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Possession of Site: Another Layer of Complexity in Road Construction

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Abstract: Time is money, and it is crucial to accelerate road construction to improve the accessibility and connectivity of infrastructure. Prolonged periods of project implementation lead to delays and cost overruns, and further delays could destabilize the construction industry, causing an economic slowdown. This study explores the causes of delay in giving site possession, a topic that has received little explicit attention. The authors qualitatively identified the causes of delayed site possession from 15 project case studies. The data analysis presented in this paper involves two stages: (1) exploring causes of delay in giving site possession from 15 federal road projects and (2) further reviewing three road projects to provide significant insights into the fundamental reasons for, and the impacts of, the delay. This approach contributes to a better understanding of the specific causes of delay using a qualitative approach. The findings show that a slow process in land acquisition, squatters, and compensation disputes contributed to delayed site possession. The authors developed a conceptual framework to recommend strategies for mitigating the delay and accelerating the timelines of road projects based on the findings.

Keywords: site possession; land acquisition; construction delay; road projects; Malaysia

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1. Introduction

In Malaysia, road network development is presented systematically and comprehensively in a master plan called the "Highway Network Development Plan" (HNDP). The latest HNDP 2030 formulates the road development concepts and strategies and recommends programs for the Twelfth and Thirteenth Malaysia Plan (MP) [1]. It is crucial to accelerate road construction to align with the national agenda in improving the accessibility and connectivity of infrastructure, as highlighted in the recent Twelfth MP (2021–2025) [2]. Malaysia has allocated a substantial budget to provide better transportation networks to boost the economic sector. The Ministry of Finance has announced RM3.53 billion for infrastructure projects in 2022. In addition to mega-road projects, the government earmarks funding for a series of anticipated projects to improve basic infrastructure. These include upgrading roads and bridges as well as maintenance of roads [3].

Practitioners in government institutions are accountable for managing the allocated budget successfully through an efficient project management team. As mentioned by Ellis and Thomas [4], project teams must take responsibility for their performance and work as a team. Fundamentally, project performance is related to leadership qualities and construction managers' performance [5–7]. Every stage of road development must be carefully planned and organized to avoid delays in project implementation and completion. One of the challenges and obstacles in the implementation of road and highway projects is the delay in giving site possession.

Countless studies about the causes of construction delays, in particular, to big building projects, have made this trend increasingly evident. However, delays in giving site possession, including land acquisition, have not been viewed as a major delaying factor in

the general construction context by studies in Malaysia [8–10], developing countries [11], and worldwide [12]. This paper is expected to fill a gap in the literature concerning road construction delays, and the paper's exclusive contribution is related to issues surrounding site possession. Hence, this research study will contribute significantly to the pragmatic approaches to mitigating such delays in the Malaysian context. This study addresses the following three main questions:

- Question 1: Which causes dominate delays in giving site possession?
- Question 2: What are the impacts of site possession issues for road construction projects?
- Question 3: What strategies can the client and construction practitioners apply to mitigate delays due to site possession issues?

2. Literature Review

2.1. Site Possession in Construction Contract

The term "site possession" is used in many construction contracts worldwide. It refers to the granting of site access to a contractor based on contract requirement. The site is a working area provided by a project owner for a contractor to perform their work [13]. Land availability is a crucial prerequisite for road and highway construction. Land acquisition by the government is a preliminary process in road construction [14]. The government is compelled to acquire land from private landowners on a large scale. For example, land is acquired compulsorily under the Land Acquisition Act (LAA) 1960 in Peninsular Malaysia. Compulsory acquisition refers to the government's power to acquire private property without the willing consent of owners or occupants for the benefit of the general public. Properties could be acquired for any one of three reasons under Section 3.1: public purpose, economic development by any person or corporation, and any single or combination of other purposes (mining/residential/agricultural/commercial/industrial/recreational) [15].

The standard form of contract explained in this study has solely addressed government contracts and relevant clauses under the Public Works Department (PWD) 203A (Rev.1/2010) Standard Form of Contract [16] with Bill of Quantities constituting part of the contract. The Public Works Department (PWD) form was extensively used in government projects (building and infrastructure projects). The public sector contributed 41.3% of projects in Q4 of 2021 [17]. Under Clause 38.2 PWD 203A (Rev.1/2010) Standard Form of Contract, site possession begins with possession and continues until completion date, including extended completion dates.

In the Letter of Acceptance (LA), the project owner or its representative (PWD) is obliged to provide access rights to the site and specify commencement dates (contractors' possession periods for site access and work execution). The possession date is preferably within 14 days from the LA, in line with most government contract construction works [18]. Specifically, contractors are able to provide necessary site access and work performance arrangements. Site possession does not necessarily include the entire site in line with the contract. Site encumbrance must be documented in the contract appendix (Clause 38.3) as possession could occur pursuant to sections concerning contractors' work execution under the work program. Clause 43.1 (g) specifies "delay in giving possession of the site" as one of the delay events giving rise to an Extension of Time (EOT) entitlement to the contractor [16]. The project's completion date is evaluated from the possession date, and site possession may be given in sections or parts (Clause 38.3). An EOT should be granted when site possession affects the critical activity in the work program and truly determines the project completion date. Delays can be minimized or avoided by releasing site sections in stages corresponding to the work program.

2.2. Delay in Giving Site Possession in Road Construction

Several studies have been conducted on infrastructure project delays, including prolonged site possession in developing countries [19–23]. Varying terms have been used, such as "site possession delays", "slow land expropriation", and "site delivery delays" (Figure 1). Following extant research, Right of Way (ROW) [24–26] and land acquisition [27–29] in

infrastructure projects reflected similar delay events. Although it has been listed as one of many factors that delay infrastructure projects in previous studies, site possession has not been discussed to a sufficient extent or separately from other concerns.

