيق التسارع المطلوب، وكذلك تباينات التكلفة والجودة التي تعيق تحقيق أهداف المشروع. واستنادا إلى دراسة الحالة التي تم فحصها في هذه الورقة وغيرها من مشاريع المسار السريع التي تم تحليلها سابقا، تم وصف مجالات المشاكل التي تتطلب اهتماما خاصا في خمس مجموعات رئيسية من المخاطر المحتملة، وتم تقديم توصيات بشأن وضع آلية علمية واضحة لتحقيق التسارع من خلال الاستفادة من تلك المخاطر. وقد وجد أيضًا أنه ما لم يتم إيلاء اهتمام كبير لمجالات المشكلات قبل البدء في مسار المشروع، فإن مثل هذه التقنية المتسارعة يمكن أن تؤدي إلى تأخيرات غير متوقعة في المشروع.

الكلمات المفتاحية: التسارع في التنفيذ، المخاطر، مشروعات التشييد، الجودة، التكلفة، النطاق.

1. INTRODUCTION

Construction and infrastructure projects are considered the cornerstone of the economy in various countries around the world. They are the fundamental building blocks for development, and the economies of advanced nations are closely linked to the expansion of rapid development projects. The importance of these projects has increased significantly with the notable advancements in construction and building technology in recent years. The construction industry plays a major role in the economy, and both public and private companies compete in developing their methodologies and construction techniques.

As construction projects today rely on first-mover strategies in the market to gain competitive advantages, there has been an increased demand for delivering projects in a manner that significantly reduces the time required for completion. Consequently, there is a need to explore strategies that can drastically reduce the project schedule, starting from the planning phase all the way to the commencement of operations. This concept is embodied in the concept of fast-track project execution.

Many studies have addressed the risks that can hinder the success of fast-track projects. For example, changes requested by clients, consultants, and contractors, skills shortages and lack of equipment availability, accountability for design errors and omissions, insufficient information, rework and modifications, and other factors can all pose obstacles to project acceleration. In addition, there are risks associated with schedule compression through the concurrent execution of different activities.

The research problem revolves around the challenges that hinder the success of fast-track projects, primarily stemming from the initiation of these projects with incomplete information derived from design activities. Furthermore, the overlapping of project activities to reduce the schedule introduces an elevated risk potential for the project. This situation poses difficulties for professionals in determining the most suitable acceleration strategy to fulfill the project's schedule acceleration requirements while minimizing the need for rework.

The objective of the research is to anticipate the potential risks that are associated with project acceleration, ensuring that the project remains within the appropriate framework considering the key constraints of time, cost, and desired quality associated with the acceleration.

2. Research Methodology

The research methodology relied on using three methods to collect data. First, a literature review was conducted to examine the current situation and identify key factors affecting fast track project management, as well as to identify knowledge gaps. Second, a review and analysis of a specific fast-track project was conducted to explore the challenges to delivery and management of fast-track projects. Third, a questionnaire was developed to identify and articulate project

challenges, with the aim of understanding the actual risks faced by fast track projects, while also allowing direct involvement of those involved in the design, management and implementation of the projects.

These three methods were used to ensure data collection, analysis, and verification, and to ensure convergence of results. In conclusion, the results were discussed, and conclusions and recommendations were presented.

3. Literature Review

Fast tracking reduces the project schedule through overlapping design and construction activities that are carried out in a sequential manner [١]. When attempting to shorten the project schedule without complete design information, it introduces additional complications to the project. These complications manifest in the form of increased design errors, rework, and limited time to implement and rectify these changes and mistakes [٢]. Vidal et al. [٣] Complexity in a project can be defined as the characteristic that makes it challenging to comprehend, predict, and maintain control over its overall behavior, even with reasonably comprehensive information about the project system. This definition implies that complexity is a multidimensional concept, encompassing uncertainties at different levels and across various categories. There are several dimensions associated with project complexity, including structural, socio-political, environmental, technical, financial, and schedule aspects [4].

3.1 Relevant theoretical studies

The following table **Table .1**. presents a collection of relevant theoretical studies that have addressed the research topic from various aspects related to risks and key obstacles encountered in fast-track projects.

Table ١. Collection of relevant theoretical studies.

Title & Author	Description
1. Analysis of Techniques Leading to Radical Reduction in Project Cycle Time (Makarand Hastak; Sanjiv Gokhale; Kartik Goyani; Taehoon Hong, A.M.ASCE; and Bhavin Safi (2008))	The study discussed in this paper conducted a survey among construction owners and architectural/engineering/construction firms to identify projects that achieved a reduction in overall project cycle time of more than 25% compared to industry standards. The collected data was analyzed to determine the techniques that enable such significant reductions in project cycle time. These techniques encompass best practices, schedule reduction techniques, and various management techniques employed in projects recognized by the Construction Industry Institute (CII). The research also identified the obstacles to achieving radical schedule reduction. The findings suggest that radical schedule reduction exceeding 25% can be accomplished through the selective application of management techniques, schedule reduction techniques, and CII best practices. Construction managers can benefit from this research to enhance project performance, whether aiming for radical reduction or simply seeking more effective execution.
2. The Predictability of Fast-Track Projects (A. A. ALHOMADI (2011))	This research delves into the correlation between project acceleration and the ability to forecast success in achieving project goals. It has been discovered that factors like schedule pressure, acceleration, and concurrent activities can impact projects in terms of attaining their original objectives and may even lead to unforeseen consequences. However, successfully accomplishing the initial project goals in a fast-track project can be achieved by avoiding unrealistic targets and excessive overlaps, engaging in thorough and realistic planning, employing an experienced and knowledgeable project team, drawing lessons from similar past projects, and establishing effective project coordination with robust communication channels. Moreover, project characteristics such as size, complexity, overhead costs, project team composition, and expected duration play crucial roles in influencing the variations observed in the final project outcomes.

3. Contractual Risks in Fast-Track Projects (M. MOAZZAMI, R. DEHGHAN, and J. Y. RUWANPURA (2011))	This research focuses on identifying the specific risks and legal challenges associated with fast-track projects. It also provides a concise examination of contractual aspects across three levels: contract language, contract type, and project delivery method. The study highlights several key findings, including the prevalence of disputes arising from inaccurate cost estimation and responsibility for cost overruns, liability for design errors and omissions, damages resulting from delays, change orders, rework, and modifications, as well as liability for overlooked work-related risks. The primary objective of this paper is to enhance understanding of the contractual risks involved in fast-track projects and offer guidance in developing contract strategies to mitigate associated legal issues.
4. Managing risks in fast-track housing projects (AHMED RAMADAN MOHAMED (2018))	The research discusses the concept of fast-track construction projects and their planning nature. It also addresses the phased planning factors for accelerated housing projects, which are often subjected to schedule pressure as a developmental project. The study examines the potential risks associated with all project stakeholders that may occur during the implementation process.
5. REDUCING CRR IN FAST-TRACK PROJECTS THROUGH BIM (Marwan Abdelbary, Andrew Edkins & Elkhayam M. Dorra (2020))	Client-Related Rework (CRR) represents one of the most common problems faced by construction projects, leading to potential financial losses and schedule delays. This study aims to investigate the potential role of Building Information Modeling (BIM) in reducing client-related rework when applied in the context of fast-track construction projects in Egypt. Through the survey study, it was found that the majority of the study sample (92.1%) experienced this problem in construction projects, resulting in an average project cost increase of 22% and an average schedule delay of 23% beyond the planned timelines. Additionally, the most significant reasons for these outcomes were attributed to "financial issues of clients," "barriers in client decision-making motivation," and "material substitutions by the client." The study concluded that the use of BIM in Egypt could potentially lead to a reduction in rework costs and schedule by 49% and 57%, respectively.
6. Managing uncertainty in fast-track construction projects: case study from South Africa (Samuel Laryeam & Ron Watermeyer (2020))	The objective of this study was to investigate the approach adopted by the client in managing uncertainty and successfully delivering projects within the allocated budget. Through document analysis and interviews with members of the client's delivery-management team, the research revealed that several key client management techniques were employed to effectively handle the high level of uncertainty and ensure project delivery within budget. These techniques included establishing a strict control budget, designing the project to align with the budget, fostering collaboration among stakeholders, maintaining disciplined control over the budget, and implementing continuous value engineering. The research findings address a significant gap in understanding and knowledge regarding the role of the client as the leader in infrastructure project delivery, and how adopting client-led delivery management practices can greatly enhance project outcomes.

