



JIMMA UNIVERSITY
JIMMA INSTITUTE OF TECHNOLOGY
SCHOOL OF GRADUATE STUDIES
FACULTY OF CIVIL AND ENVIRONMENTAL ENGINEERING
CONSTRUCTION ENGINEERING AND MANAGEMENT CHAIR

**ASSESSMENT OF FAST TRACK CONSTRUCTION CONCEPTS ON BUILDING
CONSTRUCTION PROJECTS IN ADDIS ABABA CITY**

A Thesis Submitted to the School of Graduate Studies, Jimma University, Jimma Institute of Technology, faculty of Civil and Environmental Engineering in Partial Fulfillment of the Requirements for the Degree of Masters of Science in Construction Engineering and Management.

By:
Netsanet G/hawaria Hagos

December 2019
Jimma, Ethiopia

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Advisor: Engr. Elmer C. Agon (Asso.prof)

Co-advisor: Engr. Kemal Ture (MSc)

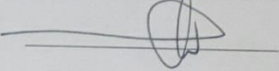
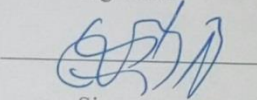
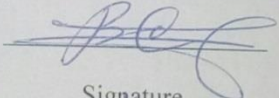
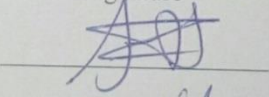
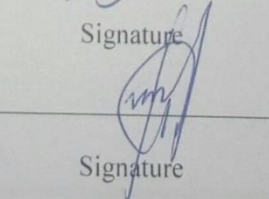
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ASSESSMENT OF FAST TRACK CONSTRUCTION
CONCEPTS ON BUILDING CONSTRUCTION
PROJECTS IN ADDIS ABABA CITY

NETSANET GEBREHAWARIA HAGOS

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DECLARATION

DECLARATION

I declare that this research entitled "Assessment of Fast Track Construction Concepts on Building Construction Projects in Addis Ababa City" is my own original work, and has not been submitted as a requirement for the award of any degree in Jimma University or elsewhere.

Netsanet G/hawaria Hagos



20/02/2020

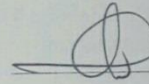
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As research Adviser, I hereby certify that I have read and evaluated this thesis paper prepared under my guidance, by Netsanet G/hawaria Hagos entitled "ASSESSMENT OF FAST TRACK CONSTRUCTION CONCEPTS ON BUILDING CONSTRUCTION PROJECTS IN ADDIS ABABA CITY" and recommend and would be accepted as a fulfilling requirement for the Degree of Master Science in Construction Engineering and Management.

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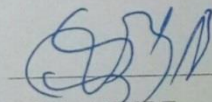
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ABSTRACT

Impact of delay in construction project is common in construction industry particularly in developing country like Ethiopia. To reduce delay or complete the project within the required time and budget, construction parties agreed to apply various management techniques in the construction industry. Fast track is one of the management technique which is used to shorten duration of the project by overlapping design and construction and by doing activities parallel. This research assessed the awareness of the construction parties about fast track concepts on building construction projects, verify the suitable factors and conditions that enforce the parties to apply fast track construction technique and determine the impacts and significances of fast tracking construction technique.

The study subjects were currently active building project in Addis Ababa City. Purposive sampling method was applied for selection of construction companies. The main tools used for collection of data were questionnaires and interview question, the collected data was analyzed by calculating Frequency and relative importance index (RII) also by using Microsoft excel and SPSS software then findings are presented in charts and tables.

The findings revealed that 50% of the respondents thought Design Build delivery system and fast track are similar terms and 36.36% respondents though it is management technique and 9.09% said that it is both delivery and management. Based on The contractors, Market condition with $RII=0.76$ and based on the consultants, project complexity with $RII=0.742$ ranked at 1st main condition which enforce the construction parties to use fast track. Project team experience with $RII=0.84/0.8$ and design suitability with $RII=0.813/0.971$ are the two main factors their RII is based on contractors and consultants point of view respectively which determine the suitability of one project for fast track or not. And reducing time with $RII=0.733/0.8$ and rework with $RII=0.746$ are the main significance and impact of fast track construction technique respectively. Lowering cost is ranked at the last by both firms but from the literatures, projects who practice fast track technique are saving their cost by minimizing delay related cost overruns

According to the results, it is concluded that by reducing the project duration, it is also possible to keep the project from cost overrun. Therefore, for the purpose of construction industry development companies who participate in the international projects have to act as key national institution in technology transfer.

Key words: construction industry, delay, fast tracking techniques

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ABBREVIATIONS

BIM	Building Information Modeling
CII	Construction Industry Institute
CSFs	Critical success factors
DBB	Design Bid Build
DB	Design Build
GNP	Growth Net Production
IT	Information Technology
JIT	Jimma Institutes of Technology
PCM	Professional Construction Management
RII	Relative Important Index
SPSS	statistical package for social science
TPS	Toyota Production System

CHAPTER ONE

INTRODUCTION

1.1. Back ground of the study

Construction industry plays an important role in social, economic and political development of a country. Construction is not only one of the major sectors of an economy, but it is also the largest and accounts for 12% to 25% of the GNP of both developed and developing countries. It consumes the higher percentage of the annual budget of a country; specifically in our country Ethiopia, it covers 58% of the annual budget [1]. It plays a vital role in meeting the needs of society and enhancing the quality of life and its importance emanates largely from the direct and indirect impact it has on all economic activities [2].

One might think that the construction industry is fighting for a lost cause, and that achieving higher quality and efficiency levels is beyond the bounds of possibilities. However, using specific project management techniques can help achieve reductions in project duration without increasing the costs and without compromising the quality. Understanding the nature and the effect of these techniques and the effects of the organizations' efforts to shorten the project execution time is very useful for the industries [3].

Several management approaches have been initiated to achieve accelerated completion. Fast tracking techniques and phased construction were essentially developed as part of the Professional Construction Management (PCM) approach to meet the challenges and accelerate the project phases [4]. When shortening a project's duration; activity crashing, fast-tracking and substitution are the three most commonly employed compression techniques [5].

Fast track project management technique is done to reduce the project time by overlapping the project design and construction phases and thereby by making maximum possible activities run parallel to each other so as to reduce the time [6].

Moreover, these projects are required to be completed in faster duration compared to normal schedules to remain competitive. In our country Ethiopia a number of modern buildings are constructed, most of them are in Addis Ababa the capital city of Ethiopia.

However most of the projects do not complete with the estimated time duration due to various factors happen during the construction process starting from the early stage that is initiation. So, fast tracking technique is one of the appropriate options to take project on its proper track.

Therefore, in this research an attempt was made to identify fast track technique that is used to reduce or minimize time delay in the construction projects. By following the findings from a surveying of consultant and contractor point of view conclusion and recommendation are going to formulate in order to give some awareness to the participants of construction industry.

1.2. Statement of the problem

Construction industry is very large, complex, and requires huge capital investments. Delay in the completion of a construction project is one of the biggest problems faced by the construction industry and can be a major problem for construction's project participant leading to costly disputes and adverse relationships amongst project participants, Delays occur in every construction project and the significant of these delays varies considerably from project to project [7].

Ethiopia one of the fastest growing, developing country, which uses construction industry as the main input for growth, employment, and infrastructure expansion. Yet, it is not contributed to the development of the country as desired due to various problems, limitations, and drawbacks. Among those, impact of delay in construction project is a common, and a predominant [8]. Any delay in a project can lead to cost and time overruns and these two are connected.

Nowadays construction projects in Addis Ababa city faces delay problem due to various reasons, however in this research, fast track project management technique was assessed to reduce the project time/to minimize delay by overlapping design and construction in the construction project and making activities run parallel to each other during the construction phase.

1.3. Research Questions

1. How much is the level of awareness of construction parties who are practicing fast track management technique on building construction projects?

2. What are the suitability factors and conditions that make the construction project to apply fast track construction technique?
3. What are the impacts and significance of fast track construction technique in the construction project?

1.4. Objectives of the Study

1.4.1. General Objective

The general objective of the study was to assess the concepts of fast track construction technique on building construction projects.

1.4.2. Specific Objectives

- To verify awareness of the construction parties who are practicing fast track management technique on building construction projects
- To describe suitability factors and conditions that make the construction project to apply fast track construction technique in building construction projects.
- To determine the impacts and Benefits of fast track construction technique in building construction projects.

1.5. Scope and limitation of the study

There are many time shortening management techniques which are used in the construction industry. Among these techniques the study focused only on fast tracking management technique, and the study was limited to the contractors and consultants which have grade one (GC/BC-I) in building construction projects conducted in Addis Ababa city.

1.6. Significance of the study

This paper will give awareness to the construction parties such as client (employer), consultants and contractors about the technique which used to reduce delay on construction projects, which is fast track construction management technique, in order to minimize delay and the cost overrun come about in the project related with time delay of the project.

Also it opens the eye of the researchers, by creating initial benchmark information on the principle fast track management technique for future study and also they can use this paper as their reference.

CHAPTER TWO

LITERATURE REVIEW

2.1. Fast track

In the traditional construction project the construction process starts from selecting an architect or engineer by the owner. The design professionals analyze the owner's needs and develop design concepts. They then prepare design development drawings, and then construction drawings. Once the designer complete those process the owner review the drawing and specification, after reviewing they prepare notices for bid in different Medias. Then during the bidding process if the contractor's price is acceptable, the owner will sign a contract with the contractor and construction can then begin. But, in fast track construction, the contractor is selected early in the process developing conceptual drawings before the plans and specifications are starts. The contractor assists with design development and submits a price proposal before the drawings are complete. Usually, the contractor provides a guaranteed maximum cost, including the contractor's fee. During fast track, construction starts well before the construction drawings are finished. The designers focus first on the site work, and foundation. While the contractor is working with the site works, and constructing the foundation, the designers prepare the remaining drawings for the rest of the project. If all goes well, the fast tracked project will complete in much less time than the traditional project. The main advantage of fast track construction is time. For those projects where time is real money, fast tracking is an option [9].

Fast tracking is the process of overlapping sequential activities in parallel to compress the project schedule [10]. It is also called phased construction, the pre-arranged phases of the project are started prior to the main project commencement. The biggest advantage is that the construction can begin before the entire designing stage is completed [6].

A fast-track project delivery strategy is designed to leverage the ability to execute multiple phases like the design, procurement and construction phases simultaneously in order to substantially reduce the overall project duration. The ability to fast track implies that the finish-to-start relationship between the activities was discretionary whereas crashing a project means to throw additional resources at the critical path [11].

The current predominant mathematical models of fast-tracking are based on the concepts of activity sensitivity, evolution, dependency and, sometimes, information exchange uncertainty, and aim to determine optimum activity overlaps [12].

According to Anjali [13] Fast tracking management technique is somehow similar with the DB delivery system, explain the DB delivery method in the following way;

Under the Design/Build method, both the design and the construction execution phases of the project are the responsibility of one party or a joint venture. Typically this party is a joint venture between a design and a contractor firm, and this entity is entitled to plan, design construct, implement and control the entire project.

A Design/Build delivery method is highly beneficial for increasing the level of communication between project stakeholders (particularly the design and construction team). The Design/Build method can reduce the total delivery time compared to the traditional approach (design/bid/build), since it allows the design and construction to overlap, in other words this delivery method allows the team to start construction before the whole building design is complete.

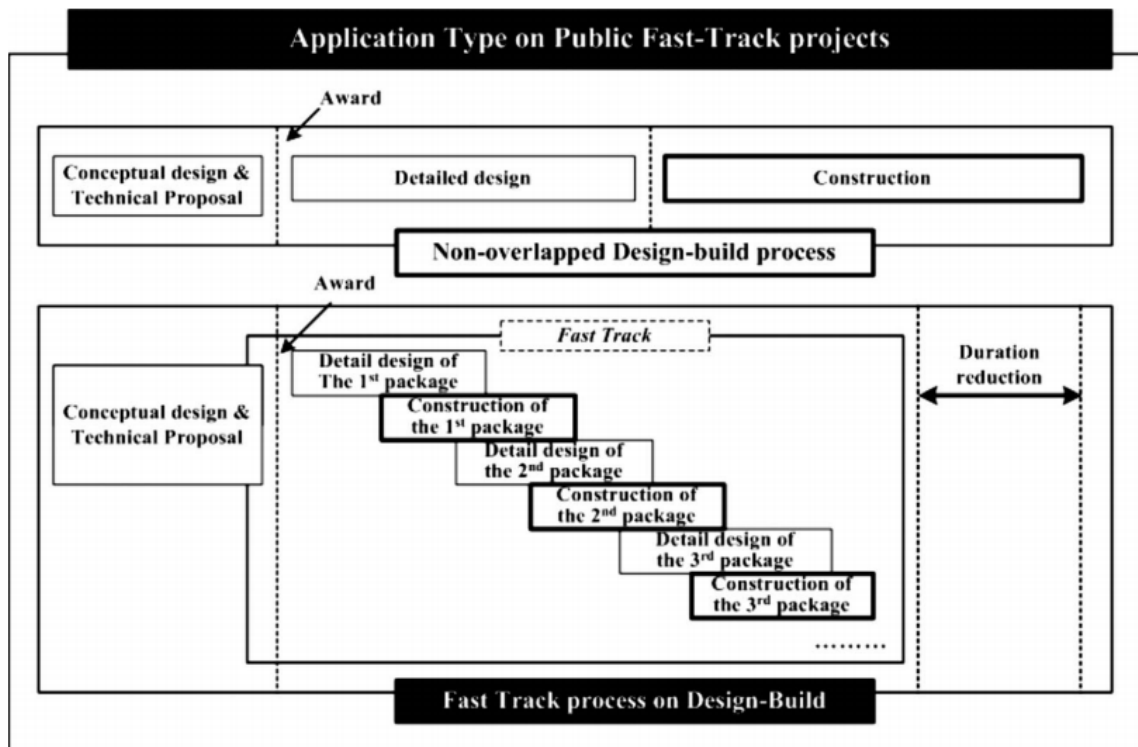


Figure 2. 1: Typical design-build and fast-track design-build models [14].

