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Construction Delays in Developing Countries: A Review

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Abstract: ***Construction delay is one of the basic constrains to achieve the project objectives in developing countries. This study aims to find the causes and effects of construction delays in developing countries. A thorough literature review has been done following the content analysis method. The relevant literature of 28 developing countries was collected from the scholarly journals published in the period of 2006 to 2016. The different developing countries are grouped into three geographic regions, i.e. South and Southeast Asia, Middle East, and Africa. In these regions, total 53 potential causes of delay under 8 major groups are identified. Frequency and ranking of these factors have been done. The factors, delay in progress payment by owner, contractors' cash flow problem, improper planning and scheduling, poor site management, and change order by owner during construction, are acknowledged as critical causes of delay in developing countries. This study will assist both academic and professional experts providing more insight about the construction delays and project management in developing countries.***

Keywords: Construction delay, Critical causes, Developing countries, Project management

I. INTRODUCTION

Many parties involve in construction industry which creates numerous problems and subsequently, the industry is turned as a high-risk trade sector [1]. Construction industry deals with various contract documents among the parties. Every project is designed with predefined schedule, budgeted cost, and expected quality. All these are mentioned in the contract documents. Due to improper contract management and some other unexpected events, so many claims and disputes are raised by the parties. Delay is one of the major sources of claim and frequently encountered problem in construction arena where its attributes are well known but fundamental factors and subsequent impacts are not understood by the experts. Therefore, many projects are suffering by schedule delay.

Due to lack of improper management, delays may arise at feasibility stage of the project and continue till to the end of construction work. In the lifecycle of a construction project three parties e.g., owner, consultant, and contractor are closely involved. Thus, they are the key players of schedule delays of a project [2]. In addition, some other factors for example country's general economy, inflation of resource prices, lack of managerial service, environmental factors etc. are the causes of project delays [3, 4, 5]. As a result of delay, many projects fail to earn sufficient revenue [1, 5]. Besides, delays have negative impacts on business for both contractors and developers, for example, it degrades the reputation of the companies. It also increases construction cost by the influence of several factors such as escalation of resources price, economic recession, extreme weather, political unrest etc. [6].

To achieve the aim, a thorough review has been done considering the research papers on construction delays published in the period of 2006 to 2016 in construction engineering and project management journals and conference proceedings. This study reviews and critics the construction delay factors of 28 developing countries. Thus, the findings of this study will provide significant knowledge regarding construction delays in developing

In this era of globalization, construction experts and industries are not confined for working in a particular country or region. For example, construction companies (contractors), engineers, labors (i.e. skilled or unskilled), and researchers are frequently migrated from South and Southeast Asia, and Africa to Middle East [7, 8]. Beside, Chinese companies are working most of the developing countries [9]. Malaysia is also depends on some other developing countries for construction and research [10]. In addition, the developing countries have almost common characteristics to develop and manage the construction projects, where schedule delay is a frequent problem. Besides, there are some common factors of project delay in different developing countries [11]. Thus, to facilitate the project management in developing countries, it is significant to have a critical review of previous studies finding the important and potential causes of construction delay in this part of rising world. Ramanathan et al. [11] presented a review paper on construction delay and cost overrun to overcome this research gap. However, they considered the research papers published in the period of 1995 to 2010. Besides, their study covered only 12 developing countries comparing the delay factors in construction industry. It is found that due to the importance of project delivery within the scheduled time, construction delay research got serious attention to the researchers; as a result, many papers from most of developing countries have been published in the last 10 years. Therefore, a comprehensive review study is critical to understand the common and unique causes of construction delay in developing countries. This study aims to find the potential causes of construction delays and their effects on project delivery in developing countries.

countries. Besides, regardless of geographic boundaries, it will helps the stakeholders in developing countries like owners, contractors, and consultants, as well as researchers working and studying in this industry to understand the delay risks for proper project management. The rest of the paper contains research methodology, construction delay in different regions of developing world, potential causes of delays and their frequency and ranking, critical causes of delay in developing countries, effects of delay, recommendation for reducing construction delay, and conclusion.

II. RESEARCH METHODOLOGY

This study conducted literature review collecting relevant research papers in the field of construction delay in developing countries, which have been published in the journals of construction engineering and project management under the period of 2006 to 2016. However, few papers published before 2006 were also considered for some countries where, there was no research paper published at 2006 and onward. To select the best quality research, Scimago Journal Rank (SJR) listed journals were mostly considered. Some other peer-reviewed journals, conference proceedings, and thesis papers have also been collected and reviewed. During the literature search, some keywords like construction delay, time overrun, delay in project delivery, developing countries, and the name of an individual developing country were used. The stepwise processes for retrieving relevant papers, selecting the contents of discussion and critical analysis of the previous findings are discussed below:

