ELSEVIER
Available online at www.sciencedirect.com
ScienceDirect
Procedia Engineering 14 (2011) 1966–1972
Procedia Engineering
www.elsevier.com/locate/procedia

The Twelfth East Asia-Pacific Conference on Structural Engineering and Construction

The Predictability of Fast-Track Projects

A. A. ALHOMADI [1*], R. DEHGHAN [1] and J. Y. RUWANPURA [1]

[1] *Project Management Specialization, Department of Civil Engineering, University of Calgary, Canada*

Abstract

Fast-Tracking to accelerate, overlap or compress schedules has an impact on project predictability in terms of achieving the planned objectives (time, cost, and quality). Predictability plays an important role in project success. Some studies focused on the fast-tracking impact on each objective; however, no research directly addressed the relationship between fast-tracking and predictability of the project's objectives. This paper investigates the relationship between fast-tracking and predictability with regard to success in meeting the project's planned objectives. A literature review was used. Significant findings in the study are the confirmations of the literature about the impact of fast-tracking on project predictability. This impact is that fast-tracking may lead to less predictability for the project's outcomes. The research results emphasize the need for further investigation of the relationship between fast-tracking technique and the project's predictability indices (cost variance, time variance and quality variance) in order to a achieve better understanding of the relationship and improve predictability.

Keywords: Fast-tracking; predictability; predictability indices.

1. INTRODUCTION

Today, fast tracking as a project delivery system has been widely implemented in several industries. Predictability of fast-track projects plays a significant role in their success. The predictability can be measured with regard to success in meeting the project's essential objectives (cost, time and quality). Many studies have investigated the fast-track projects with focusing on each one of these objectives separately while not directly addressing the relationship between fast tracking and predictability. The lack of research creates a need for more investigation in this area. The research uses literature review as the methodology and will investigate the relationship between fast tracking and predictability with respect to meeting project's objectives (cost, schedule, and quality). Fast-tracking and predictability principles are also explained.

doi:10.1016/j.proeng.2011.07.247

2. BACKGROUND

The accelerated development of the project market such as industrial, engineering, procurement, construction, and information technology (IT) during the past decades has created a large demand on shortening the project duration. The shortening usually increases the complexity of the project creating real challenges for the project's team. The main challenges occur in the interconnection between the project's phases and the reactions to the changes during the project period. As a result, 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 (Fazio et al. 1988). A simple definition of fast tracking is the process of overlapping sequential activities or phases in parallel to compress the project schedule (PMI 2004). Huovila et al. (1994) indicated in a study comparing fast tracking with the concurrent engineering approach that fast tracking is a project delivery method built on a practical basis without considering a firm conceptual or theoretical basis. The Fast-Track Manual's broad definition (Eastham 2002) considers fast-tracking as the "reduction of the schedule to the minimum practicable is the principal driving force for one or more stages of the project". Despite the different definitions, fast-track projects are similar to conventional projects in terms of predictability importance to success. In order to consider a fast track project as a successful project, the project needs to be predictable.

Project predictability, in general, can be measured by the success in meeting the project's essential objectives (Henry et al. 2007). In other words, the objectives are employed as indices of predictability to show how near to or far from to the project completion of the planned objectives. These objectives are cost, time and quality (Atkinson 1999). The more work done earlier on meeting the project's planned objectives, the more predictable the project is. UK government in 1999 selected time predictability and cost predictability in addition to other measurements (quality, client satisfaction, change orders, business performance, and health and safety) as National Construction Industry Key Performance Indicators (KPIs) (The KPI Working Group 2000). UK government defined predictability generally as the number of projects completed on time and within budget. In detail, the study expressed time predictability as a measure of how closely the project was delivered to the original schedule, and cost predictability expressed as a measure of how well outturn costs compared with original budget. Martin (2003) added that cost and time overruns are as bad as underruns for predictability. Both reflect variations of predictability for construction economists. In addition, he indicated that the specific definition of predictability would be completing the project on target or better or on target or lower. This means achieving the project planned budget or schedule within ±5%, for example. The existence of cost variances; schedule variances, changes, reworks, defects and deviations are indices of how predictable a project is.