These studies and others provide valuable insights into the complexities and potential risks in fast-track projects. However, they lack a specific reference list of challenges that hinder the success of fast-track projects. Through these studies, it can be inferred that a range of risks exist, including the owner's commitment to a defined scope of work before starting the project design, setting unrealistic project goals, rework associated with the client leading to increased project costs and schedule delays of up to 25% from the planned timeline, strong interferences between project activities without using schedule compression techniques prior to these interferences, and the absence of specific contractual frameworks for fast-track projects. The objective of this research is to categorize these risks within a specific reference framework so that they can be studied and efforts can be made to avoid or mitigate them before embarking on such projects.

3.2 Fast-track projects

Fast-track project execution is commonly characterized by the concurrent and expedited progress of activities in both the design and execution stages. This approach aims to achieve efficient and timely project completion while maintaining cost-effectiveness. In contrast to the

traditional sequential approach, where each phase must be completed before proceeding to the next, fast-track project delivery involves the overlapping and compression of different activities. This allows for a more streamlined and accelerated project timeline. The following **Table .2**. illustrates a set of concepts related to fast-track project.

Table 2. Explains a set of concepts related to fast-track projects.

Source	Fast-track projects concepts
Kwakye (1991)	Fast-track project management is an approach aimed at achieving early project delivery by incorporating innovative methods in construction procurement management and leveraging recent advancements in the industrialization of the construction process. This approach involves several key strategies, including [5]: • Integration of design and construction stages: Ensuring seamless collaboration and coordination between the design and construction teams throughout the project lifecycle. • Involvement of contractors in both design and construction phases: Engaging contractors in the design phase to leverage their expertise and insights, enabling smoother transitions and efficient execution. • Overlapping the project sections, in order to be able to follow the progress of the construction process in some of its sections until the design process progresses in the remaining sections. • Utilizing the experience of business contractors: Leveraging the knowledge and active participation of experienced contractors in both the design and construction stages, promoting effective decision-making and problem-solving.
Noyce, D. A. and Hanna, A. S (1995)	Defined as **reducing the expected time of a planned type and size of project within a given set of circumstances**, schedule reduction techniques are used before or during the execution phase for the purpose of controlling increases in project duration resulting from delays or changes in project scope during the implementation phase [6].
AIA ,American Institute of Architects (2011)	Fast-tracking is a process where specific portions of the design services overlap with execution activities to accelerate the project's overall benefits, either in full or in part, as desired by the owner. [7].
Dainty& Anumba ,Kasim (2013)	The term "**Fast-track projects**" is applied to projects that are executed in a period of less than 70% of their normal implementation rate, as they tend to overlap and compress activities (**Overlapping**) through accelerated phased construction, appropriate designs, and the optimal selection of construction mechanisms and building materials, as construction begins coinciding with the completion of Various design panels, with the aim of reducing the execution period compared to the traditional construction process [8].

Fast-track projects are characterized by the simultaneous progression of the execution phase and the ongoing design phase. In essence, the design and execution phases still require the same amount of time individually, but the overall project duration is reduced by initiating the execution phase before the design phase is fully completed.

3.3 Methods of fast-track projects

There are two ways to reduce the schedule and speed up project implementation which can be identified as follows [9]:

- Project Crashing
- Project fast tracking

Schedule compression and fast tracking are viable options for accelerating project implementation without altering the project scope. While they share the goal of shortening the project schedule, there is a key distinction between the two approaches. Schedule compression involves reducing the schedule by adding more resources or extending working hours. On the other hand, fast-tracking achieves schedule reduction by overlapping or eliminating certain project phases.

3.4 Project Crashing

Schedule crashing is a project management technique employed to reduce the overall project schedule duration without compromising the project scope. This technique involves various approaches such as adding more resources, extending working hours, or implementing alterations to the original project plan. However, disrupting the schedule is generally seen as a last-resort measure due to the potential drawbacks it entails, including increased costs and a potential decrease in quality [10].

From the previous concept, it is evident that this technique allows for crashing the project schedule by increasing the required resources during the project life cycle to reduce the overall time needed for the same activities. However, there are two extremely important concepts that must be taken into consideration when estimating activity durations within the accelerated project, specifically when employing schedule compression technique. They are:

- **Law of diminishing returns**: states that when one factor (such as additional labor) is increased while holding all other factors constant, there comes a point where additional increases of that factor begin to produce diminishing returns. In other words, the productivity of the added factor gradually decreases [9].
- **The number of resources:** It is not necessary for the time to be halved if the resources are doubled because the duration can increase due to risks, and at some point, adding too many resources to an activity can actually lead to an increase in the duration.

As shawn in **Fig. ١**. illustrates the idea of the law of diminishing returns and increasing project resources, as the turning point in the course of the project appears when factors increase beyond a certain limit, and thus productivity begins to gradually decrease.

