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Causes Of Delay In The Planning And Design Phases For Public Works Department Construction Projects

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Abstract: A construction delay is anything that impedes the ability of a certain obliged party to maintain a schedule. Delays manifest during all project phases, where they might initiate even in the design phase. There exist a limited volume of studies in the literature that have analysed delay problems or the outcomes on strategies for mitigating the delays in the planning and design phases, specifically for the Public Works Department (PWD) construction projects. Hence, this research aims to assess the extent of delay issues in PWD construction projects, their critical causes, and the possible strategies or opportunities to minimize delays in the planning and design phases. Information from SKALA JKR was retrieved to enable analysis of delay issues in PWD construction projects to be carried out. Meanwhile, a structured questionnaire was also disseminated to two main target groups which were, PWD officers and private consultants. Mean index and relative importance index (RII) analysis methods were adopted to rank delay causes in terms of their severity as perceived by the respondents. Delays in the planning and design phases for PWD construction projects were literally in a critical state. Changes in clients' requirements, poor scope definition and miscommunication were among the most critical causes of delay in the planning and design phases. The communication aspect could have been the principal key strategy to resolve some major delay causes, in the effort to mitigate delays in the planning and design phases, as well as in the construction phase.

Keywords: *Delay, planning and design phases, construction projects.*

1.0 Introduction

The construction industry is pivotal to the Malaysian economy and its development. This industry currently contributes 4% to the Malaysian Gross Domestic Product (GDP), and is relied upon to contribute 5.5% to the Malaysian GDP by 2020. The Construction Industry Transformation Program (CITP) was further acquainted with backing the eleventh Malaysia Plan, which envisioned a noteworthy stride forward in streamlining the construction industry. The CITP imagined a development via a very gainful construction industry that would be a strong contributor towards Malaysia's desire of turning into a high-paying country by 2020.

A substantial number of inclusive studies have been conducted to distinguish the reasons for delay and its effects on construction projects. However, there exist a limited number of studies in the literature that concentrate on public construction projects, particularly in Malaysia. Nevertheless, all the findings are in a general sense relevant. AlSehaimi *et al*. (2013) suggested that most studies do not explore the factors behind the causes of delay. While most studies focus on finding causes or resolving delay problems in the construction phase, few studies had analysed delay problems in the planning and design phases (Yang and Wei, 2010). Encouraged by the comparative investigation by Yang and Wei (2010), this research concentrated on delay causes in the planning and design phases for public construction projects, particularly under the Public Works Department (PWD) administration and supervision. The focus was on giving timely, complete and precise construction project data and information (i.e. drawings, specifications and other requirements) in the planning and design phases. The successful fulfilment of these task data could then diminish the likelihood of delays in the construction phase, which are rampant. In general, 88% of PWD construction projects were somewhat delayed in the planning and design phases.

The importance of improving the time performance of public construction projects is acknowledged by every construction professional. The mitigation of delays can be achieved by adopting the process of knowledge management and project learning, which allows for valuable insights on the various problems, as well as their solutions (Abdus Saeed, 2009). Regardless of this, not many investigations exist to bolster the results on viable methodologies for moderating construction project delays, even in the planning and design phases.

This research aims to institute strategies and opportunities in trying to overcome or minimise the causes of delay in the planning and design phases for PWD construction projects. The objectives of this research corresponds to a set of targets to be achieved as follows:

i) To assess the present extent of delay matters in PWD construction projects in the planning and design phases.
ii) To distinguish the collective critical causes of delay in the planning and design phases.
iii) To propose strategies of suitable viable conduct and opportunities to avoid or minimize delays in the planning and design phases.

The scope of research exclusively covered just the public construction projects overseen by PWD, Malaysia. Some data was recovered from SKALA JKR, an online control and reporting framework kept up by the PWD. A questionnaire was also disseminated to obtain certain associated data from the target project participants. The projects and respondents comprised of the accompanying criteria or limitations:

i) Project locations were meant to be in the state of Pahang, Malaysia.
ii) In-house design projects (projects designed by PWD design teams).
iii) Out-sourced design projects (projects designed by private consultants).
iv) Project cost was greater than RM 5 million each.
v) PWD Officers.
vi) Private consultants that might be involved directly or indirectly in the projects.

The identified causes of delay in the planning and design phases would inevitably help with easing or alleviating the delay all through the construction project phases. Furthermore this could help in creating a better understanding of the public construction industry in Malaysia. It additionally will give the establishment further momentum to explore a viable plan and design for construction project management in Malaysia. The prevailing strategies and opportunities ought to assist to enhance the performance of the planning and design phases in a project cycle. The strategies and opportunities could likewise prompt a capability of expanding the quantity of public projects successfully finished within the estimated time frame, which brings higher probability to minimize delays amid the construction phase.

