Journal of Data Acquisition and Processing
ISSN: 1004-9037
https://sjcjycl.cn/
DOI: 10.5281/zenodo.7546455

CONSTRUCTION CONTRACT MANAGEMENT FOR GOVERNMENT PROJECTS THAT ARE ENVIRONMENTALLY FRIENDLY

Prawit Choogliang[1*], Waranon Kongsong[2], Chaiwat Pooworakulchai[3], Korrakoch Taweesin[4] Seree Tuprakay[5], Sumath Roygulcharoen[6]

[1]Department of Engineering Law and Inspection, Ramkhamhaeng University, 10240, Thailand (Corresponding author)
[2]Assistant Professor, Department of Engineering Law and Inspection, Ramkhamhaeng University, 10240, Thailand
[3,4,5]Lecturer, Dr., Department of Engineering Law and Inspection, Ramkhamhaeng University, 10240, Thailand
[6]Department of Supreme Administrative Court, Ministry of Justice, Bangkok, 10210, Thailand

Abstract: The research aims to study the importance of environmentally friendly contract management factors in public construction projects and establish standards for contract management guidelines in environmentally friendly public construction projects under the Procurement and Supplies Management Act of 2017. The study focuses on large-scale public construction projects in Bangkok Metropolitan area and its vicinity. The research methodology involves the use of questionnaires and interviews, and data analysis is conducted by calculating the Relative Importance Index (RII) to rank the factors affecting contract management. The most significant factors influencing contract management, in order of importance, are as follows: 1. Modifying or Changing Format of the List. RII = 56.551% (Procurement and public procurement management) 2. Prevention of air pollution from dust and construction materials. RII = 50.924% (Environmentally friendly building construction) 3. Labor shortage. RII = 63.229% (Risk management in construction) Additionally, there are guidelines for mitigating the impact of construction contracts on the environment. Contract management model for government construction projects environmentally friendly, sustainable investment for long-term development of green construction projects, effective management of local issues and conflicts during construction, and the management of wastewater and air pollution to minimize environmental impact. The focus is on cost-effective and timely construction of green buildings, aiming to create projects that are valuable in all aspects.

Keywords: construction contract management, environmentally friendly construction, government construction factors, environmentally friendly construction.

1. Introduction

Public-Private Partnership Construction Projects Under the Public Procurement and Supplies Administration Act of 2017. Ensuring Integrity through Value for Money and Responsive Bids. The work must be carried out within the framework of state government regulations, causing problems in the construction management process of government projects. It is used as a tool for managing construction projects where some problems arise as a result of

the pre-construction project process for government agencies. So that construction work of government agencies can be completed efficiently and effectively and can be verified with the same standard operating framework. The procurement process uses a short bidding period, lack of precision in inspection. It is a risk factor that creates obstacles in the management of government structure construction contracts. Construction contracts are therefore a tool for determining the rights and duties of those involved and for expressing the intentions of the parties to each other. that must be followed, including effective management of construction projects and the enhancement and conservation of national environmental quality Act of 1992 (air quality and nitrogen gas values in the atmosphere in general and noise level). It was established with principles to organize an environmental management system. is environmental impact analysis (Environmental Impact: EIA) is one measure to take care of good environmental management. For sustainable development, it has been integrated with environmental management in Thailand according to the 13th National Economic and Social Development Plan (2023-2027), announced on October 1, 2022. Produce and consume that are environmentally friendly for economic growth that goes hand in hand with sustainable development and in line with the said development plan. Developing buildings into green buildings is therefore the basis of development leading to sustainable development. Environmentally friendly buildings or green buildings or Green Building. As for the green building situation in Thailand, currently the Thai Green Building Institute has not received conscientious support from the government. But there are many agencies that are aware of this. Global warming crisis and benefits from creating buildings and buildings that are environmentally friendly, and in Act of 2022. the Thai Green Building Institute has certified buildings that have passed the criteria for 77 projects, divided into 4 levels, including Certified 13 projects, Silver 11 projects, Gold 1 39 projects and 14 Platinum projects. Construction contract management (Construction Contract Administration) Sustainability: TREES) (Thai Green Building Institute, 2023). It is the process of monitoring and controlling various activities under the contract according to the project cycle from construction preparation. Proceed with construction project delivery Project maintenance Activities from the construction industry use a very high percentage of resources and energy. Compared to other business sectors, it also creates a huge amount of waste around the world, having a negative effect on the environment. Where environmental problems have accumulated and grown rapidly Reducing the amount of construction waste will not only have a positive effect on the environment. It also has a positive effect on project owners and construction contractors, reducing costs in purchasing materials and managing waste. It also promotes a good image and provides recommendations for environmentally friendly building construction for the organization. The Thai Green Building Institute has created criteria for evaluating Thailand's environmental sustainability (Thai's Rating of Energy and Environmental Sustainability: TREES) (Thai Green Building Institute. 2023). Those involved in performing work under the management of construction contracts for government projects are under their responsibility and have legal connections. Realized the importance of obstacles and impacts from making changes to construction contracts during construction. And performing duties in accordance with the Procurement Act and government supplies management Act of 2017 and the regulations of the Ministry of Finance regarding procurement management and Public Procurement and Supplies Administration Act of 2017 along with an assessment of

