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Authors	Aishatul Izwani Aminorlah, Noorlizawati Abd Rahim, Zainai Mohamed and Ain Naadia Mazlan
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Critical Delay Factors in Typical Physical Projects: The Case of the Ministry of Home Affairs in Malaysia

Aishatul Izwani Aminorlah [1*], Noorlizawati Abd Rahim [2], Zainai Mohamed [3], Ain Naadia Mazlan [4]
[1,2, 3] Razak Faculty of Technology and Informatics, Universiti Teknologi Malaysia
[4]School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia
*Corresponding author: shatz17@yahoo.com

Abstract: In Malaysia, public projects have been consistently reported as dilapidated and delayed, causing the government to bear financial losses. Furthermore, the purposes of the projects are not fully achieved, thus affecting public interest. This study examined the critical contributing factors to the delay in implementing physical projects in the Ministry of Home Affairs (MOHA). The scope involved the physical construction projects of the Immigration Department of Malaysia's offices and premises in Malaysia, which was mandated in the Eleventh Malaysia Plan. A total of 105 respondents, including contractors, consultants, end-users, and clients, participated in a survey on the factors and effects of physical project delay. The data was analysed using the Relative Importance Index (RII) and Spearman's correlation to identify the most critical delay factors and their association with delay effects. Thirty-eight delay factors were identified, with contractor-related factors being the most critical, followed by consultant-related, client-related, and other factors. These delay factors were found to be positively correlated with the effects of delay, including time and cost overrun, quality, litigation and arbitration, and abandonment.
Keywords: Construction project, Delay, Ministry of Home Affairs

INTRODUCTION

The construction industry is one of the world's largest sectors, consisting of a mix of diverse companies and professions that have a significant and strong influence on the global economy (Brookes, 2013). On a national scale, this sector has a vital role in economic growth through revenue generation, capital formation, and job creation that contributes to the country's gross domestic product (GDP) and socio-economic development (Khan, Liew and Ghazali, 2014). Malaysia's Quarter Construction Statistics reported that the value of construction work done in Quarter 1 of 2019 was RM37.4 billion (Department of Statistics Malaysia, 2019). Of that amount, the private sector continued to propel construction activity with a 56.0 per cent share (RM20.9 billion/ USD 4.64 billion) compared to the public sector's 44.0 per cent share (RM16.5 billion /

USD 3.67 billion). This data shows that Malaysia has always taken a balanced development approach that emphasises economic growth and the people's well-being. Indeed, the government has been investing heavily in this sector to ensure economic stability. For instance, during the recession, some states relied primarily on construction investments to raise employment opportunities and their local economy (Rafat and Riaz, 2017). In the public sector, the government is the main client of the construction industry, specifically through the development of government buildings and public amenities. The government’s physical projects are generally focused on improving Malaysia's service, functionality, and well-being (Pulmanis, 2015).

As the construction industry produces both trade and capital and is therefore an essential contributor to the economy, delays in project achievement are an important issue (Al-Adwani, Mollasalehi, and Fleming, 2018). Hisham and Yahya (2016) stated that as a developing country, Malaysia is growing its position in the construction industry. However, the delay in implementing projects significantly impacts the country's planning and economy. The Implementation Coordination Unit (ICU) of the Prime Minister’s Department reported that in the 4th Rolling Plan 2019, 139 physical projects were listed as delayed or behind schedule (Department of Statistics Malaysia, 2019). The report elaborates that the activity in the project implementation phase, specifically building work, appears to be the most problematic. As of September 2019, 37 per cent of Ministry Home Affairs projects were categorised as being behind schedule and late in their physical progress (Kementerian Dalam Negeri, 2019).

Although extensive research has been carried out on project delays, most have focused on construction types, such as general, residential, petrochemical, oil and gas, and road construction. Government projects, in particular, have been studied in Malaysia and other countries. However, minimal studies have examined a specific security agency’s construction project, such as that of agencies under the Ministry of Home Affairs (e.g., Royal Malaysia Police, Immigration Department of Malaysia, and Prisons Department). These agencies have unique criteria and technical specifications regarding safety and design that vary from regular and standard building construction requirements. For example, facilities such as police lockups, prison cells, and immigration detention centres vary from regular buildings in terms of material used, specifications, and installation of specific equipment. Accordingly, this paper aimed to examine the critical contributing factors to the delay of these projects and their relationships with the effects of the delay. The scope was the physical construction projects of the Immigration Department of Malaysia’s offices and premises in Malaysia.