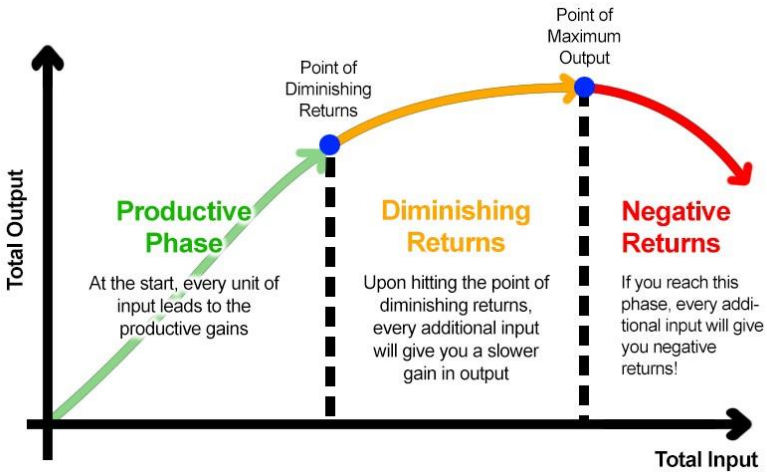
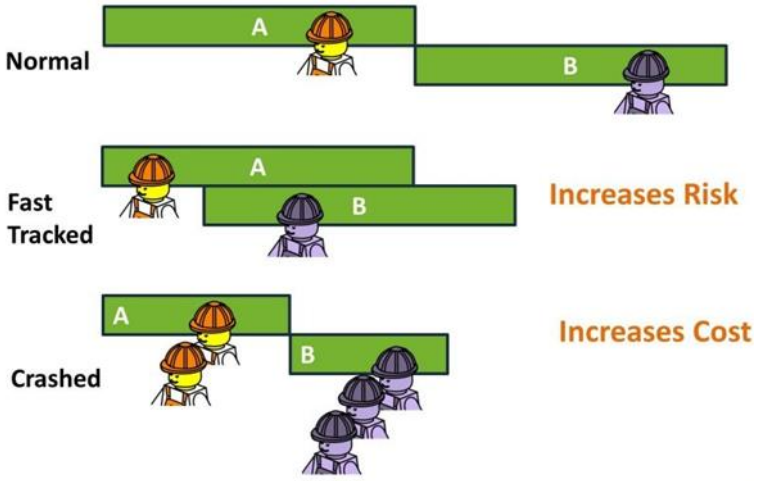


Fig. ١. Explains the idea of the law of diminishing returns and the turning point in the productivity path when factors increase.

3.5 Project Fast-tracking

Project fast-tracking refers to the practice of concurrently working on activities instead of following a linear sequence. While this approach is often seen as a means to expedite project completion, it carries inherent risks such as coordination challenges and potential compromises in the final product's quality [10]. It is evident from the previous concept that fast-tracking is considered the primary solution for project acceleration. This technique involves rearranging activities within the project's initial schedule without incurring additional costs or resources.

However, it is important to note that fast-tracking should be carried out after reviewing all activities and ensuring that their estimated durations are within a reasonable and realistic timeframe. It should be emphasized that fast-tracking may increase project risks due to activity overlaps, which can potentially extend the overall project duration. Therefore, project managers must identify activities that require schedule compression or fast-tracking techniques carefully. **Fig.2.** shows the difference between the traditional execution method and different techniques to accelerate the project.



3.6 Advantages of fast-track method

Fast-track method aims to reduce the project duration with optimal use of the project time from the beginning of the idea to delivery as a main goal in addition to the following [11]:

1. Cost reduction in construction, both direct and indirect costs, through the reduction of project duration and mitigating inflationary effects.
2. Enhancing quality and effectively achieving project goals by meeting the specific requirements set by the employer.
3. Allowing the early start of project implementation in some of its parts at the same time that design work is being completed for the rest of the sections.
4. Minimizing interest expenses related to capital and construction costs.
5. Ensuring that the total project cost remains within the estimated budget, aligning with the economic feasibility study and the overall project plan.
6. Early return for the owner and crews due to shorter overall project duration.

3.7 Disadvantages of fast-Tracking

Fast-tracking is not always the optimal choice for project managers, especially when activities are interdependent and need to be sequenced. There are several drawbacks to fast-tracking that need to be carefully addressed to safely implement this technique. The following are some of the key limitations that should be considered [12]:

1. Increased risks: Fast-tracking can lead to increased project risks, such as inadequate planning and coordination, potential rework, and increased chances of errors or omissions.

Fig.2. shows the difference between the traditional execution method and different techniques to accelerate the project.

2. Communication challenges: Fast-tracking requires effective and efficient communication among project team members and stakeholders. However, accelerated timelines can make it challenging to ensure clear and timely communication, leading to misunderstandings and potential conflicts.
3. Resource constraints: Fast-tracking often requires allocating additional resources or compressing the schedule, which can strain available resources and potentially lead to resource conflicts or overutilization.
4. Quality concerns: With fast-tracking, there may be limited time for thorough quality control processes. This can result in compromised quality and the need for rework or corrective measures.
5. Uncertain project outcomes: Fast-tracking may increase the likelihood of uncertainties and unexpected outcomes, as there is less time for comprehensive analysis and planning.
6. Stakeholder management: Fast-tracking can impact various project stakeholders, such as contractors, suppliers, and clients. It requires effective stakeholder management to ensure alignment, cooperation, and timely decision-making.

3.8 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.

4. Implications of fast-track project execution

There are three main factors considered when implementing any construction project: time, quality, and cost. These factors are known as the key constraints of projects. Like other projects, a construction project has a predetermined budget before its initiation, which can be increased or decreased by a certain percentage based on predetermined considerations by the owner. Additionally, it has a specified timeframe for execution within approved quality specifications [13].

By studying schedule crashing and fast-tracking in projects, it has become evident that it is essential to take into account the adverse effects that acceleration can have on both the design and construction phases. Furthermore, the project's key objectives, such as achieving the desired quality within the specified timeframe and budget, should be used as indicators to predict the project's trajectory and determine how closely it aligns with the pre-established goals [14]. The predictability of a project's planned goals increases as they are achieved earlier. Since 1999, the UK Government has identified time and cost predictability as crucial performance indicators for the construction industry. Additionally, quality, customer satisfaction, change orders, performance, and health and safety are also considered important measures in assessing project success in the UK construction sector. [15].

Potential risks associated with project acceleration can also be predicted by reviewing the literature related to the risks of accelerated project implementation, as well as cost and quality variations within such projects.

4.1 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 alreadyidentified issues. Consequently, it is essential to establish the connection between activity overlap and risk, enabling the development of effective tools for improved management of fast project schedules and mitigating short duration delays [16].

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 [17]. Projects become extremely unstable and complicated because of overlapping activities, resulting in non-valueadding implementations [18]. 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 [19].

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 [20].

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.

It should be noted that there are a range of contractual risks associated with fast-track projects, as traditional contracting models may not be suitable for this type of project that requires fair risk allocation among project stakeholders. Each party may unjustly transfer project risks to other parties through the use of contractual clauses.

The following are the key contractual risks in a fast-track project, according to Moazzami, Dehghan, & Ruwanpura [22]:

- Risk of inaccurate cost estimating and cost overruns, along with associated responsibility.
- Responsibility for design errors and omissions.
- Potential delay damages.
- High occurrence of change orders.
- Construction rework and modifications.
- Risk associated with overlooked work assigned to no specific party.

4.2 Cost Changes

Cost variance serves as an indicator of the predictability of the path taken in fast-track projects and can potentially lead to unforeseen additional expenses within the project budget [8], Fast-track projects can vary in cost compared to traditional track projects based on factors such as project size, complexity, overall expenses, project team, and estimated execution time. Insufficient knowledge of other disciplines during the design phase, for instance, can result in increased design assumptions and potential cost implications. research indicates that the cost of schedule compression, such as compressed or fast-tracked schedules, can increase by 40-50% or even more. This includes inaccurate cost estimates due to unclear project scope and exaggerated resource requirements. These impacts often lead to a significant number of change orders, resulting in unexpected cost increases and ultimately escalating project expenses [21].

