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Study of factors influencing construction delays at rural area in Malaysia

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Abstract. Construction is one of an important industry which contributes to the economic growth in Malaysia. However, it has been revealed that 79.5 percent and 66.7 percent of the public and private projects were not completed within the time specified in the contracts out of 359 projects in Malaysia. Therefore, the purpose of this study is to investigate the delay factor caused project delay at rural area. A 5-points Likert scale questionnaire survey were answered by 111 respondents which having experience with rural construction project. The questionnaire data were analysed by using Relative Importance Index (RII). Five top factors were determined from this study based on their RII values which are improper construction method implemented by contractor, weather condition, difficulties in providing delivery to site, breakdown of site equipment, and poor qualification of contractor's technical staffs.

1. Introduction

Construction sector plays important role in economic development of country. In Malaysia, construction is an essential and productive sector for economic growth to improve the quality of life and living standard of Malaysian people [1]. Department of Statistics Malaysia stated that the value of construction works in 1st quarter 2017 had increase of 8.1% compared to the 4th quarter of 2015 in which major type of the activity are civil engineering works following with non-residential building, residential buildings and lastly special trade activities [2]. However, Malaysia is suffering challenges in construction industry in such of poor performance of time and budget, wastage of construction, low productivity and over-reliance on foreign labours [3]. Despite from all challenges, project delay is categorised as major component of construction management process and has become the key factor to gain success in a project [4]. Malaysian Treasury Secretary-general, Datuk Dr Wan Abdul Aziz Wan Abdullah said that construction projects of 30% or three months behind the schedule are considered as

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'Sick' project [5]. It has been revealed that 79.5 percent and 66.7 percent of the public and private projects were not completed within the time specified in the contracts out of 359 projects in Malaysia [6]. Other than that, it has been reported that 80 percent of Malaysian government projects were delayed [7]. It can be seen that public projects need more attention in order to complete the project according to the time schedule given.

One of the topics that had been discussed in the Eleventh Malaysia Plan of the rural area is the Transforming Rural Areas to Uplift Wellbeing of Rural Communities which indicate issues of fewer basic infrastructure and other amenities in rural areas such as road network [8]. This statement can be supported with the statistics of construction projects in Malaysia 2015 by the Construction Industry Development Board (CIDB). From these statistics, urban areas such as Johor, Selangor and Wilayah Persekutuan show a greater number of construction projects compared to other areas such as Kedah, Kelantan and Perlis for three years [9]. A project construction in a rural area of East Coast Expressway Project Phase 2 (LPT2) was declared delayed in completion time due to changes in the entire design and structure from a Federal highway to Toll highway [10]. Another project in a rural area of Bakun Hydropower in Sarawak was reported to have experienced an extensive delay which caused cost overrun [11]. Due to the delay project issues, the demand for studies to overcome the problems has increased. However, lack of research has been done on project delay in rural areas in Malaysia. Therefore, it has become necessary to investigate the factors causing project delay in rural areas.

2. Construction Delay

Delay in construction is defined as a time over-run beyond the completion date of the stated project timeline which can affect the owner and also the contractor especially in terms of budget [12]. All the construction projects in the world might have completed projects with time overruns by giving an example of Asian Development Bank projects which were awarded with the "Outstanding Award" but still facing 9 months of project delays [13].

Every construction project should have a high productivity rate. When a construction project faces the construction constraint, it will have an impact on three major elements which are time, cost and quality of the project thus it will have a low productivity rate [14]. The whole construction phase is a critical phase of any project in which many unforeseen factors could occur. Failure to identify the unforeseen factors that cause the problem in a construction project will result in completion time delays and cost [15].

Inappropriate planning during the early stage of a project will trigger delays at various stages throughout the project [14]. Therefore, an experienced contractor and labour are needed especially in large and mega projects. A good planning and management is important to accelerate the project plan, to overcome time burn during delays.

2.1. Some of the Factors Influence Construction Delay at Rural Area

Based on previous research, there are many factors that cause delay in construction projects in rural areas. The following are factors which have been studied by the researchers.

2.1.1. Accessibility

Providing access to the site for construction is one of the responsibilities for the owner as the owner must make the site construction available to perform the work for the contractor before the construction project can be started. Failure of the owner to provide access to the worksite will cause the delay of the construction project and other organizations such as the contractor can claim the payment due to the delay of site access [15]. In rural construction projects, limited access to the project site is one of the factors that can cause the delay. A lot of matters need to be considered about the access to the site where usually rural projects are far from any headquarters thus to manage the travel time and efficient use of vehicles can be one of the challenging matters to access the site for construction in rural areas [16].

2.1.2. Site Condition

Site condition is one of the factor that can influence the time of the completion of the construction project which are involves underground condition and works that start at the beginning of the construction project [17]. A detailed investigation and preparation before commencement of construction project are required to avoid the unforeseen ground condition where usually the condition of natural ground cannot be predictable [18]. National Vocational Training Institute (NVTI) [19], explained that rural builders deal with some difficulties situation as not all the construction site has a flat and level ground. Some of the difficulties situation are:

- a) Interfering/Obstruction object
- b) Uneven ground
- c) Sloping Sites

2.1.3. Space Constraint

Space constraint or the workspace congestion is regarded as one of a main cause of productivity loss on construction site [20]. Space in the construction site are limited while construction in the progress due to many circumstances or conflict such as space needed for equipment, workers to move from one place to another place, transportation of material and to store the material [21].