2.0 Literature Review

2.1 Planning and Design Phases

A plan is a set of actions for achieving something in the future, especially a set of actions that has been considered carefully and in detail (Longman, 2003). It indicates the significance of working towards an objective and distinguishing how that objective will be accomplished. There are more extensive viewpoints or definitions be considered in what constitutes planning, for example:

a) Planning is the determination and communication of an intended course of action incorporating detailed methods showing time, place and the resources required (CIOB, 2011).
b) Planning is the creative and demanding mental activity of working out what has to be done, how and when, by whom and with what, i.e. doing the job in the mind (Neale and Neale, 1989).
c) Planning is a decision making process performed in advance of action which endeavours to design a desired future and effective ways of bringing it about (Ackoff, 1970).

Planning and design phases offer the greatest potential for influencing the performance of a project. An all-around managed project will give esteem and basically meet client prerequisites all through its lifetime and will likewise advantage the earth, society and the economy. Appropriate execution in planning and design can convey these advantages and avoid pointless expenses and delays. Mawdesley *et al.* (1997) had also stressed that all parties to the project can benefit from planning. The benefits for the client and designer include (Mawdesley *et al.*, 1997):

a) Established deadline dates for the release of information on the project.
b) The ability to forecast resource requirements and resource costs.
c) The ability to forecast the expenditure and payment schedules.
d) The ability to forecast the staffing levels.
e) The ability to provide information to the public and other third-parties.
f) Improved co-ordination of the work of the project team.
g) Co-ordination of the project with work on other projects within the client's or architect's portfolio.

2.2 Public Construction Projects

Consultants or contractors for the public construction projects are typically profit motive organizations (Liang *et al*., 2014). As a rule, they will settle on trade- offs or going with choices in accordance with their benefit target edge. Kerzner (2013) discovered that public projects can be more complex than private-sector projects and more difficult to manage. These public projects can be more difficult and complex because they:

a) Operate in an environment of often conflicting goals and outcomes.
b) Involve many layers of stakeholders with varied interests.
c) Must placate political interests and operate under media scrutiny.
d) Are allowed little tolerance for failure.
e) Operate in organizations that often have a difficult time identifying outcome measures and missions.
f) Are required to be performed under constraints imposed by administrative rules and often-cumbersome policies and processes that can delay projects and consume project resources.
g) Require the cooperation and performance of agencies outside of the projects team for purchasing, hiring, and other functions.
h) Must make do with existing staff resources more often than private-sector projects because of civil-service protections and hiring systems.
i) Are performed in organizations that may not be comfortable or used to directed action and project success.
j) Are performed in an environment that may include political adversaries.

2.3 Delays in Construction Projects

Public construction projects are for the most part capital in nature. Capital projects constitute an essential fixing in the improvement procedure of groups, countries and areas everywhere throughout the world. However before such projects can achieve the set goals for which they were conceived, they need to be successfully delivered (Amade *et al.*, 2015). In the design phase, there is also a deadline to convey the final design reports. The out-sourced, lead consultant should authoritatively convey the design reports and different prerequisites in time. However design groups of PWD officers for in-house projects should likewise resolve to meet the set deadline.

The actual time of project completion frequently exceeds the planned time, commonly known as a delay or overrun (Gonzalez *et al.*, 2014). Some definitions for delay are to make something happen later than expected or to cause something to be performed later than planned or not to act in a timely manner (Mahdavinejad and Molaee, 2011). Anything that hinders the capacity of a certain obliged party to keep up a schedule means a construction delay is happening, for example, delay in design phase by designers or delay in construction phase by contractors. Marzouk and El-Rasas (2014) acknowledged that a construction delay means a time overrun either beyond the contract date or beyond the date that the parties have agreed upon for the delivery of the project.

Delay in planning and design phases is not a separate subject from a delay in construction phases. Each phase has its own deadline in an effort to achieve the set goals and objectives. Nevertheless where contractors are the ones to deliver products in the construction phase, designers or consultants are the ones who are supposed to deliver products (design reports) in the design phase. Yau and Yang (2012) referred to this fact, that most projects have delays in the design stage, which subsequently prompts project delays. It would appear that types of delay in the planning and design phases are identical to delay in the construction phases, but with lesser potential causes and concurrent delay is unlikely to be established.

2.4 Causes of Delay in Planning and Design Phases

McManus *et al.* (1996), who investigated delay causes in architectural construction projects, concluded that many delays manifest during all project phases and primarily occur during the construction phase; however there are also many delays that start in the design phase. Basu (2005) also identified factors at the start of a project that would almost certainly lead to project delays and provided insight into the reasons for the delays and their impact on schedules. Then, Abdullah and Koskela (2008) concluded that the primary delay causes appear to cluster around management issues and the project environment. Gonzalez *et al.* (2014) brought an argument to the conclusion which requires further research to address current management practices and negative delay impacts. Inspired to carry out a related research, they proposed that non-compliance in the planning phase was the most important cause of delay.