sustainability and the Thai environment (TREES) in order to know the factors that cause changes in construction contracts. Work is carried out in accordance with laws, regulations, criteria, and correct practices. Reduce the risk of impacts from changes in work during the construction of the project in operation, reduce disputes and litigation problems. And to provide project management contract management Area management and budget management efficiently according to the needs of the project.

The objective of this research is to study the priority factors and obstacles affecting construction contract management of environmentally friendly government construction projects from the implementation of the Public Procurement and Supplies Administration Act of 2017 and Thai Environmental and Sustainability Evaluation Criteria (TREES) during construction. To create standards for contract management practices in environmentally friendly construction projects under the Public Procurement and Supplies Administration Act of 2017 and improve the work process at each step for better efficiency.

2. Literature Review

The factor that affects the most effective performance of companies operating in the construction industry in the United Arab Emirates (UAE) that focuses on project implementation (individual areas) is the Knowledge Leadership group (Mean = 3.84) where the first factor is Has sufficient resources in project knowledge management activities (Mean = 3.84) and Rewards employees who create, share, store and use knowledge to perform projects Mean = 3.84 (factor is Knowledge Culture group) which is a factor important companies and This is logic as they need to manage the resources of the company holistically as compare to junior participants. These findings are benefitted to the construction company in prioritizing the application knowledge management aspect. Important order of benefits for using the Public Procurement and Supplies Administration Act of 2017. Number one in transparency. Second, value for money and the third is ease of operation. And found the most problems in the work process Personnel in operation Procurement procedures, prices, and duration of work. It was found that the likelihood of causes leading to financial problems and obstacles in the project includes changes in design, a shortage of personnel with knowledge in job inspection, and a lack of awareness of the detailed expenses or project profits within the organization. Additionally, delayed approval of construction plans and the primary cost-related impacts resulting from a misunderstanding of the owner's requirements or unclear communication contribute to construction delays or repetitive work. The study revealed that the main contractors in Oman, operating at a high standard in the country's construction and industrial landscape (Oman Chamber of Commerce and Industry - OCCI), employ 7 key strategies to successfully deliver construction projects according to contracts with clients. These strategies are: 1. People and subcontractor management, 2. Technology and innovative solutions adoption, 3. Quality, safety and environmental protection, 4. Develop technical capability, monitor and control, (5) Organizational efficiency and financial stability, 6. Legislative compliance and 7. Clients' satisfaction. This research revisits the successful strategy for project delivery and restructures them to suit the practices in Oman. The strategy can be emulated by contractors in the country and perhaps other Middle East countries, as a way to expedite better construction performance. A study on the main factors influencing Construction Labor Productivity (CLP) related to labor factors in the construction industry in the Middle East found

