

## Key Constraint in Construction Industry: A Review

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**ABSTRACT** – Constraint is a limitation of a situation, agency, or force that obstructs movement toward a goal or purpose. There are several sorts of constraints that might impact building projects. During the early phases of a project, constraints should be recognized and explained in as much detail as possible, so that knowledge of them and their potential impact can be handled. The aim of this study is to identify types of constraints that might occur in the construction industry which may affect the time, cost and scope of the project. The study was carried out on the basis of a literature review with the result and findings of previous researchers. The result and findings from the previous researcher have been analysing in the table together with the method of analysis that being used by them in order to carry out the study. From the review, it can be summarized that the key of constraints can be divided into five major elements. There are Environmental constraints, Legal Constraints, Environmental Constraints, Technical Constraints and Social Constraints. Therefore, by doing this investigation, it will help to give a better solution and performance in term of time, cost and scope of the project by classifying and limiting the constraints in the construction industry especially at an early stage in the project planning and schedule.

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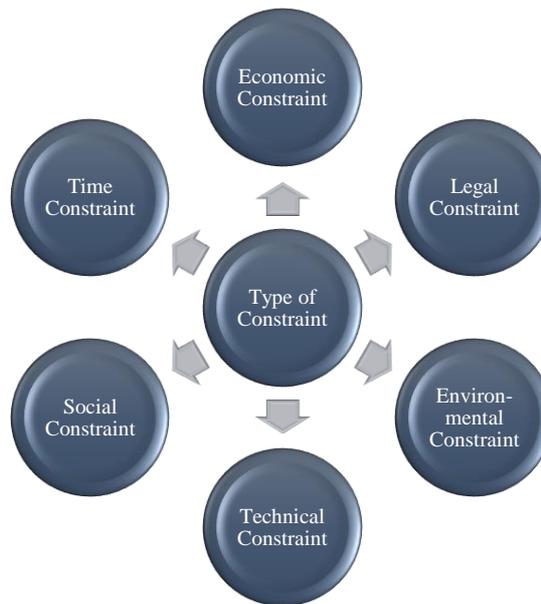
## INTRODUCTION

Project constraints are the general limitations that you need to account for during the project life cycle [1]. Disrupted activities in resource-constrained projects affect their successors due to precedence relationships, and other activities due to resource limits, both of which cause deviations in project progress [2]. Every working environment has its own set of limits. However, there are times when we are unaware of the limits or when we place too much emphasis on the project's objectives. It is essential to recognize potential constraints in the building project, as this will help in reducing excessive waste, loss of money and time due to poor planning [3]. Whether the limitation is physical or non-intangible, the restriction is any aspect or particular that prevents the firm from accomplishing its present and future objectives [4]. Project management is complicated by the demands and limits of a multi-party working setting. Clients and contractors may face direct and indirect costs as a result of these issues. On the one hand, project team members must fulfil customer needs while also overcoming constraints. During the early stages of a project, constraints should be recognised and described in as much detail as possible, so that awareness of them and their potential impact can be handled. This includes knowing the project's dynamics and how different constraints interact, as well as knowing what potential hazards exist and who is responsible for them [6].

To develop ways of improving construction productivity, it is a necessity to identify the factors which influence it [7]. The construction projects are unable to perform at a high level due to constraints. The practical processes for making organisational decisions with restrictions present are provided by identifying the constraints. It is considered that greater performance can be assumed if restrictions are better recognised at the onset [6]. According to [8], the factors such as material shortages, low project leadership skills, escalation of material prices, lack of highly experienced workforce, and poor quality of equipment, which will support in utilising those that influence positively and controlling or eliminating those that influence negatively on construction productivity. All of these factors are few types of the constraints that can affect the productivity of the construction project. The restrictions must be identified and reduced in order for the project to be successful [9].

## TYPE OF CONSTRAINTS THAT ARISE IN CONSTRUCTION INDUSTRY

Type of constraint can be divided into six categories. There are Economic Constraints, Legal Constraints, Environmental Constraints, Technical Constraints, Social Constraints and Time Constraints.