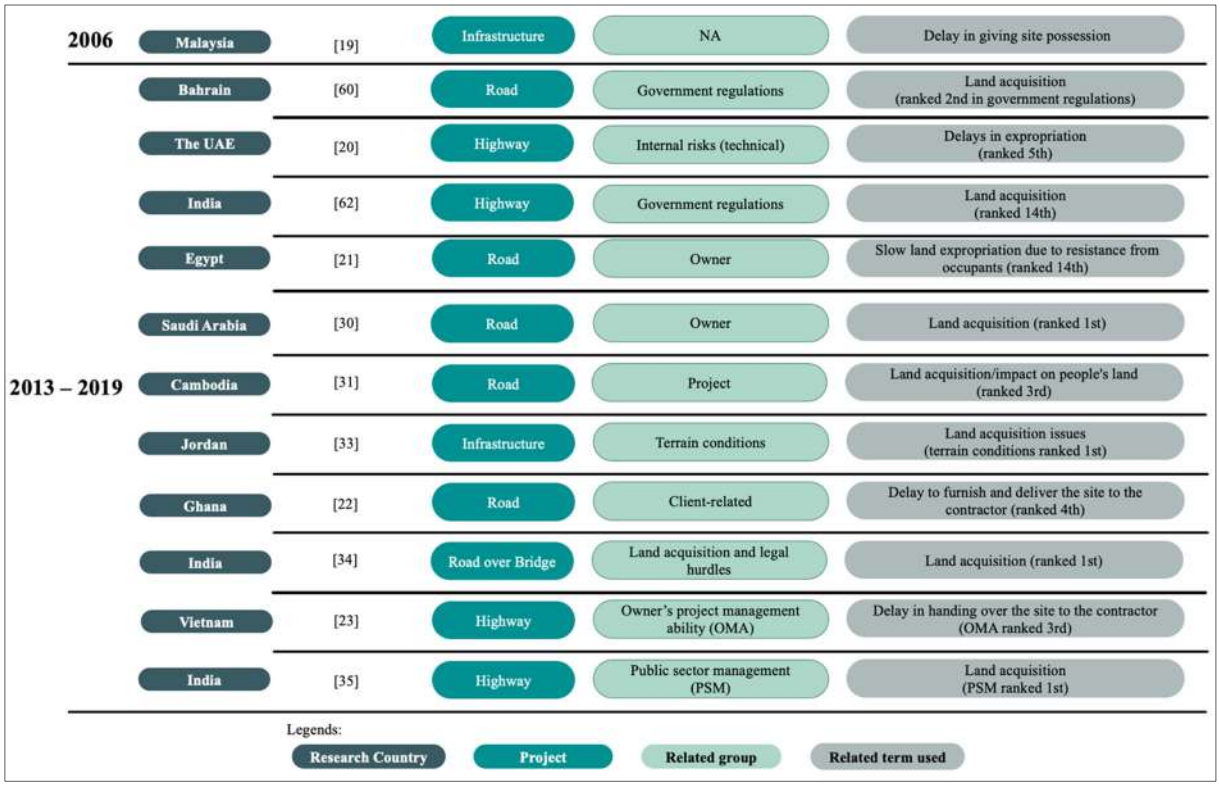

Figure 1. Previous studies listed the delay in giving site possession in infrastructure projects.

Land acquisition was indicated as one of the major causes of delay in road projects [30–32] and other infrastructure projects [33–35] that influence construction time performance. Delays were also rife in gas pipeline [36], petrochemical [37], large-scale [38], general [39], and public construction [7] projects. Thomas et al. [40] presented a land acquisition delay model for Build-Operate-Transfer (BOT) road projects categorized into projects characterized by litigation/agitation; non-availability of land, such as through a change in alignment; and missed-out-on land because of staff negligence and faulty surveys, administrative delays, and higher cost of land. Babatunde et al. [27] further validated the related delay causes for Public–Private Partnership (PPP) projects by adopting the identified delay factors from Thomas et al. [40]. The delays also included political patronage to encroachers, legal/social objections for evacuation, and compensation disputes.

The project owners must prepare the land before making it available to contractors and subcontractors in order to minimize site delivery delays in construction projects. Unfortunately, not all construction activities can be performed at the right time for several reasons, including site possession issues. A prepared site is also free from squatters who might deter contractors' work performance [41]. Typically, land left idle for some period, be it state land, alienated land, or reserved land, such as space reserved for roads, railways, and hillsides, will be taken by any person or body illegally and used for various purposes, such as residence, cultivation, business, and industry [42,43]. These areas are the most vulnerable to encroachment by unauthorized individuals [14]. Squatters and ROW invaders could instigate site possession delays. For example, such illegal occupants could pose challenges by fighting or protesting eviction notices and demanding compensation. Meanwhile, ROW invasions occur when road reserves are encroached upon or invaded in the form of illegal structures [14].

In road projects currently in progress, dealing with dissatisfied land and property owners can be challenging, a topic that the authors explore in a later section. Moreover, managing compensation and disruption may be time consuming [14,44]. Related studies on adequate compensation and dissatisfaction of affected landowners in construction projects have noted the contentious nature of relations among the parties involved [29,31,45–47]. The studies demonstrate the importance of addressing the issues arising in infrastructure projects. Naturally, compulsory acquisition affects occupants psychologically, and they may demand higher compensation for the disruption they face to their lives [35].

Another issue in site possession concerns design changes such as changes in road alignment, which require acquisition in other areas. Change in alignment is presented in the land acquisition delay model [40] and a study of land acquisition delay [27]. Late design, revisions, and plan changes were the key barriers to the ROW delivery process [25]. Design changes can significantly affect time and cost in completing construction activities [48]. Design changes may occur to cater to the current situation on construction sites due to uncertainties. Gharaibeh et al. [49] found that the significant factors influencing design changes were owners' requirements, design errors, omissions, and value engineering. Outdated designs have been identified as problems in preconstruction [50].

Moreover, land acquisition processes might determine site possession. Several authors from different countries have mentioned the slowness of the acquisition process [23,25,28,51]. Delay in decision making by the client and state government regarding the land issues can result in delays in land acquisition. In the Malaysian context, the minimum duration for the land acquisition process is expected to be six months [14].

Human issues and complicated legal systems might happen during the process of land acquisition [24]. Aleithawe [25] disclosed that the landowners and incomplete documents and plans cause delays in ROW acquisition. A study by Elawi et al. [30] in Saudi Arabia found that issues regarding land ownership take a long time to resolve legally, resulting in project delays. In India, land acquisition can be considered a challenging process as the landowners tend to resist it [34].

In Malaysia, several constraints in negotiation, land acquisition, and construction work triggered long delays to the East Coast Highway, such as landowners' dissatisfaction with compensation amounts due to discrepancies between public and private valuations. The delay in land matters is related to the lack of cooperation between the federal and state governments as land is administered by the respective state governments [52]. In Malaysian law, all land matters are under the jurisdiction and governance of state governments. The lack of coordination meetings to settle land issues also creates a problem in the process [14]. It is highlighted that no engagement session with stakeholders to resolve any site or land issues can be allowed to complicate site access by contractors [53].

Furthermore, land unavailability combined with the excessive cost of land transactions also triggers delays to the process [27]. Land values can change rapidly due to project awareness [54] and unexpected developments [27]. This fact is relevant because land prices can be much higher than the original estimated cost [27] as it is determined by market value and disturbance [29]. Land funding contributes to delays in road construction for various reasons, including land price and type of land use, such as residential, commercial, and industrial property [55].

Excluding the aforementioned causes, other researchers identified several unique causes in different countries. The causes are external difficulties and not part of the procedures that contribute to the delay in giving site possession. The causes may include environmental issues [25] and complex utility issues [25]. Political interference in the resettlement process also affects the land acquisition process [27].

2.3. Impacts of the Delay in Giving Site Possession in Road Construction

In general, any delay to construction projects also means additional costs to the client and contractor. According to Williams [56], a three-month delay in a project can lead to a one-year delay in execution, resulting in substantial costs. Delay in one activity

requires changes in resource planning on other activities. Construction resources include staffing, equipment, construction plant and machinery, materials, money, and time [57]. A contractor will have issues with additional costs when a project is subjected to delays [58], which include the wastage of resources [59]. When paying overhead and other related costs to complete a project, contractors may face a negative cash flow at some point. The construction delay effects include damaging the reputation of the government with the people [60].