that delays in responding to data requests, inadequate job control among employees, labor shortages, and a lack of knowledge and expertise, changes in work orders, and the clarity of technical information are key factors affecting productivity in the construction industry. These factors have a continuous and significant impact on reduced productivity, particularly in developing countries, where they are considered persistent issues. It was found that the Public Procurement and Supplies Administration Act of 2017. does not explicitly prioritize environmentally friendly procurement or have clear legal provisions to promote fairness, potentially resulting in environmental impacts, including trade barriers between countries, highlighted that Green Public Procurement (GPP) in Thailand should be conducted within the framework of the United Nations Framework Convention on Climate Change (UNFCCC) from 1992 to address climate change issues. This involves engaging with eco-organizations, environmentally friendly procurement practices, and constructing energy-efficient buildings that maximize efficiency and benefits. However, Thailand faces challenges due to lax enforcement of environmental laws, which necessitates increased awareness of the environmental importance of government agencies. Thus, the effective implementation of environmentally friendly procurement policies relies on each government agency's commitment to adhere to the Ministry of Finance guidelines and measures for environmentally friendly procurement practices. These policies are crucial for addressing environmental concerns, such as reducing water, soil, and air pollution by controlling hazardous substances or chemicals, and promoting the establishment of environmental standards for products and services by stimulating producers to elevate their environmental standards.

Due to challenges that impact the management of construction contracts in government and private sector projects, leading to the use of construction materials that do not align with the project objectives and result in construction timelines not being met or changes in construction costs affecting quality, duration, and overall costs for both governmental and private sectors. To ensure the successful and efficient implementation of construction projects in terms of oversight, transparency, efficiency, effectiveness, and value, this research aims to study the significance of environmentally friendly contract management factors in governmental construction projects. Additionally, the objective is to establish guidelines for contract management in governmental construction projects that are environmentally friendly under the Public Procurement and Supplies Administration Act of 2017.

3. Research Methodology

This research employs a mixed Methodology, combining Quantitative Research and Qualitative Research. The analysis involves defining variables through the use of questionnaires and in-depth interviews as research tools. The sample size is determined using Taro Yamane's criteria (1973:725), collecting data from various groups such as clients, designers, contractors, project managers, and project consultants in the Bangkok Metropolitan and surrounding areas, specifically for buildings with a floor area of 2000 square meters and above. The research ranks the significant factors influencing the management of government construction contracts using the Statistical Relative Index (RII) to determine the order of importance. The impact factors are categorized into five levels: 1 = None, 2 = Low, 3 = Medium, 4 = High, and 5 = Very High. Additionally, qualitative content analysis is performed,

and the research results are presented in a descriptive manner. The analysis involves ranking the importance of delay-causing factors based on the RII values for each sample group.

$$\text{RII} = \frac{\sum_{i=1}^{5} w_i x_i}{AN} \text{x}100\%$$

When, w_i = Criteria for measuring the severity level of negative factors that have negative impacts on construction projects range from 1-5

X_i = Number of responses in each criterion

A = The maximum measurement criteria is 5

N = Total number of questionnaires

4. Results

This research is a study of key factors influencing the contract management of public construction projects that are environmentally friendly. The data was collected from February 2023 to April 2023. As follows.

4.1 The Relative Importance Index (RII) for significant obstacle factors affecting construction contract management.

The first part of the research surveyed a specific sample group, consisting of 330 samples, and analyzed quantitative data from Table 1 using the Relative Importance Index (RII). The analysis revealed the top three obstacles to construction contract management, ranked in descending order of importance, as follows: construction defects or errors (RII=63.229%), cost estimation for construction (RII=58.668%), and scrutiny or acceptance of work stages that do not comply with specifications or are delayed (RII=56.573%). These factors had the highest mode value, indicating maximum prevalence (Mode=5). Additionally, significant factors arising from risk management in construction and key obstacles originating from the procurement and supply chain management included: non-compliance with format specifications (Rank=4, RII=56.551%) and errors resulting from subcontractor work (Rank=5, RII=54.824%).