This review paper follows content analysis method. At first the papers' topics and contents were matched with the searching keywords of relevant papers. Table 1 shows a list of some basic papers along with the area of research, country of research, year of publication, and references. The developing countries were then grouped into three geographic regions such as South and Southeast Asia (i.e. Afghanistan, Bangladesh, China, India, Indonesia, Malaysia, Pakistan, Sri-Lanka, Thailand, and Vietnam), Middle East (Iran, Iraq, Jordan, Kuwait, Lebanon, Oman, Palestine, Qatar, Saudi Arabia, and UAE), and Africa (Egypt, Ghana, Libya, Nigeria, South Africa, Tanzania, Uganda, and Zambia). As the limitation, this study did not consider any developing countries in Europe like Turkey. The potential causes (i.e. group causes and sub-factors) of construction delays were listed, and the frequency among the selected countries and the ranks of the factors in regards of regional (i.e. individual region) and global (i.e. all mentioned developing countries) were made and shown in Table 2. The most frequent and important factors found in different regions have been discussed based on the findings in Table 2. The critical causes of delays and there frequencies among 28 selected countries were shown in Table 3 and briefly discussed. This study also identified the effects of construction delays, and accumulated the actions recommended for reducing the construction delays from previous literature. Lesson learned from this study, the conclusion and future direction of research were drawn at the end.

III. CONSTRUCTION DELAYS IN DIFFERENT REGIONS OF DEVELOPING WORLD

This study classified the 28 developing countries under three geographic regions, for example South and Southeast Asia, Middle East, and Africa. The following sections discuss the findings of existing literature for the causes of construction delays in these regions.

A. Construction Delays in South and Southeast Asia

The construction delay is a common problem in this part of the world. The critical factors for delay in this region are basically related with managerial and financial issues. For example, research shows that managerial issues such as inadequate planning and scheduling, ineffective site management, poor communication among the parties, imperfect contract management etc. are the most critical factors of construction delays in India [12]. In addition to these issues, construction industry in Pakistan are encountering delay by financial issues (i.e. payment delay by owner, and contractor's fund shortage) together with shortage of equipment and materials, and environmental calamities [13]. Sri Lankan construction projects are also suffering by almost similar causes, for example, financial difficulties by contractor, payment delay by owner, ineffective project planning and scheduling, and poor site management [14]. Managerial issues, financial difficulties, shortages of resources like labor, materials, and equipment, along with contractors' inexperience are identified as most influential factors for project delay in Malaysia [15, 16]. Indonesian construction projects are also facing similar problems found in Malaysia [17]. All the problems mentioned for Malaysia along with delay in design, poor planning and scheduling, and change order during construction, are the most critical factors causing construction delay in Thailand [18]. Construction projects in Afghanistan are also facing similar problems mentioned for Malaysia. However, there is shortage of skilled labor instead of labor shortage[19]. Managerial issues and some other factors like site constraints, design changes, and material shortage at site are identified as significant factors for construction delay in Vietnam [20, 21]. Improper planning and scheduling, financial difficulties of owner and contractor, poor site management, lowest bidder selection are some critical causes of delay in Bangladesh [22, 23]. Major causes of construction delay in China are poor planning and scheduling by the contractor, poor coordination and communication among the parties in different phases of project, lowest bidder selection for construction, and shortage of materials and equipment, which are mostly unlike to other countries in this region[24].

B. Construction Delays in Middle East

Construction industries in Middle East have been experiencing severe delays because of managerial, financial, manpower, and design related issues. Jordanian

construction projects are encountering similar problems in addition to the labor shortage [25]. Construction projects in Kuwait have been suffering by schedule delay because of poor project management, change order in design, financial problem, and lack of construction experience of owner [26, 27]. In Iran, some financial, managerial, and environmental factors are most common and severe causes of construction delay [28, 29]. Financial problem (i.e. payment delay), shortage or failure of equipment; managerial problem (i.e. slow decision making, poor coordination among the project parties, conflicts between the parties at site etc.), and change order are high important factors causing delay in Lebanon [30]. Shortage of materials and skilled labor, financial difficulties, change order, and slow decision making by owner, lack of coordination between the design team, and design difficulties are some critical issues for construction delay in Qatar [31]. Improper site management, fund shortage, and material shortage or late supply at site are frequent and severe causes of delay in Palestine (Gaza Strip) [6]. Financial difficulties, poor managerial skills, resources problem (i.e. labor shortage, or unqualified manpower), and frequent change order by the owner are very important causes of construction delay in Saudi Arabia [4, 32]. Financial difficulties of the contractors, managerial problem, and manpower related issues (i.e. lack of labors or unqualified labors) are also significant factors of construction delay in UAE [33, 34]. Construction projects in Iraq are not delivered on time owing to contractor's lack of experience, delay in progress payment by owner, frequent change order, design error, and lowest bidder selection[35]. Contractor's lack of experience, and change order by owner are also significant delay factors in Oman. In addition, fund shortage of owner, and shortage of materials and equipment at site are also significant problem for delay in project delivery in Oman[36].

