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Identification and Prioritization of Decision-Making Aspects on High-Rise Fast-track Buildings – A Pilot Study

Mustafa Sultan[1], Ishtiaq Hassan[2], Shujaa Safdar Gardezi [3]

[1]PhD Scholar, Department of Civil Engineering, Capital University of Sciences and Technology, Islamabad, Pakistan. Email: DCE203002@cust.edu.pk

[2]Professor, Department of Civil Engineering, Capital University of Sciences and Technology, Islamabad, Pakistan. Email: eishtiaq@cust.edu.pk

[3]Professor, Department of Civil Engineering, Capital University of Sciences and Technology, Islamabad, Pakistan. Email: dr.shujaasafdar@cust.edu.pk

Abstract: For decades, the construction industry has been facing time overrun challenges on almost all mega projects. Rarely there are no schedule slippages. Schedule compression is an approach, applied to meet the tight project deadlines and overcome time overrun issues. Fast-track and crashing are the two techniques used for schedule compression. Worldwide, fast-track has been used on projects for more than 50 years, but Pakistan is yet to adapt it as a construction norm in a scientific way. This reluctance on behalf of the client, the contractor and the consultant is primarily due to the inherently uncertain and risky nature of fast-track projects which requires dynamic decision-making. Moreover, these dynamic decision-making aspects have never been identified and parameterized to develop a decision-making model which can lead to project success in relation to time, cost, and quality. The aim of this research is to identify and parameterize the decision-making aspects into a research questionnaire which can further be used to develop a comprehensive decision-making model for high-rise construction in Pakistan. After an extensive literature review, initially 41 fast-track decision-making aspects were identified which were reduced to 37 after consultation with research community. The refined questionnaire containing 37 decision-making aspects was used for pilot survey in Pakistan's construction industry to check its validity. Based on the input from the respondents, 19 most important decision-making aspects were discussed. The questionnaire consisted of a 5-point Likert scale, used to study the impact of each identified decision-making aspect on time variance, cost variance, scope variance and quality variance. This questionnaire will act as a stepping-stone for further development of a 3C's (client, contractor, and consultant) decision-making model for fast-track high-rise projects in Pakistan using structural equation modelling (SEM).

Keywords: Construction, Decision-making, Fast-track, Time-overrun

1 Introduction

Construction industry is amongst the major contributors to Pakistan's economy. Being the 5th most populated country in the world, with a population of approx. 242.9 million, over the years the housing and the building sector of Pakistan's construction industry has witnessed many advancements and investments. Although today, Pakistan's economy is going through the roughest patches of its history however the housing sector is still managing to pool some

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investment worth millions specially in high-rise construction. In 1968, only after 21 years of its independence, Pakistan had built the tallest building in South Asia (Habib Bank tower, Karachi,101 m) and which remained the tallest in South Asia till 1972, whereas at that time the tallest building in the world was the Empire State Building (381 m). Presently, a 593-meter high-rise (Port Tower Complex, Karachi) is in its conceptual stage. There are several already constructed skyscrapers in Pakistan with Bahria Icon tower, Lahore (272.8 meters, topped-out in 2017) being the tallest building in Pakistan and it remained the tallest building in South Asia between 2017 and 2018. Similarly, there are several 200 meter and higher buildings which are under construction in Karachi, Lahore, and Islamabad. The preceding statistics reflect Pakistan's ever-growing desire to go vertical despite the uncertain economic turmoil.
On such mega projects, time is considered a crucial aspect, specially for the client. On these projects, timely completion enables early commissioning and revenue generation for the client. The project management institute (PMI) mentioned time as one of the four constraints in the project management triangle of constraints (Figure 1). Time saving on construction projects automatically leads to reduced project cost. There can be a number of ways to reduce the project duration however the project management institute outlined crashing and fast-track as the two most commonly used techniques. Martins et al. (2019) reported that the construction industry has answered the calls for decreased project duration using techniques like fast-track and crashing. Crashing is a technique for shortening project duration at minimum incremental amount by allocating additional resources whereas fast-track is an approach for compressing the project schedule by parallel performance of phases that are usually performed in sequence as shown in figure 2 (Mubarik, 2010). Fast-track technique for design and construction overlap was introduced in 1960s and was being widely used by the 1970s (Cho et al., 2010; Skaik, 2014). In developed countries fast-track construction has been adapted as a standard procedure whereas the developing countries are still facing difficulties in its implementation due to the lack of advance construction management practices (Rasul et al., 2021).

Design

Construction

Figure 1. Triple Constraint Model *Figure 2. Fast-track Overlapping Mechanism (Mubarik 2010)*

There are a number of ways to compress project duration, fast-tracking is one of them, that enables to reduce the critical path by planning parallel realization of phases which were initially planned in a sequential manner (Biruk & Rzepecki, 2021). Contrary to the projects in

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which detailed technical information is available before the start of construction, fast-track projects depend upon practitioner's subjective experience to develop preliminary resource plans, which mostly result in plans that do not comply with the actual project design (Wu et al., 2021). Recently, the fast-track projects have gained popularity amongst the construction industry stakeholders due to the increasing requirements of construction sector (Khoueiry et al., 2013). After COVID-19, future prospect of fast-track projects was greatly realized by the construction industry stakeholders specially on medical care related projects (Gara et al., 2022). Telephonic conversations with construction industry practitioners in the US revealed that new opportunities for fast-track application emerged through construction of medical facilities on accelerated schedule and emergency basis during COVID-19 (Yang et al., 2022). Decreasing the project timeline is one of the main goals of every project manager (Feylizadeh et al., 2018). The most important aspect of time saving on a project is the decision-making process for the client, consultant, and the contractor. Timely decisions can fetch great success on the construction projects whereas delayed decisions can be catastrophic for the project's lifecycle and reputation.

1.1 Problem Statement.

Fast-tracking is an old but a relatively less practiced technique in Pakistan's construction industry, primarily due to the lack of understanding of the science involved in the fast-track approach. Although globally fast-tracking has been employed in the American and the European construction industries since 1960s however in Pakistan this technique was never adapted as a project success mantra. Due to the time constrained nature of fast-track projects, the objectivity of decision-making process becomes critical. As of now the decision-making aspects of high-rise fast-track projects in Pakistan have never been identified. There is a big research gap in exploring the fast-track decision-making aspects due to which there exists a fear of unknown amongst the construction industry stakeholders as a result the application of fast-track approach in Pakistan could not be materialized into a project success defining aspect. Hence there is a need to not only identify but also parameterize the fast-track decision-making aspects in order to gain the confidence of the industry stakeholders in fast-track approach from which the developed world has been benefitting for more than a half century.

