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Problems causing delays in major construction projects in Thailand

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Delays are frequent and recurring in construction projects in developing countries. Although the principal reasons for construction delays are comparable across developing countries, several factors pertaining to local industry, socio-economic and cultural issues and project characteristics also contribute to construction delays. Questionnaire surveys and interviews were conducted on a major construction project in Thailand to explore the most significant problems causing construction delays. Factors related to designers, contractors and consultants were rated among the top problems. Issues such as lack of resources, poor contractor management, shortage of labour, design delays, planning and scheduling deficiencies, changed orders and contractors' financial difficulties were also highlighted during the interviews. Notably, problems such as 'multicultural and multilingual environment causing ineffective communication', 'large number of participants of project' and 'involvement of several foreign designers and contractors' were rated among the bottom 10 problems in the 75-item problem inventory. These findings can be helpful for project managers to mitigate the construction delays in Thailand. In order to effectively overcome the construction delays in developing countries, suggestions are made for fundamental and large-scale reforms in procurement systems, value chain management and stakeholders' management.

Keywords: Delays, major projects, developing country, Thailand.

Introduction

Studies in various developed as well as developing countries have shown that construction delays are common (Arditi *et al.*, 1985; Long *et al.*, 2004; Sambasivan and Soon, 2007) and one of the most recurring problems in construction projects (Faridi and El-Sayegh, 2006). Construction delays do not only result in cost overruns and poor quality but also greater disputes (Al-Khalil and Al-Ghafly, 1999), even total abandonment and protracted litigation by the parties (Aibinu and Jagboro, 2002). Assaf and Al-Hejji (2006) note that delay means loss of owner's revenue due to unavailability of production and other commercial facilities in time. Contractors may also suffer from higher overheads, material and labour costs. Previous research has pointed out various problems that usually result in delayed completion of construction projects. Particularly in the developing countries, studies over the last decade have shown a range of problems that have consistently resulted in construction delays and cost overruns in almost all types of construction projects (Ogunlana *et al.*, 1996; Kaming *et al.*, 1997; Mezher and Tawil, 1998; Faridi and El-Sayegh, 2006). Major problems which construction projects face are usually due to inadequate procurement system, lack of resources, discrepancies between design and construction, lack of project management practices, variation orders, communication lapses, cultural issues, and different interests of the participants (e.g. Odeh and Battaineh, 2002; Arain and Low, 2003; Abdul-Rahman *et al.*, 2006; Sambasivan and Soon, 2007). Some others also identify poor labour productivity and lack of contractors as major problems (Kaming *et al.*, 1997). Many of these studies found that the pattern of problems causing construction delays seems to be somewhat identical across various developing countries. Further, problems such as shortage of skilled human resources and design and construction

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complexity are similar in both developing and developed countries.

Where globalization and internationalization of the construction industry have benefited the developing economies, challenges have also equally soared (Ogunlana *et al.*, 1996; Raftery *et al.*, 1998; Wang, 2000; Chan *et al.*, 2001). The volume, complexity and requirements of construction projects have also grown over time. Scarcity of construction materials and human resources has intertwined with existing socio-economic and political problems of developing countries resulting in added pressure on the construction sector. Companies have been finding it difficult to deliver on time not because of lack of financial resources but mainly due to the fact that they are facing enormous pressure of multiple jobs and parallel deadlines with less than adequate human resources. With the growing boom of construction in developing countries, clients are increasingly concerned about time schedules and are using prime contractorship to pass time-risk on to the contractor along with heavy liquidated damages for late completion (Williams, 2003).

In such circumstances, construction stakeholders must have a comprehensive understanding of the factors that result in delays and the measures that can avoid such problems. Delivering the construction facility faster does not only serve as a competitive advantage but also serves in bringing innovation in construction method. Considering the issue at macro-scale, savings from increased time efficiency can be significant and used in further business expansion. Focus on reducing the delays can also help to reduce resources spent on heavy litigation processes in the construction industry which is known for its adversarial relationships (Phua and Rowlinson, 2003). Therefore, to achieve more time efficiency on construction projects in developing countries, comprehensive studies on common problems resulting in routine delays seem much more urgent (Long *et al.*, 2004). Such studies need to pinpoint the most relevant causes of delay that have to be monitored carefully in order to avoid the construction delays (Faridi and El-Sayegh, 2006). Although there is reasonable research carried out in the area, only few studies attempt to identify the problems in managing major projects which are usually carried out in multiple projects environment (Elonen and Artto, 2003). Particularly, there is a dearth of such studies from the perspective of the construction industry in Thailand. To cover this knowledge gap, the current research attempts to address the following objectives: (1) to examine the causes of delay in major construction projects in Thailand; and (2) to explore the perception of various construction stakeholders (client, consultants, designers, contractors) about the problems causing delays.

Problems causing construction delays

One of the earlier studies examining problems causing delays on construction projects was conducted by Baldwin and Manthei (1971) who cited 17 delay factors which resulted in delays in the US. These factors include: weather, labour supply, subcontractors, design changes, shop drawings, foundation conditions, material shortage, manufactured items, sample approvals, jurisdictional disputes, equipment failure, contracts, construction mistakes, inspections, finances, permits and building codes. Other factors contributing to construction delays are labour–management relations, strikes, poor organization, scheduling, coordination, deteriorating quality of workmanship, productivity, lack of skills in craftsmen, quality of training, delivery delays and the high cost of financing (Baldwin and Manthei, 1971). The next available study in the literature was conducted by Arditi *et al.* (1985) who observed the following causes of delays in public projects in Turkey: shortage of materials, difficulty in receiving payments from agencies, contractors' difficulties and the organizational characteristics of contracting companies and public agencies.