Instead of predictability, some researchers refer to uncertainty. The more uncertainty in the projects, the less predictable the project's outcomes are. Loch and Terweisch (1998) have used the term uncertainty, which reflects the average rate of engineering changes and the reduction of modification changes rate over time. Engineering change is a term used by industry to indicate the deviation from the preliminary plans, which affects downstream and causes rework, deletion or replacement. An example is the overlapping between two dependent tasks such as the design phase and the construction phase. Any change in the upstream phase (design) from the original plans will affect the downstream phase (construction) work. The number of design changes presents the modifications. It is true that the reduction in the modification rate can be achieved with proper coordination before the start of the upstream activity. For instance, having an approved parts database for the project will help reduce modifications by preventing possible changes. Park (2002) also considered uncertainty as the repetitions of non-value additions, which are caused by construction changes. Fazio et al. (1988) and Park (1999) pointed out that the increased uncertainty and complexity in fast tracking needs more attention to achieve successful project completion.

3. FAST TRACKING PREDICTABILITY INDICES

As stated earlier, the predictability of the fast-track projects can be measured by the ability to achieve the project's planned objectives. Cost variance, time variance and quality variance are used to evaluate the predictability as indices by comparing the completion against the project's original objectives. In this section research addressing such indices is presented.

3.1 Cost

Cost variance in fast-tracking is an index of predictability. Several researchers such as Fazio et al. (1988) and Park (1999) stated that fast tracking might result in unexpected extra costs in the project budget. Williams (1995) pointed out that fast-track projects may cost less or more than the sequential delivery method depending on size, complexity, overhead, project team and expected duration. Tighe (1991) in studying fast tracking, argued that fast tracking might not lead to more costly construction. Jergeas (2008) in a study conducted to analyze the causes of cost and schedule overruns in front-end loading delivery system of Alberta oil sands megaprojects, has highlighted that implementing a fast-tracking strategy is one of the major reasons for cost overruns. These cost overruns could reach up to 100% of the project's original budget. In contrast, the European Construction Institute Fast-Tracking Manual (2002) argued that two thirds of the project managers asked have developed a risk management process to deal with penalties as a result of applying fast tracking. While the last third of the responses confirmed that there were cost increases due to additional design, redesign and rework without specifying how much this extra work cost.

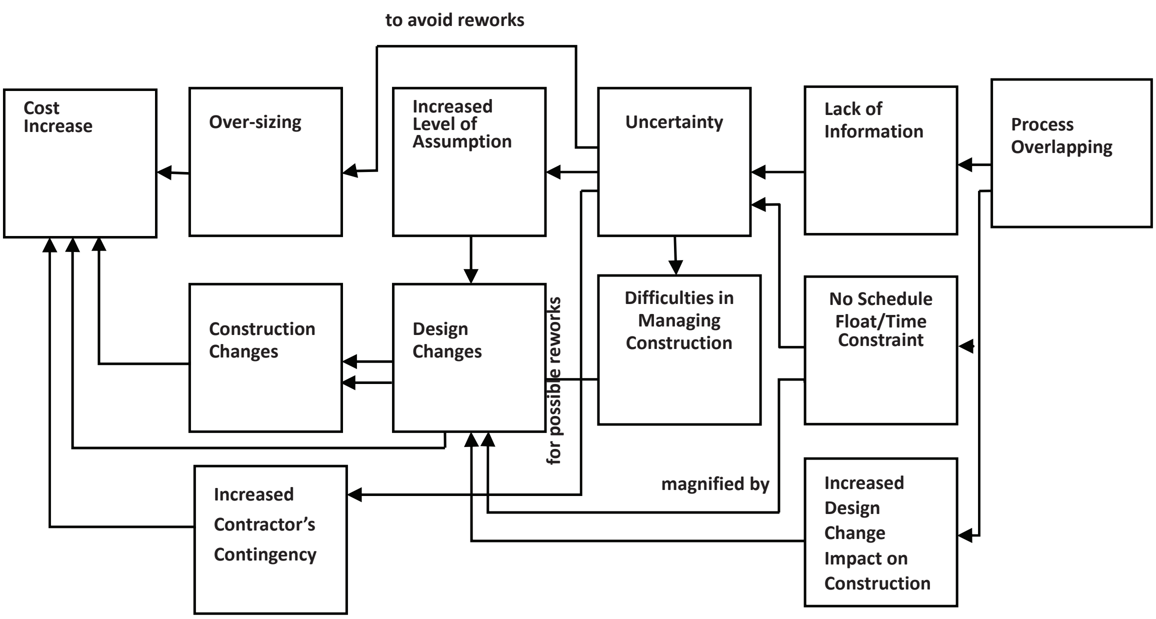

Figure 1: Cost-Increasing Factors In Fast-Tracking (adopted from Park 1999)