2 Literature Review

Cho et al. (2010) defined fast-tracking as the shortening of construction and/ or design stages through parallel realization of work packages or by decreasing the durations of the activities. An effective and a popular approach for completing a project well before its planned finish date is by parallel execution of project phases that are usually performed in a sequence. The research community has used different terminologies for this overlapping mechanism that are parallel engineering, phased construction, flash-tracking (Austin et al., 2016), simultaneous engineering (Dey, 2000) and concurrent engineering (Biruk & Rzepecki, 2021; Dehghan & Ruwnapure, 2014). The projects on which the activities are overlapped are termed as fast-track endeavors (Martins et al., 2017). Correct application of fast-track approach results in the shortest economic program for all phases of the project (Cho et al., 2010). Khoueiry et al. (2013) reported that on fast-track projects, in order to obtain reduced project duration, downstream construction phase is allowed to commence earlier than planned without complete information from upstream design phase with the risk of rework. The overlapping

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execution of sequential activities of a project, partially bypassing their actual pattern of execution, to shorten the project duration is called fast-tracking (Ballesteros-Pérez, 2017). Russell and Ranasinghe (1991) defined fast-track as, starting the construction phase when the design is either entirely or partially complete at the individual work package level. The project management body of knowledge (2021) considers fast-track as a project schedule reduction approach. In this approach, the activities that are normally executed in sequence are performed in parallel; that means, they are overlapped (Dehghan & Ruwnapura, 2014; Khatale & Aher, 2015; Dehghan & Ruwanpura, 2011). Khoueiry et al. (2013) reported that mostly, the construction project activities are performed in a sequence, which means that the construction activity will commence only if its upstream activity i.e., design is complete. Although this approach is comparatively less risky, but it cannot necessarily meet the requirements of tight project deadlines set by the client. Between 1970s and 1980s, fast-track execution through the overlapping of activities has been adapted as an alternate to the sequential project execution approach (Wearne,1984). With the ever-growing needs of the construction industry, the popularity of fast-track approach since the 1980s keeps on increasing (Blacud et al., 2009). In order to shorten the construction project schedules, the fast-track approach is one of the most adapted methodologies. However, owing to the paucity of definitive research, focusing on the implications of fast-track application in terms of project cost and duration, has been an uphill task for the clients to determine fast-track's true application (Cho & Hastak, 2013).

2.1 Decision-making on Fast-track Projects.

The decision to accelerate a project using fast-track approach is a major one, and stakeholders in the construction industry are often unaware of its final impact on the project. With a bird's eye view, it might seem beneficial to take up the fast-tracking technique on a general basis but practically, only a few construction projects are potential candidates for this management technique (Fazio et al., 1988). The interdependent project performance indicators that dictate the complex nature of fast-track construction projects create a project management challenge for decision makers (Rasul et al., 2021). Wearne (1984) reported that on fast-track projects the project owners are required to take hard decisions and display sustained discipline. Baker and Boyd (1983) reported that fast-track increases the level of activity in both the office and the field because of the shortened schedule and because of the need for prompt and effective decision-making. Tengler (1973) reported that among the many factors, the success of fast-track methodology is also determined by the client's decision-making ability. He further reported that the client's decision-making capability may well be the only constraint on fast-track projects. The architect is responsible for not only guiding the project owner through the decision-making process but also keeping him sufficiently informed to make the necessary decisions. The decisions are not only design related rather the client needs to decide the finances, schedule, manpower, material transportation systems, control and communication systems, and other important related aspects.

As a decision maker, the client's role is very important on fast-track projects. The success of fast-track projects is greatly affected by delays in client's decision-making process. The project owners are required to make quick decisions on fast-track projects because any delay on their part will delay the construction process. In case the client lacks the decision-making ability then a professional third party can be hired to take decisions on the client's behalf (Cho et al., 2010). In order to ensure project continuity, either the design-build team compels the

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owner to make difficult decisions or takes them for the owner. While executing the project on fast-track basis, if a critical decision is at hand and the project member related is on vacations, the decision must be made in his absence (Williams, 1995). While deciding to fast-track or not, the decision-makers should evaluate the results according to their risk tolerance, their capacity to proactively respond to the risks, and the scenario of the project (Martins et al., 2017). Khoueiry et al. (2013) reported that the decision to fast-track is mostly taken in the early planning phase of the project however a few researchers have shown that buildings have been fast-tracked while the construction was in progress. Contrary to the findings of Khoueiry et al. (2023), Russell and Ranasinghe (1991) stated that it is interesting to note that for several projects mentioned in the literature, the decision to implement a fast-track schedule was not part of the original plan but a subsequent one.

The only decision-making model found in literature for fast-track projects is the one developed by Cho & Hastak (2013) however this model fails to provide a detailed insight into the real-life decision-making aspect on a fast-track construction projects. The model only considered the design and construction work packages, ignoring other decision-making dimensions such as contracting, procurement, economic feasibility, management, etc. Moreover, the model does not clearly identify the design and construction work packages and scenarios faced on fast-track projects and randomly terms them as DWP_k, CWP_{nm}, and scenario 1 to 16 which does not provide a clear insight of the real-real decision-making scenarios encountered by the client, contractor, and the consultants on fast-track projects. Contrary to Cho & Hastak (2013), present research provides a comprehensive understanding of the most important 19 decision-making aspects encountered on real-life fast-track projects in Pakistan by the client, contractor, and the consultant. Moreover, this paper also provides a research instrument for fast-track projects which was not found in earlier articles. Table 1 shows the decision-making aspects on fast-track projects identified through extensive literature review.

Table 1. Fast-track decision making aspects in Literature

	Decision-making Aspects (Indicators)
1	Over-designing the facility
2	Early Procurement of Long-Lead-Time Items
3	Client Authorizing “Extras”
4	Implement Front End Planning (FEP)
5	Implement Value Engineering
6	Early involvement of the contractor in design phase
7	Adopt scope freeze approach at early design stage
8	Use prototyping (Scaled-down models of complex buildings)
9	Sufficient contingency allocations by the clients
10	Conduct Cost/Benefit analysis (Financial Feasibility)
11	Apply fast-track to commercial building (which are time critical & High profit) rather than residential projects
12	Adopt BIM based Fast-track Approach
13	Owner’s financial capacity (Ensuring no resource constraint)
14	Retain Design and Interface Management Responsibilities

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15	Decide the acceptable quality compromise extent on fast-track project preferably not less than 90%
16	Limit the design optimization process
17	Delegate Authority to Project Level
18	Implement Lean Construction
19	Adopt contractor pre-qualification Strategy
20	Quality Management Plan submission in pre-design stage
21	Conduct constructability review during planning or design phase
22	Early engagement of O&M team in the design process
23	Implement effective communication mechanism
24	Organizational restructuring (Experienced Team)
25	Implement an effective Change Management Plan
26	Adopt Pre-fabrication, Modularization and off-site Fabrication
27	Adopt Fast-track on complex high-rise buildings
28	Compliance with site safety regulations
29	Project stage at which the decision to fast-track is made
30	Adopt an effective dispute resolution technique
31	Secure Early Permits/ Approvals
32	Decide the optimal degree of overlap between activities
33	Select the most suited project delivery method (DB, CM, EPC)
34	Announce incentives/ bonus for early completion
35	Impose damages/ penalties for delays
36	Early contract award for enabling works
37	Apply Fast-track to Critical Path rather than non-critical

2.2 Project Success Criteria for Fast-track Projects.

The success of fast-track projects significantly depends on their predictability. A direct measure of predictability is that how well the project goals i.e cost, time and quality have been met (Khatale & Aher, 2015). Project predictability is impacted by the overlapping mechanism used in fast-track approach to complete the project in time. Predictability has a pivotal role in the overall success of the project (Alhomadi et al., 2011). Traditionally, the project management metrics of time, cost, scope, and quality have been the most important factors in defining the success of a project (PMBOK, 6th Ed). Tighe (1991) also mentioned time, budget and specifications as the project goals. He further defined specifications in terms of project functionality and quality. Project success is measured in terms of time, cost, and quality (Albtoush et al.,2022). A number of researchers have identified time, cost and quality adherence as the project success indicators (Barclay & Osei-Bryson, 2010; Meredith et al., 2017). These indicators form “iron triangle”, which despite the criticism from some researchers still are considered as the prime indicators of project success (Papke-Shields et al., 2010). Feylizadeh et al. (2018) and Heriyanto et al. (2020) conducted research on the impact of schedule compression on project success factors time, cost, and quality. Rasul et al. (2021) used time, cost, quality, safety and productivity as project performance indicators in their research to delineate the interrelations among the critical risk factors pertaining to fast-track.