Following these initial works, studies were conducted in various developed as well as developing countries. In order to examine the problems causing construction delays, research projects were carried out in the UK (Sullivan and Harris, 1986), Nigeria (Okpala and Aniekwu, 1988; Dlakwa and Culpin, 1990; Mansfield *et al.*, 1994), Thailand (Ogunlana *et al.*, 1996), Indonesia (Kaming *et al.*, 1997), Hong Kong (Chan and Kumaraswamy, 1997; Kumaraswamy and Chan, 1998), Lebanon (Mezher and Tawil, 1998), Saudi Arabia (Assaf *et al.*, 1995; Al-Khalil and Al-Ghafly, 1999; Assaf and Al-Hejji, 2006), Malaysia (Lim and Mohamed, 2000; Abdul-Rahman *et al.*, 2006; Sambasivan and Soon, 2007), Ghana (Frimpong *et al.*, 2003; Frimpong and Oluwoye, 2003), Vietnam (Long *et al.*, 2004), Kuwait (Koushki *et al.*, 2005) and UAE (Faridi and El-Sayegh, 2006). Most research studies examining problems causing construction delays employed the questionnaire approach—and occasionally interviews—to elicit problems causing delays in construction projects. Not only are their findings quite comparable across various geographical regions, these research studies have mostly emphasized a collaborative or partnering approach, continuous involvement throughout the project development, and increased use of value engineering to overcome the problems resulting in construction delays. They also put a strong emphasis on thorough planning, realistic scheduling and continuous monitoring to avoid construction delays. An

important lesson from these studies is that construction planning, scheduling and management of the projects should be well in accordance with the actual skill levels, available resources, probability of unexpected events, efficiency of work time, and mistakes and misunderstandings that are likely to occur during various stages of the project (Lock, 1996). Early prediction and a thorough diagnosis of the problems can help avoid construction delays and complete the projects within time, budget and expected quality.

The top problems causing construction delays in selected studies are shown in Table 1. These selected studies represent a range of various countries where the research was conducted, different kinds of construction projects using different procurement systems, and different periods during the past two decades. It seems as if problems causing delays are nearly the same in developing countries with minute contextual differences. Common problems of delays in most studies include: lack of resources (material, labour, finances, etc.); lack of adequate communication; poor contractual management; design delays; changed orders; deficiencies in public agencies' organization; deficiencies in planning and scheduling; inadequate site planning and control; lack of experienced subcontractors and nominated suppliers; poor judgement in estimating resources. However, Table 1 also shows some emergent problems in the research studies published during the past five years. These problems include: lack of contractor's experience; slowness of the owner's decision-making process; owner's lack of experience; escalation in material prices; lack of construction labour; complex and constantly evolving legal systems; and lack of standardization in design.

Method

To address the objectives stated above, a detailed case study on Suvarnabhumi International Airport was carried out by adopting questionnaires and interviews as sources of evidence. The case study method has been well supported and used by several researchers while exploring various research problems in the construction field (see Fellows and Liu, 1997; Jefferies *et al.*, 2002). Case studies result in deep but narrow findings (Fellows and Liu, 1997); however, such findings are very insightful if the case in question represents a unique case (Yin, 1984). In order to develop a comprehensive inventory of problems for the questionnaire survey, a detailed literature review was carried out. Several problem inventories were found useful in the extant literature on delays in construction projects (see Chan and Kumaraswamy, 1997, 1998; Mezher and Tawil, 1998; Long *et al.*, 2004; Assaf and Al-Hejji, 2006; Sambasivan and Soon, 2007). Preliminary interviews and pilot surveys were also conducted with academic experts and construction professionals to check the inclusiveness of the problem inventory. This procedure generated a list of 75 problems under 10 sub-groups shown in Table 2.

Questionnaire surveys and interviews were conducted during September 2004 and February 2005 on the project site of the Suvarnabhumi International Airport, the largest construction project in the history of Thailand. This approach ensured that all respondents had hand-on experience of major construction projects. This data collection approach has also been used by several researchers and has produced reliable results (see, for example: Kaming *et al.*, 1997; Kumaraswamy and Chan, 1998; Mezher and Tawil, 1998; Abdul-Rahman *et al.*, 2006; Faridi and El-Sayegh, 2006).

The final list of the problems in the form of a questionnaire was distributed to a total of 80 managers who showed their willingness to participate in the study. These managers were occupying various managerial positions in different organizations involved in the project. The client organization also sent e-mails to all available consultants, designers and contractors requesting them to participate in the study, interviews and questionnaire surveys. This endorsement from the client resulted in a high response rate. A total of 76 completed questionnaires were received which yielded a response rate of over 95%.

All respondents were males and a majority of them were civil engineers by training. A few were mechanical or electrical engineers and some belonged to commerce, computer science and social sciences. A considerable majority (over 65%) of the respondents had an average working experience of more than six years as project manager while over 35% of the respondents had held the position of project manager for more than 10 years in their career. Over 75% of respondents were working in joint ventures. Few were working in consortiums (12%) and even fewer were still working with independent organizations (11.5%). The respondents belonged to 10 different nationalities including 48 (61.5%) Thai, 12 (15.3%) English, 5 (6.4%) Japanese and 4 (5.2%) Americans. More than 90% of the respondents were engineers by training while others came from commercial, economics and computer science backgrounds. Based on their affiliation, the respondents were divided into five groups: client, project management consultants (PMC), construction supervision consultants (CSC), design consultants (DC) and construction contractors (CC).

In addition to the questionnaire surveys, 35 face-to-face interviews were also carried out to elicit opinions

Table 1 Top 10 problems causing construction delays in previous studies

Lim and Mohamed (2000)	Frimpong *et al.* (2003)	Long *et al.* (2004)	Faridi and El-Sayegh (2006)	Assaf and Al-Hejji (2006)	Sambasivan and Soon (2007)
UK	Nigeria	Thailand	Indonesia	Hong Kong	Saudi Arabia
Large construction projects	Public sector projects	High-rise projects	High-rise projects	Buildings	Public utility project
Waiting for information	Contractors' difficulties in receiving interim payments from public agencies	Materials procurement	Design changes	Poor site management	Cash flow problems faced by contractor
Changed orders	Contractors' financial difficulties	Waiting for information	Poor labour productivity	Unforeseen ground conditions	Delay in the preparation of contractor submission
Ground problems/site inspection	Inadequate public agencies' budgets	Poor contractor management	Inadequate planning	Delays in design information	Difficulties in obtaining work permits
Bad weather	Deficiencies in contractors' organizations	Labourers/tradesmen shortages	Locational restriction of the project	Lack of communication between consultant and contractor	Government tendering system requirement of selecting the lowest bidder
Design complexity	Deficiencies in planning and scheduling	Waiting for information	Skilled labour shortage	Inadequate contractor experience	Delay in progress payment by the owner
M & E subcontractors	Frequent variation/changed orders	Design delays	Equipment shortage	Low speed of decision making involving all project teams	Effects of subsurface conditions of soil
Obstructions	Difficulties in obtaining construction materials	Planning and scheduling deficiencies	Materials shortage	Client-oriented variations	Delay in mobilization
M & E plant procurement	Deficiencies in public agencies' organizations	Construction plant shortages	Inaccurate prediction of equipment production rate	Necessary variations of works	Changes in the scope of project
Materials procurement	Contractors' unrealistic tenders	Changed orders	Inaccurate prediction of craftsmen production rate	Delays in subcontractors' work	Ineffective planning and scheduling of the project by the contractor
Statutory undertakers	Unrealistic contract durations imposed by public agencies	Contractor's financial difficulties	Inaccuracy of materials estimate	Improper control over site resource allocation	Shortage of manpower (skilled, semi-skilled, and unskilled labour)
Lim and Mohamed (2000)	Frimpong *et al.* (2003)	Long *et al.* (2004)	Faridi and El-Sayegh (2006)	Assaf and Al-Hejji (2006)	Sambasivan and Soon (2007)
Malaysia	Ghana	Vietnam	UAE	Saudi Arabia (consultants)	Malaysia
Electrical transmission lines	Groundwater projects	Large construction projects	General (construction industry)	Different projects	General (construction industry)
Lacked experience	Monthly payment difficulties	Slow site clearance	Preparation and approval of drawings	Difficulties in financing project by contractor	Improper planning
Lacked site supervision	Poor contract management	Slow government permits	Inadequate early planning of the project	Inadequate contractor's experience	Site management
Lacked appropriate skills	Material procurement	Inaccurate time estimating	Slowness of the owner's decision-making process	Shortage of labour	Inadequate contractor experience