LITERATURE REVIEW

Physical Project Delay

Development activities in Malaysia are planned and implemented using the five-year Malaysia Plan introduced since 1966. The 12th Malaysia Plan only began in 2021, following the 11th Malaysia Plan from 2016 to 2020. In the latter, a considerable budget of RM260 billion was allocated and approved for Development Expenditure (physical and non-physical projects), of which the Ministry of Home Affairs (MOHA) received RM9.24 billion (Economic Planning Unit, 2015). The Development Division of MOHA is responsible for managing, monitoring, and coordinating the physical development of projects for the ministry and its eleven (11) agencies. The type of physical projects in MOHA includes office buildings, staff quarters, detention centres, police stations, police headquarters, prisons, maritime jetties, immigration complexes, and rehabilitation centres. With regard to physical project allocation, the Royal Malaysia Police received the highest allocation of RM1.34 billion, followed by the Immigration Department of Malaysia with RM169.27 million and the Malaysian Prison Department with RM131.18 million.

The success of project development is crucial for stakeholders, clients, contractors, and purchasers. Successful project execution is measured by completion within schedule, recognition of obligation, and satisfaction of the stakeholders (Nguyen and Ogunlana, 2004). Short-term project completion criteria, such as staying within budget and time goals as well as fulfilling project requirements, are determined prior to the completion of the project. In contrast, long-term criteria like the provision of both tangible and intangible benefits are often evaluated after project completion (Johnson, 2017).

Riazi, Riazi and Lamari (2013) reported that 80 per cent of public sector projects in Malaysia are behind schedule. Jatarona et al. (2016) also found that public projects in Malaysia are constantly reported to be dilapidated, late, and abandoned. Indeed, project delay is one of the most significant problems, due to which the government has not reaped the best value for money in terms of the expenditure it has incurred for projects. Furthermore, the projects' goals have not been entirely achieved, and the impact on target groups has been significantly underwhelming (Johnson, 2017). Such underperformance has resulted in further issues, including public complaints and the government's loss of reputation and revenue. Public sector projects are of major concern because they directly relate to public and national socio-economic growth. Thus, the constant recurrence of similar issues in public building projects has raised public concern. This situation calls for an exploration of the factors affecting the relationship between project management performance and project success (Rafat and Riaz, 2017).

Johnson (2017) suggested that comprehensive research and planning need to be done before attaining approval for a project, including project site information, briefing, ceiling, costing, and scheduling. This is important to ensure all projects are delivered according to schedule and with the best value for money for the government. According to the Project Management Institute (2017), "The Iron Triangle" (cost, scope, and time), perceived benefits, and stakeholder satisfaction are three main factors that define project success. In this context, project delay can cause severe consequences to a project's life, resulting in cost overrun, time overrun, litigation, disputes, arbitration, and project abandonment (Hisham and Yahya, 2016). Delay further incurs a loss of output and revenue, since the contractor cannot engage in other projects (Al-Kharashi and Skitmore, 2009; Alsuliman, 2019). Therefore, the profit lost by the contractor is equal to the opportunity cost of the projects missed by the contractor.

Identifying and studying delay comes under the project monitoring and control phase. The analysis of schedule delays is a permanent problem for practical application in project management (Guida and Sacco, 2019). In the construction industry, delays are categorised into three (3) principal types (Chandu et al., 2016): critical (non-excusable), excusable, and concurrent. Of the three, critical delay is the one that causes the project duration to be extended by some period. Guida and Sacco (2019) mentioned that delays can also be classified according to the origin of the problem or the responsible parties, such as the owner, client, contractor, or simply force majeure.

Delay Factors and Effects

In general, the main effects of delay are mostly related to project completion time and the extra cost or budget required to complete the project. Other than that, delay also affects the quality of the project's end product, which can further contribute to project disputes, arbitration, and litigation (Rashid, 2020). Finally, the project may be entirely scrapped in some situations, significantly affecting a country's socio-economy. Table 1 summarises the effects of project delays as reported in various construction types across different countries, including Malaysia. In the context of MOHA's project implementation structure, the factors contributing to delay can be categorised into four (4) groups, namely contractor-related, consultant-related, client-related, and other factors. Table 1 shows the identified delay factors for each group.

Orangi, Palaneeswaran, and Wilson (2011) stated that project delay, such as delay in securing approval, leads to severe time and cost overruns in linear construction projects in Australia. Another previous study indicated that delays have statistically significant impacts on project duration but not on project cost (Senouci, Ismail and Eldin, 2016). Hisham and Yahya (2016) used correlation analysis to evaluate the linear effect of delays on time and cost overruns. Their data revealed that the subcontractor is the most common cause of delay, which has an empirical influence on time and cost overruns.

In his study, Shah (2016) found that the most critical factor in project delays in Ghana is payment delay, which significantly impacts projects' progress, quality, and service delivery. In Australia and Malaysia, delays are reportedly caused by contractors' lack of planning and scheduling, which has a significant impact on cost within the approved budget. Rashid et al. (2013) observed that contractors, clients, consultants, materials, and equipment-related factors significantly impact delays in construction projects in Punjab, Pakistan; however, labour and general environmental elements were found to have no impact. Gomarn and Pongpeng (2018) investigated and confirmed the sets of observable delay factors and their underlying correlations.