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2.2.1 Fast-track's Impact on Time Variance.

Time is the basic parameter to gauge the success of fast-track projects Rasul et al., (2021). Prawirawati et al. (2022) conducted comparative research between what if, crashing and fast-track, they concluded that fast-track approach is the least cost incurring and most time saving technique. Fast-track construction usually results in substantial time saving in project life cycle (Skaik, 2014). Deferred decision-making and commencing construction sooner than initially possible, enables to save time and reduce project cost on fast-track projects (Tengler, 1973). Due to the time saving aspect, the traditional construction methodology has been replaced by the fast-track approach (Park, 1999). Khoueiry et al. (2013) reported that overlapping simulation models resulted in 20% time savings over the baseline schedule. Hossain & Chua (2013) reported that on their successful fast-track schedule, overall time saving achieved was 30%. Srour et al. (2013) stated that Eldin (1997) concluded in his research that fast-track application can decrease project duration up to 25% as compared to the project duration achieved in sequential execution of project activities. Similarly, Attar et al. (2009) reported that the project duration of underground projects can be decreased by 18% using the fast-track approach. Cho & Hastak (2013) reported in their research that appreciable time saving of 40% and budget reduction of 4.5% was achieved using the fast-track approach.

2.2.2 Fast-track's Impact on Cost Variance.

A general perception is that project delivery in lesser duration increases the overall project cost. But basing on factors such as the complexity and project size, expected timeline, level of overheads, and the team members involved, fast-track projects may cost lesser than the conventional projects. If everything goes as planned, the overall expenditure on completion of a fast-track project can be lesser, or it can be much greater. But once we evaluate the product-value versus time saving achieved, then the cost of constructing a facility on fast-track basis, is usually appreciably lower (Williams, 1995). Wearne (1984) reported that recently in the United Kingdom, a case study revealed that the additional costs of quicker construction can be lesser than expectation. In project financing using the fast-track method, there is no increase in the amount of labor and costs for each work on both critical and non-critical paths (Lalu et al., 2019). While drawing analogy between fast-tracking and crashing, the application of the developed model on a fictious project revealed that even though the degree of schedule reduction achieved with fast-track approach (13.8%) is lesser as compared to crashing (14.8%) however fast-tracking achieves it at a substantially lower cost than crashing (Ballesteros-Pérez et al., 2019). Effective fast-tracking in a construction project can assist in decreasing project timeline and reducing project budget (Williams, 1995; Tighe, 1991).

2.2.3 Fast-track's Impact on Quality Variance.

Researchers at times argue that when a product is delivered in half the duration then the quality gets compromised. In real there is very less quality compromise as on a fast-track projects there is little time for optimization (Williams, 1995). The fast-track technique can assist in timely completion of projects without jeopardizing quality standards. In contrast to traditional construction projects, quality management in fast-track projects has a unique and a through procedure for approval. The builder is intimated in the bidding stage regarding the quality essentials, and he is asked to prepare quality management plan and have a dedicated quality

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compliance manager. Similarly, the research showed that availability of material, inclement weather conditions, delays in availability of detailed drawings and plant and equipment break down are some of the difficulties linked with the quality management aspects on fast-track projects (Emuze & Oladokun, 2019). Along with time and cost, quality is another indicator used for anticipating the success of fast-track projects. Number of changes, reworks, deviations, omissions, and defects are used to increase project predictability with regards to quality variations. Due to insufficient time and accelerated nature of fast-track approach, project quality may suffer (Alhomadi et al., 2011). Whereas Srour et al. (2013) stated that researchers such as Smith (1997) and Shang et al. (2005) are of the opinion that it is not necessary that the life-cycle cost and project quality gets affected by improved project duration offered by fast-track technique. The simultaneous work of crew members as in case of activity overlapping, may impact the quality and the efficiency of construction processes (Biruk & Rzepecki, 2021). Feylizadeh et al. (2018) stated that reducing the duration of activity directly impacts the quality of that activity. At times, overlapping requires utilizing exceptional work procedures, that can negatively impact the project quality standards and even ruin project safety (Dehghan & Ruwanpura, 2011). Fast-track projects can attain decreased durations which result in cost overrun and quality compromises (Rasul et al., 2021).

3 Methodology

A schematic layout of the research methodology is shown below in figure 3 which reflects different stages in which this pilot study was conducted.

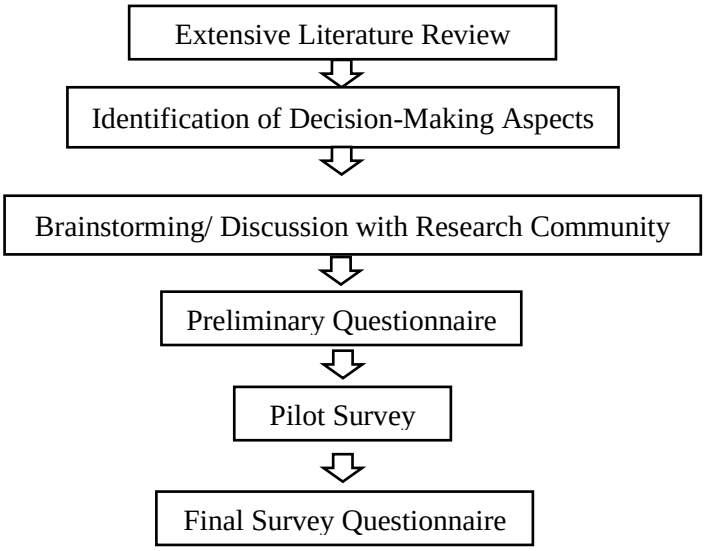

Figure 3. Schematic Layout of Research Methodology

3.1 Research Instrument.

A total of 74 research papers on fast-track approach and overlapping mechanism were reviewed for this research, out of which 51 being relevant have been included in this research moreover references to 8 internet sources and 5 books have also been made part of this research. Mostly the literature reviewed consists of articles published in journals recognized by Higher Education Commission (HEC) of Pakistan in W, X and Y categories, after which a

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preliminary questionnaire was prepared containing 41 decision-making aspects, impacting the success of fast-track projects. After 3 sessions of brainstorming and discussion with research community, a research questionnaire (Appendix A) was refined to 37 decision-making aspects. The questionnaire has 3 parts i.e., demographic information about the respondent, general information about Pakistan's construction industry and a 5-point Likert scale. The Likert scale has been used to record the perception of Pakistan's construction industry stakeholders about the impact of decision-making aspects on cost variance, time variance, scope variances and quality variance. The Likert's scale ranging from very high impact (5), high impact (4), Moderate impact (3), low impact (2), to very low impact (1) has been used in this research. Each decision-making aspect was either coded as CV, TV, SV or QV to represent cost variance, time variance, scope variances and quality variance respectively for efficient data input in structural equation modelling (SEM) software. At the end, the respondents were asked to share any additional information or remarks about fast-track decision-making aspects in Pakistan's high-rise construction industry which they deem necessary.