Table 1 (Cont)

Lim and Mohamed (2000)	Frimpong *et al.* (2003)	Long *et al.* (2004)	Faridi and El-Sayegh (2006)	Assaf and Al-Hejji (2006)	Sambasivan and Soon (2007)
Lacked knowledge	Inflation	Lack of capable representatives	Shortage of manpower	Delay in progress payments by owner.	Finance and payments of completed work
Commercial interests	Contractors' financial difficulties	Contractors' financial difficulties	Poor supervision and poor site management	Delay in material delivery	Subcontractors
Lacked feedback	Escalation of material prices	Improper planning and scheduling	Productivity of manpower	Poor site management and supervision by contractor	Shortage in material
Unforeseen circumstances	Cash flow during construction	Unsatisfactory site compensation	Skill of manpower	Ineffective planning and scheduling of project by contractor	Labour supply
Unusual site conditions	Planning and scheduling deficiencies	Inadequate experience	Non-availability of materials on time	Type of project bidding and award	Equipment availability and failure
Lacked follow-up	Bad weather	Obsolete technology	Obtaining permit/approval from the municipality/different government authorities	Poor qualification of the contractor's technical staff	Lack of communication between the parties
Inadequate planning	Deficiencies in cost estimates prepared	Lack of responsibility	Financing by contractor during construction	Low productivity level of labour	Mistakes during construction stage

Table 2 Problem categories

No.	Problem category	No. of items in category	Category code
1.	Problems related to client	8	PClient
2.	Problems related to designers	6	PDesign
3.	Problems related to project management/consultants	15	PPMC
4.	Problems related to contractors	8	PContr
5.	Problems related to labour	6	PLab
6.	Problems related to finance	5	PFinanc
7.	Problems related to contract	5	PContct
8.	Problems related communication	6	PComm
9.	Problems related to site and environment	11	PSEnv
10.	Other miscellaneous factors	5	POFs
	Total problems	75	

about problems causing delays on major projects. The interviewees were mostly project managers (12), deputy project managers (8) and senior line managers (15). It is obvious from their designation that interviewees had extensive experience of project management and the majority of them had previously worked as project manager on construction projects. The interviews were mostly open ended and questions were asked regarding problems causing delays and possible mitigation mechanisms to avoid such problems.

Data analysis and results

In order to check the internal reliability of the problems inventory, Cronbach's alpha was calculated, which resulted in a high value of 0.959. This high value confirmed the internal reliability of the problems inventory (see Santos, 1999). Analysis of variance (ANOVA) was carried out in order to examine whether respondents differed in their perception based on their type of organization (client, designer, consultants, contractors), position in the organization (project manager, deputy project manager, line manager), experience as project manager in their past projects and educational background. ANOVA is a powerful technique to test simultaneously whether two or more population means of interval data are significantly different. Researchers widely use this technique to compare the perception of three or more groups (see Xiao and Proverbs, 2002; Low and Chuan, 2006; Ling and Poh, 2007). The results of ANOVA are shown in Table 3. Except for few items under each category, the respondents show significant agreement in their opinions about the problems of delays on major construction projects. The results of ANOVA in Table 3 also

