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Full Length Research Paper

A study of the factors affecting construction time in Western Australia

Kenny Wong[1] and Vanissorn Vimonsatit[2]*

[1]Main Roads, Western Australia.
[2]Department of Civil Engineering, Curtin University, P. O. Box U1987, PERTH WA 6845, Australia.

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Delays are major problems that face the Western Australia's construction industry. Delays can lead to many negative effects such as cost overruns, and is of high concern to those who are involved in the construction industry. This study was set to identify the major causes of delays in the Western Australian construction industry, by means of a literature review and a questionnaire survey. A total of 48 delay factors were obtained from literature review and were further categorised into eight major groups that contributed to the causes of delay. The questionnaire survey was distributed to the targeted respondents from a combination of clients, contractors, and consultants in Perth, Western Australia. About 32 respondents participated in the survey. Based on the data received, albeit limited, the top ten most important causes identified were: (1) Shortage of skills; (2) Financial difficulties; (3) Shortage of labour; (4) Unrealistic deadlines for project completion; (5) Unforeseen ground conditions; (6) Poor organization of the contractor or consultant; (7) Poor communication; (8) Underestimation of time of completion; (9) low speed of decision; and (10) Design errors made by designers.

Key words: Delays, construction projects, construction industry, Western Australia, delay factors.

INTRODUCTION

In Western Australia, the construction industry is one of the major industries contributing significantly to the growth and economy of the country. One of the most important problems in the construction industry is time and cost overruns. Construction delays play a key role in any project success. The delay factors are very crucial within a construction project and it is vital that all organisations must have certain knowledge regarding this issue in order for the project to be completed effectively and satisfactorily. This report builds on the past studies by investigating the most important delay factors identified by other researchers worldwide. Besides that, this work also examines the delay factors influencing the construction times in Western Australia's construction industry by conducting a questionnaire survey to seek professional opinions from the respondents in Perth, Western Australia. In addition, some recommendations to the identified top ten delay factors will be provided. This report is intended to identify the most common and critical delay factors based on all the respondents that participated in the survey in order to prepare an action plan for reducing and mitigating any delays associated with a construction project.

This paper comprises of literature review and related works done in this area of study. It also describes the questionnaire survey design, questionnaire distribution and data collection methods of the survey. Moreover, the analysis of the information gathered through the questionnaire survey, and identities of the critical causes of delay in the Western Australia's construction industry were discussed. There were also discussions based on the survey results of the delay factors and ranking of the delay groups, and conclusions based on the research findings. It should be noted that this research outcome is

*Corresponding author. E-mail: v.vimonsatit@curtin.edu.au.

based on the data obtained from a limited number of survey respondents. It will be necessary to conduct more works before one can generalise the findings as presented in this paper.

Causes of delay

There are many factors that contribute to causes of delays in construction projects. Delays occur in every construction project and the magnitude of these delays varies considerably from project to project. It is essential to define the actual causes of delay in order to minimise and avoid delay in any construction project. A number of studies have been carried out worldwide to determine the causes of delay in construction projects.

Sambasivan and Soon (2007) have identified the 10 most important causes of delay in Malaysia through a questionnaire survey. The questionnaire survey was carried out with clients, consultants and contractors. About 150 respondents participated in the survey. Based on their survey results, the most important delay factors were: contractor's improper planning, contractor's poor site management, inadequate contractor experience, inadequate client's finance and payments for completed work, problems with subcontractors, material shortage, labour supply, equipment availability and failure, lack of communication between parties, and mistakes during the construction stage. A similar study in Malaysia was carried out by Alaghbari et al. (2007) with a list of 31 delay factors. The major delay factors from their survey results were: financial difficulties and economic problems, contractor financial problems, late supervision and slowness in making decisions, material shortages, poor site management, construction mistakes and defective work, delay in delivery of materials to site and lack of consultant's experience.