2.2. General Principles of the Fast Track Approach

Eastham [15] says that the only difference between fast track construction projects and normal/tradition construction project is the extent to which these techniques are applied, and also according to this fast track manual the general principle of fast track method categorized in to the following points.

I. Project stage overlap

A key characteristic of the fast-track project system is that design and production run concurrently. In the construction sector, the Professional Construction Management (PCM) approach combines fast-track management techniques with phased construction techniques to complete projects more quickly and economically [16].

II. Work package overlap:

It is common practice to break down a project into a number of sub-units or work packages to assist with general management and cost control. In the case of the fast track project this is also done: (a) to shorten the schedule by enabling some or all of the work packages to be progressed in parallel with other work packages and (b) to enable the stages of the project process, as it is applied to each of the work packages.

According to [17] in the construction process activity relationship can be classified in to four type.

- A. *Dependent activities*: In order to start, one activity requires the final information from another activity. This type of relationship is also known as finish-to-start dependency, implying that the first activity (predecessor) should be finished before the start of second activity (successor). Otherwise, the start of the successor before the predecessor may generate rework
- B. *Semi-independent activities*: To start, one activity requires only partial information from other activities. This type of relationship have a specific degree of overlapping by nature. However, more overlapping will be risky, similar to dependent activities.
- C. *Independent activities*: No information dependency exists between two activities. This type of relationship can be overlapped to any extent, without any risks. The only requirement is that both activities' resources such as human,

machinery, or material be available all at the same time. Most of the activities in a typical project schedule are independent activities.

- D. *Interdependent activities*: A two-way information exchange between the activities occurs until they are complete. For this type of relationship overlapping is a part of their inherent nature rather than a mean to save time. Although their overlapping is associated with risks of delay and rework, overlapping should not be considered an extra risk, but a must for interdependent activities.

The maximum overlap of a particular activity with its immediate predecessor(s) should be equal to the duration the shortest predecessor [12].

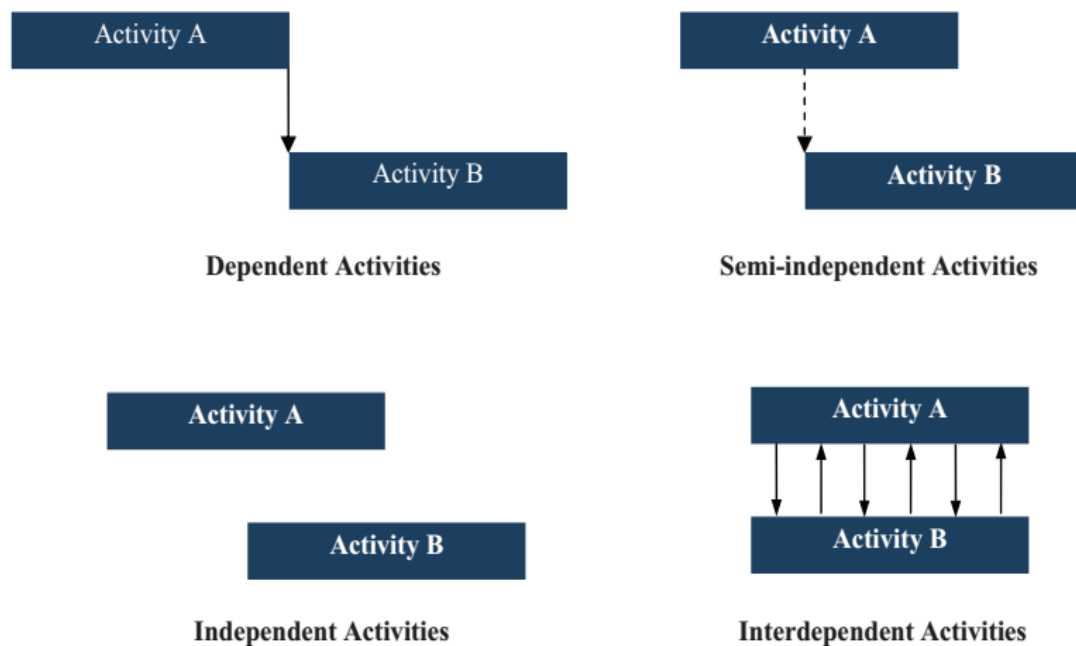


Figure 2. 2: Four types of activity relationships [17]

$$\text{Overlapping \%} = \frac{\text{Duration of the overlapped fraction}}{\text{Total duration of the shorter activity}} \times 100$$

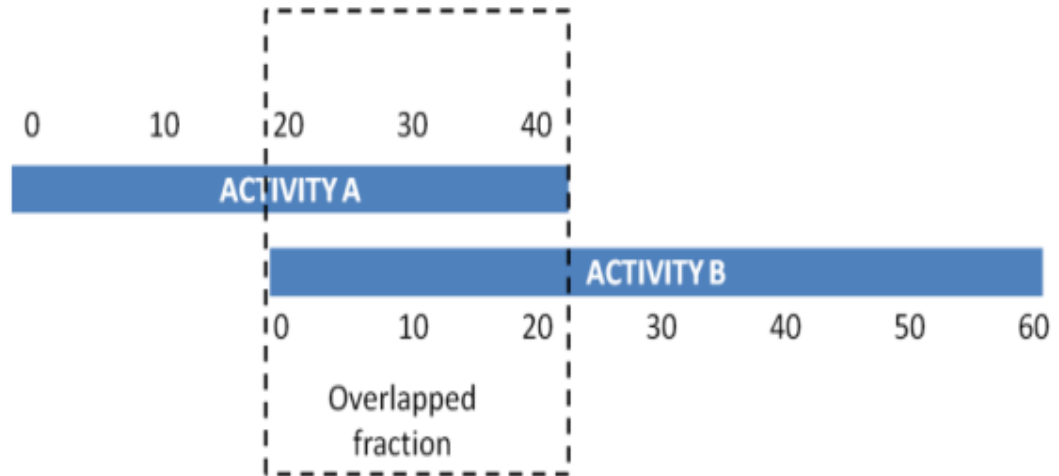


Figure 2. 3: Degree of overlapping between two activities [3].

III. Early Decision

In order to give early decision in the executed construction project first the project have to splits in to different work packages in order to create good situations for making easiest and early decision. But in order to make this kind of quick decisions it must be required experienced judgments to ensure the correct outcome of the project. E.g. starting the site work and foundation works before design of the project fully completed.

IV. Integrated project team

Integrated project team is a group of multidisciplinary people combined together in one organization or company which have common goal in the company which can be participate with their full capacity to achieve the project objectives.

The benefits that the company get from creating integrated project team as an organization are:

- Additional expertise available for the development and definition stages
- Reduction in the overall workload
- Commitment to the project definition
- Design and construction process can be developed together
- Commitment to achieve the project schedule
- Avoidance of contractor and supplier selection delays during the course of the project
- Reduction in the need for approvals from the consultants.

V. Additional staff

During implementing activities parallel more number of staffs are required rather than implementing in sequential, it is therefore necessary to provide resource levels to deliver the plan rather than levelling the plan according to the resources available. The flexible provision of these additional staff should be taken into account when deciding the resource strategy. The parallel path approach will create a higher than normal peak demand for staff to manage and execute the project.

VI. Schedule reduction technique

Scheduling the project is a very important element in a project execution plan [18]. In the construction there are many schedule/time reduction techniques the construction parties' use. Fast-tracking technique is one of the duration reducing technique in the project by means of overlapping construction and design activities.

Shortening the construction period should result in lower financing risk and reduction of indirect construction costs. Accordingly it would seem profitable to adopt the fast-tracking technique on a general basis. In fact, however, only certain construction projects are potential candidates to this management approach [19].

2.3 strategies of Fast Track Construction

Fast tracking strategies are used to achieve shorter project duration. Different types of strategies are affecting the fast track construction, here we discussing about main three strategies such as Delay management, Resources management, Choice of technology [13]. Fast-track construction ensures early completion of projects without dilution of quality. The main three strategies are discussed below:

2.3.1. Delay Management

It is well known that delays in construction projects are the major causes of project failure. Delay could be defined as the time overrun either beyond completion date specified in a contract, or beyond the date that the parties agreed upon for delivery of a project. If the delay is not identified and the corrective project management decision is not taken in time a project may incur extra cost and extension of project time, which gives rise to dissatisfaction to all the parties involved and nowadays it's becoming a major obstruction for their development for developing countries like Ethiopia [7].

2.3.2. Resource Management

Resource management is the process of managing of the required resources on the construction project to accomplish the work within the required time and budget. And prepare scheduled plan how to use, when to use and when to deliver and hire the resource on the site to achieve the goal. Without proper management of the resource the project can not address the satisfactory of the parties due to the variations that happened in the time, quality and cost.

2.3.3. Choice of Technology

As in the development of appropriate alternatives for facility design, choices of appropriate technology and methods for construction are often ill-structured yet critical ingredients in the success of the project for example; a decision whether to pump or to transport concrete in buckets will directly affect the cost and duration of tasks involved in building construction. Technological advances are rolling out almost daily. The choices made during the rushed, fast-track construction time frame affect the organization's ability to take advantage of technology [13].

2.4. Fast-tracking conditions

The reasons given for utilizing a fast track strategy varied with industry but the most common theme was an urgent requirement by the client to take commercial advantage of an opportunity either to maximize profit or limit loss. In some cases a fast track strategy had been adopted because of an imposed deadline such as the start of an academic year, end of a current lease or new legislation. Other reasons given included the need to minimize disruption of services, to improve the commercial standing of a company, especially a contractor, and to improve product quality [15].

The following conditions or project characteristics encourage design and construction overlapping [19]:

- I. *Financial conditions*: Important cost reductions and higher overall project profitability can be achieved by shortening the project duration.
- II. *Project complexity*: It is advantageous to award separate early contracts for portions of the work that are identified as potential constraints.
- III. *Political conditions*: Political decisions and budgetary policies can fix the start and -

completion dates on construction facilities. In practice, by attempting to maximize the benefits of a shorter project duration or in order to meet a fixed delivery date, a phased construction program often slips into the characteristics of a fast-track one. There is also an important condition which qualifies fast-tracking from the start of the project:

IV. *Market conditions*: For industrial buildings there are distinct advantages to being in production while the competition is still designing or building.

2.5. Determining the suitability of fast-tracking for a project

There are various ways to determine whether a project is suitable for the fast-track process or not. [16] Classify the factors in to five.

i. **Design suitability**: In order to identify whether a project is viable for fast tracking, potential participants must have a clear understanding of the field and the project. Design is important for fast-track projects as an advanced design may enable faster delivery or production. It is essential to understand the needs of the project and to identify potential challenges prior to choosing the design.

ii. **Stakeholder alignment**: Stakeholders include people with in your organization and externally and they may be some you are managing downwards or some you are managing upwards.

The needs of all stakeholders must be aligned if the project is to be successful; they must agree on the goals of the project if they are to make decisions and manage risks successfully. Beyond this, vertical alignment within the participating organizations will make it possible to integrate the companies and those involved in the project.

Honest and open communication between project members is crucial as they are being trusted and empowered by the client or owner to resolve issues and make decisions. (Jin & Ling, 2005).

iii. **Strategic clarity**: According to Ed Brenger Strategic clarity is a product of strategic thinking rather than strategic planning.it comes from being clear about who you are, what value you bring for the company or the project, and the outcome should be.

And also the serial entrepreneur defines strategic clarity as the ability to clearly define, quickly adapt, effectively communicate and properly implements the company's business strategies.

- iv. Project-team experience:** In addition to the normal requirement for managerial and technical competence, the development manager should ensure that the development team contains both conceptual and analytical thinking capability in order to reach both a speedy and appropriate conclusion on the preferred option which is to form the scope of the project. Where successive fast-track projects are conducted by the same team, they are usually accomplished more quickly and with fewer concerns. In fact, the team can add value to each new project by implementing lessons learnt from previous projects.
- v. Scope of the execution plan:** At the heart of any successful project lies a full understanding of the real objectives of the client business and the requirements for the delivery of the project. This will enable the critical success factors (CSFs) to be defined in a permanent and meaningful way for the life of the project [15]. Project Execution Planning is more than a chart showing timescales. It is a process describing how, when and by whom a specific target or set of goal is to be achieved. It sets out the strategy for managing the project, describes the policies, procedures and priorities that will be adopted. It may also define strategies in relation to items outside of the scope of the main contract [18].

2.6. Impacts of Fast Track

The impacts of fast track are classified in to three parts [20], which are listed and clarified as follow:

2.6.1. Numerous Change Orders

A fact of life for a construction project is change. Changes result from the necessity to modify aspects of the construction project in reaction to circumstances that develop during the construction process. The changes may be small, well managed, and have little effect on the whole construction project. On the other hand, changes may be large, poorly managed, and have tremendous negative impacts on the construction project performance in terms of time and cost [21].

Moreover, if the project is fast track project various change orders will be expected because design and construction are overlapped and activities are- doing parallel.to minimize the time and cost overrun occurred due to change order more contingency should be considered in the budget and time scheduling.

2.6.2. Construction Rework and Modifications

To manage rework and modification, it is first necessary to identify and classify its causes. Many analysts have suggested that rework and modification is often due to the complicated characteristics of the construction processes [22].

In Fast tracking, the construction starts before the completion of full design. Incomplete drawings and specifications causes various rework and modifications during the construction phase and those two are also become as a source of dispute and conflicts between the construction parties in the construction process.