Table 3 ANOVA for various demographical groupings

Problem code	Problem category and description	Type of organization		Firm structure		Experience as PM		Educational background	
		*F**	*P*^	*F*	*P*	*F*	*P*	*F*	*P*
	Problems of client								
PClient1	Confusing and ambiguous requirements	3.847	0.007*	6.539	0.013*	2.246	0.059	0.976	0.439
PClient2	Improper project feasibility study	0.423	0.792	0.416	0.521	1.737	0.138	0.789	0.561
PClient3	Lack of owner's representative	1.036	0.395	2.527	0.116	2.733	0.026*	0.908	0.481
PClient4	Lack of clear bidding process	1.341	0.263	1.177	0.281	1.935	0.099	0.901	0.486
PClient5	Delay of payment by client	1.610	0.181	0.421	0.518	1.843	0.116	1.338	0.258
PClient6	Too many scope changes and constructive changed orders	3.170	0.019*	8.738	0.004*	2.122	0.073	2.127	0.072
PClient7	Slow responses from the client organization	1.966	0.109	4.959	0.029*	1.167	0.334	1.094	0.371
PClient8	Wrong choice of contractor or consultant	1.757	0.147	1.710	0.195	0.580	0.715	0.722	0.609
	Problems of designers								
PDesign1	Low constructability of design	7.291	0.000*	2.375	0.128	0.296	0.914	0.894	0.490
PDesign2	Over-design increasing the overall cost	0.899	0.469	0.967	0.329	0.505	0.771	0.971	0.442
PDesign3	Errors and omissions in design documents	1.032	0.397	1.584	0.212	1.463	0.213	2.808	0.023*
PDesign4	Lack of standardization in design	0.507	0.731	1.574	0.214	0.519	0.761	2.320	0.052
PDesign5	Impractical design	3.240	0.017	5.529	0.021*	2.663	0.029*	1.528	0.192
PDesign6	Lack of involvement during construction stage	2.507	0.050	0.467	0.496	1.504	0.200	2.398	0.046*
	Problems of PM								
PPMC1	Inadequate experience of staff	0.658	0.623	0.071	0.790	0.932	0.466	0.873	0.504
PPMC2	Slow response	0.614	0.654	0.903	0.345	1.096	0.371	1.367	0.247
PPMC3	Lack of consultation with client	1.122	0.353	0.443	0.508	1.483	0.207	1.898	0.106
PPMC4	Lack or responsibility	1.188	0.323	0.947	0.334	2.688	0.028*	1.679	0.151
PPMC5	Failure to utilize tools to manage the project symmetrically	0.501	0.735	0.001	0.969	2.366	0.048*	0.456	0.808
PPMC6	Poor leadership on part of the project manager	0.891	0.474	0.015	0.902	0.996	0.427	1.366	0.248
PPMC7	Lack of timely decisions and corrective actions	1.097	0.365	0.506	0.479	0.965	0.445	1.501	0.201
PPMC8	Large number of participants of project	0.970	0.429	0.325	0.570	4.089	0.003*	1.283	0.281
PPMC9	Involvement of several foreign designers and contractors	0.208	0.933	0.005	0.942	1.127	0.354	1.771	0.130
PPMC10	Unrealistic project schedule	1.378	0.250	1.294	0.259	0.539	0.746	0.513	0.765
PPMC11	Poor project planning and control	0.422	0.792	0.574	0.451	0.127	0.986	0.994	0.428
PPMC12	Bureaucracy at the workplace	1.820	0.135	1.815	0.182	1.143	0.346	2.354	0.049*
PPMC13	Lack of top management commitment	9.222	0.000*	18.595	0.000*	0.618	0.686	4.100	0.003
PPMC14	Lack of project manager's experience	1.605	0.183	1.955	0.166	0.720	0.610	1.663	0.155
PPMC15	Unreasonable risk allocation	0.887	0.476	0.695	0.407	3.726	0.005	0.303	0.909
	Problems of contractor								
PContr1	Lack of competent subcontractors/suppliers	0.978	0.425	0.107	0.744	1.159	0.338	0.401	0.846
PContr2	Lack of necessary machinery, tools and automation available for project	0.456	0.768	0.329	0.568	0.906	0.483	1.037	0.403
PContr3	Lack of contractor's experience and control over project	1.213	0.313	2.955	0.090	1.495	0.203	0.588	0.709
PContr4	Poor efficiency of supervisor or foreman	0.449	0.773	0.272	0.604	0.622	0.683	0.681	0.640
PContr5	Using obsolete technology	0.248	0.910	0.030	0.864	1.970	0.094	3.054	0.015*
PContr6	Contractor's financial difficulties	2.654	0.040*	7.553	0.008*	4.167	0.002*	2.361	0.049*
PContr7	Inappropriate construction methods	0.648	0.630	2.102	0.151	0.801	0.552	1.270	0.287
PContr8	Lack of good relationship with client/consultant	0.712	0.586	1.384	0.243	2.391	0.046*	0.642	0.669
	Problems of labour								
PLab1	Absenteeism problems	1.417	0.237	0.062	0.804	1.378	0.243	1.306	0.271
PLab2	Unavailability of local labour	3.233	0.017*	0.688	0.409	1.559	0.183	0.948	0.456
PLab3	Non-cooperation from labour unions	0.339	0.851	0.003	0.958	2.720	0.026*	1.570	0.180

Table 3 (Cont)

Problem code	Problem category and description	Type of organization		Firm structure		Experience as PM		Educational background	
		*F**	*P*ˆ	*F*	*P*	*F*	*P*	*F*	*P*
PLab4	Unskilled labour	0.646	0.631	0.034	0.853	0.529	0.753	1.606	0.170
PLab5	Severe overtime and shifts	0.669	0.615	0.918	0.341	3.055	0.015*	1.315	0.268
PLab6	Poor labour productivity problems	2.322	0.065	6.157	0.015*	4.544	0.001*	1.370	0.246
	Problems of finance								
PFinanc1	High interest rate	0.283	0.888	0.000	0.995	0.903	0.484	1.251	0.295
PFinanc2	Increased cost due to high inflation during the project	0.418	0.795	0.123	0.727	1.035	0.404	0.634	0.675
PFinanc3	Interference in owner's decisions	0.711	0.587	0.006	0.936	2.523	0.037*	1.883	0.108
PFinanc4	Shortage of funding	1.671	0.166	2.195	0.143	2.225	0.061	1.085	0.377
PFinanc5	Unforeseeable financial and economic crises	2.083	0.092	0.073	0.787	1.152	0.342	1.034	0.405
	Problems of contract								
PContct1	Poor contract management	2.090	0.091	0.936	0.336	1.132	0.352	0.461	0.804
PContct2	Legal issues arising due to local government rules and regulations	0.526	0.717	0.165	0.685	2.760	0.025*	0.373	0.865
PContct3	Lack of cooperation from local authorities	0.449	0.773	0.087	0.769	2.615	0.032*	0.890	0.493
PContct4	Incomplete contract documents	3.776	0.008*	6.051	0.016*	2.117	0.073	0.702	0.624
PContct5	Inappropriate method of dispute resolution	1.535	0.201	1.597	0.210	2.226	0.061	1.053	0.394
	Problems of communication								
PComm1	Unclear lines of responsibility and authority	0.077	0.989	0.006	0.937	1.562	0.182	0.634	0.675
PComm2	Lack of communicating the requirements	0.553	0.697	0.031	0.860	3.187	0.012*	0.633	0.675
PComm3	Lack of effective inter-organizational communication	0.676	0.611	0.729	0.396	2.094	0.076	1.270	0.286
PComm4	Lack of coordination among project team members	3.790	0.008*	10.96	0.001*	1.177	0.329	0.612	0.691
PComm5	Multicultural and multilingual environment causing ineffective communication	0.059	0.993	0.052	0.821	0.729	0.604	0.627	0.680
PComm6	Lack of IT use for information, coordination and interface management	0.950	0.441	0.052	0.821	2.147	0.070	0.327	0.895
	Problems of site and environment								
PSEnv1	Unforeseen ground conditions	1.623	0.178	0.001	0.977	1.868	0.111	1.178	0.329
PSEnv2	Inaccurate site investigation	1.728	0.153	0.235	0.630	1.992	0.090	0.469	0.798
PSEnv3	Poor site access or availability	1.521	0.205	2.581	0.112	0.620	0.685	1.387	0.240
PSEnv4	Lack of temporary facilities on site (buildings, phones, electricity, etc.)	3.353	0.014*	8.547	0.005*	1.572	0.179	0.963	0.447
PSEnv5	Site pollution and noise	2.050	0.097	0.666	0.417	1.552	0.185	1.050	0.395
PSEnv6	Severe weather problems (hot, cold, rainy)	4.327	.003*	9.564	0.003*	3.459	0.008*	3.418	0.008*
PSEnv7	Poor site layout	0.469	0.758	0.149	0.700	0.756	0.584	0.965	0.445
PSEnv8	Poor site storage capacity	1.894	0.121	0.153	0.696	1.582	0.177	0.761	0.581
PSEnv9	Difficult site terrain to work	1.838	0.131	0.968	0.328	1.857	0.113	2.269	0.057
PSEnv10	Poor site management and slow site clearance	1.826	0.133	3.017	0.087	0.932	0.466	1.442	0.220
PSEnv11	Poor safety conditions on site	1.966	0.109	1.615	0.208	0.514	0.765	2.664	0.029*
	Problems due to other factors								
POFs1	*Force majeure* and acts of God	1.465	0.222	0.073	0.788	2.077	0.079	1.784	0.127
POFs2	Lack of available resources	3.041	0.023*	4.585	0.036*	2.191	0.065	0.916	0.476
POFs3	Non-value added works	0.773	0.546	0.024	0.878	2.085	0.077	0.502	0.774
POFs4	Poor quality control over project	1.031	0.397	1.119	0.294	2.208	0.063	0.361	0.874
POFs5	Fraudulent practices and kickbacks	1.296	0.280	0.109	0.742	1.590	0.174	0.542	0.744