Table 1. Effects of project delay

Effect of project delay/ Author, Year, Country	Hisham, S. N. A., and Yahaya, K. (2016) Malaysia	Khair, K., et al. (2016), Sudan	Aibinu, A. A., and Jagboro, G. O. (2002) Nigeria	Rashid, Y. (2020) Pakistan	Riazi, S. R. M., and Lamari, F. (2013) Malaysia	Nawi, M. N. M., et al. (2016) Malaysia	Gebrehiwet, T., and Luo, H. (2017) Ethiopia
Time overrun	✔	✔	✔	✔	✔	✔	✔
Cost Overrun	✔	✔	✔	✔	✔	✔	✔
Dispute	✔		✔		✔		
Arbitration	✔		✔		✔		✔
Litigation	✔		✔	✔	✔		✔
Total Abandonment	✔		✔	✔			

Specifically, their results indicated that delays caused by contractors are highly correlated with the delays caused by suppliers. As a result, any supplier issues or delays have a direct impact on contractors. Rashid (2020) also discovered that delays in construction projects in Pakistan result in significant project time and cost overruns, project abandonment, and litigation, all of which put projects in great danger. Besides that, Arantes, da Silva and Ferreira (2015) examined the relationships between the extracted factors (latent causes) and impacts of delay, revealing that a lack of commitment and substandard contracts are positively correlated with all impacts, whereas bad consultant performance is negatively correlated with time overrun.

In conclusion, researchers have employed diverse methods of interpreting and analysing data on the factors and effects of delay in the literature. Accordingly, each study has discovered different delay factors and effects among various levels and sample groups. Research has also produced different rankings for factors and effects. The factors and effects of delays further vary between countries, locations, and projects. Some of the factors identified in construction delays are incompetent contractors, tendering process problems, inadequate materials, rising costs, and shortage of workers (see Table 2).

Table 2. Delay factors in physical project implementation

Delay factors	Contractor-related	Consultant-related	Client-related	Other factors
	Poor site management practices Rashid, Y. (2020), Khair, K., et al. (2016), Varghese, A. R., et al. (2015), Gomarn, P., Pongpeng, J. (2018), Hisham, S. N. A., Yahaya, K. (2016)	**Incompetent standing supervision on site** Nawi, M. N. M., et al. (2016), Khair, K., et al. (2016), Idrus, N. A. (2019),Alsuliman, J. A. (2019), Razkenari, M., et al. (2015)	**Delay in progress payment** Adwani, M., et al. (2018),,Khair, K., et al. (2016), Idrus, N. A. (2019)	**The inclement weather conditions on site** Al-Adwani, M., et al. (2018), Amoatey, C. T., et al. (2015), Razkenari, M., et al. (2015), Sambasivan, M., et al.(2017)
	Inadequate experience in construction Amoatey, C. T., et al. (2015), Al-Adwani, M., et al. (2018), Shah, R. K. (2016), Sambasivan, M., et al.(2017)	**Misunderstanding client's requirements** Sambasivan, M., et al.(2017), Aziz, R. F., and Abdel- Hakam, A. A. (2016), Haq, S., et al. (2017), Khair, K., et al. (2016), Tafazzoli, M., et al. (2017)	**Problem with annual financing by client** Khair, K., et al. (2016), Idrus, N. A. (2019)	**Fluctuation of material price** Nawi, M. N. M., et al. (2016), Varghese, A. R., et al. (2015), Amoatey, C. T., et al. (2015), Van, L. T., et al.. (2016)]
Indicators	**Financial mismanagement and lack of capital** Varghese, A. R., et al. (2015), Gomarn, P., Pongpeng, J. (2018), Van, L. T., et al.. (2016), Amoatey, C. T., et al. (2015)	**Error or flaw in the design** Azhar, S. (2019), Aziz, R. F., & Abdel-Hakam, A. A. (2016), Haq, S., et al. (2017), Khair, K., et al. (2016)	**Variation order or change of scope request during construction** Hisham, S. N. A., Yahaya, K. (2016), Al-Adwani, M., et al. (2018), Azhar, S. (2019), Idrus, N. A. (2019)	**Late delivery of material on-site in comparison to the work programme** Nawi, M. N. M., et al. (2016), Varghese, A. R., et al. (2015)
	Poor communication between contractor and client Nawi, M. N. M., et al. (2016), Singh, S., Bala, A. (2018), Tafazzoli, M., et al. (2017), Gomarn, P., Pongpeng, J. (2018)	**Poor communication between consultant and client** Amoatey, C. T., et al. (2015), Tafazzoli, M., et al. (2017)	**Slow in decision making and approval upon submission** Rashid, Y. (2020), Varghese, A. R., et al. (2015), Doloi, H., et al. (2012), Tafazzoli, M., et al. (2017), Al-Adwani, M., et al. (2018), Azhar, S. (2019), Idrus, N. A. (2019)	**Poor quality of construction material** Nawi, M. N. M., et al. (2016), Amoatey, C. T., et al. (2015)
	Incompetent subcontractors Singh, S., Bala, A. (2018), Varghese, A. R., et al. (2015), Hisham, S. N.	**Lack of project supervision by the design team** Van, L. T., et al.. (2016), Amoatey, C. T., et al. (2015),	**Tendering and awarding the contract to an unreasonably low-price bidder** Nawi, M. N. M., et al.	**Unexpected conditions on site (soil, water table, etc.)** Van, L. T., et al.. (2016), Amoatey, C.