4.3 Quality Variance

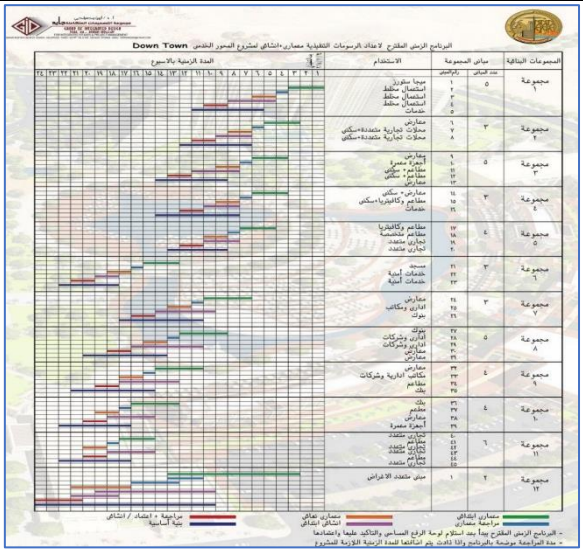
Insufficient clarity in the product description significantly contributes to risks associated with the final product's quality in fast-track projects. These risks can emerge during the design phase as well as throughout the project execution stages [21]. To mitigate and minimize these consequences, studies have emphasized the need for realistic and proactive planning and scheduling of construction activities. It is crucial to establish an effective framework for project coordination and communication. These measures aim to address time and information constraints that may lead to subpar design outcomes. The acceleration process can result in designs that are either excessive or poorly crafted. In such cases, rework becomes necessary to rectify the shortcomings and achieve the desired design. The term "change" encompasses deviations from plans or fundamental standards due to variations in work quality, work environment, or project scope. Examples of change and rework include the addition, removal, or replacement of project elements [22]. Consequently, accelerating projects without adequate planning can trigger administrative responses in the form of changes. However, these modifications introduce additional work and can compromise the overall quality of the project as a result of reacting to unforeseen changes.

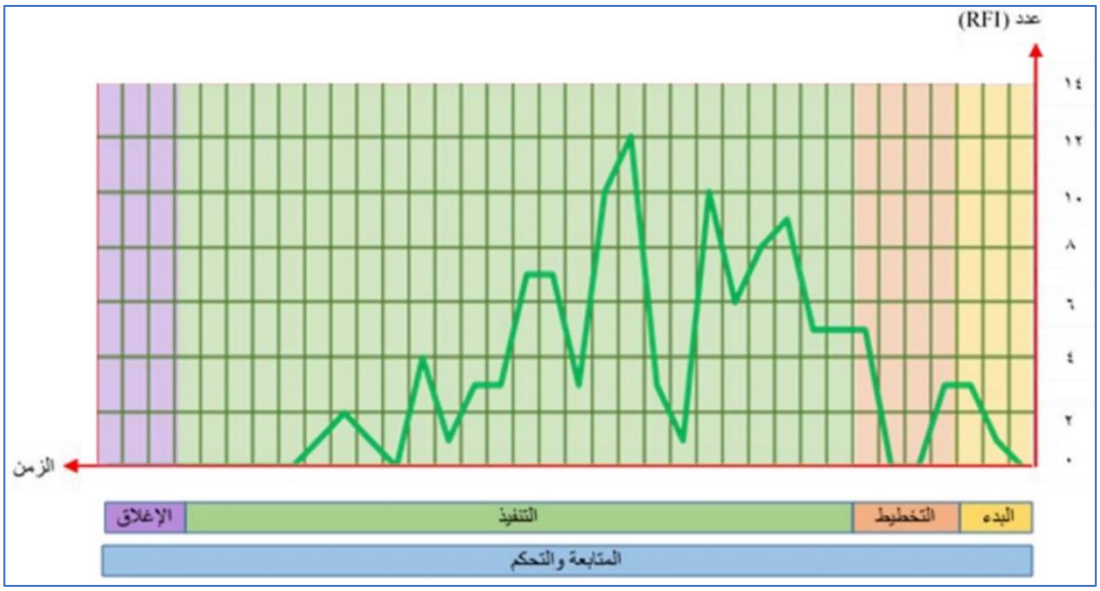
Existing literature has identified various obstacles that can affect the management and execution of fast-track projects, particularly related to project delivery and performance. For instance, the overlapping of phases like design and construction presents a significant challenge. To evaluate the suitability of each project for an accelerated approach, several factors must be considered, including design compatibility, stakeholder alignment and involvement, previous experience of contracting parties, scope implementation planning, contract forms, and risk assessment and management.

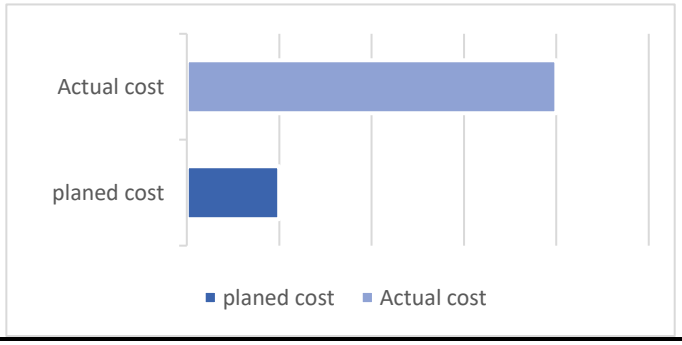
The research incorporates a case study of a project that implemented acceleration techniques. The aim of this case study is to examine and validate the identified risks mentioned in the theoretical study.

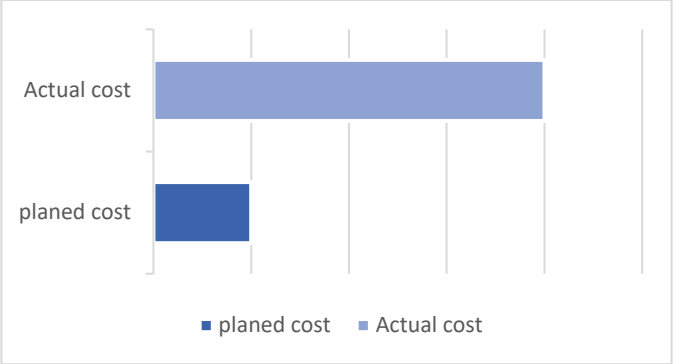
5. Case study

This research segment employed a case study methodology to investigate the challenges faced in delivering and managing fast-track construction projects. A real-life project was specifically chosen to gain a deeper understanding of the unique characteristics of such projects and to involve all project stakeholders directly in the study. **Table .3**

<table>
<tr>
<td colspan="2">The commercial and entertainment center at Galala Resort
 
</td>
<td rowspan="7">Project data</td>
<td>Location</td>
<td>Ain Sokhna - Galala Plateau</td>
</tr>
<tr><td>Owner</td><td>Armed Forces Engineering</td></tr>
<tr><td>Usage</td><td>commercial and entertainment</td></tr>
<tr><td>Area</td><td>105,000 M2</td></tr>
<tr><td>No.of Building</td><td>6 Building</td></tr>
<tr><td>Investment volume</td><td>6.3 Bilion EGP</td></tr>
<tr><td>Designer</td><td>GID-Consultancy – Group Of Integrated Design</td></tr>
<tr><td colspan="2">Deliver date</td><td colspan="2">October 2020</td></tr>
<tr><td>Project Description</td><td colspan="3">The entertainment commercial center consists of six main buildings with a total built-up area of 105,000 square meters, combining various entertainment and service elements within the Jebel Mokattam project. Building "A" is the marina services building and includes 12 cafeterias, 12 bazaars, and 36 restaurants. Building "B" is the cafes and cafeterias complex, comprising 114 shops and two celebration squares. Building "C" is the shopping mall, housing 232 shops and four major restaurants. Building "D" is the entertainment center, featuring 59 shops, six cafeterias, eight cinema halls, two electronic gaming areas, and an ice skating rink. Building "E" is the restaurants complex, including 49 restaurants, 93 commercial shops, a celebration square, and an 800-car parking lot. Building "F" is the hypermarket, consisting of a large market and 20 commercial shops.</td></tr>
<tr><td>Design & Scope phase</td><td colspan="3">Design work started in October 2018 with the aim of compressing the project timeline to be executed within a maximum of two years by October 2020, through the integration of design and execution processes. The design office prepared the construction and structural drawings during the project's execution period. The following table illustrates the schedule for preparing the construction drawings for the project.
 