Chan and Kumaraswamy (2002) conducted a survey in Hong Kong to determine and evaluate the relative importance of the significant factors affecting the construction delays. They analysed and ranked the main factors affecting the construction time, and classified them into two groups: the role of the parties in the local construction industry and the type of projects. Based on their survey results, they indicated that the five major causes of delays were: poor site management and supervision, unforeseen ground conditions, low speed of decision making involving all project teams, client initiated variations and necessary variations of works. Fugar and Agyakwah-Baah (2010) also studied the causes of delays in building construction projects in Ghana. They identified 32 possible causes of delay and further categorised into nine major groups. The list of the causes of delay was conducted into a questionnaire survey, which included 130 respondents who participate in the survey. Based on their analysis, they concluded that the delay in honouring certificates, underestimation of the costs of projects, underestimation of the complexity of projects, difficulty in accessing bank credit, poor supervision, underestimation of time for completion of projects by contractors, material shortage, poor professional management, fluctuation of prices/rising cost of materials and poor site management were found to be the top ten most important factors affecting the construction time.

The study of El-Razek et al. (2008) was carried out to determine the causes of delay in building construction projects in Egypt. A questionnaire survey was carried out to confirm the causes and identify the most important delay factors. Based on the survey results, the top five delay causes were: financing by contractor during construction, delays in contractor's payment by owner, design changes by owner or his agent during construction, partial payments during construction and non-utilization of professional construction management. Sweis et al. (2008) in a similar study carried out in Egypt, also concluded that financial difficulties faced by the contractor and too many change orders by the owner are the leading causes of construction delay. Both research outcomes showed that financial difficulties were important factors causing delays in Egypt. This factor will be included in the questionnaire survey of the present research to determine the severity on the Western Australia's construction industry.

Tumi et al. (2009) studied the delays in construction project in Libya. They concluded that the main causes of delay in construction projects were improper planning, followed by lack of effective communication, material shortage, design errors and financial problem. Alwi and Hampson (2003) had a similar study on the causes of delays in building construction projects in Indonesia. A questionnaire survey was carried out targeting only the contractors. The respondents were asked to assess the effects of the 31 potential delay factors on their projects. The delay factors were grouped into six major groups. The results showed that the top five most important delay causes were: slow decision making, which was ranked the highest, followed by design changes, poor distribution of labour, inappropriate construction methods, and poor coordination among project participants. Based on the literature review conducted, the ranking of construction delay factors in various countries are summarised in Table 1.

RESEARCH METHODOLOGY

It was considered worthwhile to conduct a survey to investigate how project completion time is affected by a series of delay factors. A questionnaire survey was designed to draw on the work experiences of engineers in the construction industry of Western Australia. This survey was developed to assess the perceptions of clients, consultants and contractors on the relative importance of the delay factors in the industry. The data collected through questionnaire surveys were analysed and ranked, followed by discussions and suggestions to mitigate the delays, which were presented in this paper. This survey presents a total of 48 delay factors generated on the basis of related research work on construction time delays and cost overruns. These factors were

Table 1. Ranking of construction delay factors in various countries.

Country	Author (s)	Ranking of Construction Delay Factors
Malaysia	Sambasivan and Soon (2007)	1. Contractor's improper planning 2. Contractor's poor site management 3. Inadequate contractor experience 4. Inadequate client's finance and payments for completed work 5. Problems with subcontractors 6. Shortage in material 7. Labour supply 8. Equipment availability and failure 9. Lack of communication between parties 10. Mistakes during the construction stage
	Alaghbari et al. (2007)	1. Financial difficulties and economic problems 2. Contractor financial problems 3. Supervision too late and slowness in making decisions 4. Material shortages 5. Poor site management 6. Construction mistakes and defective work 7. Delay in delivery of materials to site 8. Lack of consultant's experience
Hong Kong	Chan and Kumaraswamy (2002)	1. Poor site management and supervision 2. Unforeseen ground conditions 3. Low speed of decision making involving all project teams 4. Client initiated variations 5. Necessary variations of works.
Ghana	Fugar and Agyakwah-Baah (2010)	1. Delay in honouring certificates 2. Underestimation of the costs of projects 3. Underestimation of the complexity of projects 4. Difficulty in accessing bank credit 5. Poor supervision 6. Underestimation of time for completion of projects by contractors 7. Shortage of materials 8. Poor professional management 9. Fluctuation of prices/rising cost of materials 10 Poor site management
Egypt	El-Razek et al. (2008)	1. Financing by contractor during construction 2. Delays in contractor's payment by owner 3. Design changes by owner or his agent during construction 4. Partial payments during construction 5. Non-utilization of professional construction/contractual management.
	Sweis et al. (2008)	1. Financial difficulties faced by the contractor 2. Too many change orders by the owner 3. Poor Planning and scheduling of the project by the contractor
Libya	Tumi et al. (2009)	1. Improper planning 2. Lack of effective communication 3. Material shortage 4. Design errors 5. Financial problem
UK	Nkado (1995)	1. Client's specified sequence of completion 2. Contractor's programming of the construction work 3. Form of construction

Table 1. Contd.