**Figure 1.** Type of Constraints in Construction Industry [10].

### Economic Constraints

According to [11] some of the most significant challenges to obtaining macroeconomic stability in the construction sector are investment and cash flow forecasts. The cash flow forecast requires estimating when and how much money will be spent on the project. To develop a sustainable economy, economic activities and actions must be monitored throughout the duration of a project [12]. Uncertainty about economic policy reduces not only real asset returns, but also market expectations for business performance and profitability [13]. The budget limit and money allocation were the main sources of economic constraints [3]. The selected construction system may not be the optimal alternative for attaining the project aim and quality due to the financial constraints [14]. In addition, when it comes to allocating financing, if the expenditures are not correctly allocated, the project's progress will be affected. According to [15] the project's effect is the project's product quality and performance. The budget allocation should cover all components of the projects, including land payment, relocating the public to a new location, compensating the public in areas where the project will pass through, and so on. If the budget is insufficient or allocated incorrectly, it can have a detrimental influence on the project's quality, safety, functionality, and performance [16]. Other than that, due to a lack of funding, the project's financial flow may be disrupted, causing delays in site possession and, as a result, delays in the overall project [14]. The construction sector is also affected by inflation, which has an impact on the project's planned budget, causing revisions and placing the project at risk of cost overrun. The annual revision of building materials prices, labour salaries, and machinery hire rates, which is generating core aspect among stakeholders, is to responsible for this effect [17]. As conclusion, Economic Constraint is one type of constraint that needs to be considering before starts construction works especially budget limit. If there are not enough money allocation or expenditure, it will be rise to a constraint which can cause delay due to cost overrun.

### Legal Constraints

The legal restrictions exist because the construction project is governed by numerous regulations. Workplace laws, safety standards, and a monitoring plan are the major legal restraints [3]. In some cases, when new guidelines are published, the project's entire timetable must be updated in order to comply with the new rules and regulations. Regarding to impact, legal constraints affect the timeframe and cause delays [18]. Approvals, permits, and certain sorts of construction work, for example, could not be completed on Sundays or public holidays. Other than that, it may have an impact on the planning and progress of the project, such as traffic mandates and removal grants, which require approval before construction can begin [19]. In New Zealand according to the Department of Building and Housing (DBH, 2009), a number of industry experts consider regulation in its broadest sense as a major element limiting business output by increasing compliance costs, limiting activity, suffocating innovation, and reducing worksite efficiency. Generally, having a working awareness of the contents of the legislations and regulations that affect their daily operations, as well as taking proactive actions to execute them, would help industry operators in resolving compliance difficulties with the risk involved should be priced into the contracts [20]. This type of constraint also give impact to the construction projects performance. Even though it can arise in some cases only, but we have to consider this constraint and prevent it to arise which can affect project schedule or timeline such as approvals that needed to start the works especially regarding labour permit.

## Environmental Constraints

A restriction on the environment is a hard limitation to change, but we can minimise the influence that this type of constraint has. These variables frequently coincide with legal limits, but the client might provide more considerations for environmental policies [21]. The environment must be safeguarded due to public concern and restrictions, such as air quality, tree preservation, traffic management, and noise control, among other things. The responsible personnel must go to the "Environmental Department" at the planning and design stage of the project to ask for approval/justification [3]. The project should be environmentally friendly and humane, which means it should not ruin the environment. The Environmental Department should provide permissions and permits on a responsible note at every step of the project, particularly during the planning and design stages [18].

## Technical Constraints

Technical limitations are often used to describe the procedures involved in finishing construction tasks, and they are frequently dependent on the viability of construction techniques and standards. For instance, levelling the site is necessary before excavation, and formwork and reinforcement might be added thereafter before concrete is poured. The following job is constrained by the previous tasks since each one must be finished before it can start. Construction procedures, construction elements, and the time relationships between activities are all examples of construction procedural constraints [22]. According to [20] under the project management/project team characteristics group, the coordination, supervision, performance monitoring, and control set of constraints were shown to be the most influential on-site labour productivity constraint factor. There are a few technical constraints that create a barrier to the project. These limits are mainly caused by flaws in the project's design, the site environment, the working environment's surroundings, transit patterns, and storage capacity. These restrictions must be closely monitored and planned out by design engineers; coordination of services also includes technical limitations [19].