The design plans were studied, but they were incomplete, especially regarding electromechanical works, resulting in not meeting the time pressure requirements for project activities. This led to delays in delivering several construction drawings to sites and contractors, which revealed several conflicts, such as:
1. Variation in foundation excavation levels.
2. Intersection of buildings with infrastructure routes and electrical transformers.
3. Conflict between architectural and structural drawings due to poor coordination, especially regarding design modifications by the owner.</td></tr>
</table>

<table>
<tr>
<td></td>
<td>4. Increased requests for information (RFIs) and extended stoppage and delay periods due to incomplete project information.
 

5. The increase in Requests for Information (RFIs) during the execution stages, along with stoppage and delay periods due to incomplete project information, resulted in work stoppages in some locations for extended periods. This had a significant impact on the overall project duration, leading to modifications in the project scope and deliveries for certain project elements.
6. The lack of coordination caused an increase in the number of change orders, which in turn led to increased rates of wastage of time and materials and had a noticeable impact on the cost of the project.
These challenges impacted the project's progress and required additional coordination efforts to overcome the conflicts and ensure the smooth execution of the project.</td>
</tr>
<tr>
<td>Schedule & Cost</td>
<td>Regarding the project schedule and cost, no solutions were adopted to detect conflicts and reduce rework orders. This led to an increase in conflicts, response times, and rework orders, resulting in a duplication of material waste and the consumption of the designated project completion time. This had a negative impact on the project scope, leading to the following:
1. The lack of initial Requests for Information (RFIs) caused delays in the project schedule, exceeding the specified duration for completing all activities and reaching the closure phase.
2. Some project elements were reduced to align with the changes and variables in the schedule, which exceeded the specified period for project completion. This necessitated extending the project schedule by a period exceeding eight months to achieve project objectives.
 
</td>
</tr>
</table>

	3. The actual cost of executed activities exceeded the estimated value of the project cost by approximately 12.5%, equivalent to 800 million Egyptian pounds, bringing the total value of the required work to be executed to 6.45 billion pounds. This required the project management center to make adjustments to the project scope, including removing two hotel buildings from the site and modifying the finishing level for some units to maintain the actual cost within the allowed cost estimate range. 

As indicated in the previous table, the content of the project documents related to the case study was analyzed, confirming the presence of a set of risks encountered by the project under study, which aligned with the risks mentioned in the theoretical study and can be categorized into five main groups:

1. Risks related to scope and project trajectory changes.
2. Risks associated with the speed of design and alignment with stakeholders' needs.
3. Risks related to the estimation and cost of project activity extensions.
4. Risks associated with labor, materials, and equipment.
5. Risks linked to the nature of contracts with project stakeholders.

A questionnaire will be developed and administered to project management and implementation stakeholders to verify the accuracy of the data and ensure the convergence of results between the theoretical study and the case study.

6. Questionnaire

Questionnaires are widely recognized as a dependable approach for gathering pertinent and comparable data from a substantial number of individuals. Moreover, by ensuring clarity, explicitness, and repetitive questioning, valuable data can be extracted from respondents [23]. In this research, a questionnaire was created using Google Forms and distributed to construction engineering specialists of different ages and job positions. The objective was to validate the primary obstacles that may arise in fast-track construction projects, drawing from the insights obtained through the literature review and the examined case study. The research employed a simple random sampling technique, ensuring that each element in the population had an equal probability of being selected for the sample.

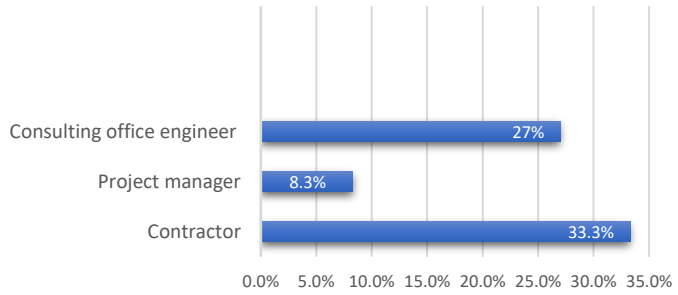
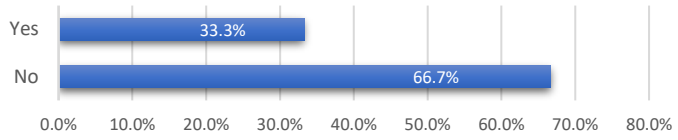
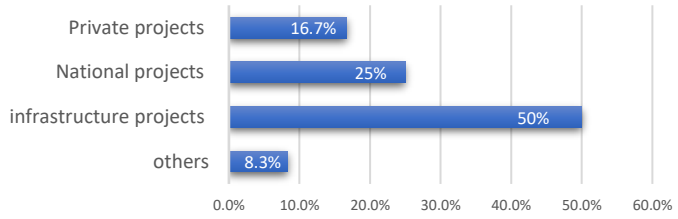
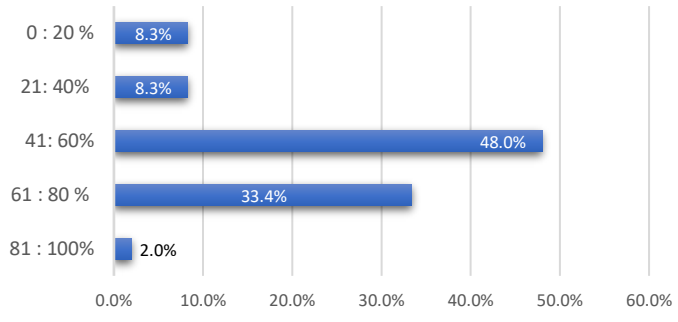
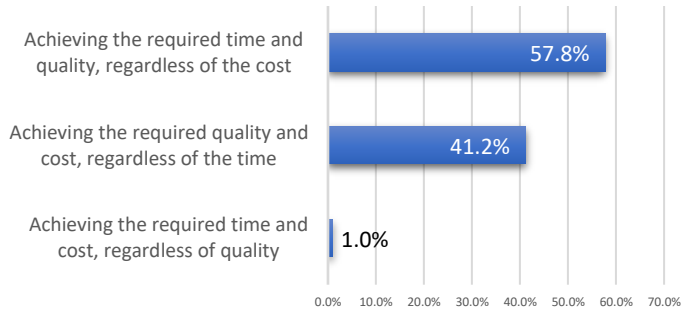
6.1 Questionnaire design