	A., Yahaya, K. (2016), Durdyev, S., et al. (2017)	Alsuliman, J. A. (2019)	(2016), Al-Adwani, M., et al. (2018), Azhar, S. (2019), Alsuliman, J. A. (2019)	T., et al. (2015), Alsuliman, J. A. (2019), Sambasivan, M., et al.(2017)
	Construction equipment's quality and availability Amoatey, C. T., et al. (2015), Sambasivan, M., et al.(2017), Khair, K., et al. (2016)	**Failure to obtain approval from local authorities before tender** Al-Adwani, M., et al. (2018), Aziz, R. F., & Abdel-Hakam, A. A. (2016), Haq, S., et al. (2017), Varghese, A. R., et al. (2015)	**Late in handing over the site from client to contractor** Al-Adwani, M., et al. (2018), Alsuliman, J. A. (2019)	**Unreliable supplier or vendor** Singh, S., Bala, A. (2018), Doloi, H., et al. (2012)
	Shortage of workforce Shah, R. K. (2016), Razkenari, M., et al. (2015), Khair, K., et al. (2016)	**Delay in preparing design and changes** Azhar, S. (2019), Idrus, N. A. (2019), Amoatey, C. T., et al. (2015), Al-Adwani, M., et al. (2018), Alsuliman, J. A. (2019)	**Unrealistic contract period in comparison to the complexity of the project** Al-Adwani, M., et al. (2018), Alsuliman, J. A. (2019), Doloi, H., et al. (2012)	
	Unrealistic project scheduling and planning Durdyev, S., et al. (2017), Al-Adwani, M., et al. (2018), Shah, R. K. (2016), Razkenari, M., et al. (2015)	**Delay in performing final inspection** Al-Adwani, M., et al. (2018), Haq, S., et al. (2017)	**Communication and coordination problem of the client** Azhar, S. (2019), Van, L. T., et al.. (2016), Amoatey, C. T., et al. (2015), Khair, K., et al. (2016)	
	Construction mistakes and defective works Idrus, N. A. (2019), Sambasivan, M., et al.(2017), Aziz, R. F., & Abdel-Hakam, A. A. (2016)	**Poor communication between consultant and contractor** Van, L. T., et al.. (2016), Khair, K., et al. (2016)	**Lack of client's experience in construction** Alsuliman, J. A. (2019), Razkenari, M., et al. (2015), Khair, K., et al. (2016)	
	Failure to comply with local authority requirements Al-Adwani, M., et al. (2018)	**Delay in the evaluation of progress payment** Hisham, S. N. A., Yahaya, K. (2016), Azhar, S. (2019)	**The high turnover rate in client's department** Amoatey, C. T., et al. (2015), Al-Adwani, M., et al. (2018)	
	Failure in the coordination of resources in construction Durdyev, S., et al. (2017), Aziz, R. F., &	**The excessive safety factor in payment evaluation** Tafazzoli, M., et al. (2017), Azhar, S. (2019)		

	Abdel-Hakam, A. A. (2016).

METHODOLOGY

This study aimed to examine the contributing factors of delay and their relationships with the effect of delays in government physical projects. Specifically, MOHA's physical construction projects in the Immigration Department of Malaysia's offices and premises, which were implemented in the Eleventh Malaysia Plan, were chosen as the case study. The choice of MOHA as the case of interest allowed a detailed investigation into the situation. Based on the quantitative approach, a survey questionnaire was developed as the measurement tool to gauge clients', consultants', contractors', and end users' thoughts, opinions, and feedback on project implementation delays from MOHA's standpoint. Content validity of the developed questionnaire was established upon consulting a MOHA practitioner with more than ten (10) years of experience in project management. The approximate number of the total population (N) and the minimum number of samples based on Krejcie and Morgan's (1970) recommendation are shown in Table 3. Ultimately, a total of 105 respondents participated in the survey, comprising contractors, consultants, end-users, and clients of the physical construction projects mentioned above. The data was analysed using the Relative Importance Index (RII) and Spearman's correlation to identify the most critical delay factors and determine their association with delay effects.