Notes: * *F = (found variation of the group averages/expected variation of the group averages)*.
ˆP reports the significance level.

reduce the chances of any partiality while drawing conclusions at the end. Moreover, these results also show that respondents were impartial in their opinions and did not adhere to any bias.

Table 4 shows the mean perception ratings (M) and ranking (R) of problems as ranked by various groups of respondents on a five-point Likert-type scale (where 1 = not at all a problem and 5 = very big problem).

Table 4 Overall ranking of problems

Problem code	Description of problem	Overall (76)		Client (7)		PMC (10)		CSC (38)		DC (5)		CC (16)	
		M	R	M	R	M	R	M	R	M	R	M	R
Design4	Lack of standardization in design	4.59	1	3.71	31	4.20	15	4.08	34	4.00	40	4.13	38
Contr3	Lack of contractor's experience and control over project	4.47	2	4.00	12	4.70	1	4.47	2	4.40	16	4.56	9
PMC1	Inadequate experience of staff	4.39	3	4.29	4	4.20	19	4.45	3	4.20	33	4.50	13
Contr1	Lack of competent subcontractors/suppliers	4.38	4	4.43	1	4.20	16	4.32	10	4.40	17	4.63	4
PMC10	Unrealistic project schedule	4.36	5	3.86	29	4.20	20	4.42	4	4.60	9	4.44	20
PMC4	Lack or responsibility	4.34	6	4.00	23	4.10	28	4.42	5	4.80	2	4.31	30
Contr6	Contractor's financial difficulties	4.34	7	3.71	45	4.70	2	4.32	11	4.20	27	4.50	12
Contct1	Poor contract management	4.33	8	4.00	14	3.90	41	4.37	6	4.40	19	4.63	5
SEnv3	Poor site access or availability	4.33	9	4.00	20	4.10	27	4.34	8	4.80	1	4.44	19
Contr4	Poor efficiency of supervisor or foreman	4.32	10	4.29	2	4.40	4	4.34	7	4.00	41	4.31	27
Client5	Delay of payment by client	4.28	11	4.00	7	4.00	32	4.24	19	4.20	22	4.69	2
Financ4	Shortage of funding	4.28	12	3.57	49	4.40	3	4.26	15	4.60	3	4.44	16
Design3	Errors and omissions in design documents	4.28	13	4.00	9	4.30	7	4.21	21	4.20	26	4.56	7
Client1	Confusing and ambiguous requirements	4.26	14	3.43	51	4.30	6	4.21	22	4.40	11	4.69	3
Design1	Low constructability of design	4.26	15	4.00	10	4.10	24	4.11	33	4.40	14	4.81	1
PMC7	Lack of timely decisions and corrective actions	4.26	16	4.00	24	4.10	29	4.29	12	4.00	46	4.50	14
Client7	Slow responses from the client organization	4.25	17	3.71	42	4.20	11	4.24	20	4.20	23	4.56	6
Design5	Impractical design	4.24	18	3.43	58	4.30	8	4.29	14	3.80	51	4.56	8
Comm1	Unclear lines of responsibility and authority	4.24	19	4.14	5	4.20	18	4.26	16	4.20	29	4.25	33
Contr2	Lack of necessary machinery, tools, and automation available for project	4.22	20	4.00	13	4.20	17	4.21	23	4.20	28	4.38	23
Contct4	Incomplete contract documents	4.20	21	3.43	59	3.90	42	4.34	9	4.60	5	4.25	32
Client8	Wrong choice of contractor or consultant	4.18	22	3.71	43	4.10	22	4.13	31	4.40	12	4.50	10
PMC2	Slow response	4.17	23	4.00	25	4.00	37	4.18	27	4.20	34	4.31	31
PMC11	Poor project planning and control	4.17	24	3.86	30	4.20	21	4.24	17	4.20	35	4.13	40
Comm3	Lack of effective inter-organizational communication	4.16	25	4.00	16	4.00	33	4.18	26	4.00	44	4.31	28
PMC6	Poor leadership on part of the project manager	4.14	26	4.00	26	4.30	10	4.18	24	4.60	10	3.88	59
PMC14	Lack of project manager's experience	4.14	27	3.43	63	4.10	30	4.29	13	4.20	36	4.13	41
Client6	Too many scope changes and construction change orders	4.14	28	3.43	52	4.20	12	4.18	25	3.60	60	4.50	11
Comm2	Lack of communicating the requirements	4.14	29	4.00	17	4.00	34	4.13	29	4.20	30	4.31	29
Client3	Lack of owner's representative	4.11	30	3.71	44	4.10	23	4.08	35	4.20	24	4.31	26
Comm4	Lack of coordination among project team members	4.11	31	3.14	67	4.00	35	4.16	28	4.40	20	4.38	24
Financ3	Interference in owner's decisions	4.09	32	4.00	6	4.00	31	4.03	39	4.00	38	4.38	21
Contr7	Inappropriate construction methods	4.08	33	3.71	46	4.10	26	4.11	32	4.00	42	4.19	35
Financ5	Unforeseeable financial and economic crises	4.07	34	3.71	39	3.80	46	4.00	42	4.60	4	4.38	22
Lab2	Unavailability of local labour	4.07	35	3.71	47	4.00	36	3.92	50	4.60	6	4.44	18
Client2	Improper project feasibility study	4.07	36	4.00	8	4.20	13	4.05	36	4.40	13	3.94	51
POFs4	Poor quality control over project	4.05	37	3.71	38	3.90	45	4.24	18	4.00	49	3.88	61
PMC3	Lack of consultation with client	4.04	38	3.71	37	3.80	48	4.13	30	4.40	21	4.00	49
Design6	Lack of involvement during construction stage	4.04	39	4.00	11	3.80	47	3.89	51	4.40	15	4.44	17
Lab6	Poor labour productivity problems	4.01	40	3.43	55	4.30	9	4.00	44	3.60	64	4.25	34
SEnv11	Poor safety conditions on site	4.01	41	4.29	3	3.50	62	4.03	41	4.60	7	4.00	48
SEnv2	Inaccurate site investigation	4.01	42	4.00	21	3.70	53	4.00	45	4.60	8	4.06	44
POFs2	Lack of available resources	4.00	43	3.14	71	3.80	49	4.05	38	4.00	50	4.38	25
Lab3	Non-cooperation from labour unions	3.99	44	3.43	56	3.70	52	4.55	1	3.20	71	3.31	71
Contr8	Lack of good relationship with client/consultant	3.99	45	3.57	50	3.90	39	4.03	40	4.40	18	4.00	46
PMC13	Lack of top management commitment	3.99	46	2.86	75	4.00	38	4.00	46	3.80	58	4.50	15