2.1.4. Underground Utilities

In the Rural Road Standards from the Public Works Department (PWD) of Baltimore country (2008), state that, due to the narrowness of the rural road, all the utilities should be relocated or place in order to maintain the scenic or history road characteristic [22]. In this case, all the utility are advisable to be made to underground for purposed of aesthetics and safety.

2.1.5. Fluctuation/Suitability Material

Price fluctuation of material is one of the factor that can lead to the cost overrun of the construction. In rural area of Morocco, the mobilization of the local materials to the rural site construction such as steel, cement, gravel and sand are brought with high price and it is unavoidable solution. So, they tend to use materials that taken from the soil directly to avoid the price fluctuation of local material thus can avoid the delay of construction project [23].

2.1.6. Material Delivery

Factors that cause the delay of the large construction project are comes from the consultant, contractor and owner [12]. From the study, material delivery is one of the major factor that cause the delay in construction project based from the consultant perspective. As material plays a big role in the productivity of the construction project, materials procurement in rural area are more complicated compared to the urban area. This is due to some of the procurement company have a different strategies which acquire additional cost such as for mobilization or delivery to the rural site construction [24].

2.1.7. Availability of Labour

Most of the 'ruralness' site project area has a problem to recruit and retain staff [16]. Hence, the project lack of expertise worker to handle certain work such as scheduling, project control, quality control and safety management. Besides that, a survey found out that there have a negative impact towards the employee's family life due to the employee working in a rural area of the construction site [24].

2.1.8. Productivity of Labour

Knowledge and consideration of numerous aspects that affect productivity of construction labour is required to avoid project cost overrun and delay in the completion time of the construction project [25]. In rural areas, due to the labour shortage and also pressure from the project schedule, working

overtime has become one of the factor that can decrease the labour productivity which eventually caused delay of the project [4].

2.1.9. Number of Skilled Labours

One of the factor that can cause delay of the construction project is lack of skilled or experienced labour which is out of contractor's control [13]. In order to increase the productivity of labour, skilled workers for the project construction in rural area are highly needed compared to urban area. However, due to the 'ruralness' area with limited access to the project site, it is challenging to get skilled workers [16].

2.1.10. Qualification of Contractor

Inadequate experienced contractor is one of the factor that can affect completion date of construction project. In some cases, incompetence contractor are awarded with large and complex project because of the lowest bid by the contractor [26]. Project in rural area, contractor are less interested to bid the competition compared to the urban project due to low rates of skilled labour [16].

2.1.11. Performances of Contractor

The performance of the contractor is reflected by successful to complete the construction project on time while inadequate of experienced or incompetence contractor will result of project delay [26]. In rural project, one of the challenges for the contractor is the limitation of ability to communicate and normally they do not using scheduling software to reduce the risk of delayed project [16].

2.1.12. Site Management

Poor site management is one of the source that affecting the timeline of construction project. Difficulties of material delivery to the site and challenging to handle waste or disposal from project site is related to management of project site [27].

2.1.13. Decision Making

Slow decision making during will affect the construction project in a whole. In rural construction area, delay of decision making happened due to the extensive physical distance from one to another whom involve in the construction project [28]. One of study in rural area revealed the fact that supervisor at the project site primarily used mobile phones and digital camera to monitor the project progress and also used e-mail communication to communicate to each other which make the process of decision making longer [29].

2.1.14. Feasibility Studies

One of the factor that caused delay in construction project is insufficient knowledge and feasibilities studies of the project [18]. Limited resource of historical data and information of the project area are one of the challenges facing in rural area [16].

2.1.15. Weather Condition

Climatic factor can disrupt the project's labour productivity in the construction project. From the past study for the rural and urban climate, it was found that urban areas has wetter climate compared to the rural area due to the effect of the topography and urbanization [30].

3. Methodology

A set of questionnaire was developed based on the factors that are cited in literature review in this study. The questionnaire is consists of 24 questions where 5 questions are related to the respondent's age, respondent's profession, years of experiences in the field, organisation and etc. The other 19 questions are related to the factors that causes delay in rural area. Likert Scale has been used to rank the factors that affect delay in a construction project at rural area. There are 5-point scale ranging from

“Strongly Disagree” on one end to “Strongly Agree” on the other with neither “Neither Agree nor Disagree” in the middle. Each agreement will tabulate a scale that is from the scale of 1 = Strongly Agree, 2 = Agree, 3 = Neutral, 4 = Disagree and 5 = Strongly Disagree. In this study, the method to analyse the data from the survey is Relative Importance Index (RII) and ranking factor. Relative Importance Index (RII) method is used to determine the relative importance of the various factors of causing delay in a construction project at rural area ‘as in equation (1)’ [31].

$$RII = \text{Sum of weights } (W1 + W2 + W3 + \dots + Wn) / A \times N \quad (1)$$

Where;

RII = Relative Important Index

W = weighting given to each factor by respondents and it ranges from 1 to 5

X = frequency of it response given for each factor

A = highest weight (i.e. 5 in this case)

N = total number of participants

4. Data Analysis and Discussion

A total of 111 respondents has been participated in this survey by professional who are currently working in construction industry as shown in **Table 1**.