3.2 Sample Size.

A sample size of 11 has been used for the pilot survey to evaluate the validity of the decision-making aspects on fast-track projects in Pakistan's construction industry. The respondents composed of 3 clients, 4 consultants and 4 contractors as shown in figure 4 who are working on high-rise projects in Islamabad, Rawalpindi, Lahore, and Karachi. Figures 5 and 6 show the experience and qualification of the respondents.

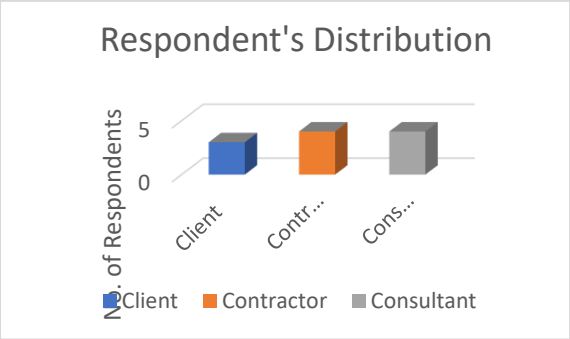

Figure 4. Respondent's Distribution

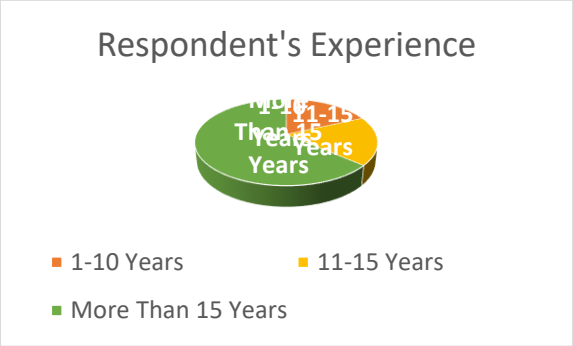

Figure 5. Respondent's Experience

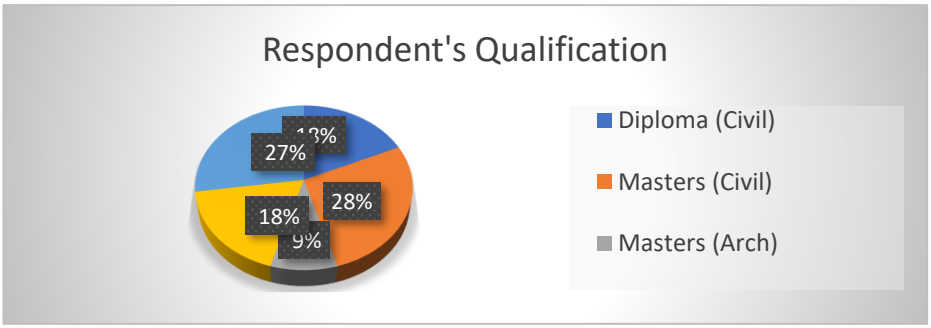

Figure 6. Respondent's Qualification

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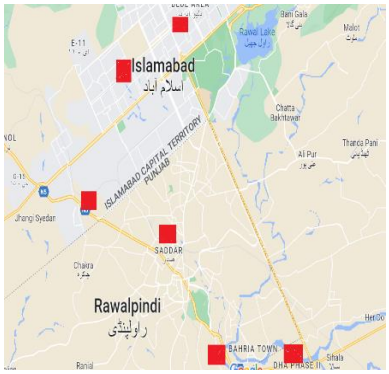
The location of the high-rise projects on which the 11 respondents are employed in the four mega cities of Pakistan i.e Karachi, Lahore, Islamabad, and Rawalpindi is shown on google maps in figure 7,8 and 9. The red squares represent the project sites. In order to maintain the privacy of the projects, their names have not been highlighted in this research.



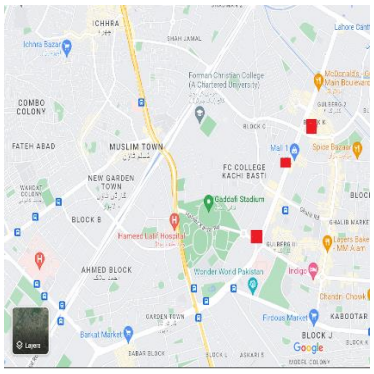


Figure 7. Projects in Karachi *Figure 8. Islamabad/ Rawalpindi* *Figure 9. Projects in Lahore*

4 Results and discussion

A threshold of 40% acceptability by the respondents was applied to the 37 decision-making aspects. Any decision-making aspect on which less than 40% respondents agreed, was removed was not discussed analyzed and discussed in this paper. Basing on the results of the pilot survey 19 out of the 37 decision-making aspects were discussed as being the most crucial ones. The following discussion on results of the pilot survey presents a comparison between the literature available on fast-track projects worldwide and opinion of stakeholders in Pakistan's construction industry with respect to the decision-making in fast-track approach.

4.1 Economic feasibility analysis/CBA.

Also known as the cost benefit analysis (CBA), is a thorough investigation of the potential risks and benefits of a project. Cost benefit analysis is helpful for making various personal and business decisions, especially those which are potentially beneficial (Khatale & Aher, 2015). Economic feasibility analysis is a tool used to assist the decision-making process on projects. It evaluates the cost versus the benefit of a project to determine project feasibility (how much the benefit outweighs the cost) as well as provide a decision-making metric when weighing up multiple options. Economic feasibility document also called business case (PMBOK, 6th Ed) is used to establish validity of the benefits of a selected component lacking sufficient definition (as in case of fast-track projects) and that is used as a basis for the authorization of further project management activities. Fazio et al. (1998) reported that financial considerations play a vital role in the success of fast-track approach as cost reduction and soaring profits on such projects can be attained by reducing the overall project timeline. Therefore, the results of the economic feasibility analysis play a vital role in deciding whether to opt for fast-track or not. 100% of the respondents from Pakistan's construction industry agreed that the economic feasibility analysis has an overwhelming impact on the success of fast-track projects therefore this decision-making aspect has been retained in the final questionnaire.

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4.2 Scope freeze approach.

A fast-track design includes clearly defining the design freeze points, early scope locks, and establishing design criteria and standards at an early stage (Austin et al., 2016; Williams, 1995). Change orders and design errors have a very crucial bearing on the success of fast-track projects which result due to the overlap between the design and construction stages (Cho et al., 2010). Skaik (2014) concluded that on fast-track projects, the consultant should make an endeavor to completely define, recognize, and freeze the client's demands as early as practically possible via comprehensive workshop interactions and final demands must be documented formally. Therefore, it is of great importance that final scope of work is agreed between the client and the contractor. The scope should be frozen before the contractor is given go ahead so that there are no change orders in the later stages of construction. 100% of the respondents from Pakistan's construction industry agreed that scope freeze approach as an important decision-making aspect which can greatly influence the success of a fast-track project in terms of time, cost, and quality variance.