C. Construction Delay in Africa

Construction industry in Africa has been experiencing delay in project delivery for some very common reasons, such as contractor's cash problem, and delay in progress payment by owner, poor site management, and change order by owner. For other delay factors, there is no identical trend among the African countries. For example, Egyptian construction projects are suffering by schedule delays owing to improper planning and scheduling, poor site management, financial hardship of both owner and contractor, change order in design during construction, and absence of experience contractor[37–39]. Similar problems have been identified for construction delay in Libya. Beyond these, poor coordination and communication, delay in decision making, and shortage of materials and equipment are significant delay factors for Libyan construction industry[40]. Like Egypt, construction projects in Ghana are getting delay due to delay in progress payment, and poor site management. Besides, they have been experiencing delay because of procurement delay and late delivery of materials and equipment, and lack of skilled labor[41]. South Africa and Tanzania have similar issues like Ghana to produce project delay. Besides, lack of experience contractor, and contractor's improper planning and scheduling are the major delay factors for South Africa and Tanzania respectively [42], [43]. Nigeria and Zambia got very identical problems regarding project delay, for example, contractor's cash problem, delay in progress payment by owner, fund shortage of owner, poor site management, change order, design error, delay in procurement and late delivery of materials and equipment at site etc. are frequent and important factors of delay[44]. Construction industry in Uganda are facing problem due to financial hardship of owner and contractor, change order, design error, poor coordination and communication, delay in decision making, and shortage of materials and equipment, which are also significant problem in Zambia[45].

Thus, from the above discussion, it is clear that the construction projects in most of the countries have serious problem regarding managerial, and financial issues. Besides, there are some other important issues not fully discussed here. From the literature review, this study identified 53 frequent causes of delay and grouped them into eight major categories and listed in Table 2. The following section discusses brief details about the potential factors of delay in developing countries and shows their frequency and ranking based on the findings of 28 countries.

TABLE I
BRIEF DETAILS OF THE SELECTED PAPERS FOR CONSTRUCTION DELAYS IN DEVELOPING COUNTRIES

No.	Research area	Group factors of delay (total factors)	Country	Year of publication	Reference
1	Construction delay	Project, client, contractor, designer, materials, equipment, labor, external (83)	Afghanistan	2012	[19]
2	Construction delay	Owner, contractor, consultant, manpower and resources (i.e. materials and equipment), project, financial, rules and regulations, managerial, and environmental, (109)	Bangladesh	2015	[23]
3	Construction delay	Owner, contractor, consultant, construction, materials, manpower and equipment, and external (35)	Bangladesh	2014	[22]
4	Construction delay	No such group but 25 factors were identified	China	2010	[46]
5	Construction delay	Owner, consultant, contractor, design, materials, labor, equipment, and external (73)	India	2013	[47]
6	Construction delay	Project, site, process, human, authority, and technical (45)	India	2012	[12]
7	Construction delay	People, professional management, design and document, material, execution, and external (31)	Indonesia	2003	[17]