Specifically, inefficiency in the acquisition process leads to delay, higher cost, and public dissatisfaction [24]. Othman, Torrance, and Hamid [19] demonstrated that time performance in road projects is affected by delays in giving site possession. Indeed, the client's financial resources will be tied up with incomplete projects [60], along with land prices higher than the original estimated cost [29,51]. Road users also face much longer-lasting traffic disruptions than anticipated and meanwhile suffer the loss of use of the new or upgraded road projects [58,61,62]. Moreover, involvement in new projects will be limited due to the time spent on the delayed project [62]. Previous studies presented site possession as a source of disputes in construction [63–66]. Thus, timely site possession is essential toward commencing construction work on time and enhancing the project delivery mechanism. Road network improvements enhance connectivity across regions, reflecting construction development, travel demand, and robust infrastructure budgets for economic growth.

2.4. Adoptions of Mitigation Strategies for Site Possession Performance

Effective site possession planning includes conducting a detailed site inspection to check structures and encumbrances. Crucial to the planning and design process is community engagement and consultation with parties, including stakeholders, adjoining landowners, authorities, and users [44]. It is necessary to identify the number of affected properties and businesses, and squatters, kiosks, and other informal developments, on the required land for land acquisition and resettlement issues [44]. The early inspection technique is practical in that inspecting the affected property might reveal encumbrances that may have been missed during appraisal [25]. In addition to statutory evolution and compulsory acquisition, negotiation for land to be acquired is beneficial in minimizing challenges by landowners [24,29]. Better clarification of scope in the pre-acquisition phase is essential to reduce design changes, and a related person must be included in the preliminary design phase [25].

Construction teams depend on acquiring possession of land during the acquisition process, or at least part of it, before the commencement of construction activities. The awarding of the contract for a road or highway project can happen before the land is fully acquired, not only in Malaysia, but also in another developing country, India [35]. Othman et al. [19] did not support unnecessary layers of bureaucracy and suggested reviewing the land acquisition procedure to expedite the process. Data systems can be applied to increase efficiency in the flow of information and accessibility to the required data [25]. It is important to align road construction planning with the land acquisition process [28]. Agreed compensation should be paid in order for the occupants to relocate themselves before construction begins [67]. Construction delay can be minimized by delivering the site on time after being awarded a project [68]. Rivera, Baguec, and Yeom [69] have described a similar strategy that involves acquiring land before construction. An appropriate legal framework should be adopted for compulsory land acquisition [70]. The aim is also to minimize the occurrence of squatter-related phenomena, including related social and environmental issues [43]. Enforcement and monitoring by authorities of government land and ROW must be implemented to avoid the legal framework from conflicting with the social responsibilities for settlement demanded by non-eligible parties [14].

Several authors have explored the significant relationship between leadership and project performance. A great leader promotes better communication through clear vision and responsibilities to enhance the flow of information [71]. Formulating policies, imple-

menting procedures, and disseminating best practices are among the significant leadership roles to encourage sustainability practice in the construction industry [72]. In the Fourth Industrial Revolution era, multiple forms of leadership intelligence contribute to effective leadership, including adapting knowledge and skills [73].

This study includes project management tips to help strategize projects efficiently and set key project milestones in project plans. These include the skills of experienced professionals involved in construction planning, required in project implementation and completion [8,69,74]. Experienced personnel can fulfill a project's plan requirement [48]. Choosing a project manager with adequate knowledge and experience of project management using appropriate tools and techniques was a top-ranked method to minimize delays in road construction projects [75]. According to Rivera, Baguec, and Yeom [69], road construction delays are positively associated with the construction manager's lack of experience, which substantially affects road construction projects.

3. Materials and Methods

3.1. Research Methodology

Although researchers prefer to use the quantitative approach in most studies of construction delay, this study explores the fundamental reasons for a specific cause of delay through real project cases. In this study, the delay causes of site possession during the construction stage of road projects have been analyzed qualitatively through multiple project documents. This contributes to a better understanding of the delay, instead of ranking several delay causes without further explaining the reasons for each delay. A study related to land acquisition in roadway projects used case studies to examine the impacts of the land acquisition phase on property owners. This systematic study on past projects highlighted the successful factors influencing land acquisition for megaprojects [29] and offered other researchers' novel insights into fundamental principles.

Following the written conditional approval of data collection, all the projects were labeled Project 1, Project 2, Project 3 . . . until Project 15 to protect project confidentiality and sensitivity. The authors gathered all the essential project information and data from the management personnel and engineers working at the Ministry of Works and PWD. Some of the project information, such as start date, completion date, and duration for EOT, is extracted from the electronic database, only accessible to authorized persons working at the PWD and handling the projects, along with other hardcopy and softcopy data provided. The analysis of project documents includes government reports and records to make valid inferences from the collected data. The following are the three stages of the qualitative data analysis in this study:

1. Selecting, coding, and categorizing the data of the delay causes through real project cases;
2. Displaying the data in the form of an infographic table and a diagram illustrating the data's patterns in order to assist the authors and readers in comprehending the data. The table includes the extended time durations due to the delay in giving site possession. Meanwhile, the diagram summarizes the causes of delay under five categories. The categories are based on the frequency of reasons identified from the project data. These categories are the following: organizational practices, design changes, land acquisition, landowners, and squatter- invaded right of way (ROW);
3. Discussing three projects for detailed elaboration on the identified causes of the delay in giving site possession and its impacts.

The later writing draws conclusions based on the data patterns of the causes of delay. The authors recognized patterns in the data from all the projects and presented coherent categories to suggest mitigation strategies for the delay.

3.2. The Case Studies

The authors used purposive sampling for this study with predetermined criteria, commonly employed in qualitative investigation. All 15 road projects involved are in eight different states in Peninsular Malaysia, governed by the Land Acquisition Act 1960, as

shown in Figure 2. Western and eastern Peninsular Malaysia have seven and eight projects, respectively. The project costs for all 15 projects ranged between RM38.50 million and RM770.00 million. Multiple delay factors exacerbated the poor time performance for all 15 projects under the 10th MP (2011–2015) and the 11th counterpart (2016–2020). In Figure 3, six of the projects are still ongoing under the 12th MP (2021–2025). As this infographic shows, all the projects also encompassed real-time performance and EOT under Clause 43.1 (g) PWD 203A: "delay in giving possession of the site". The minimum and maximum extensions of time for this specific delay are 87 and 915 days, respectively.