Table 1. Ranking of the Relative Importance Index (RII) for significant obstacle factors affecting construction contract management (combined factors)

Rank	The factors affecting construction contract management.	RII (%)	Interpretation	
1	Construction defects or errors (3)	63.229	5	Very high
2	Cost estimation for construction (3)	58.668	5	Very high
3	Inspection and acceptance of work items that do not conform to specifications or are delayed (3)	56.573	5	Very high
4	Non-compliance with item format specifications (1)	56.551	5	Very high
5	Errors in contractor's work (1)	54.824	5	Very high

From Table 2, the ranking of the Relative Importance Index (RII) for significant obstacle factors impacting the management of environmentally friendly public construction projects, with the highest mode value (Mode=5), includes 7 factors in each category. In terms of Public Procurement and Supplies Administration, two factors are highlighted: delayed decision-making processes (RII=53.352%) and unclear definition of project scope and objectives (RII=49.828%). Concerning environmentally friendly building construction, two factors are identified: prevention of air pollution from dust and construction materials (RII=50.924%) and control of wastewater discharge (after treatment) (RII=49.295%). In the realm of construction risk management, three factors stand out: labor shortages (RII=63.229%), issues arising from design (RII=58.668%), and construction planning (RII=51.968%). These factors are a result of pre-construction agreements and are practiced by the contractor, designer, and relevant project stakeholders in that order. The top obstacle factors for each aspect include changes to the design specification (RII=56.551%), prevention of air pollution from dust and construction materials, and labor shortages (RII=50.924%). Labor shortages (RII=63.229%) are predominantly factors occurring during construction and those stemming from pre-construction agreements.

Table 2. Ranking of the Relative Importance Index (RII) for significant factors influencing contract management in environmentally friendly government construction projects.

Rank	The factors affecting construction contract management.	RII (%)	Interpretation	
	Procurement and public procurement management			
1	Modifying or Changing Format of the List.	56.551	4.00	high
2	Incomplete design contains errors	54.824	4.00	high
3	Delayed decision-making processes.	53.352	5.00	Very high
4	Inefficient contractor work.	50.262	4.00	high
5	Unclear definition of project scope and objectives.	49.828	5.00	Very high
	Environmentally friendly building construction			
1	Prevention of air pollution from dust and construction materials.	50.924	5.00	Very high
2	Control of wastewater discharge (treated wastewater).	49.295	5.00	Very high
3	Prevention of air pollution from dust, which affects the health of workers.	46.072	3.00	Medium
4	Clear preparation of waste separation areas	36.657	2.00	Low
5	Prevention of construction activities that disrupt the environment and nearby wildlife.	36.364	2.00a	Low
	Risk management in construction			
1	Labor shortage.	63.229	5.00	Very high

2	Design Problems	58.668	5.00	Very high
3	High Construction Costs	56.573	4.00	high
4	Changes or additional work not specified in the contract	54.178	4.00	high
5	Delayed decision-making processes.	53.195	4.00	high

4.2 Contract Management Model for Government Construction Projects Environmentally Friendly.

The second part presents the study findings on the establishment of standards and guidelines for contract management in government construction projects that are environmentally friendly, under the Procurement and Public Sector Supply Management Act of 2017. It involves surveying a sample group of 14 cases through in-depth interviews. qualitative research was conducted to analyze the qualitative data. In the realm of procurement and public procurement management, obstacle factors impacting project quality and successful contract management for environmentally friendly public projects were identified. Key aspects for successfully managing contracts in environmentally friendly public projects include: 1. Selection of Suitable and High-Quality Materials and Technologies. Choosing materials and technologies that are appropriate and of the highest quality. 2. Construction Timing Controlling construction timing to align with project schedules. 3. Expertise and Experience of the Team. The expertise and experience of the team influence quality planning and execution. 4. Construction Standards. Adhering to construction standards, expertise, and competence of workers in accordance with project specifications. And adhering to the project specifications and standards, which are the standards for successful contract management in public construction projects, achieving the project goals through 5 guiding principles as follows: 1. Planning and preparing for the project. 2. Clear Specification and Contract Conditions. Clearly defining specifications and conditions in the contract, including setting work schedules and stages. 3. Monitoring Progress and Quality Control. Monitoring project progress and controlling work quality. 4. Managing and Addressing Obstacles. Managing and dealing with obstacles, including addressing problems that may arise during project execution. 5. Effective Communication. Ensuring effective communication among stakeholders to understand the project's goals.