Michalak (1997) claimed that cost associated with an aggressive schedule (a compressed, accelerated, or overlapped schedule), might increase unreasonably between 40% to 50% or more. Michalak also identified significant impacts of aggressive schedule related costs such as unreliable (nonaligned) cost estimates and underestimated (understated) resource requirements. These impacts would cause a high number of change orders (interim of cost), loss of image due to missed commitments to customers, less market opportunity due to loss of image, and extended level of overhead costs. Loss of income, loss of image and loss of future business have associated capital costs, which are difficult to evaluate and estimates range very widely. Moreover, all of the previous scenarios normally would be associated with additional costs due to claims, liens and litigation.

Based on a study by the Construction Industry Institute (CII) comparing the early and late start of overlapping projects, Pedwell et al. (1998) reported that the more overlapping, the more cost overruns. Projects, which started overlapping early, had the highest cost overruns with 27%. On the other hand, projects which started overlapping late had lower cost overruns of only 11%. This study used 16 projects with an average value of 80$ million.

Peña-Mora working with Park (2001) stated that adding extra allowances or increasing the assumptions in fast-track projects design lead to increased cost as a result of the improper management of resources. For example, overdesigning due to incomplete information affect other disciplines leading to increases in their design assumptions

Park (1999) identified factors that increase the cost of fast-track projects due to overlapping such as lack of information, insufficient schedule float and the design changes impacting on construction, (Figure 1). Another important finding in the study is that some contract types suit fast-tracking better than other types. Normally, a fast-track project suits a cost reimbursement strategy more than other strategies such as lump sum because the changing and uncertain nature of fast-track projects require flexible strategies such as cost reimbursement to handle the changes and additional costs.

3.2 Time

Another predictability index for fast-track projects is time variance, which is expressed as the difference between the total actual time and the total planned time. In other words, schedule slippages or delays represent the project variations in achieving the project's original time objective. An essential goal of fast-tracking techniques is to reduce or shorten the project duration. These reductions may vary depending on project characteristics. Kasim et al. (2005) mentioned that fast-track projects could be accomplished within less than 70% of the original project period. Deshpande (2009) reported that completing a fast-track project within shorter period might vary from 50% to 75% in comparison to the normal schedule in engineering, procurement and construction (EPC) projects. This comparison was based on using the concurrent engineering approach, which is one of the fast tracking practices used in industrial project management. On the other hand, based on a case study comparing the as-planned and as-built schedules of different projects, Fazio et al. (1988) argued that fast-tracking does not necessarily reduce the project schedule but may cause delays. They also mentioned that 66% of the total project delay is related directly or indirectly to fast-tracking implementation. By studying the factors affecting the construction planning outcomes, Laufer & Cohenca (1990) also argued that overlapping incomplete design prior to the start of construction might cause substantial construction delays.

Michalak (1997) also emphasized that schedule slippages range from 30% to 40% in the chemical process industry (CPI). This is a result of fast tracking critical phases such the front-end loading phase which has several effects on project progress which can generate cumulative schedule delays. Furthermore, Jergeas (2008) confirmed the slippage in schedule as a result of implementing a fast track strategy during front-end planning in oil and gas projects.

In research investigating fast tracking for nuclear power plant construction, Baker and Boyd (1983) noted that a total project delay would occur due to the absence of a 'cushion', which is usually found in normal project procurement field activities. This absence is attributed to engineering and construction overlapping. According to Park (1999) in fast-tracking the interrelationships dependency and compressed schedule are more due to overlapping, which increase the ripple effects leading to more design changes and longer activities duration and total delays (Figure 2).

Miles (1995), in studying the ultra fast-track design/build method, a method developed and implemented by the construction industry, reported that improper fast-track execution can result in communications difficulties, design errors and omissions, which contribute to schedule overrun. Moreover, Peña-Mora and Park (2001) outlined that increased overlapping between design and construction would create additional changes in design and construction more than the sequential method, which may cause delay and counterbalancing the time saving achieved by the increased overlapping.