		4. Client's and designer's priority on construction time 5. Complexity of project 6. Project location 7. Buildability of design 8. Availability of construction management team 9. Completeness of project information 10. Timeliness of project information
Indonesia	Majid (2006)	1. Insufficient numbers of equipment 2. Inaccurate time estimate 3. Monthly payment difficulties 4. Changes orders 5. Inaccurate cost estimate 6. Poor site management and supervision 7. Inadequate modern equipment 8. Shortage of construction materials 9. Improper project planning and scheduling 10. Contractor's financial difficulties.
	Kaming et al. (1997)	1. Design changes 2. Poor labour productivity 3. Inadequate planning Resource shortages
	Alwi and Hampson (2003)	1. Slow in making decisions 2. Design changes 3. Poor distribution of labour 4. Inappropriate construction methods 5. Poor coordination among project participants.
Florida, USA	Ahmed et al. (2003)	1. Building Permits approval 2. Change order 3. Changes in drawings 4. Incomplete documents 5. Inspections 6. Changes in specifications 7. Decision during development stage 8. Shop drawings approval 9. Design development 10. Changes in laws and regulations.
UAE	Faridi and El-Sayegh (2006)	1. Approval of drawings 2. Inadequate early planning 3. Slowness of the owners' decision-making process 4. Shortage of manpower 5. Poor supervision and poor site management 6. Productivity of manpower 7. Skill shortages 8. Materials shortage 9. Building permits approval 10. Financing by contractor during construction

then divided into 8 groups based on Fugar and Agyakwah-Baah (2010) research. They are financing, manpower, changes, contractual relationship, environment, equipment, materials and scheduling, and controlling.

Design of survey questionnaire

The questionnaire was designed into three sections: Section A: respondent profile; Section B: delay factors and Section C: optional.

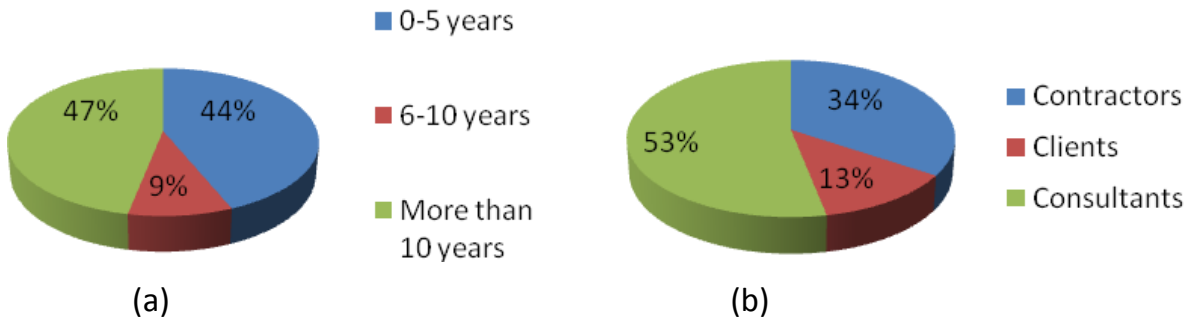

Figure 1. Respondents (a) working experiences and (b) types of organisation.

Section A: Respondent profile

This section was used to obtain the general information about the respondents. The questionnaire includes the work experience of the respondent in construction project and the type of organisation (client, consultant or contractor). This section is very important as it categorises the different perspectives from the various organisations within the industry.

Section B: Delay factors

The second part was used in rating the level of importance of the 48 delay factors obtained from previous literature review. The questionnaire is mainly based on the five-point 'Likert Scale' ranging from one (1) to five (5) according to the level of importance. Each scale represents the following rating: 1='Not Important', 2='Slightly Important', 3='Moderately Important', 4='Very Important', 5='Extremely Important'. With the data collected, it can then be analysed and ranked.

Section C: Optional

This section is to encourage respondents to cite any additional factors that they thought were important, but not included in the questionnaire. Besides that, the respondents were also asked to highlight their recommendations and comments to minimise the construction delays in dealing with construction projects through an open-ended question.