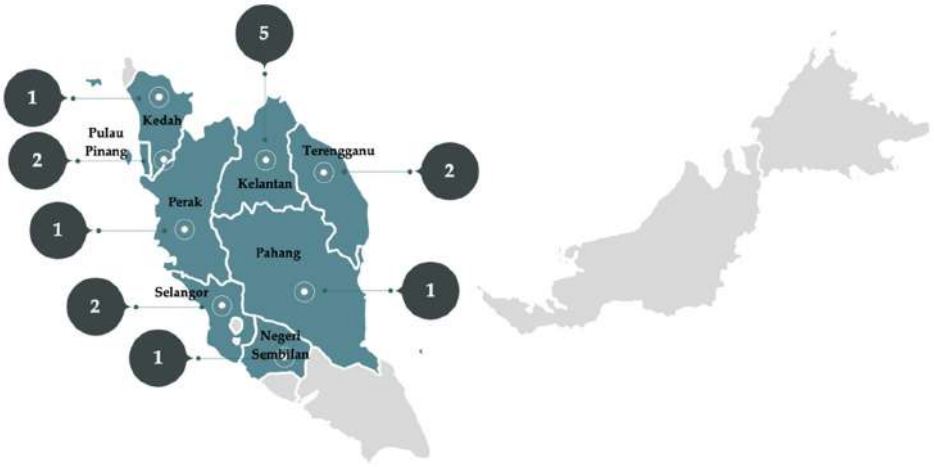

Figure 2. Location and number of project case studies in eight different states in Malaysia.

Project	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Project Location	Kelantan	Kelantan	Terengganu	Selangor	Kelantan	Pulau Pinang	Selangor	Pulau Pinang	Terengganu	Pahang	Perak	Kelantan	Kedah	N.Sembilan	Kelantan
Status ☑ Completed ☒ Ongoing	☑	☒	☒	☑	☑	☒	☑	☑	☑	☑	☒	☑	☑	☒	☒
Planned contract duration	1091	1091	913	911	1095	1095	1460	911	1095	1309	1460	729	729	1460	1091
Actual/ current contract duration	1553	2120	2241	4512	1682	1496	1790	1927	1594	1638	2346	766	1701	1945	1475
Additional duration	462	1029	1328	3601	587	401	330	1016	499	329	886	37	972	485	384
Delay duration for possession of site (PS)	267	915	458	290	587	287	180	298	87	225	578	183	115	371	270
PS delay percentage	24%	84%	50%	32%	54%	26%	12%	33%	8%	17%	40%	25%	16%	25%	25%
Interpreted categories based on project data															
Organizational Practices	Applicable to all projects														
Design Changes		✓													
Land Acquisition Process	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
Squatters and Invaded ROW		✓						✓		✓	✓	✓			
Landowners	✓		✓		✓										

Figure 3. Categories of delay in giving site possession based on 15 road projects in Malaysia.

Figure 3 contains several noteworthy points for this study regarding site possession delays. First, road projects exhibit an average delay in site possession of 31%. Next, 2 out of 15 road projects overshot their contract duration by 50% and 84%; 11 out of 15 projects experienced a more-than-20% schedule overrun. Delays in land acquisition happened in most sample projects. With the exception of Pahang, 14 projects in seven states had difficulty in land acquisition. The delay is caused by either the application process, the approval decision, or both. The approval process includes the required procedures by the acquiring agency in each state, which also involves additional administrative delay. In Pahang (Project 10), the delay is related to organizational practices due to the late eviction notice and enforcement to remove illegal structures at the site. This delay led to late demolition and construction work, leading to 225 days of delay. Delays in the land

acquisition process for eight projects, as highlighted, ranged from 87 days (2.9 months) to 371 days (a year), with four projects exceeding 250 days. Finally, although all five Kelantan projects experienced delays, ranging from 24% to 84% of the period, there is always a silver lining, such as when one project (Project 12) was completed far earlier (146 days) than the expected completion date.

The summary of delay events for all projects are presented in the Ishikawa diagram (cause and effect) to address the particular delay events, as shown in Figure 4. The causes are categorized into five factors. All the delay categories are presented in detail in three case studies.

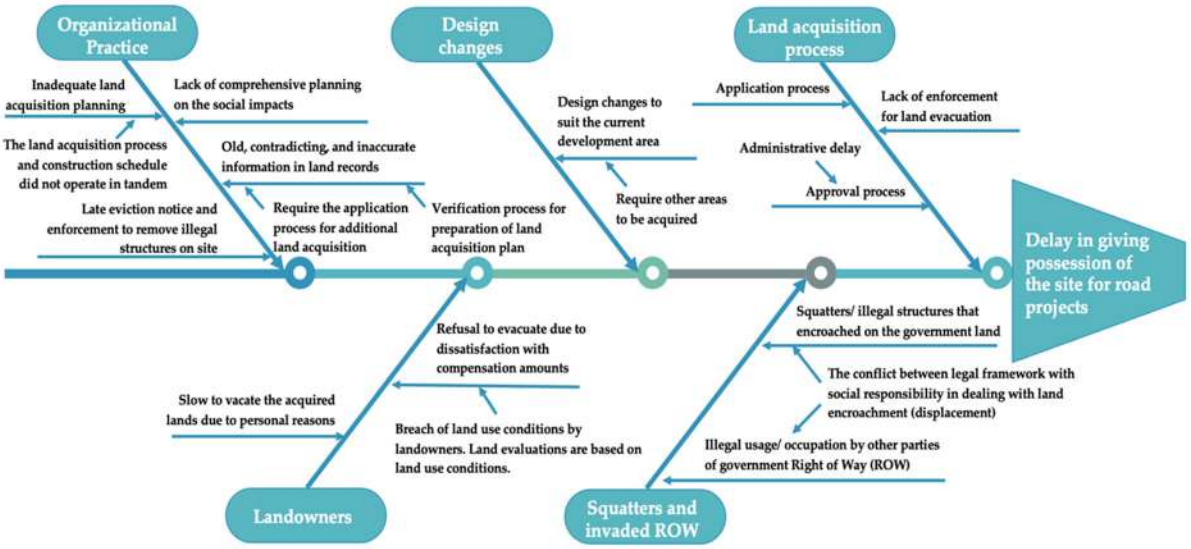

Figure 4. Causes of delay in giving site possession in 15 road projects in Malaysia.

Next, one completed project (Project 1) and two ongoing counterparts (Project 2 and 3) were reviewed to further analyze the fundamental reasons for delayed site possession and its impacts. All three projects were high-impact projects in East Peninsular Malaysia, worth over RM200 million, with more than 200 EOT days each under Clause 43.1 (g) PWD 203A Standard Form of Contract. Table 1 presents key project information for Projects 1, 2, and 3.

Table 1. Summary of key project information.