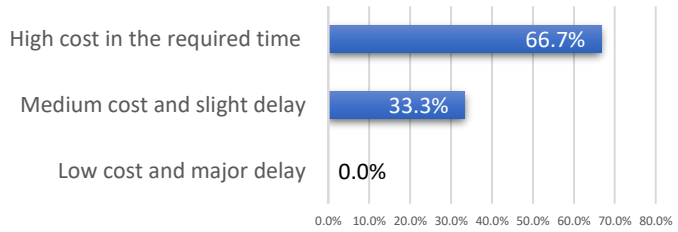
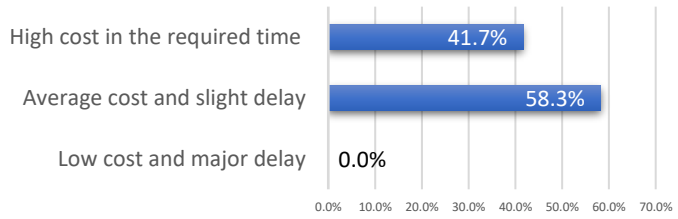
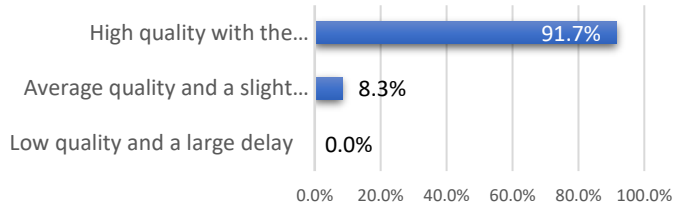
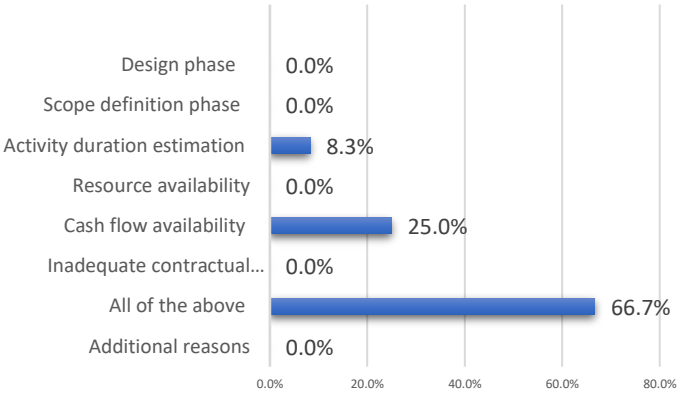
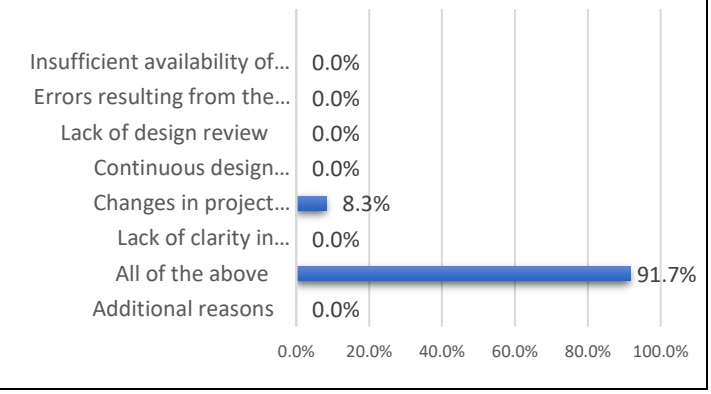
For this study, a dedicated questionnaire was created using Google Forms, taking into account the established theoretical framework. The questionnaire incorporated two types of questions, namely preference questions and multiple-choice questions, to facilitate respondents' responses. In total, the questionnaire consisted of 15 questions that focused on the primary obstacles encountered in fast-track project implementation, as well as essential variables related to fast construction, including cost and quality.

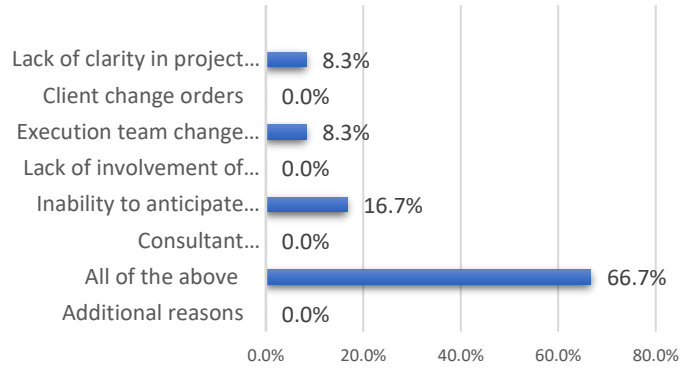
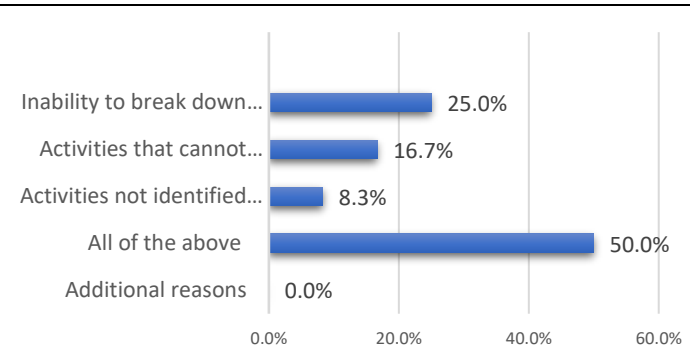
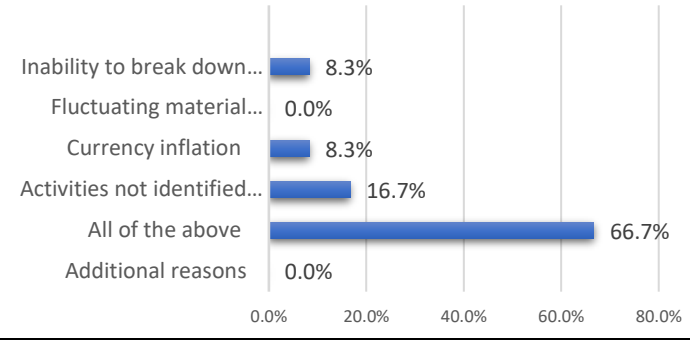
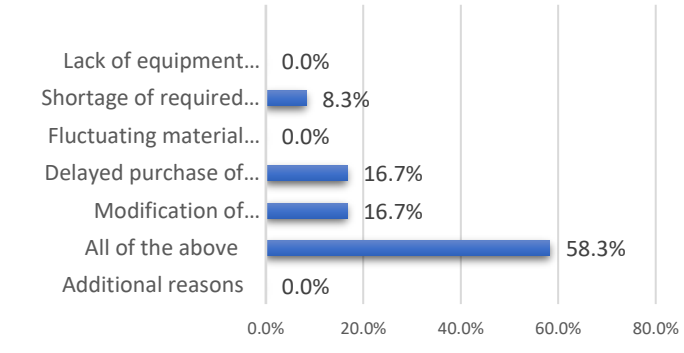
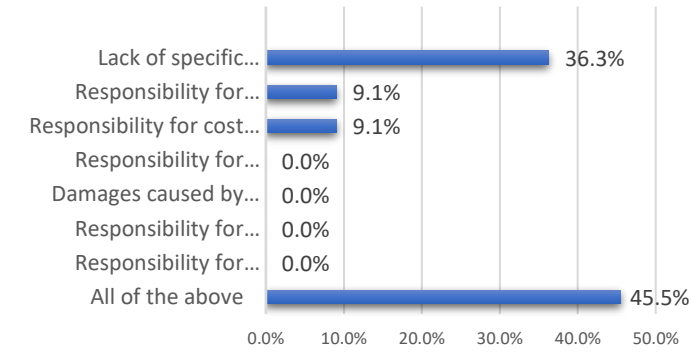
6.2 Data Collection