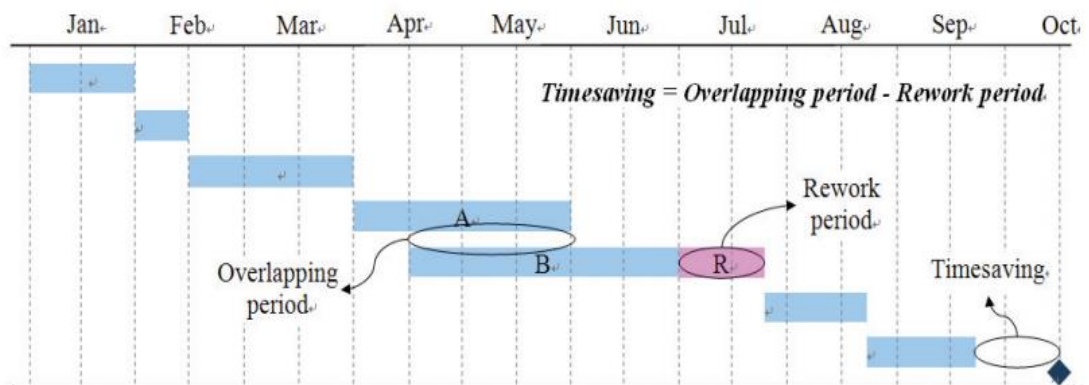


Figure 2. 4: Overlapping time impact on the project schedule [17]

2.6.3. Overlooked work (assigned to no party)

If the plans and specifications for several subcontractors, whose scopes of work interface or overlap at various points, are incomplete, it is likely that the important elements of the project are delegated to no one. Confusing risk responsibilities for these neglected tasks is another legal problem between contracting parties in fast-track projects. Appropriate contracting arrangements with open communication and strong coordination will minimize the risk of overlooking work elements [20].

Fast-track projects can be the answer for companies because they produce results that are-

of comparable quality to conventional delivery methods while still adhering to the same environmental and safety regulations. Risk is present in all types of projects, both fast-track and conventional, but this risk can be mitigated by having experienced team members implement effective risk management techniques.

From a financial perspective, the decision to opt for the fast-track route may actually reduce risk by increasing shareholder value [15].

2.7. Significance of fast tracking

2.7.1. Shorten schedule and Reducing time

Fast tracking construction projects are highly appropriate in construction in order to save time and cost. [23], it is very appropriate method of time saving and helps the project to complete in least amount of time if it is well planned and executed. Many construction delay interconnected with standard method of construction can be well eliminated through fast tracking construction. [24] To make the most of fast-tracking, look at the longest tasks on the critical path first. This provides the largest potential decrease in duration with the fewest number of risks to manage.

Moreover, by fast-tracking only a few long tasks, you also have fewer revisions to make in the schedule. Fast tracking allows us to identify the tasks that are both critical and long and helps in removing the Critical filter [9].

2.7.2. Lower Cost

Reducing the construction time from its original deadline is not normally possible in conventional linear building process so overlapping the design and construction should be introduced to make it happen. The smart construction professionals found out a most economical construction method to save both time and money is construction fast tracking and they recommend this method for future construction era for the sake of client. In addition, a smart construction saves potentially a million of pounds. In construction extension time is considered as an expensive procedure there for the client would not like to take the construction any longer part from its deadline [25].

2.7.3. Team Building

Fast tracking is a good source to maintain team spirit within the company and there are a lot of successful projects that were conducted through fast tracking [24].

Integrated project team is a group of multidisciplinary people combined together in one organization or company- which have common goal in the company which can be participate with their full capacity to achieve the project objectives [15].

2.7.4. Single Point Responsibility

Construction fast tracking can be accomplish without farther delay through single point responsibility. Single point responsibility delivers a smooth construction and that factor can be taken through design and construction type procurement nether traditional type procurement nor management type procurement. The management type procurement can shrink the duration of the project rather than design and built does but there is more chance for disputes [26]. There are also other significance of fast track. The first is the economic benefit. Shorter schedules result in lower costs, as a streamlined process requires fewer man-hours. Populations or communities situated near fast-track projects are not affected as much since these projects take less time to complete (Ogwanga, 2002).

Fast tracking may give a company an edge or advantage over its competitors or emerging similar projects. For this reason, its investors or clients may encourage it to seek early completion [20].

2.8. Delay and fast tracking technique in construction industry

Construction delays are occurring in every phase of a construction project and are common problems in construction projects in Ethiopia. Moreover, it is well known that the delays in construction projects are the major causes of project failure. If the delay is not identified and the corrective project management decision is not taken in time a project may incur extra cost and extension of project time, which gives rise to dissatisfaction to all the parties involved and nowadays it's becoming a major obstruction for their development for developing countries like Ethiopia [4].

Delays in construction cause damages to the project and result in conflict and dissatisfaction to all parties involved. For the project owner, delay may lead to loss of revenue through lack of production facilities and rentable space or a dependence on present facilities. For the contractor, delay may result in cost overrun due to longer work period or penalties, higher material and labor costs. During planning and scheduling, the planned duration of construction projects are often fixed through iterations between experience data and figures, and the requirements of the project owner / sponsor. Planning and managing

time and progress is a key element in achieving project success, both in terms of the classic time-cost-quality triplet of project management, but also in terms of commercial viability for constructors as well as project owners. It is generally assumed that it is a strong relationship between project's time to delivery and its total costs. For some types of costs, the relationship is in direct proportion; for other types, there is a direct trade-off [27].

The main critical factors that cause construction delays in Ethiopia are [4]:

- I) Difficulties in financing project by a contractor;
- II) Escalation of the materials price;
- III) Infective project planning;
- IV) Scheduling or resource management;
- V) Delay in progress payments for completed works,
- VI) Lack of skilled professionals in the field of construction management in the organization,
- VII) Fluctuating labor availability season to season /Seasonal labors availability.

Figure (a) before fast tracking activities

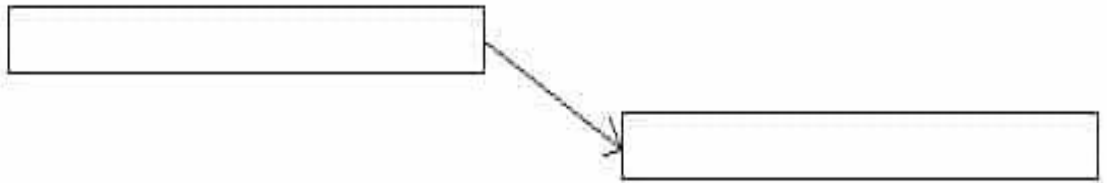


Figure (b) after fast tracking activities

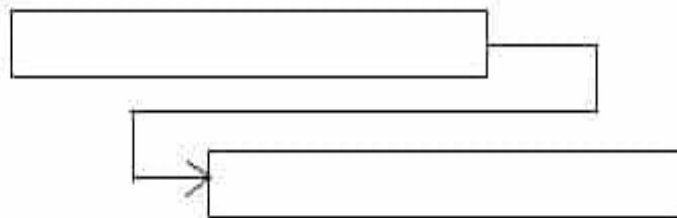


Figure 2. 5: comparing schedule before and after fast tracking the schedule

2.9. General Practices and techniques for shortening project's duration

2.9.1. Constructability Review

The concept of “constructability” is linked to the efficiency with which a structure can be build. The CII also defines constructability as the optimum use of knowledge and experience in planning, design procurement and field operations, in order to achieve the project's objectives [29].

The more constructability, the more cost efficient the building will be. This technique draws upon the importance of including the construction personnel during planning and design phases. Allowing the construction personnel to review and discuss during planning and design makes it easier to avoid problems later on [3].

2.9.2. Lean Construction

Lean construction is a construction management philosophy that has its roots in the Toyota Production System (TPS). TPS's main premises include seeking perfection, aiming for zero defects, no inventories and reducing costs. Lean producers, such as Toyota, are focused on continuously adding value to a product and eliminating the so-called “muda” (waste) or no value-adding activities. There are various approaches for applying the lean construction. However, there is a commercial application of these principles called “The Last Planner” methodology; this is a methodology seeking an increase in productivity, construction performance, quality and significant reductions of time and costs through structured meetings with interdisciplinary teams looking for ways to reduce waste that can affect the construction process [3].

2.9.3. Cycle Time Analysis

In the Operations Management Science, the cycle time indicates the length of time, on average, that it takes to complete a step or set of steps within an operation. Cycle time analysis can be applied to any phase of the project, i.e. Planning, design, materials management, construction and even project close-out [19].

Cycle time analysis can bring significant reductions of time at a relatively low cost, as the cost for implementing this technique is much lower than the total project cost. Other benefits of implementing this technique include [30]: identification of bottlenecks, it boosts productivity, increases employee's sense of ownership and motivation and so on.

2.9.4. Just-in-time Delivery

Just-in-time is a system from operations management that allows the operation to reduce storage costs and general delays because materials and equipment must arrive “just in time” to the site, without having to waste time with unnecessary actions of storing and handling in general.

This technique is can directly applied during the construction phase of a project. The most important success factor for implementing this technique is to have good coordination with suppliers and subcontractors, in order to ensure precision of delivery [30], Supplier’s commitment towards the attainment of specific delivery goals, communication and information sharing are also paramount for achieving a satisfactory JIT implementation.

2.9.5. Building Information Technology (BIM)

“A digital representation of physical and functional characteristics of a facility. A BIM is a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life-cycle; defined as existing from earliest conception to demolition [31]. BIM opens big doors for improving the construction process in terms of time. And particularly facilitates the use of prefabrication/modularization in order to make the whole process simpler and more efficient [32].

2.9.6. Project Crashing

A schedule compression technique in which cost and schedule tradeoffs are analyzed to determine how to obtain the greatest amount of compression for the least incremental cost. Examples of crashing could include approving overtime, bringing in additional resources, or paying to expedite delivery to activities on the critical path. Crashing only works for activities where additional resources will shorten the duration. Crashing does not always produce a viable alternative and may result in increased risk and/or cost [33].

2.9.7. Concurrent Engineering

Concurrent Engineering or Simultaneous Engineering is a methodology originally developed for new product development. This technique is based on the parallelization of tasks in order to shorten the time to market and improve productivity. This approach is intended to cause the developers from the very outset to consider all elements of the product life cycle, from conception to disposal, including quality, cost, schedule, and user requirements.

There are mainly three applications of concurrent engineering in the project-world, namely concurrent design, concurrent construction and project fast-track [3].

2.9.7.1. Concurrent design

Concurrent engineering can be applied during the design process, in order to reduce the time required to complete this phase of the project.

In general, this technique involves reducing the dependencies between activities. In order to find strategies for reducing these dependencies between activities, it is necessary to recognize the characteristics of evolution and sensitivity between the two activities in question [19]:

Evolution refers to the rate at which an upstream activity generates information if there is no pressure for accelerate the work and Sensitivity refers to how much rework would be needed within a downstream activity if there were information changes.

2.9.7.2. Concurrent construction

Another effective way to compress the project schedule through concurrent engineering, is by applying the technique within the construction phase of the project. In this case however, the project design must be finished and the relationships between activities (construction activities) are assumed to be only physical relationships. Bogus shows that in construction “physical relationships” are practically linked to workspace and resources availability. Thus, two activities can be overlapped only to the extent that resources and workspace are available [34].

2.9.7.3. Project fast-track

Project fast-track is a technique that also stems from the principles of concurrent engineering. The fast-tracking technique reduces the duration of the project by means of overlapping construction and design activities. A clear example would be starting the construction of foundations before the design drawings are completed. Project fast-tracking can dramatically reduce the time of a project, but at the same time it increases the risks of rework and schedule delays [3].

The Comparison of Conventional Project with Fast Track Projects Represents graphically as follows [13]:

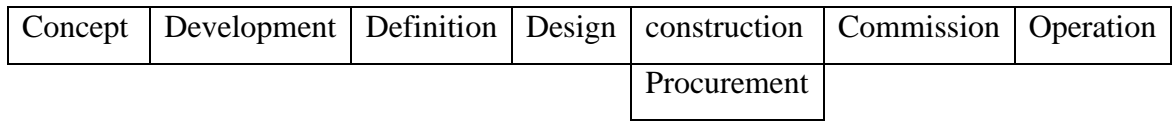


Figure (a) Conventional/ Normal project

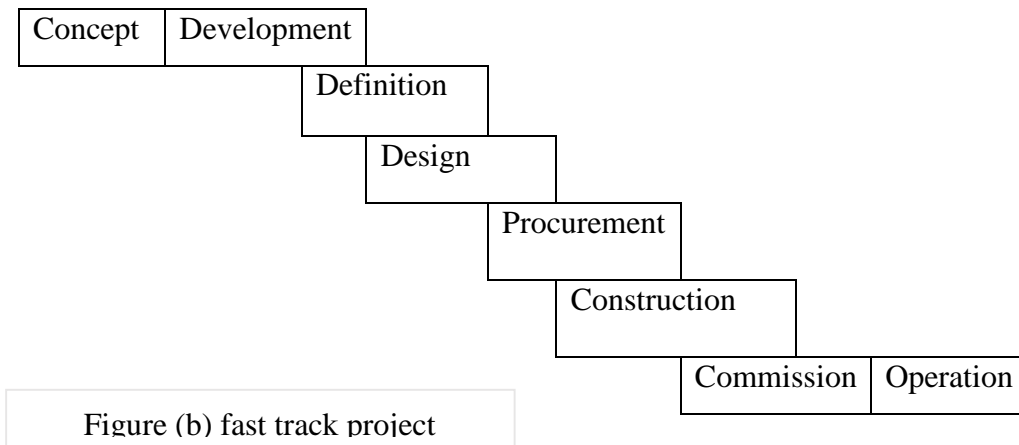


Figure (b) fast track project

Figure 2. 6: comparison of conventional project with fast track project

So, on this study the researcher assess one of the concurrent engineering applications which is fast tracking technique, the applicability and its principle on the construction industries in Ethiopia in Addis Ababa city.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Study Area

The study was conducted in Addis Ababa which is capital city of Ethiopia. The city is located at the geographical center of the country and it lies between $8^{\circ}55'$ - $9^{\circ}05'$ north latitude and $38^{\circ}40'$ - $38^{\circ}50'$ east longitude. Its average altitude is 2408 meters above the sea level. The highest peak is found at Mount Entoto with 2800 meters. The lower part of the Akaki plain has an altitude of 2200 meters. The Entoto massive in the north surrounds the city. The upper part of the city is characterized by steep slopes with high mountains, flat topped plateau while the lower part is less steep. The city is endowed with numerous streams that start from northwest and northeast running towards the south and draining to the Awash River. The city administration extends over 540 square kilometers with 10 sub-cities and 116 Woredas for administrative purpose.