No.	Research area	Group factors of delay (total factors)	Country	Year of publication	Reference
8	Construction delay and cost overrun	Clients, consultants, contractors, nominated sub-contractors or suppliers, and external parties (84)	Malaysia	2014	[48]
9	Causes and effects of delay	Client, contractor, consultant, material, labor and equipment, contract, contract relation, and external (28)	Malaysia	2007	[49]
10	Cost and schedule risk	Financial, contractual, design, health and safety, managerial, construction, and external (37)	Pakistan	2014	[50]
11	Project problem and effects of delay	Clients, consultants, contractors, contract form, labor project condition, and external (37)	Pakistan	2011	[13]
12	Construction delay	Problems of client, problems of design, problems of project manager, problems of contractor, problems of labor, problems of finance, problems of contract, problems of communication, project site and environment, and force majeure and acts of God (75)	Thailand	2008	[51]
13	Construction delay	Owner, consultant, contractor, designer, outside effects, supervisor, other (35)	Vietnam	2016	[52]
14	Construction delay and cost overrun	Owner, contractor, consultant, project, materials and labor, and external (21)	Vietnam	2008	[20]
15	Construction delay	Owner, contractor, consultant, and low, regulation, and general defects (36)	Iran	2016	[53]
16	Cause and effects of delay	No specific group (28)	Iran	2012	[29]
17	Construction delay	Client, contractor, consultant, and external (65)	Iraq	2015	[35]
18	Construction delay	Owner, contractor, consultant, labor, materials, equipment, government regulations, and weather, (40)	Jordan	2008	[25]
19	Construction delay and cost analysis	No group causes, just 8 important causes of delay were addressed	Kuwait	2005	[27]
20	Construction delay	Owner, consultant, contractor, material, labor and equipment, contract, and external (131)	Lebanon	2015	[30]
21	Construction delay	Design, contractor, financial, managerial, and rule and regulations (34)	Oman	2013	[36]
22	Construction delay	Logic and environmental, managerial, consultant, financial, and external, (43)	Palestine	2011	[54]
23	Construction delay and cost overrun	Owner's responsibilities, contractor's responsibilities, consultant's responsibilities, design and documentation, contractual relationship, execution, project, labor and equipment, government relation, and external (110)	Palestine	2009	[6]
24	Construction delay	Employer, consultant, contractor, and external (43)	Qatar	2015	[31]
25	Construction delay	No group causes (35)	Saudi Arabia	2013	[32]
26	Construction delay	Owner, contractor, consultant, design, project, labors, materials, equipment, and external (73)	Saudi Arabia	2006	[4]
27	Cause and effects of delay	Client, contractor, consultant, project manager, financial, and other unseen factors (42)	UAE	2010	[33]
28	Construction delay	Owner, contractor, consultant, financial, planning and scheduling, contractual relationship, government regulations, and unforeseen conditions (44)	UAE	2006	[34]
29	Construction delay	Owner, consultant, contractor, material, labor, equipment, project, design, and external (99)	Egypt	2013	[39]
30	Construction delay	Owner, consultant, contractor, material, labor and equipment, project, and external (42)	Egypt	2014	[38]
31	Construction delay	Financing, manpower, materials, changes, contractual relationships, environment, equipment, scheduling and control, and rules and regulations (32)	Egypt	2008	[37]
32	Delay causes and effects	Financial, resource, technical, economical, environmental, operational, government and political, relationship, and legal (37)	Ghana	2015	[55]
33	Construction delay	Material, manpower, equipment, financing, environmental, changes, scheduling and controlling techniques, contractual relations, and government actions (32)	Ghana	2010	[41]
34	Construction delay	Design, construction, financial, management, code, and acts of God (43)	Libya	2009	[40]
35	Construction delay	Design, construction, financial, management, code, and acts of God (43)	Nigeria	2012	[56]
36	Construction delay	Client, quantity surveyor, architect, structural engineer, service engineer, contractor, sub-contractor, supplier, and external (44)	Nigeria	2006	[57]
37	Construction delay and cost overrun	Client, contractor, consultant, design, project, material, equipment, labor, and external (85)	South Africa	2015	[58]
38	Construction delay and disruptions	No group causes (21)	Tanzania	2013	[43]
39	Construction delay	Causes were not classified into group (22)	Uganda	2013	[59]

No.	Research area	Group factors of delay (total factors)	Country	Year of publication	Reference
	and cost overrun				
40	Causes and effects of delay	Owner, consultant, contractor, material, equipment, labor, and external (61)	Zambia	2013	[44]
41	Cost escalation and schedule delay	Client, consultant, and contractor (14 major causes)	Zambia	2009	[45]

IV. POTENTIAL CAUSES OF CONSTRUCTION DELAYS AND THEIR FREQUENCY AND RANKING

Construction delay studies in different developing countries show that the delay factors can be classified according to the sources of delays (Table 1). For example, project owner (some study mentioned it as client), consultant, and contractor. Few studies made separate groups for delay factors related with construction materials, equipments, and labor [38, 44, 58]. Some other studies considered them as resources related factors, or two groups like labor and equipment, and material, or material and labor, and equipment [15, 20, 30]. Beyond these groups, financial, managerial, government rules and regulations, and external factors were recognized as the common groups in most of the studies (Table 1). However, few studies added some more groups like contract documents or contractual relationships, design related, and environmental factors [41, 51]. Based on these findings, this study classified the delay factors under 8 major groups, for example, financial, owner, contactor, consultant, manpower and resources, project, managerial, and external [4, 12, 47]. Besides, from the existing literature, 53 delay factors under the 8 groups are identified. All these potential delay factors are listed in Table 2 and discussed briefly in the following subsections considering their frequency and ranking.

A. Financial

Both owner and contractor need sufficient fund to carry out any project. However, project financing is one of the major causes of delay in developing countries. Different types of factors are identified, which are closely related to project financing such as fund shortage of owner [52, 56, 60], delay in contractor's progress payment by owner [45, 49, 61], contractor's cash flow problem during construction [20, 62, 63], high interest rate, economic recession or inflation [64, 49, 63]. Among the financial factors, contractor's cash flow problem during construction and delay in progress payment by owner are the top ranked factor in South and Southeast Asia and Middle East. Delay in progress payment is also the top raked factor in Africa, but another financial issue like economic rescission/inflation got priority for construction delay instead of contractor's cash flow problem. However, overall ranking shows that first two factors are the most significant delay factors in developing countries because economic recession are less frequent in other two regions.