4.3 Early involvement of the contractor.

Early participation of the contractor in the design phase of the project is the most advocated aspect amongst the research community. Wearne (1984) reported that on fast-track projects, the contractor must depute team members who represent him, and those who will take over, operate, and maintain the complete project and they should be part of the project team prior to the start of the design phase. In the present fast-track operations, the absence of the contractor's involvement in the design of the facility is full of risk Cho et al., 2010). In Pakistan, most of the construction projects are executed on design-bid-build project delivery method (DBB) where the contractor is nominated after the bidding stage but when it comes to a fast-track project, the contractor who will construct the project with incomplete design information must be involved right from the design phase. Contractor's early involvement in the design phase of fast-track projects in Pakistan was unanimously agreed by all respondents as one of the most crucial and significant decision on behalf of the client. Hence this aspect has been retained in the final questionnaire.

4.4 Appropriate Contract Strategy.

With regards to Pakistan, there does not exist any contractual provision or contract document which can appropriately handle the inherently risky nature of fast-track projects. Similarly, the literature also reflects absence of a contractual framework designed specifically to deal with the legal issues and disputes amongst the contacting parties on fast-track projects. Dey (2000) concluded that presently, the fast-track projects suffer from unbalanced risk allocation due to the non-availability of a contractual framework which is strictly fast-track focused. As a consequence of this unbalanced risk allocation which results from unavailability of fast-track contract forms, the consultants and contractors tend to add premiums and contingencies allowances in their tender price which eventually ends up with higher overall project cost (Moazzami et al,. 2011). In order to curb the tendency of contractors adding premiums and contingencies on fast-track projects, the client and his team must make the right decision while choosing or drafting a contract that is appropriate for fast-track projects (Skaik, 2014). Skaik (2014) concluded that fixed price contracts do not fit in with fast-track projects as they result in unpreventable disputes. The adaption of reimbursable contracts on fast-track projects as compared to fixed price contracts is far more beneficial (Moazzami et al., 2011). During the

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pilot survey, 100% of the respondents agreed that choosing or drafting an appropriate contract strategy on fast-track projects is an important decision-making aspect on behalf of the client therefore it has been retained in the final questionnaire.

4.5 Over-Design Approach.

Overdesign is the process of making conservative assumptions during design, which adds a safety factor to the design. Overdesign can reduce the total time but involves a cost penalty (Bogus et al., 2011). Williams (1995) suggested that on fast-track projects the implications of under-designing the foundations of a high-rise and then allowing it to fail due to overloads are dire. Therefore, in such scenarios, it is a good approach to design conservatively. Wearne (1984) reported that on fast-track projects, an analysis of risks at the start can be helpful in deciding that how much extra capacity should be kept while designing in order to be able to accommodate the changes later on. Martins et al. (2017) and Bogus et al. (2006) reported that on a fast-track project, while overlapping the phases, overdesign is a more effective strategy when taking into account just the activity durations. As in case of Burj Khalifa, the foundations were initially designed for 750m but afterwards on the client's requirements the same foundations were used to construct the building to 828m. The pilot survey showed that 9 out of the 11 respondents (82%) agreed that the decision to overdesign a high-rise building is an important decision for the consultant. Therefore, 'overdesign' is included in the research as a consultant oriented decision-making aspect.

4.6 Experienced team with decision-making authority.

The success of fast-track projects necessitates an integrated team composed of the client, the consultant, the contractor, and the supplier (Cho et al., 2010). The main advantage of a firmly aligned project team with decision-making mandate is that individuals on site have the needed perspective to make timely and correct decisions at the project level (Carroll et al., 2004). A new mindset is required for the success of fast-track approach which enables early organization of flexible teams. These teams work as a cohesive and project-focused unit (Austin et al., 2016; Williams, 1995). Seasoned design-build teams that have developed mutual respect, confidence in each other and effective communication can deliver fast-track projects much economically than teams lacking any of these aspects. For the viability of fast-track projects, the author emphasized on assembling a project team that avoids blame-game approach and each team member believes that they all either fail or succeed as a unit. On a fast-track projects, discussions, communications and directions are usually not recorded, there must be some trust. Fast-track approach requires that a handshake is as valid as a contract (Williams, 1995). Lack of decision-making authority delegation and experienced teams are the two major impediments involved in implementation of fast-track approach in Pakistan's construction industry. The lack of a contractual framework resulted in lack of experienced teams as fast-track has never been applied in Pakistan as a construction practice which makes decision-making a challenge. As a result of this the client and the top management are reluctant in delegating decision-making authority to the personnel closet to work which results in significant time loss. During the pilot survey, 7 out of the 11 respondents (64%) agreed with this decision-making aspect hence this decision-making aspect has been retained in the final questionnaire as supported by majority of respondents.

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4.7 Early procurement of long lead time items.

On fast-track projects, the vendors and the suppliers not only become part of the project rather they are part of the consultant's team. This helps in tailoring the design as per the equipment and equipment tailored as per the facility (Williams, 1995). Earliest identification and procurement of long-lead-time items is a very important decision-making aspect as delay in procuring and delivering such items on a fast-track schedule can be detrimental (Austin et al., 2016). Baker and Boyd (1983) reported that on fast-track projects the interface between design, construction and procurement becomes very important as the impact of delays due to delivery of critical long-delivery items can delay completion of the whole project and this also reduces interference during the construction works (Cho et al., 2010). 10 out the 11 respondents (91%) believed that due to the instable economic conditions in Pakistan where dollar rates are fluctuating on daily basis and due to the ban on LCs (Letter of credit) by the Government, early identification, and procurement of long lead time items such as the elevators and escalators (mostly imported from China, Korea etc) is a very important decision. One of the respondents believed that procuring an item early that is required in the later stages of the project might incur extra cost and effort to the project if the client's requirements change in the later stages of the project. However, this decision-making aspect being supported by more than 91% of the respondents has been included in the research questionnaire.

4.8* Owner's *financial capacity with no resource constraints.

Project clients must have enough backup of resources and organizational strength to ensure successful completion of the fast-track process (Austin et al., 2016). Fast-track projects executed in Korea show that client's financial capacity and organizational strength are the two very crucial success factors (Cho et al., 2010). Time overrun shows the essence of fast-track technique, that requires focus on timely provision of funds and well-organized supply chains during project life to enhance time related performance (Rasul et al., 2021). On fast-track projects, the estimated impact of the increased cost on an activity due to rework is equal to 12% of the cost of complete activity (Khoueiry et al,. 2013) which is a considerable sum of money therefore this decision-making aspect that whether the client has enough financial capacity to ensure efficient supply chain and the ability to overcome even the most unprecedented cost overruns on fast-track projects is an important one. This one particular aspect has proven to be the prime difference in successful application of fast-track approach in developed countries like Dubai and US and developing countries like Pakistan. 9 out of the 11 respondents (82%) agreed that owners' financial capacity that ensures efficient supply chain is an important decision-making aspect on fast-track projects. Being supported by the majority of the respondents, this decision-making aspect has been retained in the final questionnaire.