Table 4 (Cont)

Problem code	Description of problem	Overall (76)		Client (7)		PMC (10)		CSC (38)		DC (5)		CC (16)	
		M	R	M	R	M	R	M	R	M	R	M	R
Lab1	Absenteeism problems	3.95	47	4.00	18	4.40	5	3.87	53	3.80	53	3.88	56
Client4	Lack of clear bidding process	3.93	48	3.43	53	4.20	14	3.87	52	4.20	25	4.06	43
SEnv10	Poor site management and slow site clearance	3.91	49	3.43	62	3.70	54	3.97	47	3.80	55	4.13	39
SEnv4	Lack of temporary facilities on site (buildings, phones, electricity, etc.)	3.91	50	3.14	68	3.50	63	4.05	37	4.20	31	4.06	45
Design2	Over designing increasing the overall cost	3.89	51	3.71	32	4.10	25	3.95	48	3.40	66	3.88	54
SEnv1	Unforeseen ground conditions	3.89	52	4.00	22	3.60	57	3.82	57	4.00	45	4.19	36
Financ2	Increased cost due to high inflation during the project	3.87	53	3.71	40	3.70	50	3.84	54	4.00	39	4.06	42
Contct5	Inappropriate method of dispute resolution	3.86	54	3.43	54	3.50	59	4.00	43	3.80	52	3.94	52
Lab4	Unskilled labour	3.84	55	4.00	19	3.90	43	3.79	58	3.40	68	4.00	47
Contct2	Legal issues arising due to local government rules and regulations	3.80	56	4.00	15	3.60	56	3.82	56	3.60	62	3.88	55
POFs5	Fraudulent practices and kickbacks	3.79	57	4.00	28	3.40	69	3.92	49	4.20	37	3.50	68
PMC15	Unreasonable risk allocation	3.79	58	4.00	27	3.50	64	3.71	64	4.00	47	4.00	50
Financ1	High interest rate	3.78	59	3.71	41	3.60	55	3.82	55	3.60	59	3.88	53
SEnv8	Poor site storage capacity	3.75	60	3.71	35	3.30	71	3.76	61	4.20	32	3.88	57
Contr5	Using obsolete technology	3.74	61	3.71	33	3.90	40	3.76	60	3.60	61	3.63	64
Contct3	Lack of cooperation from local authorities	3.74	62	3.71	34	3.50	60	3.79	59	4.00	43	3.69	63
SEnv6	Severe weather problems (hot, cold, rainy)	3.68	63	2.86	74	3.40	67	3.76	63	3.20	72	4.19	37
SEnv7	Poor site layout	3.68	64	3.71	36	3.40	68	3.68	65	3.80	56	3.81	62
PMC5	Failure to utilize tools to manage the project symmetrically	3.66	65	3.43	64	3.50	65	3.76	62	3.60	65	3.63	65
Lab5	Severe overtime and shifts	3.64	66	3.43	57	3.90	44	3.63	66	3.80	54	3.56	67
PMC12	Bureaucracy at the workplace	3.59	67	3.00	73	3.30	73	3.61	69	4.00	48	3.88	60
Comm5	Multicultural and multilingual environment causing ineffective communication	3.50	68	3.43	60	3.50	61	3.50	73	3.40	67	3.56	66
Comm6	Lack of IT use for information, coordination and interface management	3.50	69	3.43	61	3.70	51	3.58	70	3.60	63	3.19	74
PMC8	Large number of participants of project	3.49	70	3.14	70	3.50	66	3.63	67	3.00	73	3.44	69
SEnv5	Site pollution and noise	3.49	71	3.71	48	3.30	72	3.61	68	3.80	57	3.13	75
SEnv9	Difficult site terrain to work	3.46	72	3.14	69	3.20	75	3.42	74	3.40	69	3.88	58
PMC9	Involvement of several foreign designers and contractors	3.42	73	3.29	66	3.30	74	3.53	72	3.40	70	3.31	72
POFs3	Non-value added works	3.41	74	3.43	65	3.40	70	3.53	71	3.00	74	3.25	73
POFs1	*Force majeure* and acts of God	3.18	75	3.14	72	3.60	58	3.00	75	3.00	75	3.44	70

Lack of standardization in design, lack of contractor's experience and control over the project, inadequate experience of staff, lack of competent subcontractors/ suppliers and an unrealistic project schedule are the top five problems.