Other than that, technical limitations also can arise by longer lead times due to a lack of coordination between onsite demand and offsite construction, higher maintenance costs for end users due to low utilisation of expensive manufacturing resources, and inconsistent quality due to a high variety of customised products and inefficient floor control are some of the drawbacks of using offsite construction [23]. Lack of coordination skills is one of the examples for technical constraints. Many constraints relating to the nature of the equipment and its relevant management principles must be considered by management. The planning and scheduling of construction activities can be influenced by a number of factors [21]. The design team, contractors, and subcontractors are all involved in the project execution process in the construction business. As a result, coordination between those stakeholders is critical in order to avoid costly mistakes, reworks, and delays in the project timeline [24]. In addition, technical limitation can also come from design and construction planning. Design and construction planning can almost run concurrently, considering many options that are desirable from both perspectives and avoiding the need for major adjustments under the pretence of value engineering. Furthermore, as the project develops from planning to design, a review of designs for constructability can be carried out [25].

## Social Constraints

In a rural location, no building job could be completed without the participation of the local population. In the construction working environment, social considerations are a constraint [14]. Factors such as media pressure and public concern operate as social restrictions on a project, causing delays in schedule costing and disrupting the project's overall connectivity [18]. It should come as no surprise that unfavourable effects are caused by a small number of essential individuals, and that the restrictions are due to human limitations. These social restraints may appear insignificant, yet they are really difficult to handle [19]. As mentioned by [26] it should come as no surprise that unfavourable consequences are caused by a limited number of crucial individuals, and that the constraints are human constraints. People-related restrictions can take three different forms which are human resistance, emotional constraints, and problem ownership [3]. There will be resistance to change when it is implemented. Constraints must be considered during the planning stage prior to implementation to reduce the impact of human resistance [14]

## Time Constraints

Delivering a project on time is usually a key indicator of its success, since any delays result in increased expenses and the need to reconsider any plans that project stakeholders may have after it is completed [27]. Nowadays, construction projects have been harmed as a result of the pandemic. Due to the outbreak, a few construction businesses had to postpone their projects, causing several delays [28]. According to [29] the delay factor are revealed as delay in payments to the contractor, delay in approval of completed work, and delay in delivering instructions by consultants during COVID-19, which compiled the main causes of delays in construction projects in Kuwait. The primary goals of time management are to keep track of time and plan out timetables, networks, and other tasks. The implications of miss deadlines are frequently severe and challenging to resolve[30]. Time Management is the function required to maintain the appropriate allocation of time to the overall conduct of the project through the successive stages of its natural life-cycle such as concept, development, execution, and finishing, through the processes of time planning, time estimating, time scheduling, and schedule control [31].

## Constraints in Construction Industry

Constraints should be identified and defined in as much detail as feasible in the early phases of a project so that knowledge of them and their potential impact can be managed. This includes knowing the project's dynamics and how different constraints interact, as well as knowing what potential hazards exist and who is responsible for them [10]. Table 1 shows the types of constraints with the example that had been discuss and analyze by few previous researchers which can arise in the construction industry. The previous researcher also has mentioned the method of analysis that they use to gain the results of the research. Table 2 shows the frequency according to different types of constraint from the previous researchers.