4.9 Most suited project delivery Method.

For better implementation of fast-track technique, linking it to a single contract type e.g., Engineering-Procurement Construction (EPC), Design-Build (DB) and Construction-Management (CM) project delivery systems can result in better coordination amongst the contractor and the consultant which improves the efficiency of design (Rasul et al. 2021). In order to obtain the most optimized project durations, the fast-track technique is being applied to design-build (DB) projects. Several fast-track projects are executed using DB and are governed by its contract documents however, DB contractual framework does not quite fit-in

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with the fast-tracking methodology (Moazzami et al,. 2011). Saltz (2007) also supported the opinion that usually for fast-track situations design-build contracts are adapted, but the contract provisions do not really contemplate fast-track methodology and must be tailored to suite that situation. Emuze and Oladokun (2019) reported that design-build not only makes it easier to accommodate the changes during the project, but also decreases the project schedule that is the basic component of fast-track technique. In Pakistan, 100% of the government construction projects are executed through design-bid-build (DBB) project delivery, in which the lowest bidder wins the contract and sometimes technical bids are also used to evaluate the contractors. Private construction projects however use both DBB and DB project delivery methods. Being agreed by all respondents (100%), the decision-making aspect of using DB project delivery approach for fast-track projects has been retained in the final questionnaire.

4.10 BIM aided Constructability Review.

Decision-making on a construction project depends greatly on the constructability review of that project. Constructability review is a technical review to determine the extent to which the design of a structure facilitates ease of construction, subject to the overall requirements (Constructability Review, 2010). Clifford & Schwinger (2011) defined "constructability" as the ease with which structures can be built. The more constructable a structure is, the more economical it will be. Constructability review is used to analyse and assess the feasibility of construction. According to Mendelsohn (1991) constructability review must begin at the earliest conceptual stage of the project to be fully effective. In this regard Chen & Pan (2016) developed a BIM aided decision-making model that achieved the seamless integration of early-stage decision making and design. Austin et al. (2016) reported that BIM was a very helpful tool for constructability review on Saint Anthony Falls bridge project which was completed on fast-track basis. BIM has engineered a paradigm shift in construction industry, it enables the virtual construction of a building so that all the problems in the construction documents can be detected and resolved before construction starts. BIM is being widely used for constructability reviews. With only a 3D printer and a BIM model, fast-tack projects could be built in tight time and with optimized costs (Bouhmoud & Loudyi, 2022). During the pilot survey, 10 out of the 11 respondents (91%) strongly agreed on BIM aided constructability review implementation in the Pakistan's construction industry. Therefore, it has been retained in the final questionnaire as an important decision-making aspect.

4.11 Design-construction interface management plan.

A very basic prerequisite for successful fast-track application is the timely release of information to the construction team by the consultants (Srour et al., 2013). One of the key elements in fast-track approach is the thorough study of the NDIFT (Necessary Design Information for Fast-Track Projects) and detailed understanding of IIDD (Input Information on the Design Disciplines). The decision whether to opt for fast-track approach or not, is based on this information. As the fast-track projects are executed with limited design information, moreover both design and construction phases are overlapped therefore there must exist an interface management plan which can ensure timely release of accurate information to the construction team (Cho et al., 2010). Fazio et al. (1998) emphasized adaption of design and construction interface management plan stating that managing the interface between design and construction on fast-track projects proves to be crucial to the project performance. Dey (2000) reported that application of fast-track for radical reduction of project duration demands

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an integrated information system for effective project management. The author strongly recommended controlling fast-track projects through an integrated information management system. During the pilot survey 8 out of the 11 respondents agreed that a well-defined interface management plan must exist on fast-track projects. Basing on the input from the respondents, the decision to have a design-construction interface management plan is supported and included in the final research questionnaire.

4.12 Early permit/ approvals.

Securing early permits and approval from the authorities in the pre-design stage is one of the very important decisions on a fast-track project. Skaik (2014) mentioned in his case study that on a fast-track high-rise project, enabling contractor was appointed before obtaining authorities' approval of preliminary design. The design was eventually rejected due to insufficient number of lifts as per the RIBA (Royal Institute of British Architects) code of practice which hindered the commencement of shoring works on site. The 81-storey building with 5 basements were redesigned to accommodate additional lifts, resultantly the project suffered a delay of 15 months. Austin et al. (2016) mentioned the case study of Saint Anthony Falls bridge which collapsed suddenly only after 40 years in 2007. It was the main artery into the downtown Minneapolis which demanded "record time" replacement. Adapting the fast-tracking approach, the bridge was delivered in little over a year as compared to the 2-years needed for similar projects. The key to project success was the early project activities which included obtaining timely permit to access the site early. MnDOT (Minnesota Department of Transportation) managed to acquire eight permits within fourteen days of collapse. Resultantly, the construction started well before the final design was finished. In Pakistan's construction industry, the development authorities like CDA, RDA, LDA, KDA (Capital/Rawalpindi/Lahore/Karachi Development Authority), DHA (Defence Housing Authority) etc, have their own construction byelaws for high-rise which require certain permits. These permits involve clearance from CAA(Civil Aviation Authority) and some other approvals which require substantial time before construction can start therefore 100% of the respondents during the pilot survey agreed that it is a very important decision for the client and his team to secure early permits from the authorities on fast-track projects so that the site can be accessed by the consultants in the pre-design stage.

4.13 "Fast-track" decision stage.

Fast-tracking is an important decision however the project stage at which this decision is taken is equally important to the project success. Cho et al. (2010) reported that according to the USACE's design-build contracting (United States Army Corps of Engineers), the client during the pre-design stage decides either the fast-track technique is required or not. During this stage, the client determines the prerequisites of fast-track approach and intimates them to the design-build team in the RFP (Request for Proposal). At this stage, the client may also intimate his desire to fast-track the project. The decision to fast-track is mostly taken in the early planning phase of the project however a few researchers have shown that buildings have been fast-tracked while the construction was in progress (Khoueiry et al., 2013). According to the construction manager of Burj Khalifa Mr. David Bardford, the design phase of Burj Khalifa spanned on 3 years and the construction team could not wait for 3 years in their offices, therefore the decision to fast-track Burj Khalifa was made early in the design phase. With regards to Pakistan's construction industry, 8 out of the 11 respondents (73%) believed that

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decision to fast-track a project should be made in the early pre-design stage however, 3 respondents believed that this decision can be deferred to later stages of the project as well e.g during the construction stage if the project is suffering delays, the first fix MEP execution can be overlapped with its predecessor that is the shop drawings. Anyhow, all the respondents agreed that earlier is better. Therefore, the "fast-track" decision-making stage has been included in the research questionnaire as a decision-making aspect for the client.