There are limited researches concerning delay causes in the planning and design phases conducted in recent years as pointed out earlier. In particular, Yang and Wei (2010) at the early stage of their research managed to determine 15 and 20 causes of delays in the planning and design phases respectively. Later, Yau and Yang (2012) identified the schedule delay factors in the design of turnkey projects in power distribution substation projects in Taiwan. In the research, 27 delay factors identified in the design stage. These delay factors by Yau and Yang (2012) were listed together with the findings by Yang and Wei (2010) in Table 1 for broader perspective of delay causes in the planning and design phases.

2.5 Effects and Impacts of Delay in Planning and Design Phases

There has been considerable and continuous interest on the effects and impacts of delay in construction projects. Projects consist of collections of activities and delays can be assessed at the activity or project level. At the activity level, delays can affect completion of activities, which may or may not have an impact on succeeding activities (Gonzalez *et al.*, 2014). In terms of economic impact, Flyvbjerg *et al.* (2004) developed a relevant study which found that cost escalation was strongly dependent on the length of the implementation phase, and also concluded that cost escalation is even worse in developing countries.

If delay occurred in the planning phase, it might simply be a time overrun or possibly a negative political view, as very few project participants are involved at this early stage and there should not be any contractual works with others yet. The Form of Consultancy Service Agreement (CSA) by Malaysia Treasury (2014) for the procurement of consultancy service briefly suggests the effects and impacts of delay in the design phase as in Table 2 below.

Table 1: Causes of Delay in the Planning and Design Phases

Causes of Delay in Planning and Design Phases	*Source*
Planning Phase • Improper basic planning. • Changes in client's requirement. • Complicated administration process of client. • Insufficient or ill-integrated basic project data. • Unfinished client-furnished item. • Slow land expropriation due to resistance from occupants. • Unreasonable contract duration. • Poor scope definition. • Project complexity. • Unreasonable or unpractical initial plan. • Inadequate planning and schedule. • Improper selection of subsequent consultants. • Change orders by client. • Incomplete or delayed document delivery by client.	• Yang and Wei (2010) • Yau and Yang (2012)

Table 1 (Cont'd): Causes of Delay in the Planning and Design Phases

Causes of Delay in Planning and Design Phases	*Source*
Planning Phase (Cont'd) • Indication of suspension or delay by client. • Tedious review processes of government agencies. • Regulation changes. • Over-subjective explanation of regulations by government officer. • Public resistance or political intervention. Design Phase • Changes in client's requirement. • Inadequate integration on project interfaces. • Change orders by deficiency design. • Unrealistic design duration imposed. • Liability ambiguity due to improper contract clauses. • Conflicts between contract clauses. • Incomplete design drawings and specifications. • Change orders by code change. • Disagreement on design specifications. • Improper or wrong cost estimation. • Slow decision making by designers. • Insufficient training of designers. • Poor communication and coordination between designers/ project user groups. • Inadequate experience of designers. • Lack of database for estimation. • Wrong or improper design. • Client's financial problems. • Unclear authority among designers. • Slow information delivery between designers. • Inadequate schedule control. • Inability of owners to review design in a timely manner. • Late incorporation of emerging technologies into a design. • Unforeseeable site conditions (e.g., existing underground conduits). • Delay due to other construction projects.	• Yang and Wei (2010) • Yau and Yang (2012)

Table 2: Effects and Impacts of Delay in the Design Phase

Effects and Impacts of Delay	*Source*
• Time overrun • Payment withhold • Unnecessary expense • Liquidated and Ascertained Damages (LAD) • Dispute • Arbitration • Litigation	Treasury (2014)

2.6 Mitigating or Minimizing Delay in Planning and Design Phases

A construction project is commonly acknowledged as successful when it is completed on time, within budget, and in accordance with specifications and to the stakeholders' satisfaction (Nguyen *et al.*, 2004). Adnan *et al.* (2014) stated that critical success factors are a crucial few factors or variables that a manager should pay more attention to in order to achieve the stated goals.

Ibironke *et al.* (2013) and Mahamid *et al*. (2012) provided concise thoughts on strategies and opportunities in mitigating or minimizing delay in the planning and design phases as in Table 3. Prior research by Yau and Yang (2012), also suggested some strategies which provide alternatives for preventing delays specifically for turnkey projects, but applicable for any construction projects. The proposed strategies were based on the perspectives of the owner and designer as exploratory recommendations to deal with similar circumstances. Their recommendations were:

a) For the Client:
- An open public hearing should be held which acts as a bridge connecting the project team and project stakeholders.
- A site tour of completed projects is a good alternative to resolving doubts of the public and the politicians.
- Selection of a qualified contractor or consultant for smooth project execution, which is attained through a transparent prequalification mechanism during the procurement process.

b) For the Designer:
- The designer needs to complete the site layout, preliminary drawings, and regulation checks as early as possible before applying for necessary permits or licenses, thus preferably completing the design work thoroughly to avoid foreseeable pitfalls in planning and design.

- The designer might need to request client support if the outcome of the review by government agencies is in conflict with the original planning and design principles issued by the client.
- A designer can assist in investigating the possibility of public resistance or political intervention.
- A designer should definitely take the position of a professional in designing a project, specifically by providing an error-free design and should be able to provide a thorough project description if required.