In the context of environmentally friendly building construction, factors influencing costs, construction duration, and the confidence in environmentally friendly building contract management, considering the nature of the work, planning, preparation, and control include: 1. Construction Processes Resulting in Pollution. Construction processes leading to pollution impact the management of environmentally friendly building construction. 2. Investment Value. The value of investment affects the long-term development of green building construction. and 3. Handling Issues and Disputes with Local Communities. Managing issues and disputes with the local community around construction sites.

And confidence in the management of environmentally friendly building construction is divided into two measures as follows: The first measure, planning and preparation, includes construction processes that lead to pollution affecting environmentally friendly building

construction management, the value of investment impacting the long-term development of green building construction, and handling issues and disputes with the local community around construction sites. And the second measure, prevention and control, includes managing wastewater and air pollution to minimize environmental impact, costs, and construction duration, with an emphasis on the importance of time and costs in constructing green buildings, crucial factors in creating a valuable project in all aspects.

Efficient and high-quality management of significant influencing factors includes the following: 1. Controlling and planning operations that align with the schedule. 2. Considering the balance of the escalation factor (K-factor) based on economic conditions and factors affecting material and labor prices related to the project. 3. Transparent and straightforward processes. 4. Contractors and project managers with suitable abilities and experience for the project. 5. Site readiness and operational preparedness in terms of inspection and construction preparation. 6. Defining details of flexibility in price change and incorporating them into the contract as essential tools in systematic and efficient project management. 7. Supervising and assessing the impact of political changes on project management. 8. Adding reasoning and consequences for temporary work stoppages in the construction contract to reduce the likelihood of disputes. 9. Mutual delays in operations can result in additional costs for both parties involved in the contract.

And the development of efficient work processes that achieve success within the specified time includes the following.1. Direct collaboration and formulation of relevant laws to create environmentally friendly policies from the government sector. 2. Planning and efficiently controlling operations during construction. 3. Thorough inspection, planning, continuous monitoring of work, and establishing standardized environmentally friendly work processes. Integrate new technologies and enhance expertise to ensure the smooth and long-term value of the project.

5. Discussion

The research results indicate the significant factors influencing contract management in government construction projects. The analysis revealed key obstacles from stakeholders or targeted sample groups (top three rankings)

1. In terms of Procurement and public procurement management as follows: 1. Modifying or Changing Format of the List (RII = 56.551%) 2. Incomplete design contains errors (RII = 54.824%) 3. Delayed decision-making processes. (RII = 53.352%) Aligned with the research study by Chaiwat, 2016. it was found that factors contributing to problems during construction, particularly in the quality aspect, include unclear definition of construction objectives, ambiguous roles and responsibilities in inspection and project control, and the creation of material specifications lacking clarity. These issues lead to problems and misinterpretations, ultimately affecting the success of the project. Channuwong el al. (2023) and Jirayout (2019) found that the usefulness of the Public Procurement and Supplies Administration Act of. 2017. is ranked in the following order: transparency, value for money, and convenience in performing tasks. The most significant challenges were identified in the working process, personnel involved in the tasks, procurement methods, pricing, and work duration. And Oluseyi (2023) studied the factors influencing delays in responding to products in construction projects, particularly in developing countries. Considered a persistent problem

over several decades, key factors include inadequate control of work by contractors, labor shortages, lack of knowledge, skills, and expertise, changes in work orders, and the clarity of technical information.