Table 3. Total population, minimum sample size, and actual responses

Respondent	Total population (N)	Minimum sample size (s)	Collected responses
Client and End User	60	52	56
Contractor and Consultant	50	44	49
TOTAL	**110**	**96**	**105**

(Client- Superintendent Officer (SO) and Development Division officers, engineers and technical assistants from MOHA; end-users- Immigration Department of Malaysia)

RESULTS

Reliability Analysis

The reliability results for this study are shown in Table 4. The values of Cronbach's Alpha for all variables were more than 0.70, indicating that the measures were reliable.

Table 4. Reliability analysis

Variable	Measurement Items	Source (Adapted fom)	Cronbach's Alpha Coefficient
Contractor-related (11 items)	Poor site management practices Inadequate experience in construction Financial mismanagement and lack ofcapital Poor communication between contractor and client Incompetent subcontractors Construction equipment's quality andavailability Shortage of workforce Unrealistic project scheduling and planning (ineffective work program) Construction mistakes and defective works Failure to comply with local authority requirements Failure in the coordination of resources inconstruction	Rashid, Y. (2020), Khair, K., et al. (2016), Varghese, A. R., et al. (2015), Gomarn, P., Pongpeng, J. (2018), Hisham, S. N. A., Yahaya, K. (2016), Amoatey, C. T., et al. (2015), Al-Adwani, M., et al. (2018), Shah, R. K. (2016), Sambasivan, M., et al.(2017)	0.864
Consultant-related (11 items)	Incompetent standing supervision on site Misunderstanding client's requirements Error or flaw in the design Poor communication between consultant and client Lack of project supervision by the design team Failure to obtain approval from local authorities before tender Delay in preparing design and changes Delay in performing final inspection Poor communication between consultant and contractor Delay in the evaluation of progress payment The excessive safety factor in paymentevaluation	Nawi, M. N. M., et al. (2016), Khair, K., et al. (2016), Idrus, N. A. (2019), Alsuliman, J. A. (2019), Razkenari, M., et al. (2015), Sambasivan, M., et al.(2017), Aziz, R. F., and Abdel-Hakam, A. A. (2016), Haq, S., et al. (2017), Tafazzoli, M., et al. (2017)	0.900

Client-related (10 items)	Delay in progress payment Problem with annual financing by client Variation order or change of scope request during construction Slow in decision making and approvalupon submission Tendering and awarding the contract to an unreasonably low-price bidder Late in handing over the site from client to contractor Unrealistic contract period in comparison to the complexity of the project Communication and coordination problem of the client Lack of client's experience in construction The high turnover rate in client's department	Rashid, Y. (2020), Varghese, A. R., et al. (2015), Doloi, H., et al. (2012), Tafazzoli, M., et al. (2017), Al-Adwani, M., et al. (2018), Azhar, S. (2019), Idrus, N. A. (2019)	0.864
Other factors (6 items)	Inclement weather condition on site Fluctuation of material price Late delivery of material on-site in comparison to the work programme Poor quality of construction material Unexpected conditions on site (soil, water table, etc.) Unreliable supplier or vendor	Van, L. T., et al.. (2016), Amoatey, C. T., et al. (2015), Alsuliman, J. A. (2019), Sambasivan, M., et al.(2017)	0.786
Effect of Delay	The project unable to be finished within the original contract term The cost of the project will be increased The annual budget would not be able tobe utilised as expected for the year Poor quality of works received by the end-user The operation of the department or process will be interrupted Total abandonment of the developmentproject Arbitration and litigation due to contract termination	Hisham, S. N. A., and Yahaya, K. (2016) Rashid, Y. (2020), Aibinu, A. A., and Jagboro, G. O. (2002), Rashid, Y. (2020), Riazi, S. R. M., and Lamari, F, Gebrehiwet, T., and Luo, H. (2017)	0.794

Delay Factors

This study explored the critical factors that cause delays in the implementation of government physical projects. A total of 38 delay factors were identified related to physical project implementation in MOHA. The delay factors were grouped according to the parties involved (contractor, consultant, and client). Relative Important Index (RII) analysis was performed to rank the overall factors.

$$IRII = \Sigma W/(A*N)$$

W = weightage to each factor by respondent

A = the highest weight

N =. Total number of respondents

A five-point Likert scale was used to determine the crucial level of delay factors, with ratings ranging from 1 (lowest) to 5 (highest). The factor with the highest RII was at the top of the list, while the factor with the lowest was at the bottom. As summarised in Table 5, all the delay factors were significant (score >0.6). According to the analysis results, there were three (3) factors with an RII value greater than 0.80, indicating high criticality. The factors were: (1) Financial mismanagement and lack of capital (RII = 0.8305); (2) Incompetent subcontractors (RII = 0.8229); and (3) Shortage of manpower (RII = 0.8171). All the top three factors were from the contractor-related group. The most critical factor groups among contractor-related, consultant-related, client-related, and others were also determined using Mean Score (MS) ranking in SPSS descriptive analysis. The contractor-related group was ranked the most critical group, followed by the 'others' group. The third group was the consultant-related group, and the least important group was the client-related group.