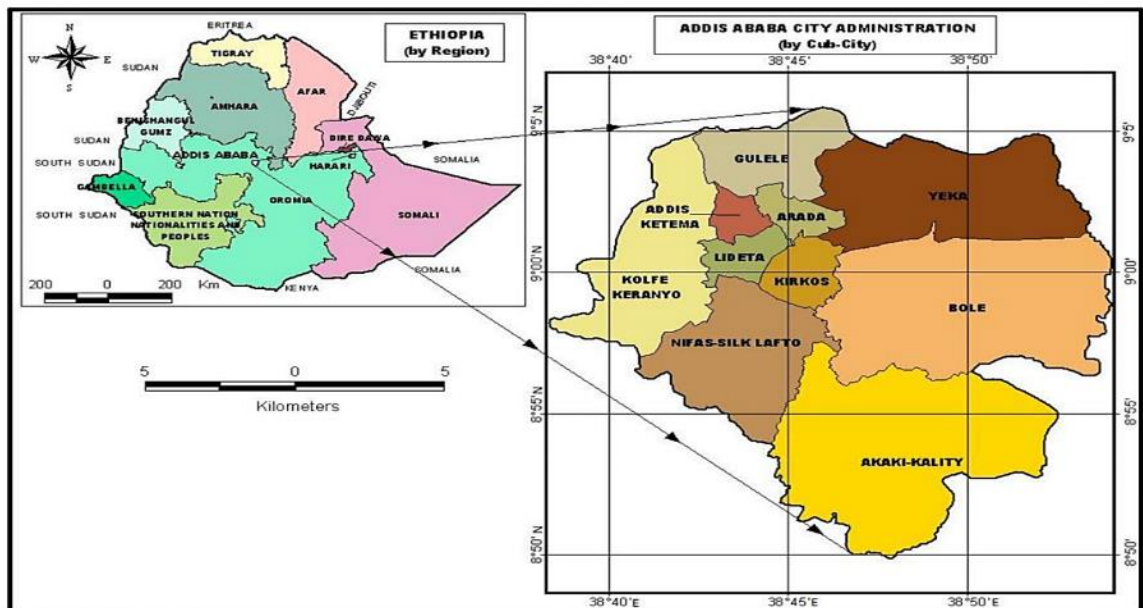


Figure 3. 1: Map of Addis Ababa administrative division

3.2 Research design

Research design is the arrangement considered for the collection and analysis of data to achieve the objectives of the research. A descriptive and numeric (qualitative and quantitative) survey research design was used in this research.

The research was numeric type because it concerned on gaining information with in percentage and frequency about the fast tracking construction principle in construction projects, and it was descriptive type because it tried to describe the applicability of fast tracking principle and the awareness of the parties who participate in the construction industry in the city of Addis Ababa.

Hence, in order to achieve the objectives of the research, the research was carried out using the following approaches.

- i) **Literature review:** The first is to undertake a literature search on previous related publications in connection with building construction defects. Literature review was carried out throughout the whole research project, this was to compile and discuss information related to the thesis objectives.
- ii) **Questionnaire and interview questions-** questionnaire was developed and distributed to the concerned bodies of building construction, i.e. contractors and consultants. The questionnaire contains four main parts, as listed below:
 - ✓ **Part one:** contains a set of questions related to the profile of the respondents in relation to organizational profile, which contains two sections.
 - ✓ **Part two:** contains a set of questions related to delay factors and effects of delay on project cost.
 - ✓ **Part three:** contains a set of questions related to the conditions, suitability factors to apply fast track and Factors that affect the adoption of fast track technique.
 - ✓ **Part four:** contains a set of questions related to impacts and significance of fast track construction techniques on the construction industry.
- iii) **Data analysis:** the data gathered from questionnaire and the interview was analyzed on the basis of the objectives of the study.
- iv) **Conclusion and recommendations:** from the analysis of the data as well as the literature review, findings are developed and conclusions are formulated respective of the objectives of the study and recommendations are then made from the findings.

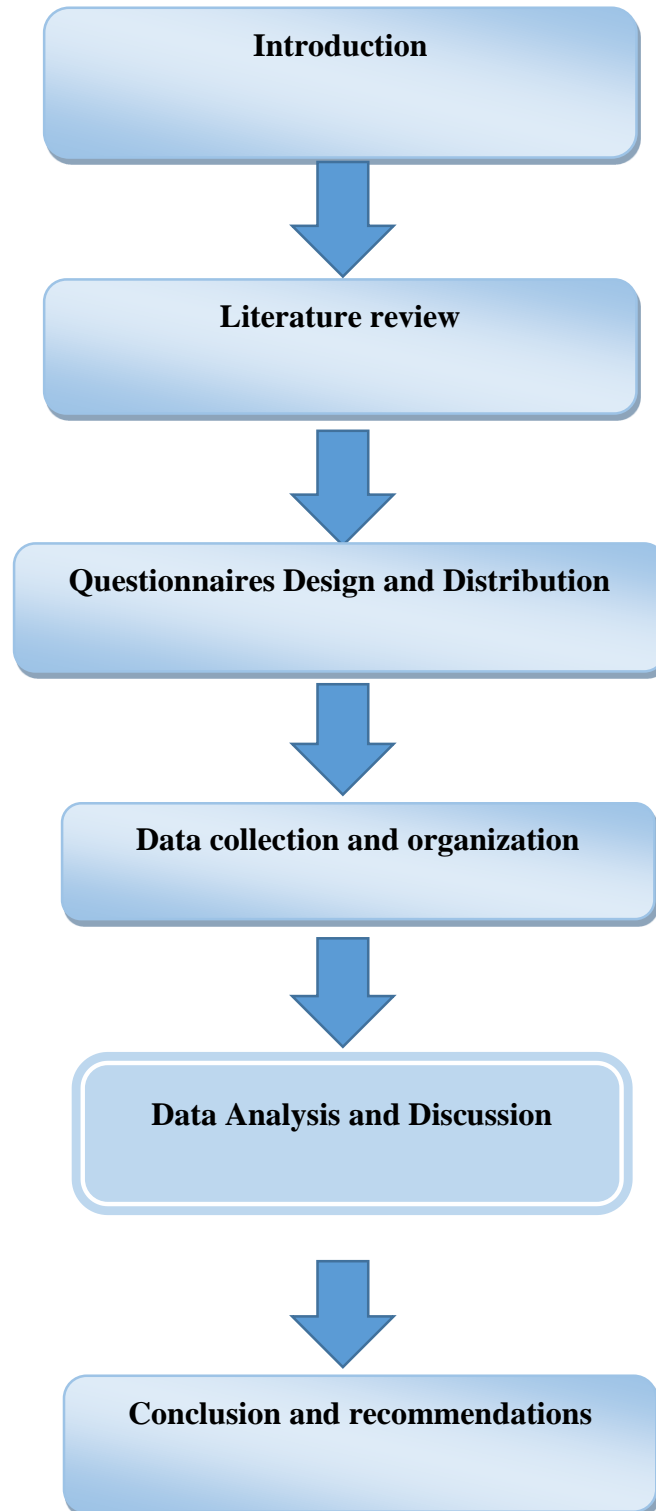


Figure 3. 2: Flow chart of the research methodology.

3.3. Study Variable

Dependent Variable

- Fast track construction Concepts

Independent Variables

- Time of completion
- Cost
- Conditions of fast track
- Factor affecting fast track construction

3.4 Population and sampling method

3.4.1 Study Population

The population of the study is building construction projects, and the main source of information was gathered from number of contractors and consultant which are involving in building construction projects in Addis Ababa city.

3.4.2 Sample Size and Sampling Procedure

The selection of the samples was done based on non-probabilistic sampling method, from non-probabilistic purposive sampling method was applied in this research paper.

The list of contractors and consultants currently involved in building construction projects were obtained from Addis Ababa construction bureau after that by considering their back ground from their website companies for the study was purposively selected.

3.5 Source of data

Both primary and secondary data collection method was adopted, primary data was collected from questionnaire, interview, and secondary data was collected from literature review and other supportive documents. Combining the above different sources and compiling them helps as evidence of one for another and as means of minimizing the errors in the data collection process in order to get good output of the research.

3.5.1. Primary Data Sources

Questionnaires

A questionnaire survey was used to examine the relevant factors and identify their importance based on RII. In order to collect data about fast track management technique on the building construction industry in Addis Ababa City. A questionnaire distributed to the construction companies might be a good approach.

Questionnaires have been widely-used for descriptive and analytical surveys in order to find out facts, opinions and views on what is happening, who, where, how many or how much. Questionnaires were used for collecting information from different construction companies to reach the final conclusions.

Interview

The primary advantage of in-depth interviews is that they provide much more detailed information than what is available through other data collection methods, such as surveys. Due to this an interview was conducted on owner and others side since they are much more available in the constructed buildings relative to the other parties.

3.5.2. Secondary Sources

The Secondary sources of data were obtained from various title related literatures through different journals, articles, MSc and BSc thesis and related documents from website.

3.6 Data collection procedure

The researcher collects some important and related literatures from journals, books and various documents which are helpful for the study. After collecting those data the researcher was prepare some questions in the form of questioner and distribute for the parties in the construction industries. The participants were requested to allocate marks from 1 to 5 (a 5-point Likert's scale): 1-very low/strongly disagree; 2-low/disagree; 3-medium/undecided; 4-high/agree; 5-very high/strongly agree to each factor according to their knowledge after some days the distributed questionaries' were gathered and data analysis was done .

3.7 Data presentation and analysis

The collected data from respondents was categorized at the time of data entry. As a result, the analysis combines groups of respondents (contractor and consultants) in order to obtain significant results. Data was analyzed by calculating frequencies and Relative Importance Index (RII) and also by using SPSS software. The Relative Importance Index (RII) was calculated as follows:

$$RII = \frac{\Sigma W}{AxN} = \frac{1*n1+2*n2+3*n3+4*n4+5*n5}{5xN} \dots\dots\dots Eqn3.1$$

Where; W = weight given to each factor by respondents ranging from 1 to 5.

n1 = number of respondents for strongly dis agree,

n2 = number of respondents for disagree,

n3 = number of respondents for neutral,
 n4 = number of respondents for agree,
 n5 = number of respondents for strongly agree).

A = highest weight

N = total number of respondents.

Relative Importance Indices (RII) is a statistical method which is used to rank the results by taking into account the average scores. The RII value had a range between $0 < RII \leq 1$.

Table 3. 1: Values assigned for the Likert scale in the questionnaire

Item	Very low	Low	Medium	High	Very high
scale	1	2	3	4	5

Table 3. 2: values assigned for the likert scale in the questionnaire

Item	strongly disagree	Disagree	undecided	Agree	strongly agree
scale	1	2	3	4	5

The collected data from different sources and results was analyzed and interpreted through charts, graphs, figures and tabular formats using Excel and other management tools that are used to verify the level of awareness of the parties in the construction industry, to describe the suitability factor and conditions that make the construction project to apply fast track construction technique and to determine the major significance and impacts of fast tracking technique in the construction industry.

3.8 Data Quality Assurance

In order to assure the quality of data, the researcher administered the questionnaires to the relevant respondents in an effort to achieve the necessary information. Moreover, data collectors were trained on the aspects of the questionnaire and how to handle the respondents and the data carefully. During the data analysis, the raw data used in Microsoft excel and SPSS software were checked repeatedly whether the values were exactly the same as the given value by the respondents to avoid any wrong results.

3.9. Ethical consideration

The researcher first informed participants about the nature of the study and requested their consent to participate. Only those organizations and personnel who were voluntary to participate in the research were approached for an interview and for comment too. The researcher also assured that the names of respondents would not be revealed in the study. For reasons of ensuring that respondents become anonymous, direct quotations from respondents were merely ascribed to respondent's code. The researcher also committed to report the research findings in a complete and honest fashion, without misleading others about the nature of the findings. In this regard, all materials belonging to another person or organization have been duly acknowledged. Finally, the researcher took appropriate measures to ensure the research would cause no physical or psychological harm to research participants. As a general rule, therefore, the study did not raise any ethical concern.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1. Basic Information on Respondents and Organization Profile

This section mainly designed to provide general information about respondent's organization, position, and experience in building construction projects. For this study, the sample population composed of professionals from the consulting firms, and constructing organizations which are engaged in building construction projects within Addis Ababa city was used as the main sources.

4.1.1. Company type

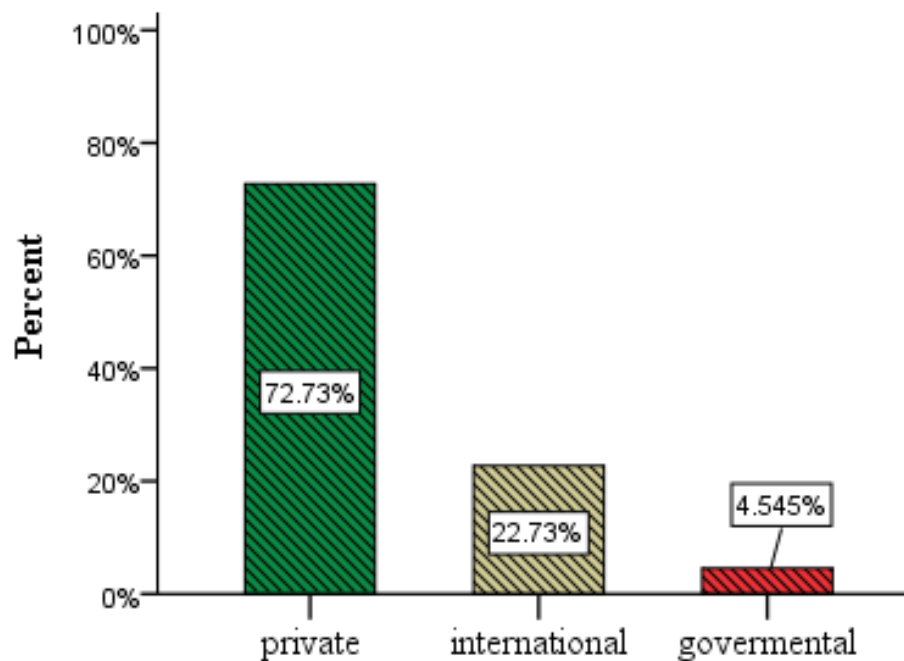


Figure 4.1: Company type of respondent.