	Project 1	**Project 2**	**Project 3**
Status	Completed	Ongoing	Ongoing
Project length (km)	6.9	10.5	5.9
Project scope	New road	New road and upgrading of existing road	New road
Value management			
Value assessment	2013	2011	2012
Value engineering	2015	2014	2015
Start date	April 2015	April 2018	July 2016
Original completion date	April 2018	March 2021	January 2019
Actual/current completion date	July 2019	January 2024	September 2022
Original project cost (RM)	189 million	254 million	250 million
Actual/Current Project Costs (RM)	215 million	312 million	384 million
Percentage of overall project cost increase	14%	23%	54%
Number of land parcels for acquisition	315 lots	107 lots	290 lots
Extension of time (EOT) related to the delay in giving site possession			
EOT 1	217 days	557 days	432 days
EOT 2	-	-	26 days
EOT 3	50 days	358 days	-

Project 1: This 6.9-km roadway initiative in East Peninsular Malaysia denotes the second phase of a major road alignment project with a predicted value of almost RM190 million and an actual counterpart of over RM215 million. The project was only completed in July 2019 although the original duration was 36 months, with April 2018 as the first completion target. This mega-infrastructure plan was given three EOTs. The first and third EOTs were associated with delays in giving site possession for 217 days and 50 days, respectively. Based on the LA, the site was provided in parts beyond 90 days from the original date of site possession. Lengthy land acquisition processes caused the delay. The land acquisition process was conducted in stages during the construction stage. After the application process was completed by the project owner, the late approval, including the stages and issuance of related forms and notifications, such as award notice and compensation offered by the acquiring agency, prolonged the land acquisition process. Notably, such delays were beyond the project team's control despite their best attempts to submit the completed project documents and plans. The delays also involved landowners' hesitance toward land evacuation within the specified period. For example, the project team made multiple attempts to notify the occupants of three house units that they needed to relocate for the contractor to execute construction works. The occupants were eventually removed from the land following several notifications. Overall, the collaborative efforts of the project team prevented prolonged delay periods in land evacuation and contractors' work execution although such complications affected the project time performance.

Project 2: This government-funded 10.5-km roadway construction is a part of the phases of several significant roadway project that aim to provide (i) a road link between one of the districts and the district boundary in East Peninsular Malaysia, (ii) an alternative road, (iii) improved access, and (iv) financial growth prospects. The construction began in April 2018, with March 2021 as the original completion date and an estimated cost of RM250 million. Although the project should be completed by January 2024 after three EOTs, the costs have already increased to RM312 million (at the time of writing) following construction and land acquisition costs. The first and third EOT involved 557 and 358 days, respectively, under Clause 43.1 (g). The underlying reason for the EOT was associated with road design alterations, late submission of land acquisition plans for the new area following alignment changes, and squatters—for which the contractor was entitled to receive EOT. The road alignment was altered to complement the current area development. A licensed surveyor was appointed to survey the land and submit the land acquisition plan.

Regardless of this, both the preparation and submission of land acquisition plans were unexpectedly prolonged because of land record verification processes. Although the site was provided in parts for the contractor's work execution, overall project progress was affected for several months, as the entire working area was unavailable. The situation worsened when the contractor was unable to execute their work in the squatters' area. A consensus was attained to settle the squatters' relocation issues (26 houses) and compensation claims following several difficult negotiations among the client, relevant government bodies, and the state government. Notably, communication and coordination between relevant parties optimally facilitated site possession.

Project 3: This 5.9-km project in East Peninsular Malaysia is regarded as one of the most challenging public roadway projects. The project has been extended to a new completion date (September 2022) although the project was meant to be completed in January 2019. The project cost has significantly increased from RM250 million to almost RM400 million. Specifically, about 45% of the total project cost involved land acquisition costs resulting from the land and property owners' dissatisfaction with the compensation amount. The amount was determined based on the market values of the land title, which the government regarded as providing a fair evaluation, that were considered. The decisions on the compensation amount were provided in Form H, and the amounts were paid to landowners or persons interested, accordingly. However, the landowners were dissatisfied with the compensation amounts in this case because, due to a breach of land use conditions, compensation did not account for the structures present in 26 parcels of land. The issue

came to the public attention after the landowners demonstrated, which generated public and political interest. The federal and state governments needed to deal with the land and property owners as they resisted evacuating the acquired land, for which the government had already paid. Moreover, they objected to the ex gratia payments that the government had offered, which they considered insufficient.

Although the construction began in July 2016, 19 parcels of land were still inaccessible in February 2019. Accordingly, the contractor could not access the site to execute contractual duties. Although the contractor requested contract termination due to unresolved sectional site possession delays, the client recommended downsizing the project scope and omitting the problematic site possession area.

This project encountered further complications when the central agency or project stakeholder rejected the aforementioned proposal and instructed the client to resolve the delays, as the government had already invested in the land, by way of compensation payments to landowners. Additionally, the project aimed to provide optimal access to the specified area. The contractor eventually agreed to perform the construction works following extensive negotiations and discussions. Relatedly, the state government offered to negotiate with the land and property owners for compensation dispute resolution and direct feedback about the concerns. An agreement was reached that appeased the owners through additional compensation. The 1328 EOT days provided to the contractor included time for delayed site possession under Clause 43.1 (g) (458 days). Overall, the project team successfully reached an agreement by communicating and discussing with the relevant parties on how to execute construction work without scope reduction.

4. Analysis and Findings

4.1. Causes for Untimely Site Possession and Its Impact on Time Performance

All three projects were assessed to investigate the total number of EOT days provided for each project. Notably, the total EOT duration under Clause 43.1 (g) exceeded 200 days for each project. Table 2 summarizes the delay in giving site possession for all three projects.

Table 2. Summary of causes of the delay in giving site possession.

	Project 1	Project 2	Project 3
Organizational practices	Inadequate planning in land acquisition The land acquisition process and the construction schedule did not operate in tandem	Inadequate planning in land acquisition The land acquisition process and the construction schedule did not operate in tandem Some of the land records was inaccurate/not updated, which require longer time for land status/information verification to prepare land acquisition plans	Lack of comprehensive planning regarding the social impact
Land acquisition process	Prolonged duration in the approval process	Late application process (delay in preparing land acquisition plans) Land verification process	Eighteen additional parcels of land were acquired (applied later and not included in the initial phase of the application process)
Design changes	-	Road design alterations (a slight change in alignment) to suit the development within the surrounding area Requirement for other areas to be acquired, as well as preparation of new acquisition plans	-

Table 2. *Cont.*

	Project 1	Project 2	Project 3
Squatter and Invaded ROW	-	Squatters—26 illegal houses on the government land	-
Landowners	Slow to vacate the acquired land due to personal reasons	-	Landowners and tenants in 19 lots (32 structures) were failed to evacuate from the land due to the dissatisfaction with compensation amounts and object the ex gratia payments offered by the government (clashed with the land use conditions)

The following five categories of causes of site possession delays were determined from the three case study analyses:

4.1.1. Organizational Practices

Four other causes of delays begin with organizational practices. Any late application by the project owner reflects the lack of adequate planning in the land acquisition process. Setting a realistic timeline for submitting the required documents for the application prevented the risk of late submission of the documents, such as preparing the land acquisition plans. Another cause that contributed to late application directly involved the land records verification at the land office. Some of the land records were inaccurate/not updated, which requires a longer time for land status/information verification. Next, the prolonged approval process instituted by the state governments was possibly the most significant cause determining whether the projects could be completed at the target completion date. The delay process includes all the stages and issuances of forms/notifications in the acquiring agency's land acquisition processes, such as award notice and compensation offer. Another cause of delay which is neglected by all organizations, either federal or state governments, is the lack of comprehensive planning on the social impacts [1]. In Project 3, 44 structures were involved with breaches in land use conditions based on the land titles (agricultural and villages). Workshops, shops, stalls, and houses were on the land parcels, which affected people's daily routine on the land.