4.14 Quality management plan submission in pre-design stage.

Emuze and Oladokun (2019) reported in a case study project in Cape Town, South Africa that to fulfill quality requirements on fast-track projects, the contractors deposit a quality management plan to the owners (DoHS, Department of Human Settlements) prior to the design phase. Dey (2000) reported that project quality management is a team effort and project quality can be ensured by forming project quality assurance teams. In Pakistan's construction industry, all the respondents reported that there is a very less number of projects on which quality management plans are prepared by the contractors however quality is ensured by conducting site and material inspections for conformity which is not enough. 9 out of the 11 (82%) respondents believed that quality management plays an important role in fast-track project success and therefore it should be well documented and submitted by the contractor to the client preferable in the pre-design stage. Submission of a quality management plan to the client by the contractor in the pre-design stage is an important decision-making aspect and is therefore included in the final questionnaire.

4.15 Fast-track application on critical path.

Biruk and Rzepecki (2017) stated that if the desire is to reduce the project duration, then enhancing efficiency of non-critical activities is economically unviable. Lalu et al. (2019) advocated the performance of fast-track approach only on critical path, especially on activities that have longer duration. Heriyanto et al. (2020) reported that fast-track method was applied on the activities on the critical path, having long durations while constructing Saint Thomas Aquinas chapel. Using the fast-track approach, the project was completed in 124 days compared to 190 days of normal time (66 days were saved). With regards to Pakistan's construction industry 8 out of the 11 respondents (72%) believed that application of fast-track approach on critical path only, can yield greater time saving as compared to the non-critical path. The author strongly agrees with this opinion as the purpose of fast-track is to compress the schedule which is only possible if the critical path is shortened, shortening the non-critical paths do not compress the overall project schedule therefore this decision-making aspect has been included in the final questionnaire.

4.16 Fast-track application to complex building.

Vidal et al. (2011) defined project complexity as the property of a project which makes it hard to understand, predict and control the overall behavior of the project, even when sufficient information about the project is available. Hass (2008) suggested that complexity is a multi-dimensional theory including structural, socio-political, environmental, technical, financial aspects and schedule. Skaik (2014) concluded that fast-tracking a high-rise building is inevitable from a viability aspect. Construction projects with complex structures are carried out through fast-track method to save construction duration (Kim et al,. 2022). Fast track may be inevitable in complex projects due to lengthy design and construction processes that are

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encountered using traditional methods (Skaik, 2014). Fazio et al. (1998) stated that in complex high-rise projects, employers tend to fast track works where construction can begin while design is still incomplete. Application of fast-track approach on complex construction projects is becoming need of the hour (Khoueiry et al., 2013). With regards to Pakistan's construction industry 8 out of the 11 respondents (73%) agreed that fast-track approach is more suitable to complex projects. Being supported by majority of respondents and the research community, this decision-making aspect is included in the final questionnaire.

4.17 Modularization (Pre-Fabrication).

A process in which the building is built away from the site, under controlled plant conditions, using the same materials and designing to the same codes and standards as traditionally constructed buildings but in almost 50% less time. Buildings are constructed in modules which are assembled on project site. To ensure success on fast-track projects, the professionals use state-of-the-art established techniques and engineering refinements, time-saving modularization, and off-site fabrications, and employ any other measures to pace up the construction process (Austin et al., 2016; Emuze & Oladokun, (2019). Modularization and off-site fabrication are most beneficial when these decisions are made early (Tighe, 1991). The scope of modular construction in Pakistan's construction industry is very limited, almost all buildings are construction on-site as the traditional norm of construction. During the pilot survey 7 out of the 11 (64%) respondents agreed on adapting modular construction on fast-track projects. Adaption of modular construction on fast-track project has been added to the research questionnaire as a decision-making aspect as it is supported by majority of the respondents and the literature review.

4.18 Fast-track application to high-profit building projects.

Fast-track approach was developed for markets such as office buildings where the increased costs necessary for speedy delivery was justified in terms of value of the asset created (Abdelbary et al., 2020). Cho & Hastak (2013) stated in their research that the projects on which profit is greater than operational cost, can produce better results using the fast-track technique. Construction projects with high profit margins like grocery stores and office buildings are considered to be more suited for application of fast-track approach. During the pilot survey 8 out of the 11 (73%) respondents agreed that it is more viable to apply fast-track technique to high-rise buildings which are either commercial or mix-use buildings rather than residential because these commercial projects start generating huge profits for the clients even before completion which serves as a balancing act to fast-track's time-cost trade-off nature. This decision-making aspect is agreed by the majority of respondents and most of the literature therefore this decision-making aspect has been retained in the final research questionnaire.

4.19 Optimal degree of overlap between activities

Different researchers have mentioned a variety of ranges for the design-construction overlap resulting in schedule compression. Williams (1995) reported that using the fast-track approach 50-70% schedule compression was achieved on a real time building project. Bogus et al. (2013), Ballesteros-Perez (2017), Khoueiry et al. (2013) & Srour et al. (2013) reported that 20-70% design and construction overlap is possible on fast-track projects and a similar response from the respondents was obtained in question 4 part 2 of the questionnaire that

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construction can begin with as less as 30% design completed which means 70% design-construction overlap. Hence it is a very important decision for the client and his team to select the most appropriate degree of overlapping. This decision-making aspect was included in the final questionnaire on recommendation of 6 respondents during the pilot survey moreover, this aspect was also highlighted by several researchers in the literature.

In the next research paper, this parameterization will be used to develop a comprehensive fast-track decision-making model for the clients, contractors and the consultants using structural equation modeling (SEM).

5. Conclusions

In this research, a research questionnaire (Appendix A) for fast-track projects has been developed for the clients, contractors, and consultants, consisting of various decision-making aspects. These decision-making aspects have been identified and parameterized in the form of a research questionnaire which will prove to be a stepping-stone for future research on fast-track projects. Each decision-making aspect in the questionnaire will be weighed at three project performance levels i.e cost variance, time variance, scope variance and quality variance. During the pilot survey, all the respondents agreed on evaluating each decision-making aspect against its impact on project time, cost, scope and quality variances. Based on the results of this research, a comprehensive decision-making model for fast-track high-rise construction projects will be developed which will help stakeholders in Pakistan's construction industry in reaching a timely and an informed decision on fast-track projects. Pakistan's construction industry stakeholders lack the confidence in the successful application of fast-track methodology apparently due to the lack of insight and understanding of the science involved in the overlapping mechanism. The lack of confidence in fast-track technique is also due to the lack of involvement of the Government housing and development authorities in devising byelaws and contractual framework for application of fast-track approach.

Appendix A

RESEARCH INSTRUMENT

Capital University of Science & Technology
C U S T
Pakistan

Department of Civil Engineering

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3C's Decision-Making Model for Fast-Track High-Rise Buildings Using Structural Equation Modelling

Mustafa Sultan, Ph.D Scholar (DCE-203002)

Time is one of the most important indicator of project success. Worldwide consultants in general, and clients and contractors in particular endeavor to deliver the project in the least possible duration so that the commissioning phase can commence at the earliest. Early project completion is a requirement mostly set by the client which is made possible by the efforts of the project stakeholders. Although there are a number of ways to compress the project schedule, however fast-track is a technique being widely implemented in the developed countries since 1960s. Fast-track technique is the overlapping of project activities/ phases that are normally/ traditionally performed in a sequence. The literature and the construction industry mostly suggest overlapping the design and construction phases however other phases can also be overlapped. According to the industry experts, the decision-making on fast-track projects is an aspect which becomes crucial under time constrained environment.