Figure 4.1 shows the respondents company type of the building construction who practice fast track technique in Addis Ababa. According to data gathered from the respondents 72% of the company type are local private companies, 27.73% of the company type are international companies and 4.545% of the company type are governmental companies.

The graph shows that local private companies are more engaged in fast track construction management technique than governmental companies.

4.1.2. Role of respondents

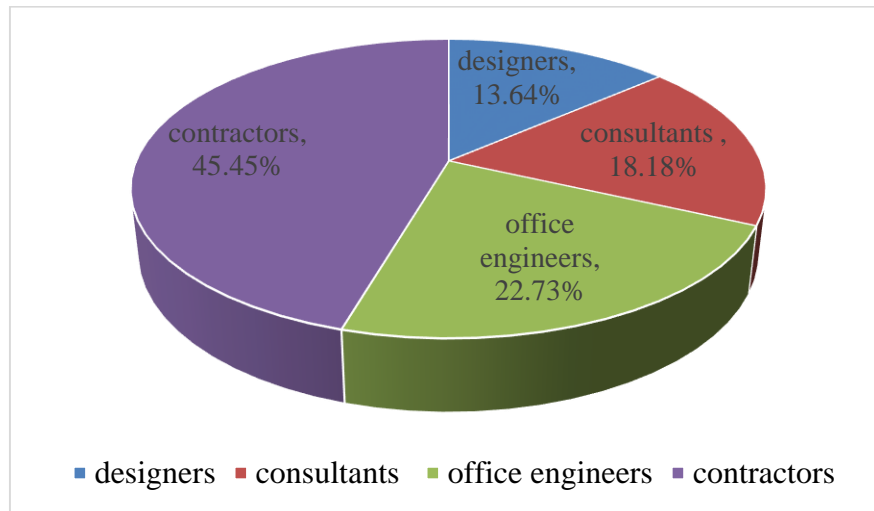


Figure 4. 2: Role of respondents who participate in the research.

The professional mix includes designer, office engineers, contractor and consultants. For the preparation of comprehensive analysis, thirty (30) questionnaires were distributed to the respondents as follows: 10 to consulting firms and 20 to constructing organizations. Out of the distributed questionnaire 26 questionnaire were filled and returned from the returned 4 (13.3%) was invalid response, 22 (73.3%) valid responses were collected as follows: 7 (31.8%) from consultants and 15 (68.18%) from contractors’ respondents.

4.1.3. Respondents year of experience

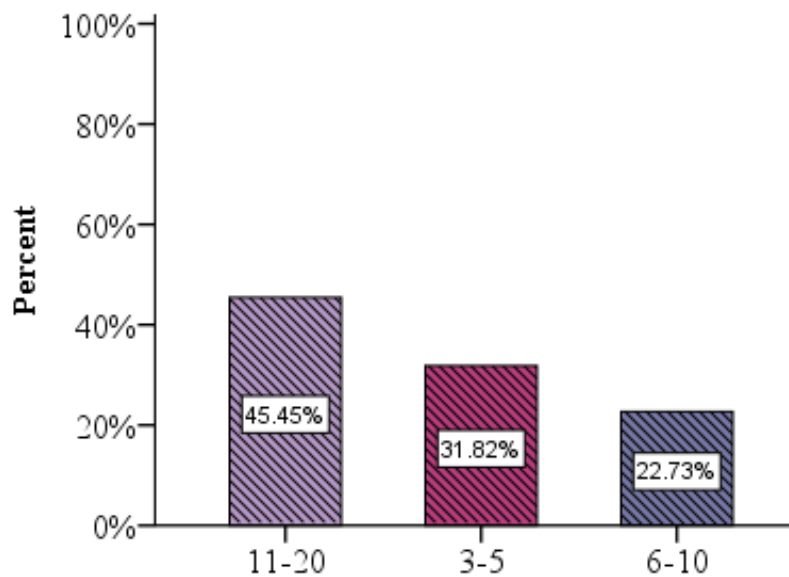


Figure 4. 3: Experience of the respondents in Addis Ababa building construction projects

Figure 4.3 shows that, the overall experience of the respondents in Addis Ababa building construction projects. In the Figure, 31.82% of the respondents found to possess a work experience of 3- 6years and 27.73% of the respondents had 6-10 years of building work experience. Similarly, the remaining 45.45% of the respondents were found to have a work experience of 11-20 years and above.

4.1.4. Projects contract type

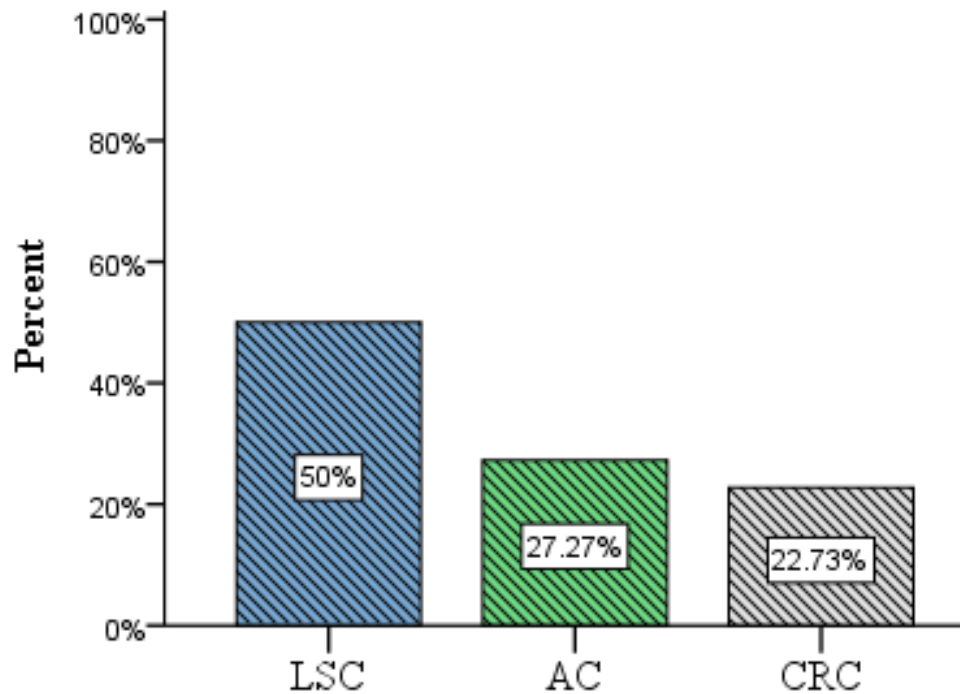


Figure 4. 4: contract type of the participating companies

Based on the result shown in Figure 4.4 out of 22 respondents 11 (50%) are used lump sum contract type and 6 (27.27%) are used Admeasurement contract type and the remaining 5 (22.73%) are used cost reimburse contract type.

Hence, from the data it can be concluded that most of the company who practice fast track management technique in building construction projects in the city of Addis Ababa uses lump sum contract type. Because lump sum contract type is a contract which the contractor and the client agreed on that the price is determined and quoted as a total sum of money without individual ratings. Payments are agreed at different stages of works or services.

4.1.5. Project delivery system

A project delivery method is a system used by an owner for organizing and financing design, construction and operations services by entering into legal agreements with one or more parties.

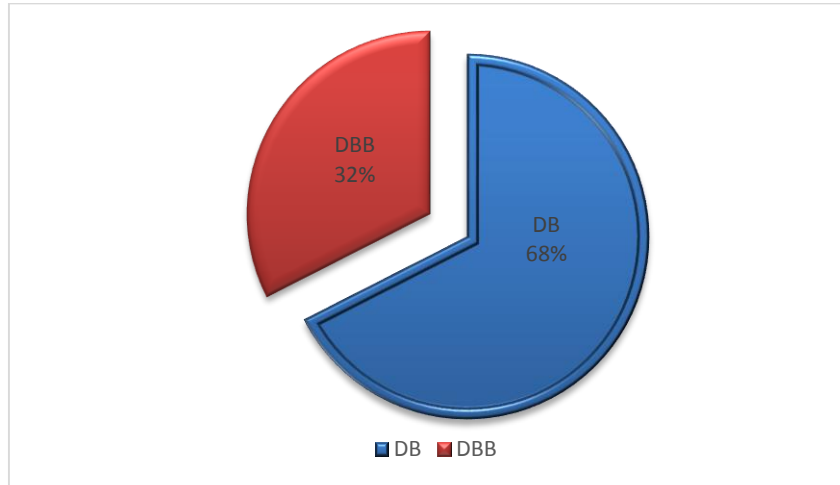


Figure 4. 5: project delivery system

Out of the different project delivery systems the building construction project who practice fast track management technique uses DB and DBB delivery system only, and out 22 respondents 15(68%) use DB and 7(32%) uses DBB.

Based on the data gathered most of the fast tracked building construction project in Addis Ababa city uses design build delivery system. Because during using DB delivery system an owner develops a conceptual plan for a project, then asks bids from joint ventures of architects and/or engineer and builders for the design and construction of the project. But during using DBB delivery system an owner develops contract documents with an architect or engineer consisting of a set of blueprints and a detailed specification. Bids are asked from contractors based on these documents; a contract is then awarded to the lowest responsive and responsible bidder.

So during design bid build delivery system the contractor and consultants do not have much smooth relations like the consultant and contractors who make joint venture on the DB delivery system to facilitate the project as required by the client. Based on those reasons DB delivery system is more suitable for fast track management technique than DBB delivery system.

The number of building projects executed by each organization involved in the study are clearly detailed in the table below.

Table 4. 1: Frequency and percent of number of projects executed in each target group

Number of Executed Projects	Contractor		Consultant	
	Frequency	Percent	Frequency	Percent
1-5	13	86.67%	5	71.4%
6-10	1	6.67%	2	28.6%
11-15	1	6.67%	0	0
Over 16	0	0	0	0
Total	15	100%	7	100%

Based on the finding presented in Table 4.1 86% of the contractors executed 1-5 projects by using fast track management technique, 6.67% contractors executed 6-10 projects and similarly 6.67% contractors executed 11-15 projects. And it can be seen from the consultant point of view similar to contractor’s project 1-5 projects take the highest percent which is 71.4% and 28.6% consultants consult and design project 6-10 projects but not executed 11-15 projects.

4.1.6 Respondents awareness

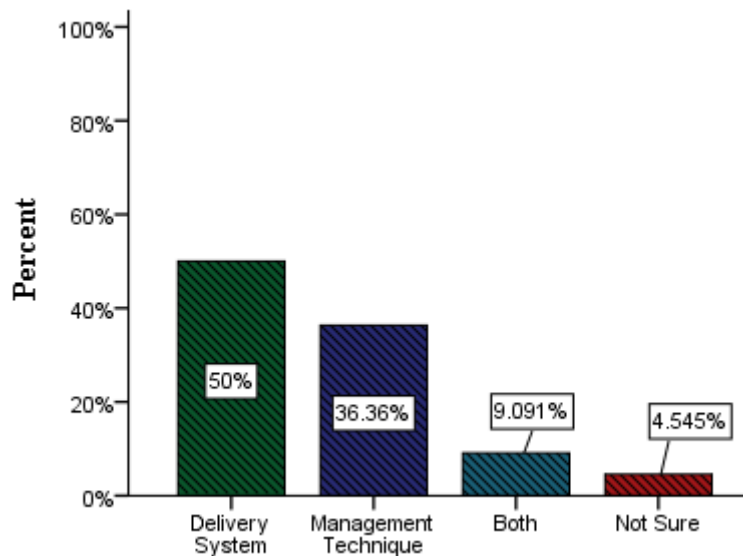


Figure 4. 6: Awareness of the respondents about fast track concept

The first objective of the research, which focused on verifying the level of awareness of the construction parties on fast track construction technique in building construction projects, Was discussed on this part, a questioner which includes question that measure the level of awareness of the respondents distributed among the parties and based on their response the result is analyzed in figure 4.6 by using SPSS software.

From Figure 4.6, 50% of the respondents agree that fast track is delivery system rather than management technique, 36.36% of the respondents agree that it is management technique, 9.091% of respondents think it is both delivery system and management technique and the remaining 4.545% respondents do not have any idea whether it is delivery system or management technique.

Depending on their response most of the respondents think that the design build delivery system and fast track are similar terms. But according to the literature reviews fast track is not design build delivery system but it is management technique which is used in both design build delivery system and design bid build delivery system.

So that the awareness of most of the parties on fast track management technique in Addis Ababa city is different from its main concept in the literature but there are parties who understood the correct concept of fast track.

4.2. Factors that Causes Delay on Building construction project

Table 4. 2: RII Analysis Factors that Causes Delay on Building Construction Project

				Contractors Response			Consultants response		
No	Factors	Likert Scale	Wi	Total	RII	Rank	Total	RII	Rank
1	Poor planning and scheduling of the project	Very low	1	59	0.786	1	32	0.914	1
		Low	2						
		Medium	3						
		High	4						
		Very high	5						
2	Availability of resources	Very low	1	55	0.733	5	27	0.771	2
		Low	2						
		Medium	3						
		High	4						
		Very high	5						
3	Market Strike	Very low	1	58	0.773	2	24	0.685	3
		Low	2						
		Medium	3						
		High	4						
		Very high	5						

4	Shortage of skilled labor	Very low	1	57	0.760	3	22	0.628	4
		Low	2						
		Medium	3						
		High	4						
		Very high	5						
5	Organizational influence and culture	Very low	1	46	0.613	6	22	0.628	4
		Low	2						
		Medium	3						
		High	4						
		Very high	5						
6	Redtapes (bureaucratic)	Very low	1	56	0.746	4	21	0.60	5
		Low	2						
		Medium	3						
		High	4						
		Very high	5						
7	Environmental conditions	Very low	1	41	0.546	7	20	0.571	6
		Low	2						
		Medium	3						
		High	4						
		Very high	5						

As described in Table 4.2 the top three factors which cause delay according to the contractor's point of view and consultants' point of view are discussed below.