Design issues in most construction projects could be the results of inadequate on-site investigation, design and specifications inaccuracy, incomplete drawings, lack of details, design changes, and so on. Achieving error free design entails good communication with the entire design team and integrating a design process that is properly planned, giving enough time for corrections, extensive investigation and reviews (Ambituuni, 2011).

Table 3: Strategies in Mitigating Delay in the Planning and Design Phases

Strategies/ Opportunities in Mitigating or Minimizing Delay in Planning and Design Phases	*Source*
• Allow sufficient time for proper planning, design, information, documentation, and tender submission. • Allocation of sufficient time and money at the design phase. • Check for resources and capabilities before awarding the contract to the lowest bidder. • Detailed and comprehensive site investigation should be done at the design phase. • Multidisciplinary/ competent project team. • Better communication and coordination with other parties.	• Mahamid *et al.* (2012) • Ibironke *et al.* (2013)

2.7 Time Estimation

Chan and Kumaraswamy (2002) grasped the idea that there is a need for more reliable front-end predictions of construction durations at the planning and even the tender preparation stages. Fraisse (1984) indicated time as a highly complex notion; the clearest way to begin is by an analysis of the notion of time commonly held by the adult. Experience was literally implied as a key to the good estimation of time required to feasibly execute and complete a project. Otherwise, historical data from similar projects with similar contractual circumstances could be a great reliable source for use in time estimation.

3.0 Methodology

3.1 Data Collection

In summary, Figure 1 shows the research framework for this research.

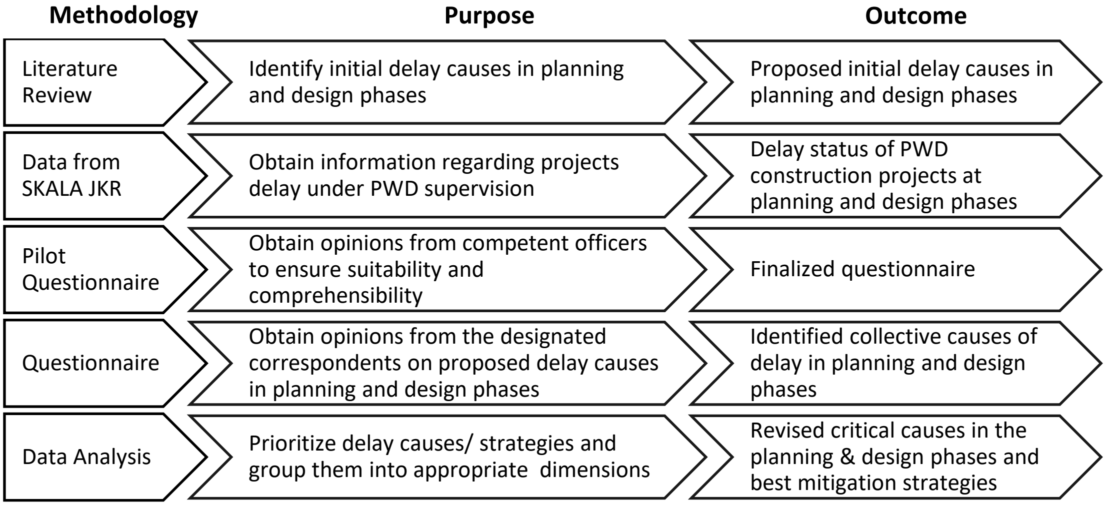


Figure 1: Research Frameworks for This Research

Apart of doing a persistent literature review, the first objective of this research was directed at recovering and breaking down the information from SKALA JKR database, to assess the present extent of delay problems in PWD construction projects in the planning and design phases. SKALA JKR online system is essentially an online database developed for registering, monitoring and reporting projects under the PWD supervision. The system has been in place since 1985, during which time the dissemination of information was done via conventional mail service. The system was then upgraded a couple of times with the introduction of MSDOS and Windows in 1991 and 2000 subsequently. The year 2003 denoted the beginning of a web-based system where the status of projects is literally monitored in a real time manner until today.

The second and third objectives of this research began with developing a set of questionnaire. A questionnaire was developed and at first distributed as a pilot. The selected respondents were sought for their expert opinions to validate initial findings and to obtain additional data. These experts were competent PWD officers who were acknowledged for their experience in construction project management and certified under the PWD Project Managers Certification Programme. The certification programme was introduced in 2007 where the evaluation was based on PWD Project

Management Competency Standard. The standard was originally developed with reference to the Australian Project Management Competency Standard. After that, a structured and comprehensive questionnaire was disseminated and extended to two main target groups, which were PWD officers and consultants.

3.2 Data Analysis

A standout amongst the most well-known reliability tests utilized for this research was Cronbach's alpha. Cronbach's alpha can decide the internal consistency or normal connection of things in an overview instrument to quantify its reliability. Other than that, the frequently used mean index or score analysis was also preferred for this research. In order to analyse existing performance of PWD construction projects particularly in the planning and design phases, the interpretation of mean value used in this research adapted the five rating scales proposed by Abd. Majid (1997) as defined in Table 4.