These results match those observed in earlier studies by Rashid (2020) and Varghese and Varghese (2015), which found contractor-related factors to contribute the most to the delay in project implementation in Pakistan and India. However, this result differs from that of Shahsavand, Marefat and Parchamijalal (2018), who found that in construction project delays in Iran, client-related factors are ranked first, followed by labour and equipment factors and contractor-related factors. This somewhat contradictory result may be due to the type, scope, and location of the construction project. As stated by Alsulaiti and Kerbache (2020), project delays can be caused by several circumstances, including the project's nature, scale, level of complexity, and types of stakeholders involved. From the perspective of MOHA projects, the main contractor's role is critical to project success to ensure that the project is executed as specified in the contract. The main contractor must complete the project on time and to the highest quality standards while also adhering to local rules and regulations to protect the interests of the owners, local communities, and employees. This finding highlights the need for a contractor's engagement throughout the project's implementation, including in material procurement and delivery to the job site, labour and equipment coordination, and management of all subcontractors' work (Tafazzoli and Shrestha, 2017; Anyanwu, 2013).

Table 5. Ranking of delay factors

Rank	Delay Factors in MOHA Project Implementation	RII	Factor Group
1	Financial mismanagement and lack of capital	0.8305	Contractor-related
2	Incompetent subcontractors	0.8229	Contractor-related
3	Shortage of manpower	0.8171	Contractor-related
4	Incompetent standing supervision on site	0.7695	Consultant-related
4	Variation order or change of scope request during construction	0.7695	Client-related
6	Late delivery of material on site in comparison to thework program	0.7562	Other factor
7	Tendering and awarding contract to unreasonably low-price bidder	0.7543	Client-related
7	Unrealistic project scheduling and planning (ineffective work program)	0.7543	Contractor-related
9	Slow in decision making and approval upon submission	0.7524	Client-related
9	Failure in coordination of resources in construction	0.7524	Contractor-related
9	Poor site management practices	0.7524	Contractor-related
12	Unexpected conditions on site (soil, water table, etc.)	0.7505	Other factor
13	Poor communication between consultant and contractor	0.7467	Consultant-related
14	Construction mistakes and defective works	0.7410	Contractor-related
15	Lack of project supervision by design team	0.7314	Consultant-related
16	Delay in preparing design and changes	0.7276	Contractor-related
16	Poor communication between contractor and client	0.7276	Contractor-related
18	Inadequate experience in construction	0.7124	Contractor-related
19	Poor quality of construction material	0.7048	Other factor
20	Construction equipment's quality and availability	0.7027	Contractor-related
21	Unreliable supplier or vendor	0.7010	Other factor
22	Fluctuation of material price	0.6914	Other factor
23	Poor communication between consultant and client	0.6876	Consultant-related
24	Problem with annual financing by client	0.6819	Client-related
25	Failure to obtain approval from local authorities before tender	0.6781	Consultant-related
26	Error or flaw in the design	0.6762	Consultant-related
27	Communication and coordination problem of the client	0.6724	Client-related
28	Delay in progress payment	0.6686	Client-related
29	Unrealistic contract period in comparison to the complexity of the project	0.6667	Client-related
30	Misunderstanding client's requirements	0.6629	Consultant-related
30	Delay in performing final inspection	0.6629	Consultant-related
32	Delay in evaluation of progress payment	0.6590	Consultant-related
33	Inclement weather condition on site	0.6552	Other factor
34	Failure to comply with local authority requirements	0.6495	Contractor-related
35	Lack of client's experience in construction	0.6457	Client-related
36	The high turnover rate in client's department	0.6381	Client-related
37	Excessive safety factor in payment evaluation	0.6248	Consultant-related
38	Late in handing over the site from client to contractor	0.6133	Client-related

Contractor-related Factors

Regarding contractor-related delay factors, the results in Table 5 reveal that financial mismanagement and a lack of capital are the most critical factors in a physical project's delay (RII = 0.8305). These findings appear to align with previous research which found that contractors' financial difficulties and weakness in financial management are among the most common factors of construction project delay (Al-Kharashi and Skitmore, 2009; Thomas and Sudhakumar, 2013). In Malaysia, specifically in MOHA, a similar pattern can be found in public projects, as contractors typically lack sufficient assets and rely heavily on outsourced capital, such as from bank institutions. Contractors in Malaysia, particularly local contractors, have a poor profit margin and lack the monitoring of project cash flow systems (Halim et al., 2010; Salim et al., 2018).