The data collection process involved individual participants responding to the questionnaire. All questionnaires were distributed online using Google Forms, allowing for broad accessibility. Respondents were able to access the questionnaire quickly and at minimal cost by following a Google Forms link, regardless of their location [23].

The questions and responses from the survey conducted using Google Forms are presented in the following **Table .4**

1. What is your specific role or contribution within the construction industry? (Consulting office engineer - Execution engineer - project manager - owner – contractor)	
2. In your opinion, is it absolutely recommended to use the fast-track method for projects? (Yes - No)	
3. In your opinion, what projects require the application of fast-track mechanisms in implementation? (Private projects - national projects - infrastructure projects - others).	
4. How does the success rate of fast-track projects compare to projects executed using traditional methods? - % ٨٠ : ٦١ - ٪٦٠ :٤١ - ٪٤٠ :٢١ - ٪٢٠ :٠) (٪١٠٠ : ٨١	
5. In your opinion, what are the critical factors that contribute to the success of fast-track projects? (Achieving the required time and quality, regardless of the cost - Achieving the required quality and cost, regardless of the time - Achieving the required time and cost, regardless of quality).	

6. When it comes to project completion, what is your preferred balance between quality and cost? (High cost with the required quality-Average cost and average quality-Low cost and poor quality)	
7. Considering cost and time constraints, what is your preferred approach to completing a project? (High cost in the required time - Average cost and slight delay - Low cost and major delay)	
8. When prioritizing quality and time, what approach do you prefer for project completion? (High quality with the required time - Average quality and a slight delay - Low quality and a large delay)	
9. In your opinion, what are the main obstacles that fast-track projects may encounter? (Design phase - Scope definition phase - Activity duration estimation - Resource availability - Cash flow availability - Inadequate contractual structure designed for fast-track projects - All of the above - Additional reasons)	
10. In your opinion, What are the main obstacles that fast-track projects may encounter during the design phase? (Insufficient availability of information - Errors resulting from the required design speed - Lack of design review - Continuous design development without a specific stage - Changes in project requirements after starting the design - Lack of clarity in requirements from day one of the design process - All of the above - Other reasons)	

11. In your opinion, What are the main obstacles that fast-track projects may encounter during the scope definition phase? (Lack of clarity in project scope - Client change orders - Execution team change request - Lack of involvement of the execution team in scope definition - Inability to anticipate scope changes - Consultant modifications after scope definition - All of the above - Other reasons)	
12. In your opinion, What are the main obstacles that fast-track projects may encounter during the activity duration estimation phase? (Inability to break down tasks in a way that allows for accurate activity duration estimation - Activities that cannot be compressed in duration - Activities not identified within the project scope from day one - All of the above - Other reasons)	
13. In your opinion, What are the main obstacles that fast-track projects may encounter during the project cost estimation phase? (Inability to break down tasks in a way that allows for accurate cost estimation - Fluctuating material prices - Currency inflation - Activities not identified within the project scope from day one - All of the above - Other reasons)	
14. In your opinion, What are the main obstacles that fast-track projects may encounter during the resource and equipment procurement phase? (Lack of equipment availability - Shortage of required labor for the project - Fluctuating material prices - Delayed purchase of materials for the required phase - Modification of materials during project stages by any of the project parties - All of the above - Other reasons)	
15. What are the main obstacles that fast-track projects may encounter during the contracting phase? (Absence of a well-defined contractual framework for fast-track projects - Responsibility for inaccurate cost estimation - Responsibility for cost overrun risks - Responsibility for design errors and omissions - Damages caused by delays and change orders - Responsibility for rework and	

modifications - Responsibility for overlooked work-related risks- All of the above)	

7. RESULTS AND DISCUSSION

The questionnaire was divided into two main groups. The first group, consisting of questions one to eight, focused on the nature of work in the construction field and perspectives related to the concept of project acceleration. It also sought recommendations on the types of projects where acceleration mechanisms can be applied, as well as identifying key indicators of success for these projects.

Upon analyzing the questionnaire results, the following findings emerged:

- Over 50% of the respondents to the questionnaire were construction engineers, project managers, and contractors, indicating that these professionals are the most affected by the pressures of project acceleration during the execution stages.
- When asked about their recommendation for adopting project acceleration, the majority expressed reservations about implementing project acceleration methods unconditionally, with a ratio of 67% against and 33% in favor.
- Most respondents agreed on the idea of using project acceleration mechanisms in infrastructure and national projects, while also acknowledging the importance of considering project-specific advantages when deciding to adopt acceleration in private projects.
- The majority of survey respondents emphasized that achieving the desired project duration and quality are key factors for the success of accelerated projects, regardless of the associated costs. However, it is not typical to prioritize completing a project in the shortest possible time if it leads to significantly increased expenses, potentially doubling the construction budget. The following ratio indicates that sacrificing quality to reduce the project duration leads to post-completion defects and increased maintenance work, resulting in additional costs associated with quality-unrelated acceleration.

The second group of questions, from question nine to fifteen, addressed the risks that may be encountered in accelerated projects. It presented a set of options representing the key project stages, followed by the identification of obstacles and associated risks for each stage. Each question allowed for the possibility of selecting multiple points regarding the proposed risks or adding another suggestion.

The results of this questionnaire group indicated two main findings:

- All the risks mentioned, whether in the specified project stages or within each stage, are major factors affecting the acceleration process. However, their relative importance varies, and there are knowledge gaps in evaluating these obstacles faced by project management in fast-track projects.

- The mechanisms of fast-track project in the construction sector in Egypt lack a clear scientific approach to achieve acceleration in a manner that can be applied to different types of projects.

The following **Table .5** provides a summary of the guide to potential risk predictions derived from the theoretical study, case study, and conducted questionnaire. These predictions can be formulated into five main categories, with each category containing the corresponding sub-risks.