In this regard, I am conducting research in order to develop a decision-making model for the clients, contractors and the consultants (3 C's) on fast-track high-rise building projects in Pakistan. This decision-making model will be developed using a statistical technique called Structural Equation modeling which will confirm or reject the significance of each decision-making aspect on fast-track building projects on the global success indicators i.e time, cost, quality and scope variances. This research will contribute towards implementation of fast-track technique in Pakistan's construction industry.

With above in view, I am administering a research questionnaire which comprises of three parts i.e demographic information, general information and the decision-making aspects. The first part requires information about the respondent which will be used only for research purposes. The second part requires the respondent to give general information on their familiarity with fast-track technique and the third part consists of the fast-track decision-making aspects in which you are requested to rate the impact of each decision-making aspect on time, cost, quality and scope variances.

I shall be highly obliged if you can spare some time and share your valuable feedback on fast-tracking high-rise buildings in Pakistan.

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Part 1: **DEMOGRAPHICAL DATA AND GENERAL INFORMATION**

Generic:

1. **Name**……..(Optional)

2. **Gender**
   o Male o Female

3. **Age**
   o 20-30 o 31-40 o 41-50 o Above 50

4. **Qualification**
o Diploma (Civil) o BS Civil Engineering o Masters (Civil) o PhD (Civil) o Others……. (Please Specify)

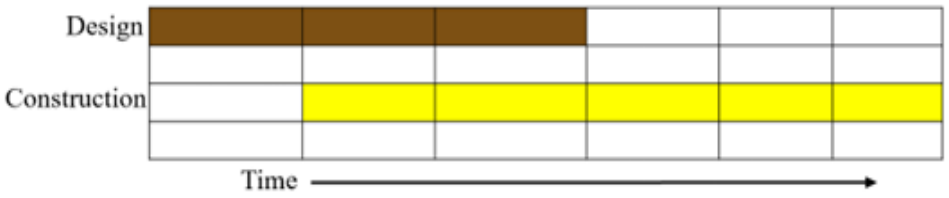
5. **Type of firm**
   o Consultant o Contractor o Client o Others……(Please Specify)

6. **Working experience**
   o 1-10 years o 11-15 years o 16 -20 years o More than 20 years

7. **Designation**…….

Part 2:

Fast-Track. It is the process of overlapping two or more activities which traditionally follow a finish to start sequence. Activities that are normally executed in a sequence, are performed in parallel. In fast-tracking, the activities are overlapped such as design and construction rather than doing it in a sequence. The sole purpose of fast-tracking is to compress the project schedule to save time and meet the project deadlines.



1. Are you familiar with the concept of fast-tracking? Yes

   No

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2. Have you ever done a project in which the design was incomplete, and construction was started? Yes No

3. In your opinion what %age of design should be complete before one can confidently allow the construction to start?_____

4. How long does it take to completely design a 14 Storey or 50 Meters and above buildings? (Consultants only) _____

Part 3:

Keeping in view your experience please evaluate the impact of the following decision-making aspects on the success of fast-track approach in terms of cost variance, time variance, scope variance (change/ variation orders and addenda) and the impact of lack of quality optimization decisions on quality variance (reworks etc) by ticking the relevant box keeping in mind Pakistan's construction industry.

(5) represents **very high impact**, (4) represents **high impact**, (3) represents **Moderate impact**, (2) represents **Low impact**, (1) represents **very low impact**.

S/No	Fast-Track Decision-Making Aspects	Code	TIME VARIANCE				
			5	4	3	2	1
1	Implement Front-End-Planning (FEP)	TV-1					
2	Adopt Pre-fabrication and Modularization	TV-2					
3.	Adopting Fast-track on complex high-rise buildings	TV-3					
4.	Compliance with site safety regulations	TV-4					
5.	Project stage at which the decision to fast-track is made	TV-5					
6	Adapting an effective dispute resolution technique	TV-6					
7	Securing Early Permits/ Approvals	TV-7					
8.	Decide the optimal degree of overlap between activities	TV-8					
9.	Selecting the most suited project delivery method (DB, CM, EPC)	TV-9					
10.	Announce incentives/ bonus for early completion	TV-10					
11.	Impose damages/ penalties for delays	TV-11					
12.	Early contract award for enabling works	TV-12					
13.	Apply Fast-track to Critical Path rather than non-critical	TV-13					

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	Fast-Track Decision-Making Aspects		**COST VARIANCE**				
			5	**4**	**3**	**2**	**1**
1.	Over-designing the facility	**CV-1**					
2.	Early Procurement of Long-Lead-Time Items	**CV-2**					
3	Adopt an appropriate contractual strategy	**CV-3**					
4	Implement an effective resource management plan	**CV-4**					
5.	Implement Value Engineering	**CV-5**					
6.	Implement an effective Risk Management Plan	**CV-6**					
7.	Limit the cost impact due to fast-track to 120% compared to traditional construction	**CV-7**					
8	Use prototyping (Scaled-down models of complex buildings)	**CV-8**					
9.	Sufficient contingency allocations by the clients	**CV-9**					
10.	Conduct Cost/Benefit analysis (Financial Feasibility)	**CV-10**					
11.	Apply fast-track to commercial building (which are time critical & High profit) rather than residential	**CV - 11**					
S/No	**Fast-Track Decision-Making Aspects**	**Code**	**QUALITY VARIANCE**				
			5	**4**	**3**	**2**	**1**
1.	Adopt BIM based Fast-track Approach	**QV-1**					
2.	Decision on Owner's financial capacity (Ensuring no resource constraint)	**QV-2**					
3.	Retain Design and Interface Management Responsibilities	**QV-3**					
4.	Decide the acceptable quality compromise extent on fast-track project preferably not less than 90%	**QV-4**					
5.	Limit the design optimization/ iteration process	**QV-5**					
6.	Delegate Authority to Project Level	**QV-6**					
7.	Implement Lean Construction	**QV-7**					
8.	Adopt contractor pre-qualification Strategy	**QV-8**					
9.	Quality Management Plan submission in pre-design stage	**QV-9**					
10.	Conduct constructability review during planning or design phase	**QV-10**					

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11.	Early engagement of O&M team in the design process	**QV-11**					
12.	Implement effective communication mechanism	**QV-12**					
13	Organizational restructuring (Experienced Team)	**QV-13**					
	Fast-Track Decision-Making Aspects		**SCOPE VARIANCE**				
			5	**4**	**3**	**2**	**1**
1.	Implement an effective Scope Management Plan	**SV-1**					
2.	Client Authorizing "Extras"	**SV-2**					
3	Decide between the potential time savings due to overlapping and the amount of expected reworks	**SV-3**					
4	Adopt Relational Approaches (Partnering & Alliancing)	**SV-4**					
5.	Implement an effective Change Management Plan	**SV-5**					
6.	Implement design & construction interface management plan	**SV-6**					
7.	Implement Front-End-Engineering Design (FEED)	**SV-7**					
8.	Early scope definition at conceptual or design stage	**SV-8**					
9.	Early involvement of the contractor in design phase	**SV-9**					
10.	Adopt scope freeze approach at early design stage	**SV10**					

Additional remarks (if any)

Thank You

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