Data collection

A questionnaire survey was prepared (both document and email version) and 81 copies of the survey were sent out. Overall, a total of 32 sets were received, which consisted of 11 sets from contractors, 4 sets from clients and 17 sets from consultants. Based on the 32 respondents, 14 (44%) had less than 5 years experience in the construction industry, 3 (9%) had between 6 - 10 years experience, and 15 (47%) had more than 10 year experience. Figure 1 shows the classification of the distribution of the experiences and organisation types of the respondents.

Data analysis

The relative importance index (RII) ranking method had been applied to determine the ranks of the different delay causes. From the ranking assigned to each cause of delays, it is able to identify the most critical delay factors in the construction industry. The RII has been used in many domains to evaluate the comparative importance of a single item to others. Several studies such as Chan and Kumaraswamy (2002), Odeh and Battaineh (2002) used RII to rank the delay causes in their research. The equation stated below was used to compute the relative importance index for all the causes. The five-point scale ranging from 1 (not important) to 5 (extremely important) was adopted and transformed to relative importance indices (RII) for each factor as follows:

$$RII = \frac{\sum W}{A \times N}$$

where W is the weighting given to each factor (ranging from 1 to 5); A is 5 (the highest weight) and N is the total number of respondents. The RII value had a range from 0 to 1 (0 not inclusive), the higher the value of RII indicates that the more important was the delay factor to the construction industry.

The reliability of the data can be referred to the consistency or dependability of a measure over time, over questionnaire items, or over observers/raters (Allen and Bennett, 2010). The Cronbach α coefficient is a measure of the inner consistency. The reliability test depicts the consistency degree of the data collected. The data collected (total respondents and delay factors) in this study was analysed with SPSS version 18.0 to calculate the value of Cronbach's alpha of the survey results. Some past studies carried out by Memon et al. (2010), Enshassi et al. (2009) and Abdullah et al. (2010) also chose to use the Cronbach α to calculate the accuracy of the data obtained. Cronbach α value can be calculated as:

$$\text{Cronbach } \alpha = \left(\frac{k}{(k-1)}\right) \times \left[1 - \frac{\sum(s^2{}_i)}{s^2{}_{sum}}\right]$$

where s^2_i is the Variance for the current sample of respondents; k is the total number of delay factors and s^2_{sum} is the variance for the sum of all respondents. Ideally, Cronbach's α should be greater than 0.9, but anything above 0.7 is considered acceptable for most research purposes (Allen and Bennett, 2010). Based on the data used, the Cronbach's α is equal to 0.944, which indicates a very good overall reliability. The correlation analysis of the data was also conducted using Excel, and in this case the obtained Cronbach's α is 0.954.

To further understand the correlation of the data, a series of multiple regression analyses can be performed. An example presented herewith, is based on a hypothesis that low labour productivity can be predicted by communication factors among labour and financial difficulties. Based on the analysis using Excel, the obtained R^2 was 0.512, meaning that 51.2% of the low labour

Table 2. Overall ranking of delay factors.

Delay factors (from all respondents)	RII	Rank
Skill shortage	0.8375	1
Financial difficulties	0.8313	2
Shortage of labour	0.8000	3
Unrealistic deadlines for project completion	0.7938	4
Unforeseen ground conditions	0.7875	5
Poor organization of the contractor or consultant	0.7875	5
Poor Communication	0.7875	5
Underestimation of time of completion	0.7875	5
Low speed of decision	0.7813	6
Design errors made by designers	0.7688	7