Poor planning and scheduling of the project have were ranked by the contractors' and consultants' respondents in the first position with RII = 0.786 and RII = 0.914 respectively. Availability of resources was ranked by consultants' respondents in the second position with RII = 0.771 but ranked by contractor's respondents at the fifth position with RII = 0.733 and market strike was ranked by contractors' respondents in the second position with RII = 0.773 but ranked by consultants' respondents in the third position with RII = 0.685. Shortage of skilled labor was ranked by the contractors' respondents in the third position with RII = 0.760 but ranked by consultants' respondents in the fourth position.

The finding show that poor planning and scheduling and market strike are the key cause of delay respectively for both contractor and consultant, this indicates that the industry should have to improve the planning and scheduling system and also the parties have to assess the sustainability of the market. Based on the results environmental conditions or delay due to ecology is not key factor to consider as cause of delay in the construction projects.

4.3. Effects of Construction Delay on the Project Cost

Table 4.3: RII Analysis on Effects of Construction Delay on the Project Cost

No	Effects of construction delay on project cost	Likert Scale	W _i	Contractors Response			Consultants Response		
				Total	RII	Rank	Total	RII	Rank
1	Market Inflation/ increase material cost	S. Disagree	1	67	0.893	1	34	0.971	1
		Disagree	2						
		Neutral	3						
		Agree	4						
		S. Agree	5						
2	By increase overhead cost	S. Disagree	1	65	0.866	2	33	0.942	2
		Disagree	2						
		Neutral	3						
		Agree	4						
		S. Agree	5						
3	Lobar cost	S. Disagree	1	64	0.853	3	29	0.814	3
		Disagree	2						
		Neutral	3						
		Agree	4						
		S. Agree	5						
4	Foreign exchange rate	S. Disagree	1	63	0.84	4	26	0.742	4
		Disagree	2						
		Neutral	3						
		Agree	4						
		S. Agree	5						
5	Time value of money	S. Disagree	1	47	0.626	5	23	0.657	5
		Disagree	2						
		Neutral	3						
		Agree	4						
		S. Agree	5						

Under this section, both the contractors and consultants' respondents has similar point of view on the effects of construction delay on the project which they give similar ranks for all the listed factor. Such that the first effect of delay on the project cost is due to increasing material cost/market inflation with RII = 0.893 and RII = 0.971 respectively. The second factor was by increased overhead cost with RII = 0.866 and RII = 0.942 respectively.

The third factor is labor cost with RII = 0.853 and RII = 0.814 respectively. Fourth Foreign exchange rate with RII = 0.84 and RII = 0.742 respectively.

In addition, the fifth factor is Time value of money with RII 0.626 and RII = 0.657 respectively.

The main effect of delay obtained from the study is market inflation/increasing material cost. This factor adversely affecting project performance due to unstable market conditions while the 2nd ranked effect of delay is related with over-head cost of the project. This factor affects the parties by expending additional cost. Those additional cost are payment for labor and other related costs of project loses due to delay happens on the project.

4.4. Conditions that Make the Construction Parties to Apply Fast Track

Table 4. 4: RII Analysis on Conditions that Make the Construction Parities to Apply Fast Track Technique.

				Contractors Response			Consultants Response		
No	Fast track conditions	Likert Scale	W _i	Total	RII	Rank	Total	RII	Rank
1	Project complexity	Very low	1	55	0.733	2	26	0.742	1
		Low	2						
		Medium	3						
		High	4						
		Very high	5						
2	Market conditions	Very	1	57	0.760	1	25	0.714	2
		Low	2						
		Medium	3						
		High	4						
		Very high	5						
3	Political conditions	Very low	1	44	0.586	4	22	0.628	3
		Low	2						
		Medium	3						
		High	4						
		Very high	5						
4	Financial conditions	Very low	1	45	0.60	3	21	0.6	4
		Low	2						
		Medium	3						
		High	4						
		Very high	5						

Among the four conditions listed for ranking their priority, Market conditions is the first condition selected by the contractors' respondents with RII = 0.760 and selected by the-Consultant respondents at the second condition with RII = 0.714.

The second condition selected by the contractor's respondents was project complexity with RII = 0.733 and this condition is selected by consultant respondents at the first condition with RII = 0.742. Financial conditions selected by the contractors' respondent at the third condition with RII = 0.60 but the consultants' respondents select at fourth condition with RII = 0.6 and Political conditions selected by the contractors' respondent at the fourth condition with RII = 0.586 but the consultant respondents select at third condition with RII = 0.628.

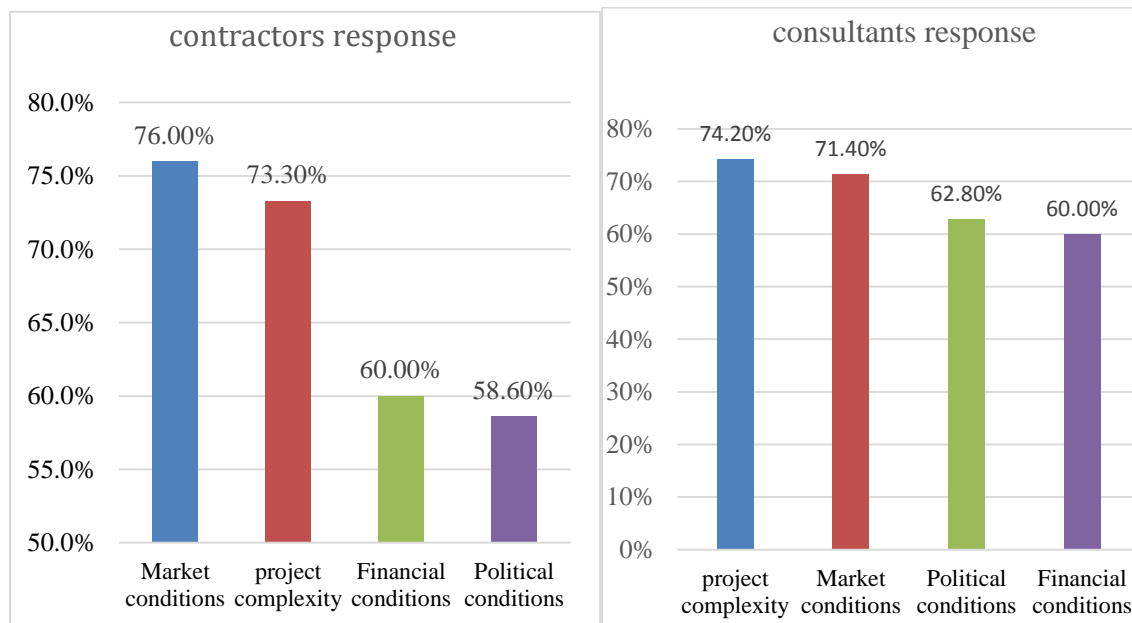


Figure 4. 7: conditions that make Construction Company to use fast track

The crucial driver to implement fast track management systems were identified by the study are project complexity in order to give the work for different sub-contractors separately for the purpose of facilitating the project. The other important condition for fast track is market condition which related with to remain competitive within industry market.

4.5. Suitable Factors for Fast Track

Table 4. 5: RII Analysis on Suitable Factors for Fast Track

No	Key considerations	Likert	W _i	Contractors Response			Consultants Response		
				Total	RII	Rank	Total	RII	Rank
1	Design suitability	Very low	1	61	0.813	2	34	0.971	1
		Low	2						
		Medium	3						
		High	4						
		Very high	5						
2	Stake holder alignment	Very low	1	52	0.693	4	28	0.8	2
		Low	2						
		Medium	3						
		High	4						
		Very high	5						
3	Project team experience	Very low	1	63	0.84	1	28	0.8	2
		Low	2						
		Medium	3						
		High	4						
		Very high	5						
4	Strategic clarity	Very low	1	49	0.653	5	24	0.685	3
		Low	2						
		Medium	3						
		High	4						
		Very high	5						
5	Scope of the execution plan	Very low	1	53	0.707	3	20	0.571	4
		Low	2						
		Medium	3						
		High	4						
		Very high	5						

The analysis shown in the Table 4.5 describe that suitability factors for construction project to apply fast track technique ranked by using RII based on both contractors and consultants point of view. According to contractors the first three suitability factors are: Project team experience (RII=0.84), design suitability (RII=0.813) and scope of the execution plan (RII=0.707) are ranked respectively.

In addition, according to consultants' response the first three suitability factors are: Design suitability (RII=0.971), project team experience and stake holder alignment (RII=0.8) and strategic clarity (0.685) are ranked respectively.

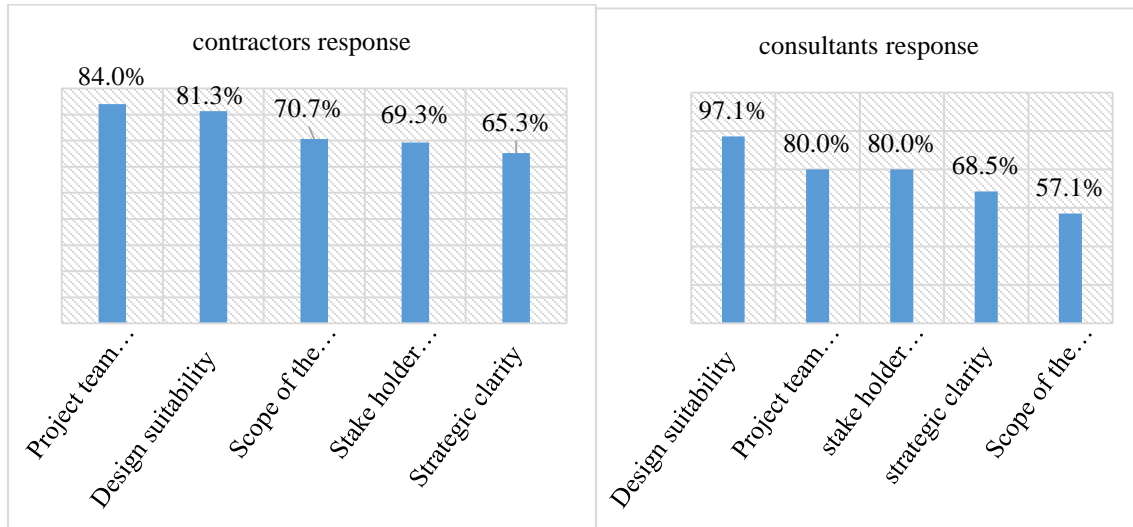


Figure 4. 8: Suitability factors

Both the contractors and consultant response ranked design suitability and project team experience among the first three suitability factors.

Design suitability ranked at first position because Design is important for fast-track projects as an advanced design may enable faster delivery. And in order to attain the project objective skilled and experienced team are required in the project.

4.6. Factors that Affect the Adoption of Fast Track Technique

Table 4. 6: RII Analysis on Factors that Affect the Adoption of Fast Track Technique

No	Factors that affects the adoption of fast track	Likert Scale	Wi	Contractors Response			Consultants response		
				Total	RII	Rank	Total	RII	Rank
1	Requiring strong and experienced manpower resource,	S. Disagree	1	63	0.84	1	33	0.942	1
		Disagree	2						
		Neutral	3						
		Agree	4						
		S. Agree	5						
2	Design and procurement	S. Disagree	1	58	0.773	4	32	0.914	2
		Disagree	2						
		Neutral	3						
		Agree	4						
		S. Agree	5						
3	Environmental conditions	S. Disagree	1	45	0.6	6	32	0.914	2
		Disagree	2						
		Neutral	3						
		Agree	4						
		S. Agree	5						

4	Selecting contractor	Disagree	1	57	0.76	5	30	0.857	3
		Disagree	2						
		Neutral	3						
		Agree	4						
		S. Agree	5						
5	Poor Design management	S. Disagree	1	61	0.813	2	27	0.771	4
		Disagree	2						
		Neutral	3						
		Agree	4						
		S. Agree	5						
6	Material procuring	S. Disagree	1	59	0.786	3	25	0.714	5
		Disagree	2						
		Neutral	3						
		Agree	4						
		S. Agree	5						

The top three most factors that affect the adoption of fast track technique according to the contractor's point of view and consultants' point of view are discussed below.

Requiring strong and experienced manpower resource, especially in project management has been ranked by both the contractors' and consultants' respondents in the first position with RII = 0.84 and RII = 0.942 respectively. Poor Design management has been ranked by contractors' respondents in the second position with RII = 0.813 but ranked by consultants respondents at the fifth position with RII = 0.77 and Material procuring has been ranked by contractors' respondents in the third position with RII = 0.786 but ranked by consultants' respondents in the sixth position with RII = 0.714. Design and procurement and Quality were ranked by the consultants' respondents in the second and third position with RII = 0.914 and RII = 0.885 respectively.