It is noticeable that the top 20 problems belonged to eight different categories of problems (in Table 2) which were originally categorized under 10 categories in all. However, four designer-related problems, five contractor-related problems, four project management and consultant-related problems, and three client-related problems appeared among the top 20 problems. Only one related to site and environment was rated among the top 30 problems (see Table 4). Similarly, three problems related to communication, one related to finance, and no problems related to labour were rated among the top 30 problems. Table 4 also shows some problems have been rated among the bottom 10 for causing delays. These include: 'multicultural and multilingual environment causing ineffective communication', 'large number of participants of project', and 'involvement of several foreign designers and contractors'. It illustrates that working with cross-cultural stakeholders is no longer novel to the construction industry. Owing to large-scale internationalization of the industry, foreign designers, multicultural environment, and large number of participants in the project are not perceived as problems causing delays.

In order to examine the severity of rating received by each category for causing delays, the average of the mean ratings of all problems under each category was computed. Table 5 illustrates that the categories of

designers, contractors, client, finance and project management and consultants received highest average scores. It can be seen that the client has given highest average scores to the categories of contractors, designers and finance. Also, PMC and CSC have rated the categories of contractors, client and designers at the top. The designers have given top ratings to the categories of client, finance and contractors. The contractors have given highest average rating to the categories of client, designers and contractors. Notably, all respondent groups have given low average rating to the categories such as 'contracts', 'communication' 'site and environment', 'other factors'.

Similar trends were noticed during the interviews where most interviewees raised concerns regarding incomplete design, errors in design, insufficient details and over-design. For example, one project manager working in a construction joint venture observed:

> I think the major issue here is incomplete design, large number of variations, and lack of communication about these variations. You look at the size of the project, it is so big. We have to struggle to incorporate the design changes at this stage when construction is more than half way through.

Financial difficulties and lack of competence on the part of contractors, subcontractors and suppliers were also mentioned several times. Unrealistic deadlines for the completion of tasks, lack of communication and coordination interfaces on construction sites, and slow decision making were some issues mentioned about the consultants. Confusing requirements of clients, slow responsiveness, and delayed payments by the client were also emphasized by some interviewees.

A construction manager belonging to a CSC articulated the above issues, saying:

> I am afraid to say that we are facing too many physical interfaces, too many deadlines, and too many variations. No one is ready to accept the responsibility for variation orders and it is resulting in delays … sometimes we do not even know what is exactly expected from us. There are no clear guidelines and this is the main reason of slow decision making. How can you expect the project to complete in time under these conditions.

These findings are similar to the results of Ogunlana *et al.* (1996) on problems causing delays on high-rise building projects in Thailand. Their study also showed that most of the problems on major construction projects related to lack of resources, poor contractor management, shortage of labour, design delays, planning and scheduling deficiencies, changed orders and contractor's financial difficulties.

Discussion and implications

Table 6 shows the top 20 problems in the current study and mention of these problems in studies from other countries (Table 1). This comparison shows that some problems causing delays in the construction projects are recurring (see Lim and Mohamed, 2000; Faridi and El-Sayegh, 2006). Also, there seems to be a similar pattern of problems in all developing countries. Inexperienced clients, incompetent and inexperienced contractors and subcontractors/suppliers, lack of resources, lack of contractual knowledge, complex and confusing government regulations, lack of strong financial packaging by the contractor, impractical, incomplete or too complicated designs, lack of project management best practices, and socio-political and economic problems are common factors that result in delays of the construction projects (see Table 1). However, Table 6 shows a notable trend that some problems are occurring only after 2000 that can be regarded as an year when Asian economies started to recover from the financial crisis and construction volumes slowly started growing—even booming in recent years. With growing construction spending all

Table 5 Average ratings received by each category of problems

Problem category	Average rating of all problems under each category					
	Overall	Client	PMC	CSC	DC	CC
Problems related to client	4.15	3.68	4.16	4.13	4.20	4.41
Problems related to designers	4.22	3.81	4.13	4.09	4.03	4.40
Problems related to project management/consultants	4.00	3.66	3.87	4.06	4.07	4.06
Problems related to contractors	4.19	3.93	4.26	4.19	4.15	4.27
Problems related to labour	3.92	3.67	4.03	3.96	3.73	3.91
Problems related to finance	4.02	3.74	3.90	3.99	4.16	4.23
Problems related to contracts	3.94	3.69	3.90	3.97	3.97	4.00
Problems related to communication	3.98	3.71	3.68	4.06	4.08	4.08
Problems related to site and environment	3.83	3.64	3.52	3.86	4.04	3.98
Problems related to other factors	3.69	3.49	3.62	3.75	3.64	3.69

Table 6 Comparison of top problems with previous studies

Problem code	Current study	Previous studies (before 2000)	Previous studies (after 2000)
Design4	Lack of standardization in design		Wang (2000)*; Toor and Ogunlana (2006)*
Contr3	Lack of contractor's experience and control over project	Chan and Kumaraswamy (1997)	Lim and Mohamed (2000)*; Assaf and Al-Hejji (2006)*
PMC1	Inadequate experience of staff		Lim and Mohamed (2000)*; Assaf and Al-Hejji (2006)*
Contr1	Lack of competent subcontractors/suppliers	Chan and Kumaraswamy (1997); Mansfield *et al.* (1994)*; Sullivan and Harris (1986)	
PMC10	Unrealistic project schedule	Arditi *et al.* (1985)*; Dlakwa and Culpin (1990)*; Ogunlana *et al.* (1996)*; Mazher and Tawil (1998)*; Al-Khalil and Al-Ghafly (1999)*	Frimpong *et al.* (2003)*; Long *et al.* (2004)*; Assaf and Al-Hejji (2006)*
PMC4	Lack or responsibility		Long *et al.* (2004)*
Contr6	Contractor's financial difficulties	Arditi *et al.* (1985)*; Al-Khalil and Al-Ghafly (1999)*; Mazher and Tawil (1998)*	Koushki *et al.* (2005)*; Frimpong *et al.* (2003)*; Long *et al.* (2004)*
Contct1	Poor contract management	Arditi *et al.* (1985)*; Mansfield *et al.* (1994)*	Frimpong *et al.* (2003)*
SEnv3	Poor site access or availability	Sullivan and Harris (1986); Chan and Kumaraswamy (1997); Mazher and Tawil (1998)*; Chan and Kumaraswamy (1997)	Long *et al.* (2004)*; Faridi and El-Sayegh (2006)*; Assaf and Al-Hejji (2006)*; Sambasivan and Soon (2007)*
Contr4	Poor efficiency of supervisor or foreman		Lim and Mohamed (2000)*; Faridi and El-Sayegh (2006)*; Assaf and Al-Hejji (2006)*
Client5	Delay of payment by client	Mansfield *et al.* (1994)*; Al-Khalil and Al-Ghafly (1999)*	Frimpong *et al.* (2003)*; Assaf and Al-Hejji (2006)*; Sambasivan and Soon (2007)*
Financ4	Shortage of funding	Arditi *et al.* (1985)*; Dlakwa and Culpin (1990)*; Mansfield *et al.* (1994)*; Ogunlana *et al.* (1996)*	Frimpong *et al.* (2003)*; Long *et al.* (2004)*; Koushki *et al.* (2005)*
Design3	Errors and omissions in design documents	Sullivan and Harris (1986); Mansfield *et al.* (1994)*; Ogunlana *et al.* (1996)*	
Client1	Confusing and ambiguous requirements	Kaming *et al.* (1997)*; Mazher and Tawil (1998)*; Dlakwa and Culpin (1990)*	Koushki *et al.* (2005)*
Design1	Low constructability of design	Sullivan and Harris (1986)	
PMC7	Lack of timely decisions and corrective actions	Chan and Kumaraswamy (1997)	Faridi and El-Sayegh (2006)*
Client7	Slow responses from the client organization		Faridi and El-Sayegh (2006)*
Design5	Impractical design	Sullivan and Harris (1986)	
Comm1	Unclear lines of responsibility and authority		Long *et al.* (2004)*
Contr2	Lack of necessary machinery, tools, and automation available for project	Sullivan and Harris (1986); Ogunlana *et al.* (1996)*; Kaming *et al.* (1997)*; Chan and Kumaraswamy (1997); Mazher and Tawil (1998)*	Sambasivan and Soon (2007)*