B. Owner

In construction industry, owner plays key role from inception phase to end of the project. Since, owner has various scopes of works, there are plenty of options to delay the project by them, for example, improper feasibility study, change order in design, lack of proper management, delay in decision making [4, 60], lowest bidder selection [38, 65, 66], poor contract management by owner [18, 31, 67], delay to approve shop drawing [47, 37, 34], and inadequate involvement of consultant in design/construction phase [20, 48 51]. The factor change order during design got highest priority all over the developing countries, followed by delay in decision making. Other factors in this group are less frequent and got very lower ranks overall. Thus, the project owners in the developing world have more or less similar characteristics in general.

C. Contractor

Different types of contractor are involved in construction projects, for example, general contractor, subcontractors, and specialized contractors (i.e. electrical contractor, plumbing and sanitary contractor). They have vital roles to achieve the targeted schedule of the project. Some contractor related causes of delay are improper construction planning and scheduling [32, 67–69], improper progress monitoring and cost control [66, 70, 71], poor site management [21, 26, 28], inaccurate cost estimation [6, 39, 59], incompetent project team [33, 42, 72], lack of experience [23, 27, 28], lack of modern equipment [12, 73, 74], multiple subcontractors [29, 75, 49], lack of appropriate and modern techniques in construction [70, 76]. Within these factors, improper planning and scheduling is the most frequent and significant factor considering all developing regions. Incompetent sub-contractor is the 2nd ranked factor in South and Southeast Asia, but other regions found it as less frequent. Inadequate site inspection is an important factor in South and Southeast Asia and Africa but not in the Middle East. Similarly, improper progress monitoring and cost control, and contractor's lack of experience are recognized as high ranked factors in Middle East but not in other parts of developing world.

D. Consultant (A/E)

The consultants are the sole agent of preparing design and specification of the project and also supervised the construction works on behalf of the owner. Besides, they have the duties to analyze constructability, control the quality, ensure the project developing as per drawing, and verify and approve contractor's invoice for progress payment. They are responsible for schedule delay in various ways, for instance, lack of experience [15, 29, 68], error in design [3, 32, 68], delay in preparation of shop drawing [77, 37, 78], conflict between drawing and

specification [12, 34, 37, 59], delay in response for work inspection and approval [21, 38, 79], and inaccurate constructability analysis (impractical design) [79, 80]. Among these factors, although there are ranking differences in the different regions, the factors error in design, lack or unclear shop drawing or design documents, and delay in work inspection and approval are most frequent throughout the developing countries.

E. Manpower and Resources

From literature review, 10 causes of delay under manpower and resources category are identified. In this category, materials and equipment are considered under resources. The factors in this group are lack of skilled workers [31, 53, 67], unskilled operator/technical person [4, 35, 45], escalation of resources price [53, 72, 73], equipment failure [13, 16, 67], shortage of equipment [17, 21, 33], delay in material procurement [14, 27, 69], slow delivery of material and equipment [12, 17, 49], and transportation problem [6, 31, 74]. In general, the factors lack of skilled workers, delay in material procurement and delivery, and shortage of equipment are most frequent in developing countries. Regardless of minor changes in their ranks in different regions, these three factors are recognized as most important factors for producing construction delays. In addition, Middle East and South and Southeast Asia experienced serious problem due to material shortage at site, which is less frequent in Africa. However, shortage of labor is a frequent issue in Middle East and Africa but not in South and Southeast Asia.

F. Project

Characteristics of construction projects vary from one project to another, thus, proper investigation for an individual project, based on past experience instead of speculation, is strongly recommended or even mandatory in some cases. Some project related problem such as inaccurate site investigation [12, 13], site constraints [21, 77], change in site condition [24, 78, 87] obsolete construction methods and technologies [24, 53, 79], and delay in site clearance [23, 81, 82] were identified as the potential causes of construction delay. In this group most of the factors are moderately important regardless of geographic boundaries. There overall ranks are in between 15 to 25 among 53 factors of delay. Particularly, change in site condition is the most frequent delay factor all over the developing countries. Besides, site constraint, and delay in site clearance are frequent factors in South and Southeast Asia and Middle East only.

G. Managerial

Proper management is very important to achieve the objectives of any project. There are vast scopes of work for the management team in construction project. An experienced and competent professional project manager can solve frequently encountered causes of delays in construction industry all over the world [61]. The factors of delay in this group are lack of experience construction manager [7, 23, 36, 83], poor site management [17, 20, 53], contractors' excessive workload [83, 86, 87], poor contract management [16, 18, 20, 57], conflicts between the parties [4, 12, 27, 34], poor material management [27, 53, 89], poor coordination among parties [13, 17, 18, 53], contract related dispute/claim [3, 17, 91], and insufficient communication between the owner and designer in design phase [4, 13, 84]. Among these factors, poor coordination and communication, and poor site management are found as most frequent causes in all the regions. Overall, poor coordination and communication is identified as 2nd ranked frequent factor in developing countries. Besides, lack of construction manager is another frequent factor of delay in South and Southeast Asia and Middle, however, African studies mostly ignored it as an individual factor of delay.