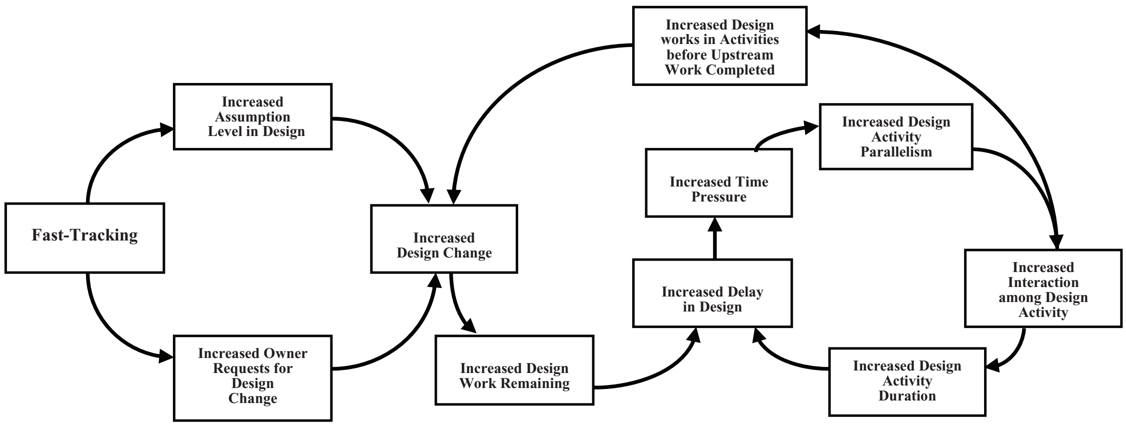

Figure 2: Ripple Effects of Design Changes under Fast-Tracking (adopted from Park 1999)

3.3 Quality

Quality, in addition to cost and time, is a measure of predictability for fast-track projects. Project predictability with respect to quality variation can be measured by the number of changes, reworks, deviations, omissions or defects. The project quality may suffer due to the accelerated nature of fast-tracking and insufficient time. Based on studying the effects of schedule pressure on construction performance, Nepal et al. (2006) emphasized that schedule acceleration could lower the project's quality; the more pressure on schedule the lower quality. This is a result of working out of sequence, generating work defects, cutting corners, and losing the motivation to work. However, to overcome and minimize these effects Nepal el al.(2006) recommended planning construction schedule activities realistically and proactively, motivating workers, and establishing an effective project coordination and communication mechanism. Furthermore, lack of time and information may lead to sub-optimal design (Deshpande, 2009). The design can be overdesigned or undersized. In both cases rework is required to fix the variation problem from the original design. Williams (1995) concluded that the lack of a proper definition of the final product could be considered a main reason for problems in fast-track projects during the design phase.

Fazio et al. (1988), in a case study, indicated that the design impact of fast-track projects requires additional work and some rework more than the conventional projects due the amplified severity and frequency of the disruption associated with fast-track technique. By studying the design impact on procurement, they found, in some cases during tendering several addenda were issued; a large number of drawings were revised, added, or deleted. In one case for structural steel package awarding, the bid closing date of package was rescheduled three times, 190 drawings were added, and 109 drawings were revised. All of theses revisions or deletions contribute to the low quality associated with design stage deliverables, which would affect the procurement phase deliverables quality and completeness.

During investigating robust control of cost impact on fast-track building construction projects, Park (1999) identified that the design changes will cause other changes during the later construction phase. In addition, the research emphasized that changes are normal practices in all projects; however, in fast tracking they are more frequent. These changes of specification or scope by the designer or owner and changes during the construction phase are categorized as common type of changes in fast-track projects.

Park (2002), in another study examining the dynamic change management of fast tracking construction projects, has distinguished between change types and change and rework. Change means deviating from the essential plans or standards as a result of work quality, work conditions and scope changes. On the other hand, rework could be done by deleting previous work. Change and rework are performed in one of the following actions: adding, deleting or replacement (Park 2002). Fast tracking projects without proper planning may lead to change as a management reaction to rectify the problem. However, the change would cause subsequent changes adding more work and lower quality (Park 2002).

4. CONCLUSIONS

This paper investigated the relationship between fast-tracking and predictability through an extensive literature review. It revealed that schedule compression, accelerating or overlapping has an impact on projects in terms of achieving the original objectives and sometimes may lead to unexpected outcomes. However, a fast-track project's original objectives can be successfully achieved by avoiding unrealistic goals and aggressive overlapping, planning properly and realistically, using an experienced and knowledgeable project team, learning from previous similar projects, and establishing effective project coordination and communication. Moreover, the projects' characteristics such as size, complexity, overhead, project team and expected duration are important factors which may increase the variances of the projects' final outcomes.