Note: * Studies conducted in developing countries.

around the world, there is a rising dearth of experienced contractors, subcontractors, suppliers, and skilled or semi-skilled labour. Owing to the involvement of designers from various countries, the need for design standardization has also emerged as a concern in major construction projects.

In order to gain financial returns as early as possible, time constraints have increased; the ability to deliver a project fast is becoming an ever more important element in winning a bid (Williams, 2003). Cheung *et al.* (2000) note that the problems and obstacles, if not solved swiftly, can cause delays and cost overruns in projects, harm cooperative relationships, reduce efficiency, lead to claims and disputes, and probably invoke litigation proceedings (Bubshait and Manzanera, 1990). Delays result not only in financial setbacks but also in a bad reputation for the contractors. Therefore, time efficiency should be looked at as a long-term competitive advantage.

Li and Love (1998) argue that construction problems are mostly ill structured and 'the theory of construction problem solving must consider the nature of construction problems, the problem solvers, as well as the construction industry within which problems transpire and individuals seek solutions' (p. 722). Proper understanding of the problems and adequate use of management tools can help in mitigating the delays (Abdul-Rahman *et al.*, 2006). However, this integrative approach of problem solving is largely absent in developing countries. In order to overcome the problems causing construction delays in developing countries, fundamental and large-scale reforms are required in procurement systems, value chain management and stakeholders' management. The majority of the interviewees in this study agreed that innovative procurement systems and the involvement of designers and contractors right from the project conception stage could avoid many overwhelming issues at later stages of the projects. Other common suggestions to avoid problems include: comprehensive design preparation; adoption of realistic and agreed-upon time schedules by all parties; minimization of change orders; provision of adequate compensation to contractors and consultants; formulation of a robust risk mitigation plan; continuous involvement of stakeholders in constructive dialogue; more frequent site meetings involving all parties; and thorough resource planning and development of the project concept.

Discussions with project managers also suggested that experienced construction managers and seasoned site supervisors played a key role in avoiding many site-related problems. Some interviewees also proposed that all construction stakeholders (client, consultants, designers and contractors) should form an independent commission for performance evaluation on major construction projects. Comprising the representatives of related stakeholders, this stakeholders to take commission can prepare independent reports, anticipate problems and risks, and advise the necessary measures to overcome the problems. The role of such a commission should be purely advisory and it should hold regular meetings to present its impartial reports. Such a proposal, if implemented properly, would not only result in savings of resources but also increase the overall efficiency on the projects.

Conclusions and recommendations

An inventory of 75 problems categorized under 10 groups was used to examine the most significant problems causing delays in the major projects in Thailand. The findings showed that most problems related to designers, clients, contractors and finance were rated among the top problems; whereas a multicultural and multilingual environment, large numbers of project participants and the involvement of foreign designers were perceived as not very significant problems. Among many problems that construction projects face worldwide include shortage of human resources, machinery and equipment and construction materials. However, there are additional factors causing delays in developing countries such as lack of finance, technically incompetent and less experienced local companies, an underdeveloped business environment, complexities in legal and regulatory systems, and distinct socio-cultural issues. A literature review and findings from the analysis show that the factors causing construction delays in construction projects are mostly identical across developing countries. Nevertheless, the findings of this research should be interpreted in the context of the Thai construction industry. This is because different countries and geographical locations have their own set of socio-economic and political factors, their own structure in the construction industry, local construction practices and, more importantly, the project characteristics which together influence the problems that usually occur on a given project. While interpreting the results, one should also note that the data were collected from a single major project which was chosen as a case study because it was the largest project in the history of Thailand's construction industry. Also, data were collected over a limited period of time while the project was near its expected completion. This may have influenced respondents' perceptions about which problems were causing delays on the project.

Research in the field of procurement has shown that procurement of construction projects in developing countries involves a significant amount of bureaucracy,

several administrative levels, approval checks, fragmentation of laws on procurement, high levels of corruption, and lack of coherence between procurement systems and local culture and administrative systems and authority structure. All these factors result in inefficiencies, high cost and construction delays. In order to improve efficiency in construction, large-scale procurement reform is urgently needed in developing countries. Hence it would be useful for future research to focus on innovative, culture-specific, national-level and project-related procurement reforms. An integrated approach to studying problems causing delays with critical success factors, key performance indicators, procurement methods, and socio-cultural and economic issues can also provide a broader understanding of the issue which seems to have existed for a long time. Future research can also focus on how the perception of research participants—about problems causing delays—varies over the different stages of a construction project. Last but not least, many delays occur because of failure to anticipate the problems in the first place and to solve the problems when they have arisen. Therefore, developing countries need to invest in attracting more talent and develop the existing human resources to cope with mounting construction demand.

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