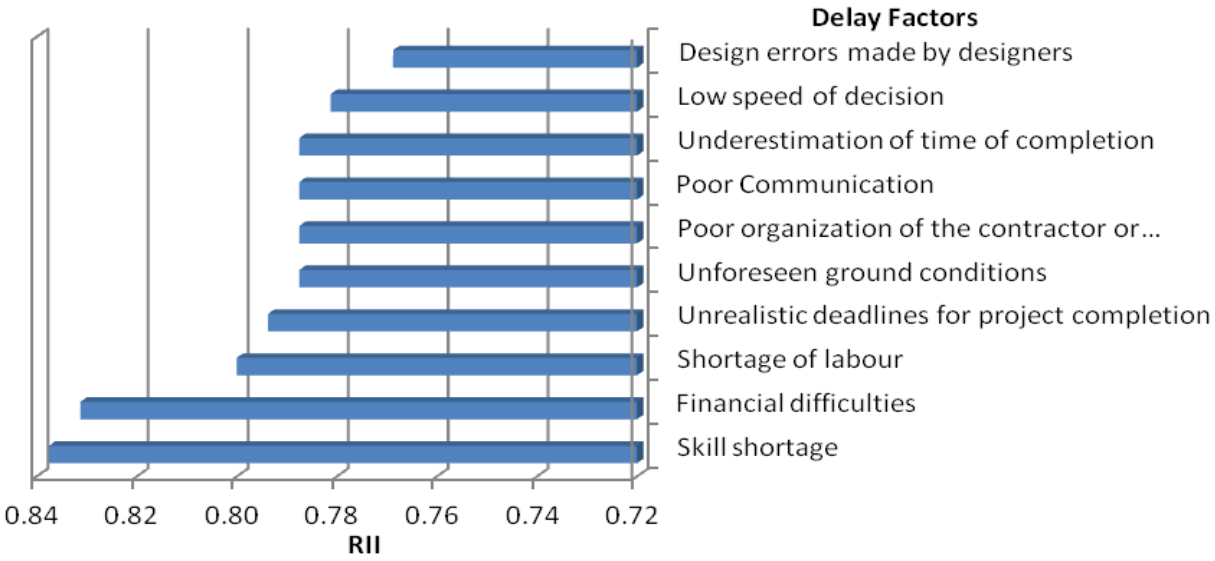

Figure 2. RII of the overall ranking of the delay factors.

productivity variation around its mean value can be explained by communication factors among labour and financial difficulties. The analysis of variance (ANOVA) results indicate that the significance F is lower than the associated P-value for this set of data. Therefore, it is possible to accept null hypothesis in this case (Cameron, 2012; Sekaran, 2003). More rigorous data analyses can be performed, for example, by means of multi-objective programming (Xu and Yao, 2009), a dynamic virtual environment (Nikoofarid and Aalaei, 2012), a resource assignment model under fuzzy environment (Yao and Xu, 2012), and a multi-criteria decision analysis (Makan et al., 2012). However, these analyses are beyond the scope of this paper. The intent of the paper is to report the data in an arbitrary meaning.

RESULTS

Table 2 gives the ranking of the delay factors based on the survey outcome. It can be seen that Rank 1 delay factor affecting the construction industry in Western Australia is comparatively different from Rank 1 delay factors in other countries as presented in Tables 1 and 2. Other factors are generally similar with some changes in ranking orders across different countries. Figure 2 is a graphical representation of the relative importance index of the overall ranking of the delay factors. When analysing the data obtained from the clients group, contractors group and consultants group separately, the rankings were quite different, as seen in Table 3. Based on Table 3, the perceptions of the factors causing delays are quite different per respondents groups. The ranking can be seen to be subjective to the work responsibilities carried by the respondents.

In addition to the 48 delay causes documented in the questionnaire, some respondents nominated a range of other delay causes, which are:

(i) Contractors excessive workload.
(ii) Contractors limited resources to carried out the work.

Table 3. Ranking of delay factors from different respondents groups.

Delay factors (from clients)	RII	Rank
Skill shortage	0.8500	1
Design errors made by designers	0.8000	2
Slow delivery of materials	0.8000	2
Poor site management	0.8000	2
Underestimation of time of completion	0.8000	2
Improper planning	0.8000	2
Shortage of labour	0.7500	3
Unforeseen ground conditions	0.7500	3
Delay in instructions from consultants	0.7500	3
Difficulty of coordination between various parties	0.7500	3
Delay factors (from consultants)		
Changes in specifications during construction	0.8588	1
Financial difficulties	0.8470	2
Skill shortage	0.8352	3
Shortage of labour	0.8117	4
Unrealistic deadlines for project completion	0.8117	4
Underestimation of complexity of projects	0.8000	5
Poor communication	0.7882	6
Materials shortage	0.7882	6
Underestimation of costs of projects	0.7882	6
Unforeseen ground conditions	0.7764	7
Delay factors (from contractors)		
Financial difficulties	0.8727	1
Low speed of decision	0.8545	2
Skill shortage	0.8364	3
Design errors made by designers	0.8182	4
Unforeseen ground conditions	0.8182	4
Poor organization of the contractor or consultant	0.8182	4
Difficulty of coordination between various parties	0.8182	4
Poor communication	0.8182	4
Shortage of labour	0.8000	5
Underestimation of time of completion	0.8000	5

(iii) Political factors.
(iv) Limited detailed analysis of project from all parties.
(v) Lack of environmental or heritage permits.
(vi) Quality management system and assurance control.
(vii) Poor Risk Management Plan.
(viii) Waiting time for approval of tests and inspection.
(ix) Problems with subcontractors.