2. In terms of environmentally friendly building construction, the first priority is the prevention of air pollution from dust from soil and construction materials (RII=50.924%). The second priority is controlling the discharge of treated wastewater (RII=49.295%), and the third priority is preventing air pollution caused by dust from soil and construction materials that can impact the health of workers (RII = 46.072%) which is consistent with the requirements of the Thai Green Building Institute (TREE-NC) for the environmental impact during construction, TREE-NC has established criteria for selecting the use of the impact on the environment during construction as follows: Group 1: Building Management, Group 6: Indoor Environmental Quality, Group 7: Environmental Protection, and Group 8: Green Innovation. Additionally, 3 in terms of construction risk management, the priorities are as follows: the first priority is labor shortages (RII = 63.229%), the second priority is design problems (RII = 58.668%), and the third priority is high construction costs (RII = 56.573%). This aligns with the research by Songyot (2020). which identified environmental and physical space-related causes of construction delays, as well as issues related to methods, designs, and personnel. These include unauthorized construction, discrepancies between job conditions and the design, and difficulties in obtaining construction permits from responsible authorities. And [14]. identified factors contributing to problems during construction in terms of time and cost. These include labor shortages in construction, lack of planning, and the absence of plan adjustments to align with delayed work. External factors beyond project control include natural disasters, urban crises, and war. In another study by Channuwong (2018) and Bancha (2021). The most impactful factor on projects with the highest likelihood of conflicts is the inefficiency of subcontractors, resulting from the inefficient selection of main contractors. The most influential factor causing conflicts is the operational breakdown affecting the project's success.

And the results of interviews with experts on the factors causing obstacles that have an impact on quality, provide guidelines for planning, preparation, prevention, and control measures to minimize the impact on time, expenses, and to build confidence in the environmentally friendly management of construction contracts. To work efficiently and achieve success within the specified timeframe, and to ensure the achievement of project goals in procurement and state material management that are environmentally friendly. These factors arise from the process of implementing contracts by stakeholders within the project. The factors hindering the construction of environmentally friendly buildings that have an impact on the community or the surrounding society, according to the criteria for assessing sustainability and the environment in Thailand (TREES), are divided into 6 issues as follows. Issue 1. Scheduling management for buildings impacting construction contracts. Issue 2. Clear policy setting for green buildings from the government and relevant legislation that is environmentally friendly. Issue 3. Construction processes leading to pollution affecting the environmentally friendly management of project buildings. Issue 4. Addressing and resolving issues and conflicts with the local community during construction to align with the environmentally friendly management of project buildings. Issue 5. Factors influencing the long-term investment value affecting the development of green building construction. Issue 6. Time management in the development of green buildings aligned with the research by Prawit (2023; 2021). the top three

obstacles in environmentally friendly building construction are identified as follows: First, preventing air pollution from dust generated by soil and construction materials. Factors include controlling sources of toxic emissions, dispersion of dust, colors, adhesives, and preventive measures against air pollution arising from dust and construction materials that impact the health of workers. These factors are crucial for the management of construction contracts and environmentally friendly building projects. Second, controlling sources of toxic emissions, dispersion of dust, colors, adhesives, and the implementation of waste separation and recycling plans, including composting in the factory and the use of incinerators or raiseable furnaces, are critical factors that should be urgently addressed (SI) to reduce the impact on construction contract and project management. In accordance with the Thai Green Building Institute (TGBI) (2023). Thai Green Building Institute's criteria for assessing energy and environmental sustainability in construction and renovation projects (TREES-NC) as of June 22, 2020. under Group 5. - Materials and Resources in Construction, Waste Management from Construction, Selection of Sustainable Materials, and the Use of Recyclable Materials. In Group 6 - Environmental Quality in Buildings, measures include reducing environmental impacts and using non-toxic materials. Group 7. focuses on preventing environmental impacts, minimizing pollution from construction, waste management, and compliance with the National Environmental Quality Act of 1992. This includes principles for establishing environmental management systems, environmental impact assessment (EIA) analysis in accordance with the announcement of the National Environmental Board No.10 (1995) on air quality standards, and No. 33(2009) on nitrogen dioxide standards, both in accordance with the Enhancement and conservation of national environmental quality Act of 2017.