Moreover, the competency of a project team member, including subcontractors in construction, is crucial. This starts with a good relationship between the main contractor and subcontractor, which leads to clear communication of specific project requirements. The improper appointment of a subcontractor can thus cause problems. This is supported by Duma (2012), who mentioned that the main contractor as a client should look for a good subcontractor on paper with specific criteria such as financial strength, adequacy of experienced staff, and standard of workmanship. Shortage of workforce was identified as the third most critical factor in the contractor-related group (RII = 0.8171), followed by unrealistic project scheduling and planning (RII = 0.7543), poor site management practices (RII = 0.7524), and failure in the coordination of resources in construction (RII = 0.7524). All these factors are associated with the contractor's internal management issues. These results concur with Gomarn and Pongpeng’s (2018) findings, which showed that the significant reason for construction delays is inadequate site management and poor planning and scheduling.

Consultant-related Factors

In terms of consultant-related delay factors, the results in Table 5 show that the most critical factor causing a physical project to be delayed is incompetent standing supervision on site (RII = 0.7695). Poor communication between the consultant and the contractor is the second most critical factor that leads to project delays (RII = 0.7467), whereas a lack of project supervision by the design team is the third most critical factor in the consultant-related group (RII = 0.7314). These findings show that the consultant group's technical competency is the primary cause of delays, corroborating the study by Głuszak and Leśniak (2015) which also found that low-quality construction site supervision is among the essential factors of project delay. Khoiry, Kalaisilvan and Abdullah (2018) emphasised the importance of site supervision in ensuring the quality of construction work and minimising future repair or rework issues.

On the management side, the communication problem with the contractor is a similar factor to that reported by Orangi, Palaneeswaran, and Wilson (2011). Consultants provide expert advice in all aspects of construction and have in-depth knowledge of the field. Any miscommunication between the consultant and the contractor may result in design deviations. This may create delays and lead to rework due to reparative activities, which has financial implications and puts the project at risk. To meet construction targets, excellent communication and coordination are required in construction management along with strong relationships between the owner, consultant, contractor, and site workers.

Client-related Factors

The most critical client-related factor in a physical project's delay is a variation order or change of scope request during construction (RII = 0.7695). This result is consistent with other studies (Ghasemzadeh, 2014; Shahsavand, Marefat and Parchamijalal, 2018) which also found this factor to be listed among the top five (5) delay factors in construction projects. The issue in MOHA project implementation is that the project brief is always inadequate, owing to the absence of the involvement of all parties throughout the design process, especially the client and end-user. This finding matches the results observed in an earlier study by Mohammad and Hamzah (2019) on the causes of a variation order in Malaysian construction projects from the clients' perspective.

The results of this study indicate that the client is the key contributor to the variation order, which includes scope changes and design failures and omissions. Aside from that, the second most critical client factor that causes project delays is tendering and awarding contracts to unreasonably low-priced bidders (RII= 0.7543), while the third most critical factor is slow decision-making and approval upon submission (RII = 0.7524). The awarding of contracts to low-price bidders was also discussed by Alsuliman (2019), who found that the most significant delay in Saudi public construction is due to focusing on financial analysis and awarding the lowest bidder. To better address this issue, contractors' selection criteria in project implementation should be improved.

Other Factors

The work programme has the highest RII value (RII = 0.7562) among the external factors causing project delays beyond the contractors', consultants', or clients' control. This result is not surprising since late material delivery and unanticipated site conditions are frequently evaluated and addressed in the project delay literature to determine critical delay thresholds among external factors. The finding is consistent with studies by Gebrehiwet and Luo (2017) and Riazi, Riazi and Lamari (2013), which reported that due to poor planning and a lack of commitment from vendors or suppliers to accommodate material orders on schedule, there is a shortage of materials or a delay in receiving materials at the project site. Aside from that, the second most critical factor that causes project delays from this group is the unexpected conditions on site (soil, water, etc.) (RII = 0.7505). This problem usually occurs after a contract has been awarded, and is only discovered during site clearance or at the start of piling activity at the construction site. Aswathy, Mittal and Behera (2020) also agreed that the presence of a water table, boulders, and unforeseen underground conditions are challenging to solve, resulting in work being halted.

Effects of Delay

Table 6 shows the RII and simple mean score of every effect statement. The highest RII is for the time-related effect (RII = 0.8476, mean = 4.24), which is when a project is unable to be finished within the original contract term. Cost overrun results are ranked second and third, with the implications being that the project's cost will rise and the annual budget will not be utilised as planned for the year. With an RII score of 0.6971, the litigation and arbitration effect has the lowest ranking as an impact of delay in project implementation. These findings are consistent with studies (Rashid, 2020; Senouci, Ismail and Eldin, 2016; Shah, 2016) that found time and cost overruns to be the most significant effects of project delays. This result was further corroborated by MOHA's (KDN, 2020) data, which showed that time and cost overruns are the most critical issues. Taking the development project of the immigration post and quarters in Bakelalan, Sarawak as an example, MOHA's report mentioned that the project was delayed by 54.50 per cent in March 2020, on top of the 50 days' Extension of Time (EOT) that had been approved previously. It was also understood at the time that this contract would be terminated. This indicates that the time overrun in this situation had already impacted the completion date and had a later cost impact in terms of losses due to contract termination and the appointment of a new contractor.