Table 4: Interpretation of Mean Index for Existing PWD Projects Status

Level of Criticality	*Mean Value*
Acceptable	1.00 ≤ Mean Index < 1.50
Attention Needed	1.50 ≤ Mean Index < 2.50
Warning	2.50 ≤ Mean Index < 3.50
Critical	3.50 ≤ Mean Index < 4.50
Very Critical	4.50 ≤ Mean Index ≤ 5.00

An importance-performance matrix introduced by Martilla and James (1977) was transformed and used as an importance-frequency matrix by Yang and Wei (2010) for evaluating the suitability of selected causes in this research. Relative importance index (RII) was adopted to rank the delay causes. The contribution of each of the identified causes to delays in the planning and design phases were investigated for the ranking of the attributes in terms of their severity as perceived by the respondents.

$$RII = \frac{\sum W_i}{A \times N} \quad (1)$$

where,

W_i = *the weighting assigned to each cause by respondents.*
A = *the highest value of weighting.*
N = *the total number of respondents.*

As suggested by Yang and Wei (2010), the value of the severity index (SI) was calculated by multiplying both the RII value for importance and frequency as follows:

$$SI = RII_{imp} \times RII_{freq} \quad (2)$$

where,
RII_{imp} = *RII values for importance.*
RII_{freq} = *RII values for frequency.*

The five-point Likert scale range from 1 to 5 was also adopted and transformed to relative importance, frequency and agreement indices, as outlined in Table 5.

Table 5: Five-point Likert Scale Ordinal Measures of Importance, Frequency and Agreement

Scale	*Importance Weightage*	*Frequency Weightage*	*Agreement Weightage*
1	Least Important	Very Low	Least Agree
2	Slightly Important	Low	Slightly Agree
3	Important	High	Somewhat Agree
4	Very Important	Very High	Agree
5	Extremely Important	Extremely High	Strongly Agree

4.0 Results and Analysis

4.1 Overview

Information and data from SKALA JKR database were retrieved and deemed true as of 4th May 2016. Access was authorized and limited to information on projects in the state of Pahang, Malaysia only but consisted of federal and state projects. The finalized questionnaire was disseminated via official electronic mail in bulk to most, if not all PWD officers in Malaysia. They were given 15 days to answer the questionnaire, and were kindly requested to also extend the questionnaire to local consultants who they might know or were currently working with on any project.

4.2 PWD Construction Projects Status Analysis

There were 83 active projects out of 154 projects that were registered in SKALA JKR for the state of Pahang. Active projects were those already under construction phase or could be completed projects but still within the Defects Liability Period (DLP). Information from 88 projects that satisfied this research criteria were viewed and retrieved for analysis. 47 (53%) projects were in-house projects and 41 (47%) were out-sourced projects. The analysis focused on delay occurrence of each project which then computed for overall mean index in separate and combined phases. The results were summarized in Table 6. Lesser number of projects was mulled over for design phase delays in light of the fact that the overlooked projects were not yet into it, but rather obviously may have endured delay in the planning phase.

Table 6: Delay Occurrence Results and Analysis in Planning and Design Phases for PWD Construction Projects

No.	*Project Phase*	*In-house*		*Out-source*		*All*	
		Projects	*Mean*	*Projects*	*Mean*	*Projects*	*Mean*
1	Planning	47	2.74	41	2.05	88	2.42
2	Design	38	3.29	40	3.18	78	3.23
3	Planning & design	38	3.66	40	3.48	78	3.56

4.3 Questionnaire Responses Results and Analysis

At the initial stage, a pilot study was carried out by distributing the questionnaire to experts comprising a few competent PWD officers who were certified under the PWD Project Managers Certification Programme. Responses from these few selected respondents aided into finalizing a comprehensive questionnaire. Seven experts returned the pilot questionnaire and agreed that the questionnaire was sufficient to capture the causes of delay, but added up to two more mutual opinions for the proposed strategies and opportunities as listed below:

i) Scope Investigation with clients in order to fully understand their requirements and finalize the outcome of the projects.
ii) Comprehensive project communication plan needs to be in place, implemented and monitored.

With the finalized questionnaire, 51 responses of 39 (76%) PWD officers and 12 (24%) private consultants were successfully collected or returned and all of them were valid for extensive analysis. The following analysis essentially used data and information from all 51 valid responses. The unwavering quality or reliability of the questionnaire responses turned out to be outstanding as the alpha values were more noteworthy than 0.90 as exhibited in Table 7.