4.1.2. Land Acquisition Process

The land verification process can eat into the time involved in preparing land acquisition plans (Project 2) due to obsolete and conflicting land records (e.g., land ownership). This issue caused land to be excluded, and additional land was acquired from private landowners during the construction stage. Earlier studies listed excluded land and administrative delays for land acquisition in construction projects [27,40]. These issues have led to client delays in the application process, but the late submission of the required documents is not solely the client's fault. In Project 1, the main delay was related to the land acquisition process. This may have included the delay in executing the required procedures and in preparing the required documents under the Land Acquisition Act 1960. The client had to deal with the state's/acquiring agency's bureaucracy when applying for land acquisition.

Notwithstanding the application process, the approval of the submissions was also not agreeable with the construction schedule—the prolonged approval process followed by the relevant agency adversely affected construction time performance. The slowness in the acquisition processes may have included delays in the decision-making process by the state government, late acquisition of authority in executing the required procedures, and late processing by other government agencies concerning the required procedures. The slow land acquisition process has been highlighted by another study in neighboring Indonesia [51]. Although it is beyond the control of the project owner and project team, the project team must track various stages of the approval process to measure progress.

4.1.3. Design Changes

Many studies of construction delay have discussed design issues and redesigning. The problems include design errors [49,68,76], incomplete design during the tendering stage of procurement process [49,68,76], and delay in submitting design documents [68]. However, this paper shows that design changes proved unavoidable to complement the current area development. An earlier study framed the change in alignment as one of non-availability of land. The study also linked unexpected economic development of the area to weak planning institutions [27]. However, this study relates the cause of change in alignment due to the development within the surrounding area to a different category, design changes. Notably, design-related changes to suit the development area have necessitated the need for acquiring additional parcels of land. The delay in giving site possession occurred when the client was unable to submit the land acquisition plan for private lands at the earliest possible time. While design changes are possible, other critical activities have greater effects on project implementation.

4.1.4. Squatters

Squatter areas that encroached upon government land created displacement issues for squatters. In Project 2, ex gratia payments (out of goodwill rather than legal requirements) were made to the displaced individuals, based on the number of houses involved. Several negotiations between related government agencies were conducted to present and discuss the critical situation onsite so that construction work could be performed according to plan. Squatters challenged their removal when ordered to leave, affecting contractors' performance in completing their work [14].

4.1.5. Landowners

Compensation disputes and landowners' dissatisfaction with the land acquisition process prolonged that process, and construction projects suffered from the delay, as noted by Santoso and Soeng [31] in their study of road construction delays in Cambodia. In Project 3, a reasonable rate was awarded in the government view based on the consideration of market value and land use conditions. However, the compensation rate was contested by relevant parties. The ex gratia payments of the invested structures built on the land were objected to by those who broke the land use conditions. They were greatly affected by the disruptions to their businesses and daily routines. They were psychologically affected when the compensation amounts were not up to their expectations. Thus, they caused chaos in project implementation by demonstrating, refusing to cooperate, and making the site unavailable to the contractor to perform construction work. Accordingly, the landowners demanded more compensation for the greater loss and disruption they had suffered, as noted by Tawalare [35].

Moreover, occupiers' reluctance toward land evacuation within the specified period created problems for site possession. Venkateswaran and Murugasan [34] mentioned resistance from landowners toward land acquisition in road-over-bridge construction in India. However, the real reasons for Project 1 are personal in nature. Based on the unrecorded information provided by a member of the project team, a family stated that they needed to wait until their new house was ready to be moved into. Although the occupants did not resist the acquisition process, they took their own time to evacuate the acquired land.

5. Discussion

This paper discusses the impacts of site possession delays on the time performance, cost performance, and the suppression/limitation of socioeconomic demand for road construction projects. Projects 1 and 2 shared the same objective: to improve the safety and comfort of road users along the new alternative roads and maximize seamless traffic. The projects can minimize traffic congestion in the town area, especially during peak hours

and the main festive seasons. Project 2 also fulfills the requirements stated in the HNDP. Meanwhile, Project 3 aims to improve transportation flow in the city center.

5.1. Time Performance

Table 3 summarizes the time performance for Projects 1, 2, and 3. A study in Malaysia attributed delays in road projects to site possession delays [19]. In Projects 2 and 3, the EOT for solely delayed site possession came more than a year after the original completion date. This shows that government institutions should pay attention to this delay regardless of other major delay factors in road and highway construction identified in numerous delay studies. The government will have to wait much longer to launch the projects for public use as mentioned by Thapanont, Santi, and Pruethipong [58]. Construction delays hurt the public's perception of the government [60]. The projects represent the reputation of government organizations for delivering public projects that enhance the economy and add value to society.

Table 3. Summary of planned versus actual or current contract duration from three case studies.

Project & Status		Planned Contract Duration (a)	Actual/Current Contract Duration (b)	EOT Related to Delay in Giving Possession of Site (Excluding Other Delay Factors) (c)	Time Performance Index (TPI) (d) = (b)/(a)	Time Overrun Due to Delay in Giving Site Possession e = (a + c)/(a)
		Days				%
1—Completed	July 2019	1091	1553	267	1.42	124
2—Ongoing	January 2024	1091	2120	915	1.94	184
3—Ongoing	September 2022	913	2241	458	2.45	150

5.2. Cost Performance

The extended completion period, granted because of prolonged delays of three road projects, has a substantial impact on cost performance, particularly to the client, as the client has planned the budget and cash flow for the projects. The client needed to pay additional supervision fees (Projects 1, 2, and 3). Moreover, the actual compensation cost for land acquisition is much higher than what was estimated during the application process and after value management labs (Projects 1, 2, and 3). Several researchers observed similar findings related to higher land cost [24,27,40,51]. Notwithstanding the additional costs, the client also dealt with ex gratia payments unplanned in the original budget (Projects 2 and 3). Although not legally necessary, the government paid the impacted person to assist them in their relocation and compensate them for their loss. Although the percentages for Projects 2 and 3 were less than 10%, the total amount was in million ringgits, which could be used to fund other infrastructure projects or maintenance work.

Table 4 summarizes the estimated percentage increase in cost elements related to the delayed site possession from the initial budget in the Value Assessment Report. Projects 1 and 2, located in Kelantan, show a significant increase in land acquisition costs. The actual rates paid for land acquisition costs for 315 and 107 lots were higher than the original estimated cost. In Project 1, the compensation payments began in 2015 and went on until 2017. Project 2 involves an almost equivalent distance in kilometers for both new and upgrading roads. In July 2019, only 23 lots were acquired, and 84 other lots needed to be acquired. It involves a more-than-100% increase in land costs due to the late acquisition as the current values were considered. In Project 3, the land costs were increased by more than 200% based on the Value Engineering Report (three years after the Value Assessment Lab). This evidence shows that the later the acquisition, the higher the land costs due to the rapid change of land values linked to project awareness [54]. The original land costs in the Value Assessment Reports did not predict the higher costs incurred.

Table 4. Summary of estimated percentage increase of related cost elements.