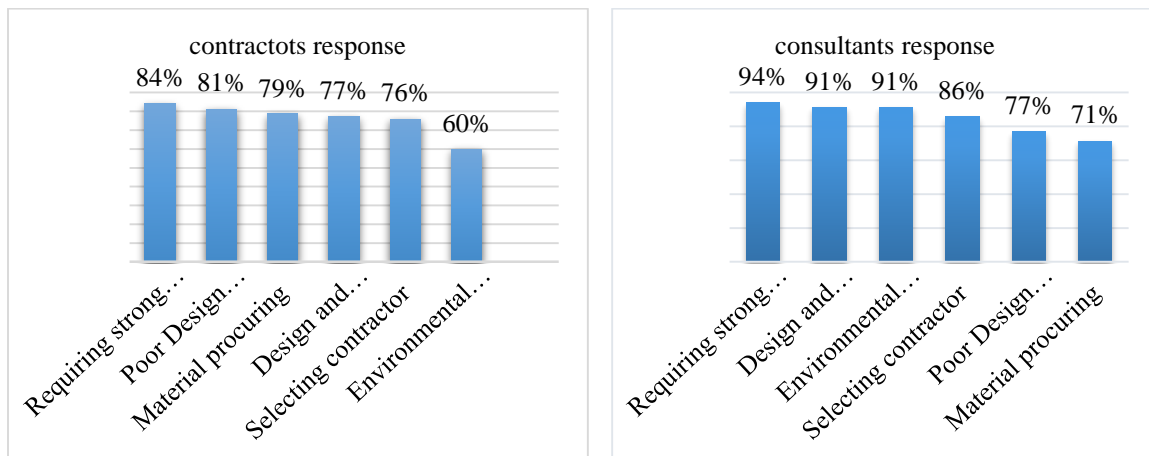


Figure 4. 9: Factor affects the adoption of fast track

Requiring strong and experienced manpower resource, especially in project management is very essential for fast track projects because if there is shortage of experienced or skilled manpower in the project it affects the firm directly.

4.7. The Benefits of fast track management technique

Table 4. 7: RII Analysis on the Benefits of Fast Track

No	Benefits of fast track	Likert Scale	W _i	Contractors Response			Consultants Response		
				Total	RII	Rank	Total	RII	Rank
1	Reducing time	Very low	1	58	0.773	1	28	0.8	1
		Low	2						
		Medium	3						
		High	4						
		Very high	5						
2	Team building	Very	1	56	0.746	2	26	0.742	2
		Low	2						
		Medium	3						
		High	4						
		Very high	5						
3	Single point responsibility	Very low	1	52	0.693	4	25	0.714	3
		Low	2						
		Medium	3						
		High	4						
		Very high	5						
4	Shorten schedule	Very low	1	54	0.72	3	23	0.657	4
		Low	2						
		Medium	3						
		High	4						
		Very high	5						
5	Lower cost	Very low	1	52	0.693	4	21	0.6	5
		Low	2						
		Medium	3						
		High	4						
		Very high	5						

The analysis shown in Table 4.7 describe that the benefits of fast track construction technique on the building construction project in Addis Ababa city. the result of the study was ranked by using RII based on both contractors and consultant’s point of view. According to contractors the first three benefits getting from applying fast track technique are:

1. Reducing time (RII= 0.773)
2. Team building (RII=0.746)
3. Shorten schedule (RII=0.72)

Single point responsibility and Lower cost are ranked similarly at the fourth level. And according to consultants response the first three suitability factors are:

1. Reducing time (RII=0.8)
2. Team building (RII=0.742)
3. Single point responsibility (RII=0.714)

Shorten schedule and Lower cost are ranked at the fourth and fifth level respectively.

Both the contractors and consultant respondent’s ranked Reducing time and Team building are the first and second benefit of fast track.

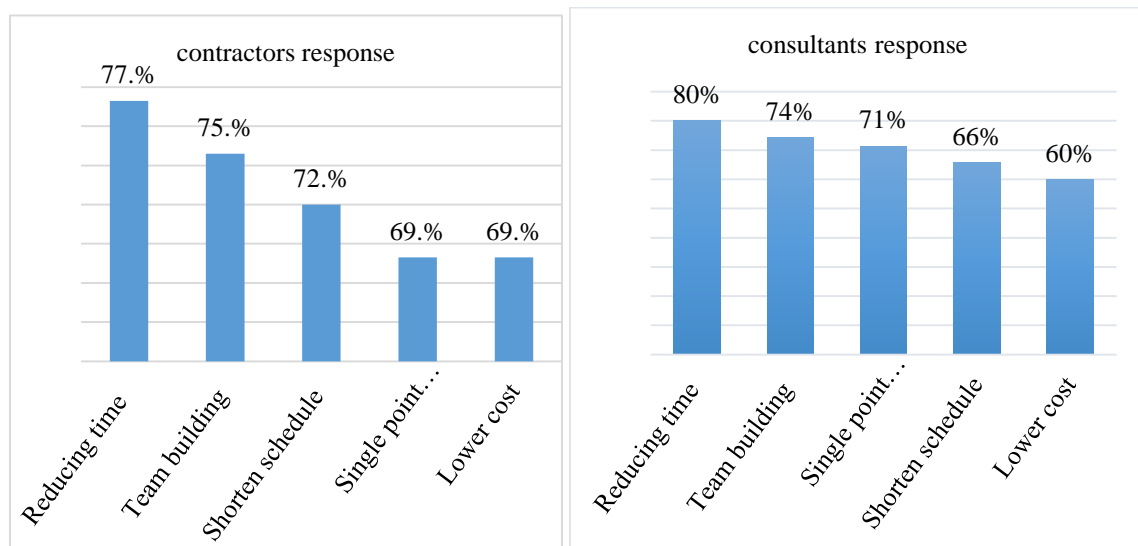


Figure 4. 10: Benefits of fast track

Based on the literatures many construction project delay, interconnected with fast track construction management technique is well eliminated. And also construction projects who practices fast track as method of management save 25-30% of project time effectively.

In addition to that in order to achieve the goal of the project with regard time, cost and quality and in order to fast track one project integrated team which have common goal on the company which can be participate with their full capacity are needed. According to the respondents' point of view lowering cost is ranked at the last but from the literature projects who practice fast track technique are saving their cost by minimizing delay related cost overruns and by finishing the work before the scheduled time they also gat their production profit.

4.8. Impacts of Fast Track management technique

Table 4. 8: RII analysis on Impacts of Fast Track

No	Impacts of Fast Track	Likert Scale	W _i	Contractors Response			Consultants Response		
				Total	RII	Rank	Total	RII	Rank
1	Cost related to change order and rework	S. Disagree	1	55	0.733	2	33	0.942	1
		Disagree	2						
		Neutral	3						
		Agree	4						
		S. Agree	5						
2	Introduction of unexpected variation during the construction	S. Disagree	1	56	0.746	1	30	0.857	2
		Disagree	2						
		Neutral	3						
		Agree	4						
		S. Agree	5						
3	Numerous Change Orders	S. Disagree	1	53	0.706	3	30	0.857	2
		Disagree	2						
		Neutral	3						
		Agree	4						
		S. Agree	5						
4	Claim and dispute among the parties	S. Disagree	1	47	0.626	4	28	0.8	3
		Disagree	2						
		Neutral	3						
		Agree	4						
		S. Agree	5						
5	Overlooked work (assigned to no party)	S. Disagree	1	45	0.6	5	26	0.742	4
		Disagree	2						
		Neutral	3						
		Agree	4						
		S. Agree	5						

As described in Table 4.8 Introduction of unexpected variation during the construction (rework) has been ranked by the contractors 'respondents in the first position with RII =

0.746 but ranked by consultants' respondents at second position with RII = 0.857. Cost related to change order and rework has been ranked by consultants' respondents in the first position with RII = 0.942 but ranked by contractor's respondents at the second position with RII = 0.733 and numerous change orders has been ranked by contractors' respondents in the third position with RII= 0.706 but ranked by consultants' respondents in the second position similar with introduction of unexpected variation during the construction (rework) with RII = 0.857.

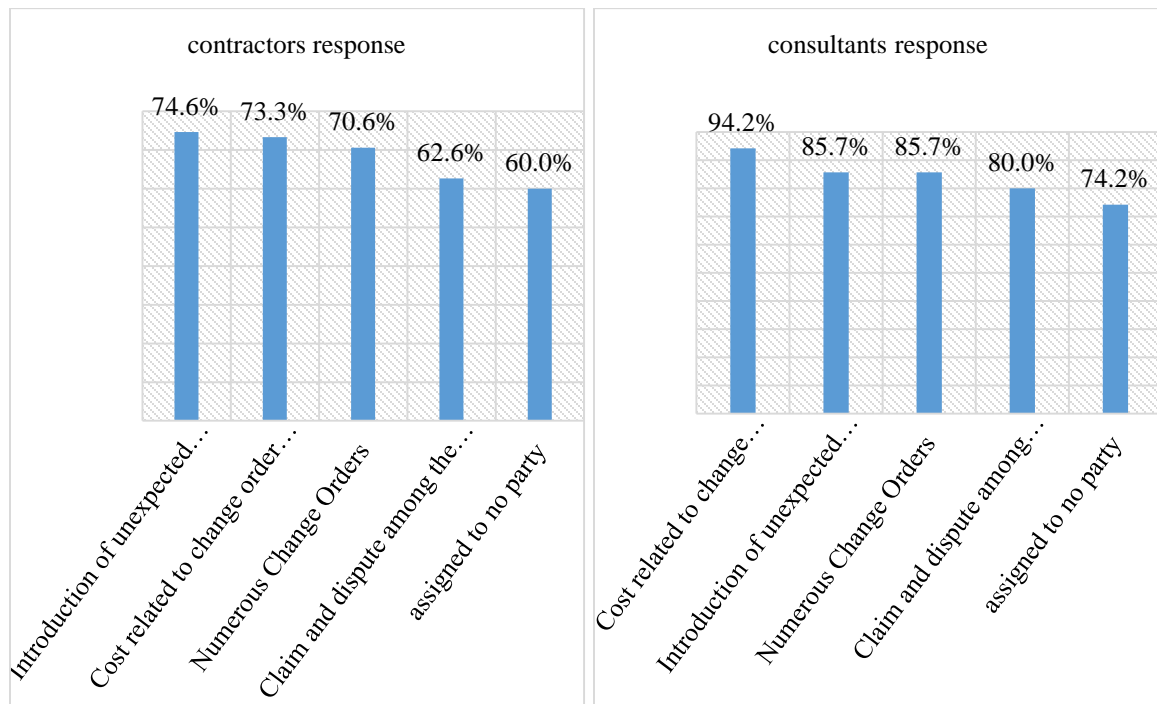


Figure 4. 11: Impacts of fast track

As the result shown from the table the main impacts of fast track are numerous change order and rework and also cost related to rework and change order but to minimize the time and cost overrun occurred due to change order more contingency should be considered in the budget and time scheduling.

4.9. Analysis for Interview questions

The first question that the researcher discussed during interview with the respondents was the mechanisms that the companies use to overlap/parallel the construction activities.

Based on the interview with some of the professional respondents most of them were agreed with sub dividing the project in to different work packages in order to make the

activities simple for overlapping/making activities parallel. And then after sub dividing the activities in to working package, assigned crew with required skill and needed resources for each work package. And it was also agreed by the participants that the only activities that do not affect by its predecessor or independent activities are suitable for fast tracking technique.

But least of the respondents also think that DB delivery system is good mechanism for making the activities parallel/overlap. And also there are respondents who use BIM and lean construction mechanism as method of schedule shortening.

The other point discussed with the participant was the means of minimizing or reducing project completion time and cost overrun in construction project by using fast track construction technique.

Almost all the participant says that in our country Ethiopia almost all the construction starts before all working drawings are fully complete but for the sake of regulations raff of the whole drawing should prepared and completed the permission process from the government. Then after getting the permission from the government body, the contractor makes its utmost effort to finalize the project in the intended time duration in order to minimize delay related cost and to finalize the project without happening conflict and claim between the contracting parties. From the interview data, company that practices fast track construction techniques get to the construction with only finished structural drawing or releasing the drawings phase by phase then the other drawing prepared parallel with construction stage. According to site observation done by the researcher, the international company who construct CBE HQ only structural drawings are completed when they start construction and the interior drawings are prepared till the time the researcher visit the site and the other local private company who construct international hotel by creating joint venture with international consulting company fast tracking their project by releasing working drawings from the consultants' phase by phase. And also the other international company fast track their project by making activities parallel after completing the full working drawings for their entire project and so on.

The overlap of design and construction, or doing activities in parallel way significantly reduces the completion time and hence the completion time is reduced the delay related various costs also minimized.

Out of the 10 professionals from both contractor and consultant firms who participated in the interview question, 50% of them agreed with that the projects constructed with fast track management technique should not affect the quality of the project it only focuses on the reduction of time duration and delay related cost but quality will depends on the professionals and project managerial, And 30% of the respondents agree with that the projects constructed by using fast track construction management technique have great quality than the projects constructed by using traditional management techniques because the design will be finished in proactive. The remaining 20% of the respondents was agreed with that the fast tracked project have poor quality than the traditional one because most of the time in our country if work is fast then its quality becomes somehow poor due to management problem.

The last interview question that the researcher asked the professionals was, will fast track management technique uses in our country construction industry in the near/far future?

60% out of 10 participants was agreed with that it will be adopted decently in the future due to its purpose giving to the construction parties related to the main factors which affect the project which are time and cost, but 40% of the participants was think that it will not adopted but they are in practices with the technique.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

From the analysis, it showed that half of the respondents agreed that DB delivery and fast track are similar terms which means that fast track is delivery system rather than its management technique. Among the four conditions listed for ranking, market conditions with (RII=0.76/0.714) and project complexity with (RII=0.742/0.733) are the two main conditions which enforce the construction parties to apply fast track management technique. Then after determining those conditions, the parties have to consider the suitability factors to apply fast track management technique. project team experience (RII=0.84/0.8) contains both conceptual and analytical thinking capability in order to reach both a speedy and appropriate conclusion on the preferred option which is to form the scope of the project., design suitability (RII=0.971/0.813) in order to identify whether a project is viable for fast tracking, potential participants must have a clear understanding of the field and the project design and the third is scope of the execution plan (RII=0.707/0.571) Project execution planning is more than a chart showing timescales, It describes how, when and by whom a specific target or set of goal is to be achieved are ranked the first three factors respectively.

Fast track construction also have many benefits, out of those many benefits, reducing duration time with (RII=0.8/0.733) and team building with (RII=0.746/0.742) in the construction projects are the factors which ranked most by the participants of the research. For delayed project, fast tracking is more important technique to complete project within specified time period. However, introduction of unexpected variation during the construction (RII=0.857/0.746), cost related to change order and rework (RII=0.942/0.733) and numerous change orders (RII=0.857/0.706) are the main impacts of fast track construction technique.