Table 7: Reliability Test Results for Questionnaire Responses

Analysed Information	*Cronbach's Alpha Coefficients*		
	Importance	*Frequency*	*Agreement*
Results for causes of delay in planning phase.	0.953	0.952	
Results for causes of delay in design phase.	0.968	0.943	
Results for strategies and opportunities to avoid or minimize delays in planning and design phases.			0.952

Table 8: Various Index Values and Ranking Results for Causes of Delay in the Planning Phase

Item No.	Delay Causes	Importance			Frequency			Severity Index	
		Mean	RII	Rank	Mean	RII	Rank	Value	Rank
B1.1	Improper basic planning.	4.08	0.816	1	3.45	0.690	5	0.5630	2
B1.2	Changes in client's requirement.	3.90	0.780	3	3.71	0.741	1	0.5784	1
B1.3	Complicated administration process of client.	3.24	0.647	17	2.96	0.592	15	0.3832	16
B1.4	Insufficient or ill-integrated basic project data.	3.73	0.745	6	3.39	0.678	6	0.5055	6
B1.5	Unfinished client-furnished item.	3.57	0.714	11	3.18	0.635	10	0.4534	10
B1.6	Slow land expropriation due to resistance from occupants.	3.78	0.757	5	3.06	0.612	12	0.4630	9
B1.7	Unreasonable planning duration.	3.63	0.725	9	3.20	0.639	9	0.4637	8
B1.8	Poor scope definition.	3.71	0.741	7	3.49	0.698	2	0.5174	5
B1.9	Project complexity.	3.67	0.733	8	3.31	0.663	7	0.4860	7
B1.10	Unreasonable or unpractical initial plan.	3.61	0.722	10	3.06	0.612	13	0.4414	12
B1.11	Inadequate planning and schedule.	3.94	0.788	2	3.49	0.698	3	0.5502	3
B1.12	Improper selection of project team and subsequent consultants.	3.49	0.698	12	3.08	0.616	11	0.4298	13
B1.13	Change orders by client.	3.86	0.773	4	3.47	0.694	4	0.5362	4
B1.14	Incomplete or delayed document delivery by client.	3.49	0.698	13	3.22	0.643	8	0.4489	11
B1.15	Indication of suspension or delay by client.	3.31	0.663	16	2.86	0.573	17	0.3795	17
B1.16	Tedious review processes.	3.35	0.671	15	2.94	0.588	16	0.3945	15
B1.17	Regulation changes.	3.14	0.627	19	2.67	0.533	18	0.3346	18
B1.18	Over-subjective explanation of regulations.	3.18	0.635	18	2.55	0.510	19	0.3239	19
B1.19	Public resistance or political intervention.	3.41	0.682	14	3.04	0.608	14	0.4148	14

Table 9: Various Index Values and Ranking Results for Causes of Delay in the Design Phase

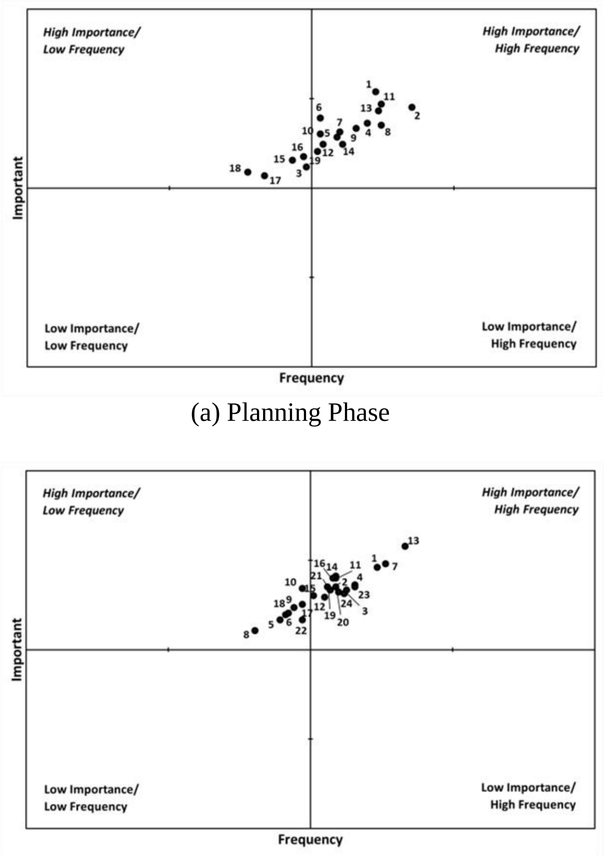
Item No.	Delay Causes	Importance			Frequency			Severity Index	
		Mean	RII	Rank	Mean	RII	Rank	Value	Rank
B2.1	Changes in client's requirement.	3.92	0.784	3	3.47	0.694	3	0.5444	3
B2.2	Inadequate integration on project interfaces.	3.71	0.741	8	3.18	0.635	9	0.4709	10
B2.3	Change orders by deficiency design.	3.67	0.733	12	3.25	0.651	6	0.4774	9
B2.4	Unrealistic design duration imposed.	3.73	0.745	7	3.31	0.663	4	0.4938	4
B2.5	Liability ambiguity due to improper contract clauses.	3.33	0.667	22	2.78	0.557	23	0.3712	23
B2.6	Conflicts between contract clauses.	3.39	0.678	21	2.82	0.565	22	0.3831	22
B2.7	Incomplete design drawings and specifications.	3.96	0.792	2	3.53	0.706	2	0.5592	2
B2.8	Change orders by code change.	3.22	0.643	24	2.61	0.522	24	0.3354	24
B2.9	Disagreement on design specifications.	3.47	0.694	19	2.88	0.576	20	0.4001	19
B2.10	Improper or wrong cost estimation.	3.69	0.737	11	2.94	0.588	17	0.4337	17
B2.11	Slow decision making by designers.	3.80	0.761	5	3.18	0.635	10	0.4833	7
B2.12	Insufficient training of designers.	3.59	0.718	17	3.10	0.620	15	0.4447	15
B2.13	Poor communication and coordination between designers/ project user groups.	4.16	0.831	1	3.67	0.733	1	0.6097	1
B2.14	Inadequate experience of designers.	3.82	0.765	4	3.18	0.635	11	0.4858	6
B2.15	Lack of database for estimation.	3.61	0.722	16	3.02	0.604	16	0.4358	16
B2.16	Wrong or improper design.	3.80	0.761	6	3.16	0.631	12	0.4803	8
B2.17	Client's financial problems.	3.51	0.702	18	2.94	0.588	18	0.4129	18
B2.18	Unclear authority among designers.	3.41	0.682	20	2.84	0.569	21	0.3880	21
B2.19	Slow information delivery between designers.	3.67	0.733	13	3.14	0.627	13	0.4601	14
B2.20	Inadequate schedule control.	3.65	0.729	14	3.20	0.639	8	0.4663	12