The research into the relationship between predictability and fast-tracking to improve fast-track project predictability is necessary. Further studies are needed to continue to evaluate the predictability indices based on actual data of completed fast-track projects. The use of actual data would increase the accuracy of the predictability evaluation. Also, investigating the causes that lead to variances in actual project predictability is important. More in depth research is required to understand the relationship between fast-track projects and predictability and to improve predictability, which will increase project success and the completion of planned objectives.

REFERENCES

[1] Atkinson R (1999). Project management: cost, time and quality, two best guesses and a phenomenon, its time to accept other success criteria. Journal of Project Management, 17(6), pp. 337-342.

[2] Baker AC and Boyd K (1983). Fast-tracking for nuclear power plant construction. Journal of Project Management. 1(3), pp. 148-154.

[3] Deshpande A (2009). Best Practices for the management of design in fast track industrial projects. Ph. D. thesis, Department of Civil Engineering, University of Cincinnati.

[4] Eastham G (2002). The fast track manual: a guide to schedule reduction for clients and contractors on engineering and construction projects. European Construction Institute. (n.d) Edition.

[5] Fazio P, Moselhi O, Thberge S, and Revay S (1988). Design impact of construction fast-track. Journal of Construction Management and Economics, 6(3), pp. 195-208.

[6] Henry R, Mccray G, Purvis R, and Roberts T (2007). Exploiting organizational knowledge in developing IS project cost and schedule estimates: an empirical study. Journal of Information & Management. 44(6), pp. 598-612.

[7] Huovila P, Koskela L, and Lautanala M (1994). Fast or concurrent: the art of getting construction improved. Proceedings Second workshop on Lean Construction, Santiago, pp 149-166.

[8] Jergeas G (2008). Analysis of the front-end loading of Alberta mega oil sands projects. Journal of Project Management. 39(4), pp. 95-104.

[9] Kasim N, Anumba C, and Dainty A (2005). Improving materials management practices on fast-track construction projects. Proceedings Twenty First Annual Association of Researchers in Construction Management (ARCOM) Conference, Khosrowshahi, pp. 793-802.

[10] Laufer A and Cohenca D (1990). Factors affecting construction-planning outcomes. Journal of Construction Engineering and Management. 116(1), pp.135.

[11] Loch C and Terweisch C (1998). Communication and uncertainty in concurrent engineering. Journal of Management Science. 44(8), pp. 1032.

[12] Martin J (2003). Performance measurement of time and cost predictability. Proceedings FIG Working Week, Paris, pp. 1-10.

[13] Michalak C (1997). The cost of chasing unrealistic project schedules. Journal of AACE International Transactions, pp. 269.

[14] Miles RS (1995). Ultra fast-track project delivery: 21st century partnering and the role of ADR. Proceedings Third workshop on Lean Construction, Albuquerque, pp.322-342

[15] Nepal MP, Park M, and Son B (2006). Effects of schedule pressure on construction performance. Journal of Construction Engineering and Management. 132(2), pp. 182.

[16] Park M (1999). Robust control of cost impact on fast-tracking building construction projects. MSc. thesis, Department of Civil and Environmental Engineering, Massachusetts Institute of Technology.

[17] Park M (2002). Dynamic change management for fast-tracking construction projects. Proceedings Nineteenth International Symposium on Automation and Robotics in Construction (ISARC), Gaithersburg, Maryland, pp. 81-89.

[18] Pedwell K, T Hartman F, and Jergeas GF (1998). Project capital cost risks and contracting strategies. Journal of Cost Engineering. (1), pp. 37.

[19] Pena-Mora F and Park M (2001). Dynamic planning for fast-tracking building construction projects. Journal of Construction Engineering and Management. 127(6), pp. 445.

[20] Peña-Mora F and Li M (2001). Dynamic planning and control methodology for design⁄build fast-track construction projects. Journal of Construction Engineering and Management. 127(1), pp. 1.

[21] PMI. (2004). A guide to the project management body of knowledge: PMBOK guide. Project Management Institute Inc., Third Edition.

[22] The KPI Working Group (2000). KPI report for the minister for construction. Technical Report 00-01, Department of the Environment, Transport and the Regions, London.

[23] Tighe J (1991). Benefits of fast tracking are a myth. Journal of International Project Management, 9(1), pp. 49-51.

[24] Williams GV (1995). Fast track pros and cons: considerations for industrial projects. Journal of Management in Engineering. 11(5), pp. 24.

.