	Project 1	**Project 2**	**Project 3**
Land costs (land acquisition based on market value and year of acquisition)	>60% (Rate per hectare increase 129% within 2 years)	>100% (The actual paid amount has not been finalized and provided)	>200%
Land costs (ex gratia payments—additional percentage from the actual land acquisition cost)	-	1.3%	8.8%
Professional fees for the extended period (supervision) due to the delay in giving site possession	>15%	Not provided	Not provided

When the projects involved additional time and cost due to the additional cost of land, the government institutions (client and technical agency) had to spend more time preparing the paperwork to apply for additional funding from the central agency, which served as a budget coordinator. Adequate data were provided to support and justify the budget application to avoid delays in payment processing to landowners/occupants, consultants, and contractors. This process must be completed before the client gets involved with severe cash flow problems for payment processing and therefore needs to avoid the financial hurdle. The government must maintain its reputation of being a good client by adhering to good payment practices to assist those involved in project execution. Delays require changes to resource planning for the contractor [57]. Thus, delays in payments will impair the construction performance and the whole construction business chain (e.g., subcontractors, suppliers, and workers).

5.3. Suppression/Limitation of Socioeconomic Demand

Infrastructure development can encourage the improvement of the business environment. Upgrading roads and improving highways will provide better access and prospects for trade, industry, and tourism growth. Every infrastructure project funded by the government has contributed significantly to the purpose of the 12th MP in terms of the diversification of the economic base, improvement of accessibility, connectivity, and acceleration of the construction sector [2]. The main benefit of these three projects is that they will shorten transportation times both inside and outside the main road. Furthermore, from the perspective of economic development, the projects will attract significant investments from associated projects. The projects involve the consideration of expanding design flexibility for current and future capacity to cater to new development, such as new residential areas/townships.

Technically, in Project 1, the designers had considered expanding design flexibility for current and future capacity and connectivity to the development area. The project function optimized road accessibility (interchanges), safety, and durability (design life) of the overall project. The existing federal road is not able to manage the current traffic demands. Thus, the new alternative route features a dual carriageway in either direction to offer comfortable travel to road users and is undeniably good in terms of road pavement. This project was officially opened and used by the public in October 2019. The delays in site possession (267 days) increased the total duration of project completion.

Project 2 will boost capacity and fulfill the requirement in HNDP and the master plan of the East Coast Economic Region. The project function also helps to improve safety and comfortable travel for road users along the route. Connectivity to current and future development, such as industrial areas, is included in the project function. Significantly, Project 2 is part of a large-scale road project divided into multiple stretches and broken into separate contracts. Table 5 summarizes the significant impacts of the completed road alignments in a neighboring state evaluated so far: 41 km in total. The benefits of the project function in maximizing seamless traffic may be difficult for the road users to enjoy

in the near future [58]. When complete, the road will form part of the route connecting the main town in the region and will become one of the most significant stretches of road in the country.

Table 5. Significant impacts of the completed road alignments in a neighboring state (Project 2 is part of the whole project development).

Level of Service (LOS)	Time Travel	Road Safety
LOS D at the existing federal road to LOS A at new alternative road	120 min from point A to B at the existing federal road to 30–40 min at the new alternative road	Significantly reduce road accidents. More than 400 accidents occurred every year from 2010 to 2014 at the existing federal roads (blackspot areas)

Project 3 will see the improvement of transportation flow into the city center. The current federal road has suffered high traffic demands, mainly during peak hours. The project is a strategy for better traffic dispersal, which can help reduce traffic congestion and increase the level of service of the existing federal road. Moreover, this alternative route will help improve safety for road users and make travel along the road more comfortable as the project features two lanes in either direction. Completion of the project is scheduled for September 2022. The project is a necessity, yet it must wait another year to be accomplished, partly due to site possession issues, which contributed to 458 days' worth of delay to this project. The government, stakeholders, and road users are looking forward to project completion for more convenient travel, which will further assist the local economy.

Improving the Level of Service (LOS) is one of the most significant functions of new or upgraded road projects. The LOS represents speed, journey time, maneuverability, comfort, traffic disruption, and safety. The ideal conditions are represented by LOS A, whereas LOS F denotes a very congested flow with traffic demand surpassing highway capacity. Figure 5 illustrates the road networks for all three projects in providing sustainability of the socioeconomic demand. Road construction delays have suppressed the socioeconomic demand in maximizing the benefits of road operations at the specified time, due to the population increase from 2019 to 2020 in both states, and in providing a better quality of life as demanded.

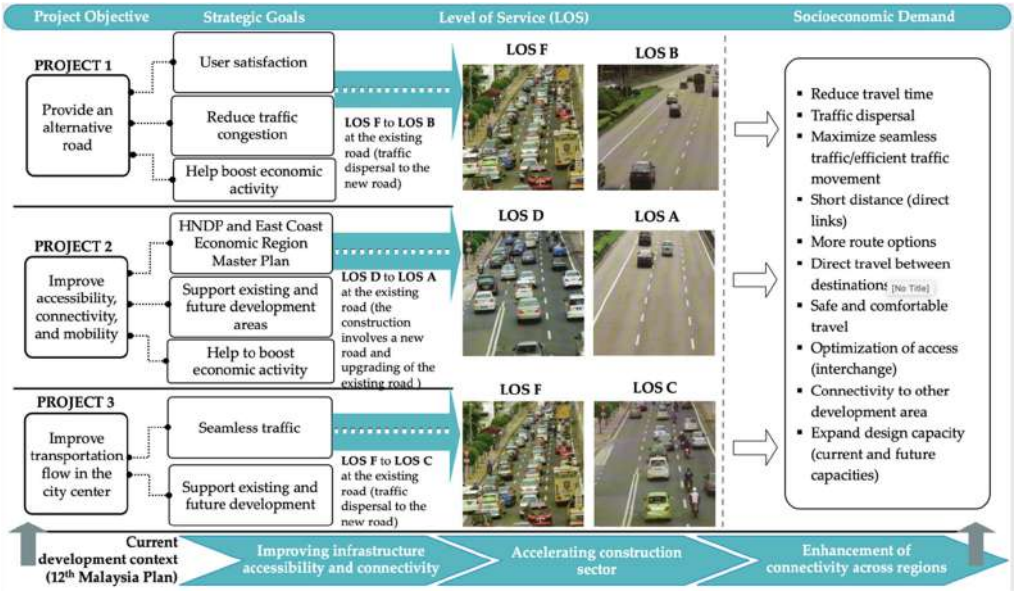

Figure 5. Road networks in providing sustainability of the socioeconomic demand.

Table 6 provides data for population and road development in both states. The total length of road network in both states continued with economic growth and travel demand. Having comprehensive infrastructure in both states significantly increases productivity as the states' populations rise from the year 2019 to the year 2021.

Table 6. Populations and road developments (Sources: Department of Statistics Malaysia, 2022 [77]; JKR, 2021 [78]).