Further investigations are required to determine the significance of these causes compared to the 48 other listed causes.

DISCUSSION

Herein, the results obtained from analysing the causes of delays as presented were discussed. Each delay factor was briefly described and followed by some recommendations to mitigate these delays on a construction project.

Skill shortages

The skill shortage is expected to be a major problem due to increasing numbers of new resource projects in Western Australia. According to the data analysis, skill shortages was noted as the most critical delay factors affecting construction industry in Western Australia ranked by all respondents with RII value of 0.8375. In Western Australia, many projects have suffered from the shortage of skill and had resulted in construction time and

costs overruns. Therefore, a strategic plan needs to carry out to minimise the impact of this. Programmes such as immigration, training and development were found to be the most common and effective strategy so far. Several actions such as training subsides for employers, training a younger generation of engineers with the aim to develop a core of skilled engineers, continuously providing training on improving management, technical, engineers can be considered. In addition, retain skilled engineers and encourage ageing professional engineers to mentor or help younger engineers with partial retirement rather than retiring early. In order to overcome the skill shortages in the construction industry, government should focus on training the young graduate engineers instead of relying too much on the skilled immigration which only solve a short term skill shortages. As a result, a better strategy would be provided to resolve the long term skill shortages in the construction industry.

Financial difficulties

According to the results, most of the parties agreed that financial difficulties are crucial delay factors influencing construction projects. Financial difficulties ranked second in the overall results, with a relatively high RII value of 0.8313 compared to the other delay factors. The findings of this study are the same as previous studies such as Alaghbari et al. (2007), El-Razek et al. (2008), Sweis et al. (2008), and Tumi et al. (2009) who determined that the “financial difficulties” are the main factor affecting delay in the construction time. Project cost is one of the most important criteria of success of the project and is of high concern to those involved. Abdul-Rahman et al. (2011) suggested some possible solutions in reducing the financial-related delay such as to structure the market, not to over develop, to conduct training on cash flow management, to access risk management, to be smart in accepting the contract, to choose a good paymaster, and to apply payment bond with bank and client. All these planning, problem solving and communication skills of methods can be considered in managing the financial difficulties facing in the construction projects and prevent unnecessary delays caused by financial related factors. Work progress can be delayed due to the late payments from the clients because there is inadequate cash flow to support construction expenses especially for the contractors who had instability financial resources. Therefore, a well-managed cash flow will improve the project’s cash flow and subsequently improve the timely performance of a project.

Shortage of labour

Shortage of labour is of high concern to the industry. The shortage of labour will slow down the project progress due to low productivity of site activities. If the low number of labours is being occupied for a project, it might affect the project schedule. To overcome the shortage of labour, increasing wages can be a major step for employers, as wage increases are necessary to attract new workers. In order to discount this delay factor, the government should take proactive measures to train and encourage more people to join the construction industry labour force. Benefits such as increasing wages, better work environment, holidays, and bonuses to be provided to the labourers will be good incentives and attract more labourers to the industry.

Unrealistic deadlines for project completion

Unrealistic deadlines for project completion were perceived by consultants and contractors as a major cause of delay. Contractors who are tendering for the project would risk paying liquidated damages for late completion. The reason for the quick deadline may be to motivate the project teams to try to achieve it. There are several steps to follow in order to meet the unrealistic deadlines: first, proactively utilise risk management by identifying risks and risk mitigation strategies and scope; secondly, manage the work plan when starting a project with the deadline at risk; and finally, work with the project team and evaluate on the execution of the project. It is very important to evaluate on the work plan to determine whether there are any alternatives for further improvement of the project and further reduction of construction cost and time.

Unforeseen ground condition

Unforeseen ground condition had been ranked fifth in the overall results by all respondents. Chan and Kumaraswamy (2002) had a similar finding with the present results in which unforeseen ground conditions were identified as causing extensive delays to projects after work commencement on site. Sambasivan and Soon (2007) also stated that unforeseen ground condition was one of the most significant causes of construction delays. A well planned site investigation should be conducted before the commencement of any projects because insufficient knowledge or information of the sites causes many delays or failure in projects. Thus, the investigation of site conditions, together with the design of groundwork and foundations, should be complete and clearly presented before commencement of a construction so as to reduce the impact of any unforeseen ground conditions.