By developing the benefits of fast track in making different way of knowledge sharing center and by minimizing the impacts of fast track through different trainings, project will be completed within or before the specified time period.

5.2. Recommendations

Based on the findings of the research and the discussions above, the following issues are recommendations to alleviate the concepts of fast track management technique by respective stakeholders in the city of Addis Ababa building construction projects.

1. Since fast-tracking is developing concept, the learning curves of consultants and contractors should have to be considered by adopting giving proper and continuous training programs about new construction management techniques to improve performance of building construction projects.
2. To reduce the gap, the industrial parties need more experts who study the condition and suitability factors of project before they proceed into the work.
3. There is a need for standard forms of contract for use with fast-tracking technique.
4. As it can be seen from the outcomes of the research, good coordination between the consultants and construction firms helps in avoiding repetitive change order and rework during executing the construction project. The construction parties have to have good communication and smooth relationship to complete the project with the required time, cost and quality. Managers should have an authority to selecting key team members of the project to facilitate the work.
5. Companies who participate in the international project have to act as a key national institution for technology transfer. All new technologies implemented in the projects have to be disseminated to the local construction industry through various outreach mechanisms; including publication, construction magazines and seminars.

5.3. Implication for Further study

Basically, many things can be referred to as being obstacles from doing the research in a right manner or very accurately. Because the specific topic that the researcher chooses is a bit unique that it needs much more effort. What made the challenges worse is that, the term “fast track” is difficult to the respondents to easily understand and to give their willingness for the interview and to fill the questionnaire. Hence, the researcher proposes that, more can be done on the project under study by focusing on its various factors for future research.

REFERENCE

- [1] Semere T. A, Assessment of Delays in Building Construction Projects in Ethiopia. Thesis paper in Construction Technology & Management, Addis Ababa University, Faculty of Technology (South), Department of Construction technology & management. 2006.
- [2] Shen V. T, Material wastage in construction activities a Hong Kong survey. Department of Building & Real Estate, the Hong Kong Polytechnic University, Hong Kong.2002; pp2.
- [3] Rondon PJ. Shortening the execution time in projects : a state-of-the-art survey. 2014; p. 112.
- [4] Alhomadi AA, Dehghan R, Ruwanpura JY. The predictability of fast-track projects. *Procedia Eng* [Internet]. Elsevier B.V.; 2011;14:1966–72.
- [5] Ballesteros-Pérez P, Elamrousy KM, González-Cruz MC. Non-linear time-cost trade-off models of activity crashing: Application to construction scheduling and project compression with fast-tracking. *Autom Constr* [Internet]. Elsevier; 2019;97(December 2017):229–40.
- [6] Sohaliya SG, Bhavsar VD. *International Journal of Advance Engineering and Research Development Fast Tracked Concept Based on DSM Model*. 2015;126–32.
- [7] Hareru W, Neeraj Jha K, Koshe W, Jha KN. Investigating Causes of Construction Delay in Ethiopian Construction Industries. *J Civil, Constr Environ Eng* [Internet]. 2016;1(1):18–29.
- [8] Gebrehiwet T, Luo H. Analysis of Delay Impact on Construction Project Based on RII and Correlation Coefficient: Empirical Study. *Procedia Eng* [Internet]. The Author(s); 2017;196(June):366–74.
- [9] “construction law for engineers and contractors page-1 construction law for engineers and contractors i. Project delivery methods,” pp. 1–47.
- [10] Kalirajan, Vishnuram. Fast Track Construction – the Need of the Hour Fast Track Construction – the Need of the Hour. 2016;(January 2010).

- [11] Vignesh K, Prakash MS. A Study on the Existing Networking Systems Followed in Construction Project and Evaluating a Module for Implementing Fast. *Int J Innov Res Sci* [Internet]. 2016;5(2):2598–603.
- [12] Ballesteros-Pérez P, “Modelling the boundaries of project fast-tracking,” *Autom. Constr.*, vol. 84, no. March 2017; 231–241.
- [13] Das A, “Strategies of Fast Track Mode of Construction,” *Int. Res. J. Eng. Technol.*, pp. 4995–4999, 2018.
- [14] Cho K, Hyun C, Koo K, Hong T. Partnering process model for public-sector fast-track design-build projects in Korea. *J Manag Eng.* 2010;26(1):19–29.
- [15] Gerry E, “The Fast Track Manual, ” A guide to schedule reduction for clients and contractors on engineering and construction projects, 2002.
- [16] June P, Harthi B Al, Act P. Risk Management in Fast-Track Projects : a Study of Uae Construction Projects. 2015;1–235.
- [17] Dehghan R, Ruwanpura JY. The Mechanism of Design Activity Overlapping in Construction Projects and the Time-Cost Tradeoff Function. *Procedia Eng* [Internet]. Elsevier B.V.; 2011;14:1959–65.
- [18] Pandit KA, Bhangale PP. Major elements of project execution planning for construction of buildings. 2015;472–5.
- [19] Fazio P, Moselhi O, Theberge P, and Revay S, “Fast-tracking of construction projects: A case study,” *Can. J. Civ. Eng.* 1988, vol. 15, no. 4, pp. 493–499.
- [20] Moazzami M, Dehghan R, Ruwanpura JY. Contractual risks in fast-track projects. *Procedia Eng* [Internet]. Elsevier B.V.; 2011;14:2552–7.
- [21] Hanna AS, Lotfallah WB, Lee MJ. Statistical-fuzzy approach to quantify cumulative impact of change orders. *J Comput Civ Eng.* 2002;16(4):252–8.
- [22] Hwang BG, Thomas SR, Haas CT, Caldas CH. Measuring the impact of rework on construction cost performance. *J Constr Eng Manag.* 2009;135(3):187–98.
- [23] Kench B, “fast track construction becomes the norm.” 2012.

- [24] Rushdhle A, “Impacts of fast track project delivery in current construction industry.”
- [25] Behm M, Cowart P, Smith S and Thinen R, “smart construction. Economical building solutions to save time and money. ”
- [26] Dung, fast track project delivery strategy for civil engineering and architectural high rise building projects.2009.
- [27] Johansen A, Landmark AD, Olshausen F, Van Der Kooij R, Skappel S. Time Elasticity - Who and what Determines the Correct Project Duration? Procedia Comput Sci [Internet]. The Author(s); 2016;100(1877):586–93.
- [28] Usmani F, Fast Tracking and Crashing – Schedule Compression Techniques in Time Management. 2019.
- [29] Harvard Business School. HBS Toolkit – Basic Operations Self – Instructional Workbook. Retrieved from: <http://hbswk.hbs.edu/archive/1460.html> on the 21/03/2014.2000
- [30]De la Garza, V., Escobar, D. Schedule Acceleration Techniques Using a CM. Final Report. College of Engineering. Virginia Tech.2006
- [31] Thompson DE. a Study of Building Information Modeling Usage Through the. (December 2014).
- [32] Fitch E. Prefabrication and Modularization. SmartMarket Report. 2011. 56 p.
- [33] Path C, Chain C. Project Time Management. Case Stud Proj Program, Organ Proj Manag. 2010;103–4.
- [34] Bogus S, Diekmann J. E, & Molenaar K. R. A methodology to reconfigure the design–construction interface for fast-track projects.2002; 1258-1272.

APPENDICES

Appendix A: Questionnaire

Dear all participants, I request your participation and support in my research on “Assessment of Fast Track Construction Concepts on Building Construction Projects in Addis Ababa City” undertaken as a part of my Master Thesis at Jimma university of construction engineering and management. This survey is part of academic research that aims to Assess Fast track Construction Concepts on Construction Projects in Addis Ababa City. In the long term this research help the contract parties to complete project on time, within budget and with highest quality. All information you provide will kept in strict confidentially and only used for academic research. Please feel free to answer the questions with what you know and what you think in your mind. I value your participation and thank you for the commitment of time, energy and effort.

Sincerely

Investigation Team:

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What is construction fast track?

Fast track is project management technique which done to reduce the project time by overlapping the project design and construction phases and thereby by making maximum possible activities run parallel to each other so as to reduce the time. Or it define as starting the construction phase before the design phase completed.

This questionnaire contains three parts: -

- ✓ **Part one:** contains a set of questions related to the profile of the respondents in relation to organizational profile, which contains two sections.
- ✓ **Part two:** contains a set of questions related to delay factors and effects of delay on project cost.

- ✓ **Part three:** contains a set of questions related to the conditions, suitability factors to apply fast track and Factors that affect the adoption of fast track technique.
- ✓ **Part four:** contains a set of questions related to impacts and significance of fast track construction techniques on the construction industry.

Part I – Company and respondent profile

Section 1

1. Please write your Company's name: _____

2. Project Name: _____

3. Date and time: _____

4. Your Company is:

Local Private

International

Governmental

5. Your current role regarding construction is:

Site engineer

Designer

consultant

Contractor

6. Please indicate your years of construction experience:

0-2yrs

3-5yrs

6-10yrs

11-20yrs.

Over 20 yrs.

7. Please select your experience based on project type (You can tick more than one)

Building

Industrial

Infrastructure/Heavy

Engineering

Other(s)

Section 2

1. What kind of contract type does your company use when it practices fast track technique?

Lump sum

Cost - reimbursable

Cost -plus

Admeasurements

2. What type of delivery system is more suitable for fast track projects?

BOT

DB

DBB

CM at risk

CM at fee

3. In your opinion is fast track management technique or delivery system?

Management technique
 Delivery system
 both
 Not sure

4. How many fast-track projects has your organization undertaken in the past years?

1-5.
 5-10.
 11-15.
 Over 15

Part 2

1. Delay factors management

No	Delay factors	Very low	Low	Medium	High	Very high
1.1	Shortage of skilled labor					
1.2	Availability of resources					
1.3	Red-tapes(bureaucratic)					
1.4	Environmental conditions					
1.5	Poor planning and scheduling of the project					
1.6	Market Strike					
1.7	Organizational influence and culture					

2. Effects of construction delay with regard to project cost

No	Effects delay with regard to project cost	Strongly disagree	disagree	undecided	Agreed	Strongly agreed
2.1	By increase overhead cost					
2.2	Market Inflation					
2.3	Time value of money					
2.4	Foreign exchange rate					
2.5	Lobar cost					

Part 3

3. Here is list of Conditions that make the construction parties to apply fast track in the construction project, please put your opinion.

Assessment of Fast Track Construction Concepts on Building Construction Projects

No	Fast-tracking conditions	Very low	Low	medium	High	Very high
3.1	Financial conditions					
3.2	Project complexity					
3.3	Political conditions					
3.4	Market conditions					

4. There are various ways to determine whether a project is suitable for the fast-track process or not. Please rank the following key factors according to your project consideration during selecting fast track management technique.

No	Key considerations	Very low	Low	medium	High	Very high
4.1	Design suitability					
4.2	Stake holder alignment					
4.3	Strategic clarity					
4.4	Project team experience					
4.5	Scope of the execution plan					

5. Below are lists of Factors that affect the adoption of fast track technique, according to your point of view please tick (✓) on the appropriate cell according to their degree of acceptance.

No	Factors that affect the adoption of fast track technique	Strongly disagree	Disagree	undecided	Agreed	Strongly agreed
5.1	Requiring strong and experienced manpower resource, especially in project management					
5.2	Design and procurement					

5.3	Material procuring					
5.4	Quality					
5.5	Selecting contractor					
5.6	Poor Design management					

Part 4

6. Please Rank the significance of construction fast tracking according to your point of view

No	Benefits of fast tracking	Very low	Low	medium	High	Very high
6.1	Reducing time					
6.2	Lower cost					
6.3	Team building					
6.4	Shorten schedule					
6.5	Single point responsibility					

7. Below are lists of expected impacts of fast track on the construction industry. From your experience, please tick the appropriate cell by indicating how much you agree.

No	Impacts of Fast Track	Strongly disagree	Disagree	Undecided	Agreed	Strongly agreed
7.1	Numerous Change Orders					
7.2	Introduction of unexpected variation during the construction(rework)					
7.3	Overlooked work (assigned to no party)					
7.4	Claim and dispute among the parties					
7.5	Cost related to change order and rework					

Interview Questions

1. What mechanisms do your company use to overlap/parallel the construction activities?
2. What are the means to minimize/reduce time and cost overrun by using fast tracking construction technique?
3. Do you think the projects constructed with fast tracking project management techniques have great quality than the project with normal project management techniques? Why? How common are fast-track projects in our country Ethiopia?
4. Will fast-tracking be used in our country construction in the near/far future?

Appendix B: Liker scale analysis

No	Factors	Likert Scale	W _i	Contractor response					Consultant response				
				Frequency (f _i)	f _i * w _i	$\sum_{i=1}^{15} f_i * w_i$	RII	Rank	frequency	f _i * w _i	$\sum_{i=1}^7 f_i * w_i$	RII	Rank
1	Shortage of skilled labor	Very low	1	0	0	57	0.760	3	0	0	22	0.628	4
		Low	2	2	4				3	6			
		Medium	3	3	9				0	0			
		High	4	6	24				4	16			
		Very high	5	4	20				0	0			
2	Availability of resources	Very	1	1	1	55	0.733	5	0	0	27	0.771	2
		Low	2	1	2				1	2			
		Medium	3	4	12				1	3			
		High	4	5	20				3	12			
		Very high	5	4	20				2	10			
3	Red-tapes(bureaucratic)	Very low	1	0	0	56	0.746	4	1	1	21	0.60	6
		Low	2	2	4				0	0			
		Medium	3	4	12				5	15			
		High	4	5	20				0	0			
		Very high	5	4	20				1	5			
4	Environmental conditions	Very low	1	2	2	41	0.546	7	1	1	20	0.571	7
		Low	2	3	6				1	2			
		Medium	3	7	21				4	12			
		High	4	3	12				0	0			
		Very high	5	0	0				1	5			