H. External

Construction activities regulated by public works department, civil aviation, fire safety department, department of environment, and utilities departments to provide connections of electricity, gas, water, and telephone. Previous studies found that delay in obtaining permits from local authority [7, 18], government laws, regulation and bureaucracy, [4, 17, 45, 92], and safety issues like work accident [13, 35] are some potential delay factors. In addition, some political and environmental issues such as strike and other problems, national and local politics [6, 67, 95], and adverse weather [14, 31, 93] are some frequent factors of delay. All these factors are considered as external factors producing delay in project delivery. Among these, adverse weather condition is the most frequent factor regardless of geographic boundaries of developing countries, and got 3rd highest rank within 56 delay factors. The factors delay in obtaining permits from local authority, and governmental issues are discovered as major problems in South and Southeast Asia and Middle East, while work accident is found as a frequent factor in Africa.

TABLE II
FREQUENCY AND RANKING OF CONSTRUCTION DELAYS IN DEVELOPING COUNTRIES

Group	Delay causes from literature review (53)	South and Southeast Asia		Middle East		Africa		Total Frequency (28)	Overall Rank
		Freq. (10)	Rank	Freq. (10)	Rank	Freq. (8)	Rank		
Financing	Contractor's cash flow problem during construction	8	1	9	1	5	3	22	6
	Delays in contractor's progress payment by Owner	7	2	9	1	8	1	24	3
	Fund shortage by owner	5	3	5	3	5	3	15	21
	High interest rate/Economic rescission/Inflation	3	4	4	4	6	2	13	29
Owner	Frequent change order by owner during construction	10	1	10	1	8	1	28	1

Group	Delay causes from literature review (53)	South and Southeast Asia		Middle East		Africa		Total Frequency (28)	Overall Rank
		Freq. (10)	Rank	Freq. (10)	Rank	Freq. (8)	Rank		
	Lack of experience	1	7	3	4	3	3	7	48
	Delay in decision making	7	2	9	2	6	2	22	6
	Lowest/unqualified bidder selection	3	4	2	7	3	3	8	45
	Owner's poor contract management	2	6	3	4	1	6	6	51
	Delay to approve shop drawing	3	4	5	3	2	5	10	39
	Inadequate involvement of consultant in design/construction phase	5	3	3	7	1	10	9	42
Contractor	Improper planning and scheduling	8	1	9	1	6	1	23	5
	Improper progress monitoring and cost control	3	7	7	2	3	8	13	29
	Inadequate site inspection	5	3	1	10	5	2	11	35
	Inaccurate time and cost estimation	2	10	3	8	3	8	8	45
	Incompetent project team	4	6	5	6	5	2	14	24
	Lack of experience	5	3	7	2	4	4	16	18
	Lack of appropriate and modern techniques in construction	5	3	6	4	4	4	15	21
	Poor contract management	3	7	3	8	4	4	10	39
	Delay/Conflicts in subcontractors' works	3	7	6	4	4	4	13	29
	Incompetent sub-contractor	7	2	5	6	1	10	13	29
Consultant	Lack of knowledge and experience	4	5	9	1	3	4	16	18
	Error in design	6	2	7	3	6	1	19	14
	Delay in preparation of shop drawing	4	5	7	3	3	4	14	24
	Lack or unclear of shop drawing/design documents	8	1	8	2	4	3	20	10
	Conflict of the drawing and specification	2	7	3	7	1	7	6	51
	Delay in response for design revision	5	4	6	6	2	6	13	29
	Delay in work inspection and approval	6	2	7	3	5	2	18	15
Manpower and Resource	Lack of skilled workers	6	2	7	4	7	1	20	10
	Shortage of manpower	1	10	8	2	5	5	14	24
	Poor productivity of worker	4	5	6	7	2	12	12	34
	Material shortage	6	2	10	1	4	6	20	10
	Poor productivity of equipment	3	7	1	14	2	12	6	51
	Delay in material procurement and delivery	6	2	7	4	7	1	20	10
	Shortage of equipment	7	1	8	2	6	3	21	8
	Material changes in types and specification during construction	3	7	3	13	3	8	9	42
	Unskilled operator/technical personal	3	7	6	7	2	12	11	35
	Escalation of resources price	4	5	4	12	3	8	11	35
Project	Site constraints	6	2	5	4	3	3	14	24
	Change in site condition	5	7	7	1	6	1	18	15
	Obsolete construction methods and technologies,	5	7	6	2	3	3	14	24
	Delay in site clearance	6	2	6	2	4	2	16	18
Managerial	Conflicts between the parties in the site	2	4	2	5	3	3	7	48
	Poor coordination and communication among parties	9	1	10	1	8	1	27	2
	Poor resource management	1	5	4	4	2	4	7	48
	Poor site management	5	2	9	2	7	2	21	8
	Lack of experience construction manager	4	3	5	3	1	5	10	39
External	Delay in obtaining permits from local authority	5	3	7	2	3	4	15	21
	Govt. laws and regulations and bureaucracy	6	2	7	2	4	3	17	17
	Adverse weather conditions	8	1	8	1	8	1	24	3
	Strike or other problem	3	6	3	4	3	4	9	42
	National and local politics	4	4	1	6	3	4	8	45
	Work accidents	4	4	2	5	5	2	11	35