Table 1. No. of Respondents according to position level.

Position Level	No. of Respondent
Non-executive	70
Executive	31
Middle Manager	7
Top Management	3
Total	111

4.1. Ranking of Factors

Based on the calculation of Relative Importance Index, each of the factors have obtain its RII value. The maximum value of the RII value is 1.0. **Table 2** shows the list of factors with RII values. The 5 major causes of delay at rural area are as follows;

4.1.1. Improper Construction Methods Implemented By Contractor

Zumrawi[32] stated that insufficient geotechnical investigation is the first factor that causes project delays, disputes, claims, and project cost overruns. According to report prepared after the disaster, from the outcrops exposed after the landslide, the geological structure at the site is primarily composed of sandstone and shale. The sandstone in the upper strata was weathered with well-developed joints [33].

4.1.2. Weather Condition (Heavy Rain)

Weather can have a major effect on any construction project such as highway construction due to the continuous exposure to the environment [34]. In addition, surroundings such as air temperature, rainfall and air velocity cause delays in construction project. Forecasting plan delays caused by weather circumstances such as snow, rain and cold temperature is essential as it is obviously weather plays the role to contribute delay [35]. It shows level of consequences on project activities were different depends on type of weather condition.

4.1.3. Difficulties in Providing Delivery to Site

Accessibilities is one of major challenges in rural area to manage construction project [36]. The ‘ruralness’ and long distance of the project complicates the process of provide delivery to the

construction; for example, machinery for excavation. Machinery for excavation and bore piling machine are extremely heavy and need lorry trailer to deliver to the construction site. When these types of machinery are unable to reach to the project site, it will definitely cause delay. Bad condition of road will increase the level of difficulties in delivering material and equipment to the site [29].

Therefore, a good management to handle project is important in order to overcome problems that arise during construction phase and limit the cause of delay issue.

Table 2. Ranking of Factors

No.	Factor	Relative Important Index
1.	Accessibility of human resources.	0.654
2.	The loose control over communication and management.	0.621
3.	Availability of the required resources.	0.637
4.	Inaccurate estimations of certain work progress. (work progress timeline and inaccurate estimation slope stability)	0.674
5.	The extensive physical distance between project participants, sometimes extending over national boundaries.	0.623
6.	Lack of project pre-planning, certainty, and/or clarity concerning project process integration. (e.g. mounting details of machineries, power feed layout and connection is site, wrongly scheduling of work progress)	0.664
7.	Difficulties in providing delivery to site. (Delay in term of time arrival)	0.705
8.	'Ruralness' of the project location.	0.649
9.	Lack of management skills.	0.638
10.	Unpredictable site condition	0.640
11.	Weather condition (Heavy rain)	0.719
12.	Timely decision-making.	0.661
13.	Improper construction methods implemented by the contractor	0.732
14.	Low performance of the selected contractors. (e.g. Slow work progress by contractor)	0.681
15.	Delays and or shortages within materials and equipment.	0.668
16.	Poor qualification of contractor technical staff. (e.g. Unqualified personal doing high technical work)	0.683
17.	Poor site management.	0.676
18.	Breakdown of site equipment.	0.692
19.	Material fluctuation	0.677

4.1.4. Breakdown of Site Equipment

Poor management of plant and machinery[37] and low level of equipment of operator's skill [12] will definitely cause delay of progress construction project. Equipment or machinery is an essential tool in the construction industry which helps to proceed the heavy task job such as excavation in a construction site. If machinery such as an excavator face mechanical failure, it will affect the work progress of construction project especially if the location of the construction project is at rural area.

4.1.5. Poor Qualification of Contractor's Technical Staff

Contractor selection is a major factor for a construction project to gain success. Success of project is to complete the project within schedule and budget allocate as agreed in the contract. Great leader from

contractor will manage to select and hire technical staff according qualification and experience level. Poor qualification contractor's technical staff is one of the factors that causes delay in the construction project [38]. This is because a good and qualify contractor's technical staff will able to perform task and ensure project delivery on time.

5. Conclusion

The objectives of this research study is to determine the factors that causes delay rural area and rank the factors based on perception of industrial workers. Based on the outcome of questionnaires that have done, this research study is able to find out the factors that causes delay.

These are the top 5 factors that contribute delay at rural area:

1. Improper construction method implemented by contractor.
2. Weather condition. (Heavy Rain)
3. Difficulties in providing delivery to site.
4. Breakdown of site equipment.
5. Poor qualification of contractor technical staff.

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