Table 6. Results of RII analysis and mean score for effects of delay in project implementation

Rank	Client-related Factors	RII	Group	Mean
1	The project unable to be finished within the original contract term	0.8476	Time overrun	4.24
2	The cost of the project will be increased	0.8457	Cost overrun	4.19
3	The annual budget would not be ableto be utilised as expected for the year	0.8305	Cost overrun	
4	Poor quality of works received by theend-user	0.7981	Quality	3.96
5	The operation of the department or organisation will be interrupted	0.7867	Quality	
6	Arbitration and litigation due to contract termination	0.7714	Litigation & arbitration	3.86
7	Total abandonment of the development project	0.6971	Abandonment	3.49

Relationship Between Delay Factors and Effects

Pearson's correlation was used to determine the association between the delay factors and delay effects in MOHA project implementation (see Appendix A). The results show that delay factor groups have a positive correlation with the effects of delay. A positive correlation suggests that as the occurrence of one contributing factor rises, so does the frequency of its corresponding effect (Arantes, da Silva and Ferreira, 2015). In addition, at the significance level (two-tailed) of 0.01 and 0.05, a statistically significant association between the two parameters was observed. These results indicate that the effects of project delays are significantly associated with each delay factor group, with moderate and low associations, respectively. This is in line with Hisham and Yahya's (2016) finding that most causes and effects of delays are linearly related. However, the results contradict the study of Arantes, da Silva and Ferreira (2015) that found negative associations between the causes and effects of delay. Specifically, they found a negative association between consultant factors and time overrun as well as between client factors and litigation. These differences in Pearson's correlation happen possibly due to the amount of variability in the data sample or the presence of an outlier (Goodwin and Leech, 2006).

CONCLUSION

In Malaysia, public projects have been consistently reported as neglected and late, causing the government to bear financial losses. Furthermore, the objectives of the projects are not fully achieved, thus affecting public interest. This study examined the critical contributing factors to the delay in implementing physical projects in MOHA, Malaysia. Thirty-eight delay factors were identified, with contractor-related factors being the most critical, followed by consultant-related, client-related, and other factors. These delay factors are positively correlated with corresponding delay effects, including time and cost overrun, quality, litigation and arbitration, and abandonment. The continued expansion of knowledge and proper understanding of these causes will assist stakeholders in reducing the occurrences of delays and formulating appropriate strategies to improve project schedule performance. In MOHA physical projects in particular, several areas should be carefully assessed and evaluated in light of the ministry's safety and security concerns. Since this study was limited to the case of MOHA, it was not possible to generalise the findings to other contexts. Further research is recommended to examine how the application of project management tools and techniques can be leveraged to reduce delays in public-sector building projects. Researchers should also examine the relationships among the identified factors in similar or different contexts.

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APPENDIX Pearson's correlation (r) value

	Variables	Contractor-related	Consultant-related	Client-related	Other factors	Time overrun	Cost overrun	Quality	Arbitration and litigation	Abandonment
		Delay Factors				Effects of Delay				
Delay Factors	Contractor-related	1.000				0.387** (moderate)	0.241*	0.491** (moderate)	0.293**	0.229*
	Consultant-related		1.000			0.194*	0.278**	0.455** (moderate)	0.337** (moderate)	0.243*
	Client-related			1.000		0.213*	0.299**	0.400** (moderate)	0.401** (moderate)	0.250*
	Other factors				1.000	0.344** (moderate)	0.206*	0.314** (moderate)	0.332** (moderate)	0.255**
Effects of delay	Time overrun	0.387* (moderate)	0.194*	0.213*	0.344** (moderate)	1.000				
	Cost overrun	0.241*	0.278**	0.299**	0.206*		1.000			
	Quality	0.491** (moderate)	0.455** (moderate)	0.400** (moderate)	0.314** (moderate)			1.000		
	Arbitration and litigation	0.293*	0.337** (moderate)	0.401* (moderate)	0.332** (moderate)				1.000	
	Abandonment	0.229*	0.243*	0.250*	0.255**					1.000

**Correlation is significant at the 0.01 level (2-tailed) * Correlation is significant at the 0.05 level (2-tailed)

Note : Correlation Coefficient (r) (Cohen, 1988) : 0.10 -0.29 (weak), 0.30 – 0.49 (moderate), 0.50 – 1.