Table 5. Showing the guide to potential risk predictions

Main risks	Sub- risks
Risks related to design and coordination	Lack of information
	Errors resulting from the required design speed.
	Lack of design review.
	Continuous development of the design beyond a certain stage.
	Changing project requirements after starting the design.
	Insufficient coordination between project teams.
Risks related to scope and predicting the course of the project	Lack of clarity in project scope.
	Change orders from the client.
	Change orders from the execution team.
	Inability of the execution team to participate in scope determination.
	Inability to predict scope developments.
	Modifications by consultants after scope determination.
Risks related to estimates of durations and costs of project activities	Improper breakdown of work for accurate estimation of durations and costs
	Activities that cannot be compressed
	Activities that are not included in the project scope from the beginning
Risks related to materials and equipment	Shortage of required labor for the project
	Lack of equipment availability
	Delay in purchasing materials beyond the required stage
	Modifications to materials during execution stages by any project party
Risks related to contractual risks	Lack of a specific contractual framework for accelerated projects
	Responsibility for inaccurate cost estimation
	Responsibility for design errors and omissions
	Responsibility for delays and change orders
	Responsibility for rework and modifications
	Responsibility for overlooked work-related risks

8. Conclusion

The research focused on reviewing relevant theoretical studies regarding project acceleration and the resulting effects of schedule pressures. Additionally, a case study of a project characterized by fast-track implementation was examined to validate the findings from the relevant studies. Furthermore, the aim was to summary of the guide to potential risk predictions achieving project acceleration. Multiple data sources were analyzed, including conducting a survey on the main risks in managing fast-track projects. The research yielded several key findings, as follows:

1. Fast-tracking is commonly employed as a primary method for project acceleration, involving the reordering of tasks in the initial project schedule without the need for extra resources or costs. Nonetheless, it is crucial to acknowledge that fast-tracking introduces project risks by deviating from and resequencing the project schedule.

2. The successful achievement of the desired project duration and quality serves as the key benchmarks for accelerated projects. However, it is not customary to prioritize completing a project in the shortest possible time at the expense of escalated costs, which can potentially double the construction expenses. Compromising on quality to expedite the project duration results in post-completion defects and heightened maintenance work, leading to additional costs unrelated to quality-driven acceleration.
3. The research has identified various risks that fall into five primary categories: risks associated with design and coordination, risks stemming from scope changes or change orders during the project timeline (i.e., the ability to predict the trajectory of accelerated projects), risks linked to estimating the duration and cost of activities, risks related to materials and equipment, and contractual risks.
4. All the risks mentioned in the different project stages discussed in the research, as well as those included in each stage, are significant influencers on the acceleration process, albeit with varying degrees of impact. There are knowledge gaps in evaluating these risks encountered by managing accelerated projects due to the lack of a clear scientific mechanism that can be universally applied to different project types.

The research recommends the need to conduct a study that aims to establish a clear scientific mechanism for accelerating project implementation by leveraging the potential risk guide. This study aims to find solutions, mitigate, or avoid these risks throughout the project lifecycle. This should be followed by an applied study on a specific project to test the effectiveness of this mechanism, starting from the design phase and ending with project delivery. This ensures the generalization of the mechanism and its potential application in different projects.

References

[1] Khoueiry Y, Srour I, Yassine A. 2013. An optimizationbased model for maximizing the benefits of fast-track construction activities. J Oper Res Soc. 64(8):1137–1146.

[2] Eastham G. European Construction, I., Great, B., Department of, T., & Industry 2002. The fast track manual: a guide to schedule reduction for clients and constractors on engineering and construction projects. Loughborough: European Construction Institute.

[3] Vidal L-A, Marle F, Bocquet J-C. 2011. Measuring project complexity using the analytic hierarchy process. Int J Project Manag. 29(6):718–727.

[4] Hass KB, PMP KBH. 2008. Managing complex projects: a new model. Oakland (USA): Berrett-Koehler Publishers.

[5] A.A.Kwakye, “Fast Track Occasional Paper no.46, CIOB (Chartered Institute of Building), 1991.

[6] Noyce, D. A. and Hanna, A. S, “The Impacts of Planned and Unplanned Schedule Compression or Acceleration on the Labor Productivity of Contractors”, the University of Wisconsin Madison 1995.

[7] AIA ,American Institute of Architects , “The Architect's Handbook of Professional Practice”, John Wiley & Sons,14th ed, N J, (2011)

[8] Kasim NB, Anumba CJ and Dainty ARJ, “Improving materials management practices on fast-track construction projects”. In Proceedings 21st Annual ARCOM Conference (Khosrowshahi F (ed.)). Association of Researchers in Construction Management, London, UK, vol. 2, pp. 793–802 (2005).

[9] Project Management Institute, “A Guide to the Project Management Body of Knowledge PMBOK”, 6th edition, 2017.

[10] Jennifer Greene and Andrew Stellman, “Head First PMP”, Fourth Edition, 2018.

[11] Fazio. P, Moselhi- O, Thberge, P,& Revay S, Design impact Of construction fast-track, Construction Management and Economics, 6:3, 95-208.

[12] A. S. E. BABA, "Project Risk Management and its Application into Dubai's Fast Track Projects," The British University in Dubai, 2019.

[13] Lester, Albert, Project Management Planning and Control, Managing Engineering, Construction,& Manufacturing Projects to PMI, APM, and BSI Standards, Oxford , Butterworth-Heinemann,6th ed, (2014)

[14] Atkinson R ,Project management: cost, time and quality, two best guesses and a phenomenon, it’s time to accept other success criteria ,International Journal of Project Management 17(6): 337–342, https:// doi.org/10.1016/S0263-7863(98)00069-6. (1999)

[15] Alhomadi AA, Dehghan R and Ruwanpura JY ,Time, cost and quality predictability in fast-track projects. Proceedings, Annual Conference - Canadian Society for Civil Engineering, Montreal, Québec, pp. 1283–1291. (2013)

[16] M. Garrido, Claudia, Valentin, Bogus and M. Susan, "RISK ASSESSMENT IN FAST-TRACK CONSTRUCTION PROJECTS: A CONCEPTUAL MODEL," Leadership in Sustainable Infrastructure Leadership en Infrastructures Durables, pp. pp. 1-10, 2017.

[17] F. Khoramshahi and J. Ruwanpura, Speed up of project delivery through application of effective fast tracking strategies in the engineering phase, Zurich, Switzerland: Proceedings of Modern Methods and Advances in Structural Engineering and Construction, 2011.

[18] M. Park, "Dynamic change management for fast-track- ing construction projects," in The 19th International Symposium on Automation and Robotics in Construction (ISARC), 2002.

[19] C. Garrido Martins, "Assessment of Project Risks in Fast-Track Construction Projects," in The University of New MexicoProQuest Dissertations Publishing, 2019.

[20] A. Akintoye, J. Goulding and G. Zawdie, Construction Innovation and Process Improvement, UK: Blackwell Publishing Ltd.: West Sussex, 2010.

[21] Lalu M, Tiong I and Shidqul AM ,Application of fast track method to accelerate project implementation time in the hospital construction. International Journal of Scientific Engineering and Science 3(11): 49–53. (2019)

[22] Moazzami M, Dehghan R and Ruwanpura JY ,Contractual risks in fast-track projects. Procedia Engineering 14: 2552–2557, https://doi. org/10.1016/j.proeng.2011.07.321. (2011)

[23] Navarro-Rivera J and Kosmin BA (2013) Surveys and questionnaires. In The Routledge Handbook of Research Methods in the Study of Religion, 1st edn (Stausberg M and Engler S (eds)). Routledge, London, UK, pp. 395–420.