Table 9 (cont'd) Various Index Values and Ranking Results for Causes of Delay in the Design Phase

Item No.	Delay Causes	Importance			Frequency			Severity Index	
		Mean	RII	Rank	Mean	RII	Rank	Value	Rank
B2.21	Inability of owners to review design in a timely manner.	3.71	0.741	9	3.12	0.624	14	0.4621	13
B2.22	Late incorporation of emerging technologies into a design.	3.33	0.667	23	2.94	0.588	19	0.3922	20
B2.23	Unforeseeable site conditions (e.g., existing underground conduits).	3.71	0.741	10	3.31	0.663	5	0.4912	5
B2.24	Delay due to other construction projects in hand.	3.63	0.725	15	3.24	0.647	7	0.4694	11

Each individual cause was calculated for the RII value to identify the most significant causes. The causes were ranked based on RII values. The ranking assigned was no more than to briefly describe or rather depict the most essential causes of delay in PWD construction projects. Results on importance, frequency and severity for causes of delay in planning and design phases are illustrated in Table 8 and Table 9 respectively.

The mean scores of importance and frequency from circumstantial analysis results as provided in Table 8 and Table 9 were used to plot the importance-frequency matrix. The plotted quadrant matrix for both planning and design phases are shown in Figure 2(a) and Figure 2(b) respectively. Noticeably, all evaluated causes of delay in the planning and design phases were perceived as highly important even if a few were placed within the low frequency quadrant.



(a) Planning Phase

(b) Design Phase

Figure 2: Importance-Frequency Matrix of Delay Causes in the Planning and Design Phases

The third part of the questionnaire responses was analysed for agreement on identified or proposed strategies and opportunities to avoid or minimize delays in the planning and design phases of PWD construction projects. Each point of suggestions was calculated for the RII value and ranked to seek best strategies or opportunities to be implemented. The assigned rank was no more than to briefly acknowledge the advisable strategies and opportunities worthy for implementation. Results are given in Table 10.

Table 10: Agreement Results for Strategies and Opportunities to Avoid or Minimize Delays in the Planning and Design Phases

Item No.	*Strategies and Opportunities*	*Agreement*		
		Mean	*RII*	*Rank*
C1.1	Allow sufficient time for proper planning, design, information, documentation, and tender submission.	4.43	0.886	1
C1.2	Allocation of sufficient time and money at the design phase.	4.33	0.867	3
C1.3	A client is obliged to provide complete project data to planners or designers.	4.33	0.867	4
C1.4	Detailed and comprehensive site investigation should be done at the design phase.	4.29	0.859	5
C1.5	Multidisciplinary/ competent project team.	4.25	0.851	7
C1.6	Better communication and coordination with other parties.	4.39	0.878	2
C1.7	Designer need to complete the site layout, preliminary drawings, and regulation checks as early as possible before applying for necessary permits or licenses, thus preferably complete the design work thoroughly to avoid foreseeable pitfalls in planning and design.	4.24	0.847	8
C1.8	Government to conduct continuous training programs.	3.82	0.765	12
C1.9	Government to modify and improve the related regulations and laws.	3.55	0.710	15
C1.10	Awarding bids to the right/ experienced consultant.	4.20	0.839	9
C1.11	Competent and capable client representatives.	3.92	0.784	11
C1.12	Designer might need to request client support if the outcome of the review by government agencies is in conflict with the original planning and design principles issued by the client.	3.78	0.757	14
C1.13	Value Engineering might help in reviewing the design and get into the best solution on certain issues from the outset.	3.82	0.765	13
C1.14	Scope Investigation with clients in order to fully understand their requirement and finalize the outcome of the projects.	4.10	0.820	10
C1.15	Comprehensive project communication plan needs to be in place, implemented and monitored.	4.29	0.859	6