**Table 1.** Previous Research on Constraint in Construction Industry

Title	Researcher	Types of Constraint	Method of Analysis
Identification of Constrains in Construction Projects to Improve Performance	[3]	<ul style="list-style-type: none"> <li>• Economic Constraint</li> <li>• Legal Constraint</li> <li>• Environmental Constraint</li> <li>• Technical Constraint</li> <li>• Social Constraint</li> </ul>	Ranking Scores
Identification of constraints in project schedule management	[6]	<ul style="list-style-type: none"> <li>• Economic Constraint</li> <li>• Legal Constraint</li> <li>• Environmental Constraint</li> <li>• Technical Constraint</li> <li>• Social Constraint</li> </ul>	Ranking Scores
Identification of Constraints in Construction Projects	[32]	<ul style="list-style-type: none"> <li>• Economic Constraint</li> <li>• Legal Constraint</li> <li>• Environmental Constraint</li> <li>• Technical Constraint</li> <li>• Social Constraint</li> </ul>	Importance Performance Analysis method (IPA)
On-site construction productivity in Malaysian infrastructure projects	[7]	<ul style="list-style-type: none"> <li>• Level of skill and experience of the workforce</li> <li>• Lack of adequacy in supply or high cost of needed resources</li> <li>• Supervision, performance monitoring and control</li> <li>• Slow local authorities' approval</li> <li>• Poor weather conditions</li> </ul>	Statistical Techniques and One-way ANOVA
Various Constraints for Delays in Construction Work and Suggesting Remedial Measures for the Same	[14]	<ul style="list-style-type: none"> <li>• Economic Constraint</li> <li>• Legal Constraint</li> <li>• Environmental Constraint</li> <li>• Technical Constraint</li> <li>• Social Constraint</li> </ul>	Relative Importance Index (RII)
Identification of Constraints in Construction Projects to Improve Performance	[18]	<ul style="list-style-type: none"> <li>• Economic Constraint</li> <li>• Legal Constraint</li> <li>• Environmental Constraint</li> <li>• Technical Constraint</li> <li>• Social Constraint</li> </ul>	Relative Importance Index (RII)
On-site Labour Productivity of New Zealand Construction Industry: Key Constraints and Improvement Measures	[20]	<p>Internal Constraint</p> <ul style="list-style-type: none"> <li>- Project Finance</li> <li>- Workforce</li> <li>- Technology/process</li> <li>- Project Characteristic</li> <li>- Project Management</li> </ul> <p>External Constraint</p> <ul style="list-style-type: none"> <li>- Statutory Compliances</li> <li>- Unforeseen Events</li> <li>- External Forces</li> </ul>	Mean Rating (MR),

**Table 1.** Previous Research on Constraint in Construction Industry (cont.)

Title	Researcher	Types of Constraint	Method of Analysis
Empirical Study on Theory of Constraints in a Construction Project Management	[19]	<ul style="list-style-type: none"> <li>• Technical Constraint</li> <li>• Economical Constraint</li> <li>• Legal Constraint</li> <li>• Time Constraint</li> <li>• Management Constraint</li> <li>• Social Constraint</li> </ul>	Ranking Scores
A Framework of Total Constraint Management for Improving Work Flow in Liquefied Natural Gas Construction	[26]	<ul style="list-style-type: none"> <li>• Bad Weather</li> <li>• Design Change</li> <li>• Quality Unqualified</li> <li>• Material Shortage</li> <li>• Labour Shortage</li> <li>• Late delivery of the equipment</li> <li>• Late delivery of the work permit</li> </ul>	Controlled Experiments
Key constraints and mitigation strategies for prefabricated prefinished volumetric construction	[23]	<ul style="list-style-type: none"> <li>• Extensive coordination required prior to and during construction</li> <li>• Need for additional project planning and design efforts</li> <li>• Increased transportation and logistics considerations</li> <li>• Requirement for early commitment</li> <li>• Higher initial cost than conventional construction method</li> </ul>	Mean Ranking (MR)

**Table 2.** Frequency according to type of constraints by previous researcher

Types of Constraints	Frequency
Economic Constraints	8
Legal Constraints	7
Environmental Constraints	8
Technical Constraints	10
Social Constraints	8
Time Constraints	4

## SUMMARY AND RECOMMENDATION

The identification of constraints enables in not only comprehending the constraints features, but also in predicting the time and stage at which they will be faced. Furthermore, the ability to accurately foresee limits will helps in project planning and resource management. In conclusion, as a recommendation, the management team can clarify the identified constraints and consider them in the relevant project planning agenda and schedule, as well as in the design of the organisational structure, in order to have a good awareness of the recognised constraints during the planning stages.