V. CRITICAL FACTORS OF CONSTRUCTION DELAY IN DEVELOPING COUNTRIES

Table 3 shows a comparative list of most important causes of delay encountered in developing countries. It is noticed that financial factors are found as the most frequent causes of delay. For example, contractor's cash flow problem during construction, and delay in progress payment, owner's fund shortage, and have been found in 20 and 19 countries respectively out 28 developing countries. In addition, contractor's poor site management, and ineffective planning and scheduling (some studies defined this term as poor estimation of time for project activities) are acknowledged as very high frequent causes, which have been found in 19 and 18 countries successively. Owner related factor like change order during construction period is also found as most frequent and critical cause of delay (i.e. 18 out of 28 countries have this problem). Beyond these, poor coordination and communication, procurement and late delivery of materials and equipment at site, and shortage of materials and equipment are the high frequent causes of delay in developing countries. Some other factors, for instance, fund shortage of owner,

contractor's lack of experience, shortage of labor, lack of skilled labor, etc. are also some important and frequently encountered delay factors in some parts of the developing world.

TABLE III
CRITICAL CAUSES OF DELAY IN DEVELOPING COUNTRIES

Country	Frequency of the critical causes of delay (√)																
	SL	CLE	IPS	CCP	DPP	DPDME	PSM	COO	ED	FSO	LBS	ISC	LSB	UTP	PCC	DDM	SME
Afghanistan			√	√	√						√	√	√	√	√		
Bangladesh			√	√			√			√	√	√	√				
China			√								√				√		√
India			√	√	√	√	√	√	√				√		√	√	
Indonesia			√					√	√							√	√
Malaysia		√	√	√	√	√	√								√	√	√
Pakistan		√	√	√	√	√	√			√							√
Sri-Lanka										√		√					
Thailand		√	√	√			√	√				√					
Vietnam		√	√		√	√	√	√	√	√		√			√		
Iran			√	√	√		√	√	√								
Iraq		√			√			√	√		√					√	
Jordan	√		√	√	√			√									
Kuwait	√	√					√	√		√							√
Lebanon			√	√	√		√	√		√					√	√	√
Oman		√						√		√							√
Palestine				√	√	√	√										
Qatar				√	√	√		√					√		√		√
Saudi Arabia	√	√	√	√	√	√	√	√			√		√		√		
UAE	√		√	√		√	√		√				√			√	√
Egypt		√	√	√	√		√	√			√						√
Ghana					√	√	√						√				
Libya			√	√			√	√	√	√					√	√	√
Nigeria			√	√	√	√	√	√	√				√		√	√	√
South Africa		√		√	√	√	√						√				
Tanzania			√	√	√	√	√	√		√					√	√	
Uganda				√	√			√		√					√	√	√
Zambia	√			√	√	√	√	√	√	√			√		√		√
Total (28)	5	10	18	20	19	13	19	18	9	11	6	5	10		13	10	14

SL=Shortage of labor, CLE=Contractor lack of experience, IPS=Improper planning and scheduling, CCP= Contractor's cash flow problem during construction, DPP=Delay in progress payment, FSO=Fund shortage of owner, DPDME=Delay in procurement or delivery of materials and equipment, PSM=Poor site management, COO=Change order by owner, ED=Error in design, LBS=Lowest bidder selection, ISC=Incompetent sub-contractors, LSB=Lack of skilled labors, UTP=unskilled technical persons, PCC=Poor coordination and communication, DDM=Delay in decision making, SME=Shortage of materials and equipment

VI. EFFECTS OF DELAYS IN CONSTRUCTION PROJECTS

There are numerous consequences of construction delays on project performance. Haseeb et al. [13] stated that the impacts of delay are varying with respect to the parties' view for example owner thinks delay means loss of revenue and lack of services, alternatively contractor considers it as loss of money. The delay in construction projects has enormous impacts on time and cost overrun. It also creates caustic situation between owner and contractor such as dispute, ligation, arbitration, and sometimes total abandonment of the project [20, 31, 57]. However, cost overrun is considered as the most significant effect which may suspend or even terminate the project before completion. Due to project delay in long term, prices of materials and equipment, and labor costs. Besides, economic inflation, extra amount of bank interest, and indirect cost like salaries of the staff, and rental price of project offices increase. All these effects incurred good amount of cost and directly increase project cost [6, 63].