Poor organisation of the contractor/consultant

Poor organisation of the contractor/consultant is similar to

a poor management in the project that leads to a construction delays. Studies such as Sambasivan and Soon (2007), Alaghbari et al. (2007), Chan and Kumaraswamy (2002), Fugar and Agyakwah-Baah (2010), Sweis et al. (2008); Tumi et al. (2009) found that, poor organisation or poor management were the most critical factors according to their results. To overcome this delay factor, there are no straightforward solutions to the poor organisation of the contractor/consultant in the construction projects. Efficient project management tools and practices may be adopted to minimise the effect of this cause of delay. For any project, scope needs to be well defined from the beginning of the project to completion. This is to minimise unnecessary changes. As suggested by Hao et al. (2008), the construction industry needs an effective construction change management process in order to effectively minimise the impacts to the changes in construction projects. Companies should ensure that they have the right personnel with the right qualifications to manage their projects so that they can effectively utilise the project management tools that are suitable for the project.

Poor communication

Since there are many parties involved in a project, the communication between the parties is very crucial for the success of the project. Proper and effective communication between the parties must be established during the planning stage. Any problem with communication can lead to severe misunderstanding and therefore, delays in the execution of the project. Past studies such as Sambasivan and Soon (2007) and Tumi et al. (2009) indicated that inadequate communications among all project parties was an important reason for delays in the projects, which impeded the job and resulted in problems in the project coordination and schedules. Hence, in order to accelerate the communications and decision making among all parties, appropriate communication systems linking all project teams and weekly meetings record should be developed throughout the life cycle of the project. It is highly recommended that a computerised communication system should be used as an enhancing communication tool in every project.

Underestimation of time of completion

Some of the reasons leading to the underestimation of time of completion are the inadequate time estimation and planning. Often, people underestimate the amount of time needed to complete a project, especially when the project manager is not familiar with the task to be carried out. Unexpected events or unscheduled high priority work may not be taken into account. Therefore, it is recommended that at the beginning of any projects, understanding the project outcome, reviewing the project/task given in detail and listing down the entire component task in full detail will help with the time planning for the project.

Low speed of decision

Studies carried out by Chan and Kumaraswamy (2002) and Alwi and Hampson (2003) had come to an agreement on how the client's low speed of decision had a significant impact to the construction timelines. In most projects, clients and consultants are blamed for slow in decision making, while many contractors waste resources waiting for the decisions. This slow response inevitably delays work on site. In order to overcome this, deadline has to be made and met at all times to shorten the waiting time for the decisions from the client or consultants.

Design errors made by designers

Chan and Kumaraswamy (2002) and Tumi et al. (2009) had agreed on the design errors as one of the critical delay factors. The design errors made by designers can be due to misunderstandings, mistakes, miscommunications or inadequate experience. Design errors made by designers can be rectified by understanding client's needs and clarifying project objectives at the beginning of the project. Consultants require certain knowledge on the site conditions and the buildability aspects of the project while designing it; these will prevent any unnecessary changes/errors during the construction stage.

Conclusion

This report summarised the causes of delays in the construction industry and suggested some recommendations to mitigate the delays. It should be noted that the small sample size of 32 respondents to the questionnaire survey poses some limitations to the extent in which the results of the study could be generalised. Due to this limitation, the survey may not have identified all the possible factors that could cause construction delays in Western Australian construction projects. However, the study made a significant attempt at identifying the major causes of delay factors in the construction projects in Western Australia based on the limited data.

Meanwhile, there are no specific procedures to overcome delays in the projects, but it depends mainly on the causes and appropriate actions taken. Based on the delay factors identified in this research, discussions and recommendations have been made to minimise their causes. The ranking of the delay factors provided in this

research was based on the responses to the questionnaire survey sent out to the engineers in Perth, Western Australia, and could be used as a guideline for other researchers to conduct additional studies on construction delays. The results of this study can be of immense help to the practitioners (clients, contractors and consultants) and academicians. On the one hand, the practitioners can better understand the delay factors and make efforts to reduce the incidences of delays. While on the other hand, academics can conduct similar studies and identify the causes and effects of delays, or focus on a particular method in minimising delays.

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