## REFERENCES

- [1] Team Asana, "6 Project Constraints and How to Manage Them for Project Success." 2021. [Online]. Available: <https://asana.com/resources/project-constraints>.
- [2] J. Song, A. Martens, and M. Vanhoucke, "Using Earned Value Management and Schedule Risk Analysis with resource constraints for project control," *Eur. J. Oper. Res.*, vol. 297, no. 2, pp. 451–466, 2022, doi: 10.1016/j.ejor.2021.05.036.
- [3] E. Lau1 and J. J. Kong2, "Identification of Constraints in Construction Projects to Improve Performance," *Int. J. Res. Appl. Sci. Eng. Technol.*, vol. 9, no. 1, pp. 710–713, 2021, doi: 10.22214/ijraset.2021.32912.
- [4] M. H. Talib and A. M. H. Kashkol, "Theory of Constraints in Construction Projects," *J. Univ. Babylon Eng. Sci.*, vol. 27, no. 2, pp. 109–124, 2019, doi: 10.29196/jubes.v27i2.2302.
- [6] A. Kumar Mishra and K. Kumar Moktan, "Identification of Constraints in Project Schedule Management," *Int. J. Res. - GRANTHAALAYAH*, vol. 7, no. 2, pp. 18–35, 2019, doi: 10.29121/granthaalayah.v7.i2.2019.990.
- [7] S. Durdyev and S. Ismail, "On-site construction productivity in Malaysian infrastructure projects," *Struct. Surv.*, vol. 34, no. 4–5, pp. 446–462, 2016, doi: 10.1108/SS-12-2015-0058.
- [8] A. Enshassi, S. Mohamed, Z. A. Mustafa, and P. E. Mayer, "Factors affecting labour productivity in building projects in the Gaza strip," *J. Civ. Eng. Manag.*, vol. 13, no. 4, pp. 245–254, 2007, doi: 10.1080/13923730.2007.9636444.