VII. RECOMMENDATIONS TO REDUCE CONSTRUCTION DELAY

Since delay is a common phenomenon all over the developing countries, many studies have been done with the aim of finding frequently occurring causes of delays in construction projects. But, most of the studies did not provide proper guide line to minimize the delay in this circumstance. Some studies such as Frimpong et al. [63], Aibinu and Odeyinka[57], Assaf and Hejji[4], Faridi and Sayegh[34], Sambasivan and Soon [49], Enshassi et al.

[6], Kaliba et al. [45], Haseeb et al. [13], and Pourrostam and Ismail [29] provided constructive guidelines to overcome delays in construction project. Frimpong et al. [16] recommended that contractor should calculate total project cost accurately before construction to avoid delay of payment for workers, arrange regular training to improve managerial competence for introducing up-to-date knowledge about modern management system, procurement of material and equipment need to be effective and efficient, and allocate sufficient contingency to cope increase cost of material during construction period. Aibinu and Odeyinka [89] suggested that integrated procurement, integrated team structure, establishment of a national agency (to coordinate the affairs of the industry and to facilitate the use of innovative management methods), and establishment of construction bank may solve financial problem and subsequently reduce the construction delay.

To reduce delay, some researchers recommended that owner should timely pay the contactor's progress payment, minimize change order during construction, avoid delay in approving design, and check capabilities of bidder before awarding the project [4, 6, 20]. Assaf and Hejji [4] added that contractor should ensure about project finance and cash flow, sufficient labor and their productivity, timely update planning and scheduling, appoint skilled project manager achieving specified completion time without compromising quality and cost. In addition, consultants have to review and approve submittals without intentional delay before construction, as well as to evaluate work request by contractor for controlling delay [4, 20]. To minimize delays in construction, Faridi and El-Sayegh [34] recommended that projects stakeholders (i.e. owner, consultants, and contractors) must have agreed upon the schedule and have to follow the schedule strictly, specialist companies of construction management need to involve, require regular training for the employees, and contractor should conscious to get permission and approval earlier from different government agencies. According to Sambasivan and Soon [20], the consultant should incorporate contract duration, process for solving disputes and assessing the causes of delay, prepare risk management plans at the time of contract between owner and bidder. Haseeb et al. [13] emphasize to reduce change order (related to owner or A/E) at construction phase, increase the productivity of labors, introduce modern equipment and technologies in construction. Beside contractor should ensure sources of finance for uninterrupted cash flow, and appoint competent staff to reduce delay in construction projects [6, 31]. Enshassi et al. [31] suggested to the contractors for purchasing materials at the starting of the project work and also emphasized to make schedule for delivering material at site. Besides, proper planning and scheduling, enough expertise for construction work, competent project manager and adequate economic support are the pre-requisite for contractor to reduce construction delay [20]. Pourrostam and Ismail [29] acknowledged that good procurement of material, improvement of human resources with sufficient finance by contractor may reduce construction delay. Kaliba et al. [45] recommended in detail to reduce construction delay. According to their study, construction works need to plan and schedule considering weather condition, scope of work should be defined clearly in contract document to avoid any claim. Besides, accurate cost estimation to ensure project financing for both owner and contractor are required to minimize delay. In addition, they also mentioned that efficient communication, skilled employees for all parties, capacity building and appropriate legislation (i.e. owner, contactor and consultant) may reduce most of the factors related to delay and cost overrun.

VIII. CONCLUSION

Construction delay is one of the basic problems to achieve the project objectives. It is frequently encountered in developing countries. This study aims to find the potential causes of construction delays and their effects on project delivery in developing countries. For this reason, a good number of studies in this area have been reviewed. The causes of delay are classified into 8 major groups and 53 frequent causes of delay are found under these groups as significant in developing countries. Among these causes, the financial issues like contractor's cash flow problem, and delay in progress payment by owner, managerial issue such as poor site management, contractor related factor, i.e., improper planning and scheduling, and owner related factor like change order during construction are the most important and frequent factors that directly force to schedule delay all over the developing world. The factor labor shortage is also the severe factor of delay in Malaysia, Saudi Arabia, UAE, and Jordan. On the other hand, there is shortage of skilled labor in Afghanistan, Bangladesh, and India, and also some parts of Middle East and Africa. Change order in design or contract documents is identified as a major factor of delay mostly in Middle East and Africa and few countries in South Asia like India, and Indonesia.

The delays have serious effects on project objectives such as schedule and cost overrun of the project. It also creates claim, dispute, litigation, and arbitration among project stakeholders, which sometimes abandoned the project. To reduce construction delay in developing countries, owner should pay progress payment regularly and reduce change order, and contractor should ensure cash flow throughout the project. Besides improving the managerial competency, and ensuring timely procurement of equipment, material, and labor with effective and efficient way are suggested for reducing delay. As a limitation, this study did not consider to discuss the methodologies so far used in previous studies conducted in construction delay in developing countries. Thus, review on varies methodologies used in delay studies to find the most appropriate methods of prioritizing delay factors and facilitating the decision making processes in project management is a potential area for further study.

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