Project & Location	Original/Actual Completion Year	Population (Millions) and Road Mileage (km)					
		2019		2020		2021	
		Million	km	Million	km	Million	km
Project 1 & 2-Kelantan	2018/2019 & 2021/2024	1.88	20,223	1.79	21,176	1.93	-
Project 3-Terengganu	2019/2022	1.24	21,439	1.15	21,999	1.28	-

5.4. Development of a Conceptual Framework of Site Possession Performance in Road Construction Projects

Landowners could pose challenges in the land acquisition phase although not all site possession delays originate from illegally occupied structures. Land acquisition (application and approval processes) and squatters contributed to poor time performance in road construction. Moreover, dissatisfied land or property owners contest the compensation amount, and their reluctance toward land evacuation denotes some of the reasons underlying site possession delays. The findings of delay cause aid in developing the following conceptual framework (Figure 6) to recommend strategies to mitigate site possession delays:

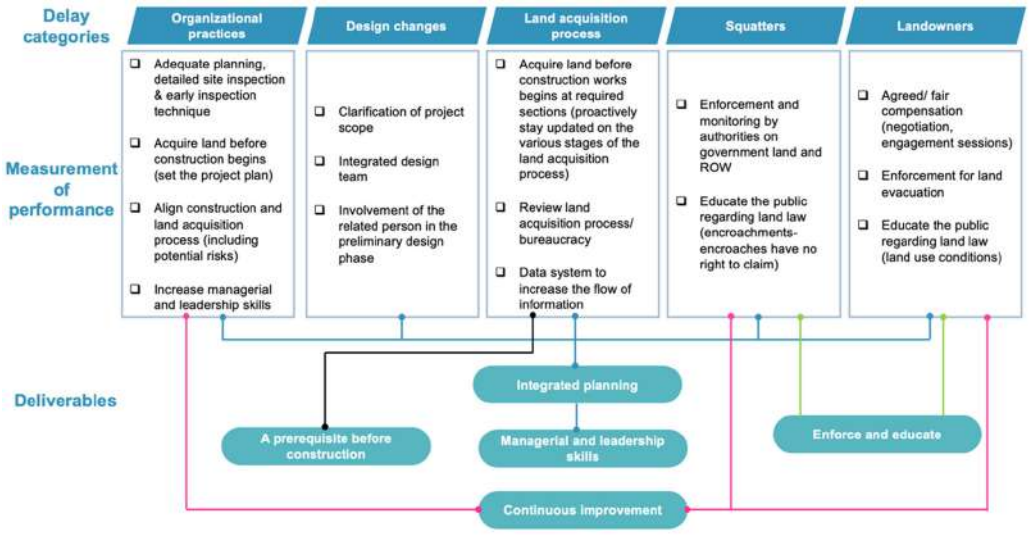

Figure 6. Conceptual framework of site possession performance in road construction projects here.

1. Integrated planning should occur to prevent miscalculations. Preliminary and adequate planning is crucial to deter construction-related changes. The number of affected properties and businesses, squatters, kiosks, and informal developments on the specific land must be identified for land acquisition and resettlement issues [44]. Better clarification of scope in the pre-acquisition phase is essential toward reducing design changes, and a related person must be included in the preliminary design phase [25]. Road construction project planning should also correspond to land acquisition processes in line with construction plans [28];
2. Establish a prerequisite before construction begins. Clients play a significant role in giving site possession, and land must already be acquired before the construction process [27,69] or site delivery after the award of a project. Regardless of the urgency

in executing a road construction project, land issues must be considered to ensure contractors enter the site and perform their contractual obligations. The amount of bureaucracy involved in the land acquisition process could be reviewed to expedite the process [19];

3. Legal conflicts should be prevented in a socially accountable way through enforcement by authorities to resolve land-oriented complexities [14]. The state governments and relevant authorities should draw the obvious lessons from this study to fully implement the law for minimal squatter issues, such as social and environmental concerns. The government seeks to respect the legal framework and social responsibility norms at the same time. Thus, it is challenging to deal with this complex set of circumstances. At the same time, illegal occupiers receive political patronage [40]. The government, or entities familiar with the law, such as the National Land Code 1965, should educate the public about the breach of land use conditions and encroachments on government land. People must understand that encroachers have no claim to the government land, and landowners cannot debate or protest the land use conditions;
4. Construction practitioners should possess competent managerial and leadership skills. Following literature on significant leadership–project performance correlations [72,73], competent leaders catalyze communication processes and information flow with a clear vision [71]. For example, competent leaders could fulfill project plan requirements, offer creative problem-solving skills, and implement work plans in line with pertinent knowledge, experience, and networking. Notably, outcomes on road construction delays are positively related to project/construction managers' experience, which significantly affects road construction projects [69,75];
5. Soft skills, which include communication, teamwork, and critical thinking, should be incorporated into project management for continuous improvement in project implementation. Soft skills facilitate effective communication, negotiation, planning, design processes, social involvement, and consultation with the relevant parties [44]. It is worth involving landowners during the design and planning stage to facilitate their requirements better and ensure sufficient compensation [24,29].

6. Conclusions

Meeting the original construction contract completion date is a challenge in road projects. It is critical for the government as a project owner and the project teams to understand how the delay in giving site possession affects the overall planning of construction schedules. Only then can they avoid the delay from happening or manage the delay to minimize the delay effects on time and cost performance. The causes of delay in the sample projects can be summarized as follows: inadequate planning in land acquisition; lack of comprehensive planning on the social impacts contributing to public demonstrations and refusal to evacuate the land; delaying either the application, approval (prolonged duration), or both of the land acquisition process; landowners slow to vacate the land due to personal reasons; and dealing with the displacement of squatters.

The significant impact of road construction delay is related to both time and cost. The rationale is vivid: the greater the construction delay, the more significant the cost impact. A prolonged delay in the land acquisition process will continue to taint the government's reputation for its ability to deliver projects and break the ceiling cost of the projects. Another point worth mentioning is that the compensation amounts that the government believed sufficient based on the land use conditions have provoked a public outcry. Thus, engagement with all key stakeholders from the early planning stages of road projects is critical, requiring the adoption of leadership and soft skills.

Although delays commonly occur in the construction sector following particular site ambiguities and complications, construction professionals should strive for minimal site possession delays despite the prominence of other causes of delay. Timely road construction has proved vital for resource deployment, budget management, and immediate site utilization. In contrast, prolonged road constructions hamper financial and urban development

following the delayed opening of new roads, thus suspending investments in relevant projects. In the Malaysian context, road construction should be accelerated in line with the national agenda to optimize infrastructure accessibility and connectivity under the 12th MP (2021–2025).

Following past studies, the outcomes of this study provided valuable insights and pragmatic strategies to mitigate site possession issues. Meanwhile, the approaches could facilitate (i) enhanced site delivery by clients and construction practitioners and (ii) management of serious drawbacks and unforeseen circumstances by construction teams. Clients are highly capable of resolving site possession delays. Nevertheless, failure to comply with contractual prerequisites could lead to disputes. In this vein, crucial activities must be promptly undertaken to prevent delays. Most construction contracts implement specific procedures with obligations on both parties. The proposed strategies are mainly related to integrated project planning, legal requirements, and continuous improvement of the project participants. Overall, effective communication and coordination with in-depth input and constructive feedback are essential for successful projects.

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