- [9] K. M. Sannakki, T. M. M. Kumar, and A. Kumar, "The effect of constraints in cost and schedule control by using primavera : a commercial building project case study," vol. 1, no. 1, pp. 11–16, 2017.
- [10] Design Buildings, "Constraints on construction projects," *Designingbuildings.co.uk*. 2016. [Online]. Available: [https://www.designingbuildings.co.uk/wiki/Constraints\\_on\\_construction\\_projects#Legal\\_constraints%0Ahttps://www.designingbuildings.co.uk/wiki/Constraints\\_on\\_construction\\_projects](https://www.designingbuildings.co.uk/wiki/Constraints_on_construction_projects#Legal_constraints%0Ahttps://www.designingbuildings.co.uk/wiki/Constraints_on_construction_projects).
- [11] M. Altaf *et al.*, "Evaluating the awareness and implementation level of LCCA in the construction industry of Malaysia," *Ain Shams Eng. J.*, vol. 13, no. 5, p. 101686, 2022, doi: 10.1016/j.asej.2021.101686.
- [12] W. Salah Alaloul, M. Altaf, M. Ali Musarat, M. Faisal Javeed, and A. Mo-savi, "Life Cycle Assessment and Life Cycle Cost Analysis in Infra-structure Projects: A Systematic Review," no. March, 2021, doi: 10.20944/preprints202103.0316.v1.
- [13] H. Ma and D. Hao, "Economic policy uncertainty, financial development, and financial constraints: Evidence from China," *Int. Rev. Econ. Financ.*, vol. 79, no. December 2019, pp. 368–386, 2022, doi: 10.1016/j.iref.2022.02.027.
- [14] V. Y. Kolte and H. Ahire, "Various Constraints for Delays in Construction Work and Suggesting Remedial Measures for the Same," no. 1, pp. 3–8, 2020.
- [15] L. Muhwezi, J. Acai, and G. Otim, "An assessment of the factors causing delays on building construction projects in Uganda," *Constr. Eng. Manag.*, vol. 3, no. 1, pp. 13–23, 2014, doi: 10.5923/j.ijcem.20140301.02.
- [16] G. J. Kinyua, "Topic : A study of social-economic constraints in delivery of building and civil engineering projects in kenya . NAME : PhD," no. January, 2019, doi: 10.13140/RG.2.2.36658.04806.
- [17] M. A. Musarat, W. S. Alaloul, and M. S. Liew, "Impact of inflation rate on construction projects budget: A review," *Ain Shams Eng. J.*, vol. 12, no. 1, pp. 407–414, 2021, doi: 10.1016/j.asej.2020.04.009.
- [18] Tanaya Shinde<sup>1</sup> Divyanshu Sachidanand<sup>2</sup> Nikhil Sachdev<sup>3</sup>, "Identification of Constraints in Construction Projects to Improve Performance," *Int. J. Res. Appl. Sci. Eng. Technol.*, vol. 9, no. 1, pp. 710–713, 2019, doi: 10.22214/ijraset.2021.32912.
- [19] S. Sultana, "Empirical study on theory of constraints in a construction project," vol. 6, no. 3, pp. 205–209, 2019.
- [20] S. Durdyev and J. Mbachu, "On-site labour productivity of New Zealand construction industry: Key constraints and improvement measures," *Australas. J. Constr. Econ. Build.*, vol. 11, no. 3, pp. 18–33, 2011, doi: 10.5130/ajceb.v11i3.2120.
- [21] R. Emde, "What are constraints in the construction business?" *Commercial Law*. pp. 1284–1285. doi: 10.5771/9783845276564-1284-1.
- [22] B. Zhong *et al.*, "Deep learning-based extraction of construction procedural constraints from construction regulations," *Adv. Eng. Informatics*, vol. 43, no. August 2019, p. 101003, 2020, doi: 10.1016/j.aei.2019.101003.
- [23] B. G. Hwang, M. Shan, and K. Y. Looi, "Key constraints and mitigation strategies for prefabricated prefinished volumetric construction," *J. Clean. Prod.*, vol. 183, pp. 183–193, 2018, doi: 10.1016/j.jclepro.2018.02.136.
- [24] S. Durdyev, S. Ismail, and N. A. Bakar, "Factors causing cost overruns in construction of residential projects; Case study of Turkey," *Asian J. Manag. Res.*, vol. 1(1), pp. 3–12, 2010.
- [25] C. T. Hendrickson and T. Au, "Project Management for Construction: The Design and Construction Process," *Project Management for Construction: Fundamental Concepts for Owners, Engineers, Architects, and Builders*, vol. 0. p. 537, 1989. [Online]. Available: [https://www.cmu.edu/cee/projects/PMbook/03\\_The\\_Design\\_And\\_Construction\\_Process.html](https://www.cmu.edu/cee/projects/PMbook/03_The_Design_And_Construction_Process.html)
- [26] J. Wang, W. Shou, and X. Wang, "A framework of total constraint management for improving work flow in liquefied natural gas construction," *Proc. 31st Annu. Assoc. Res. Constr. Manag. Conf. ARCOM 2015*, no. September, pp. 803–812, 2015.
- [27] I. E. Team, "Understanding Project Constraints and Ways To Overcome Them\_Indeed." [Online]. Available: <https://www.indeed.com/career-advice/career-development/project-constraints>
- [28] S. Aslan and O. H. Türkakın, "A construction project scheduling methodology considering COVID-19 pandemic measures," *J. Safety Res.*, vol. 80, pp. 54–66, 2022, doi: 10.1016/j.jsr.2021.11.007.
- [29] T. A. N Alenezi, "Covid-19 Causes Of Delays On Construction Projects In Kuwait," *Int. J. Eng. Res. Gen. Sci.*, vol. 8, no. 4, pp. 36–39, 2020, [Online]. Available: [www.ijergs.org](http://www.ijergs.org)
- [30] J. Pedro Couto, F. José, B. Santos, E. Rahnemay, and E. Rabbani, "How Time Constraints Affect Safety Conditions at Construction Sites: Analysis of the Perception of Portuguese Construction Participants," *Ejge*, vol. 2, no. January, p. 563, 2017.
- [31] V. F. Dr. Vladimir, *The Time Trap*, vol. 1, no. 69. 1967.
- [32] U. Rai, "Identification of Constraints in Construction Projects to Improve Performance," *Int. J. Res. Appl. Sci. Eng. Technol.*, vol. 9, no. 1, pp. 710–713, 2021, doi: 10.22214/ijraset.2021.32912.