5.0 Discussion

5.1 PWD Construction Projects Status

Most existing PWD construction projects have obviously taken longer to be completed than their original schedule in the planning and design phases. Mean Index of 2.42 in the planning phase for all projects envisaged the need for attention and improvement, especially when dealing with in-house projects (Mean Index = 2.74) which seemed to be more critical compared with out-sourced projects (Mean Index = 2.05). Despite this, delay in the planning phase was not really an issue because the information on the ground was yet to be known or tangible to the public.

However, delay in the design phase should really need much more attention if there was a concern to seriously mitigate delays in planning and design phases efficiently. This phase might involve a contractual job (with consultants) that is always time sensitive. A Mean Index of 3.23 for overall projects analysed, shows that projects very often required a much longer time period than stipulated in the original schedule in the design phase. Tedious processes and communication could have been the challenges to the project participants. Broome and Hayes (1997) also emphasized that vague contract clauses of lead to creating many conflicts among the parties in the construction industry.

Generally speaking, most, if not all of PWD construction projects were already at critical status in both planning and design phases with a Mean Index equal to 3.56. Consequently the delay in the planning and design phases could have been up to 60 days. Still, there were a few projects that gone up to more than 500 days delay to completion of both planning and design phases. Delay occurrence of in-house projects were considered worse (Mean Index = 3.66) compared with out-sourced projects (Mean Index = 3.48). Certainly, these delays would have meant a very long stretch of overall project duration when accumulated with any further delays throughout the following phases especially in the construction phase.

5.2 Causes of Delay in Planning and Design Phases

This research might have confirmed that changes in client's requirement (SI = 0.5784), improper basic planning (SI = 0.5630), inadequate planning and schedule (SI = 0.5502), change orders by client (SI = 0.5362), and poor scope definition (0.5174) were the most critical causes of delay in planning phase. Nevertheless, the evaluated delay causes, all very important, were still to be resolved.

Meanwhile delays in design phases were collectively agreed to be the results of, particularly, poor communication and coordination between designers/ project user groups (SI = 0.6097), incomplete design drawings and specifications (SI = 0.5592), and changes in client's requirement (SI = 0.5444). Likewise, all identified delay causes were considered as very important to be resolved.

These findings were in conjunction with Yang and Wei (2010) who concluded in their research that a client is responsible for most of the delay causes in the planning and design phases. They implied that a client is obliged to provide complete project data to planners or designers to eliminate delays, otherwise project delays will be attributed to the client. They also found that changes in client's requirements as the most significance cause, which is good justification for many public clients. However, designers too play an important role as their duty and responsibility stretch far, from onset to a project completion.

5.3 Strategies or Opportunities to Mitigate Delays in the Planning and Design Phases

From the analysis, the top strategies or opportunities to mitigate delays in the planning and design phases were depicted as follows:

1- Allow sufficient time for proper planning, design, information, documentation, and tender submission (RII = 0.886).
2- Better communication and coordination with other parties (RII = 0.878).
3- Allocation of sufficient time and money at the design phase (RII = 0.867).
4- A client is obliged to provide complete project data to planners or designers (RII = 0.867).
5- Detailed and comprehensive site investigation should be done at the design phase (RII = 0.859).
6- Comprehensive project communication plan needs to be in place, implemented and monitored (RII = 0.859).
7- Multidisciplinary/ competent project team (RII = 0.851).

Ability to precisely estimate time needed for activities or tasks is a significant skill in project management. Establishing realistic time-frame at the planning phase of project development can help an agency meet public expectations of project duration, thus avoiding the public relations problems associated with time overruns (Irfan *et al.*, 2011). Where the due date was far too tight, odds were that tempers were frayed, clients were despondent, and colleagues or team members were working unearthly hours. Chances are this happened in light of the fact that somebody under-estimated the measure of work expected to finish the projects.

6.0 Conclusion

Delays in planning and design phases for PWD construction projects are literally at critical status, which in this case might be up to 60 extra days. Even if the delays are usually not known to the public, they are relatively always cost and time consuming. Identifying the main causes and preventing these problems from occurring is better than resolving subsequent delay-related disputes (Yang and Wei, 2010).

The results on collective critical causes of delay in planning and design phases are comparatively in alignment with previous researches. This research concluded that the changes in clients' requirements is the most prevailing delay cause in both the planning and design phases. The finding is a good justification for public clients who usually change their requirements during the planning and design phases and thus absolutely delay construction projects.

The communication aspect could have been the principal key strategy to resolve some major or critical delay causes in the effort to mitigate delays in the planning and design phases, as well as in the construction phase. Transparency and better dissemination of data and information could provide great aid to resolve issues especially communication issues with clients, which mainly and frequently occurred in a project's lifecycle.

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