The results of the study also relevant to research conducted by Jeffrey (2023), which studied the key factors and obstacles in presenting collaborative procurement methods related to the developing construction industry globally, using Malaysia as the study base. The identified factors include improved quality, better cost control, enhanced time management, and efficient problem-solving, leading to increased customer satisfaction (Vikas & Divya, 2023; Weerawong et al., 2023). The implementation of Total Quality Management (TQM) in the construction industry has been well-received, resulting in positive feedback. This approach has proven effective in achieving customer satisfaction and improving organizational efficiency. Additionally, it has successfully fostered internal team management within the organization. The construction industry in India plays a crucial role in the economy, ranking second only to the agricultural sector. However, it faces numerous management and quality challenges. The ISO 9000 standard is an integral part of establishing quality management systems with guidelines for processes impacting products or services. The use of this system brings significant benefits in improving company management and efficiency. However, a major drawback is the lack of understanding of the system among personnel. Preparation and auditing (both internal and external) are essential to overcome this obstacle and eliminate barriers to the effective utilization of this system. Additionally, on the hindrances to implementing Green Procurement (GP) in the Malaysian construction industry emphasizes the need for understanding and involvement from the government, particularly through policies, activities, and support. The application of Green Procurement is still unclear and faces challenges due to unfamiliarity, a lack of existing standard guidelines, limited awareness among stakeholders, and the fundamental importance of collaboration among industry

stakeholders for the success of construction projects, relying on support from various stakeholders to achieve project objectives.

6. Conclusion

The study on obstacles during construction arising from internal stakeholders within the project, when considering the overall perspective, identified the top three critical obstacles impacting construction contract management. The first-ranked factor is issues arising from deficiencies or errors occurring during construction. The second-ranked factor is related to the preparation of construction cost estimates, and the third-ranked factor is associated with the inspection and acceptance of work phases that do not conform to specifications or are delayed. As for the significant obstacle factors (RII) arising from contractual practices and posing risks to construction impacts from contractors, they include labor shortages, deficiencies or errors during construction, high construction cost estimates, and factors originating from the employer or designer. These factors include design-related issues and considerations during the inspection and acceptance of work phases that do not conform to specifications or are delayed. The obstacles also extend to factors impacting the management of procurement, contracting, and public sector procurement, with the top three factors being As follows. Incomplete designs have errors and problems stemming from the design phase, along with the identified issue of labor shortages. It is found that labor shortage factors from contractors, deficiencies, or errors arising from construction have significant and impactful implications for public sector construction projects. These align with the Public Procurement and Supplies Administration Act of 2017. Which aims to prevent corruption. The Act sets criteria for evaluating the suitability and responsiveness to ethical considerations in the operations of public sector agencies, the selection process, and contracting with the state. Decision-making is based on the principles of value for money and responsiveness to objectives to mitigate delays in government construction projects.

The interview results propose measures by experts in quality development and strategies to reduce environmental impact in the management of environmentally friendly building construction contracts (cost, construction period, and building confidence in environmentally friendly contract management). Adhering to these factors in practice can help minimize the environmental and human health impact of environmental activities, creating a healthy and sustainable environment for society and the surrounding area where these activities take place. These measures are divided into two Measures as follows. 1. Planning and Preparation Category. Construction processes, cost-effectiveness, and investment are crucial for the long-term development of green building construction. 2. Prevention and Control Category. Managing wastewater and air pollution to minimize environmental impact with the least cost and construction time is vital for creating valuable projects in all aspects. (Form Figure 1.) Additional details of the research can be studied in articles related to this research, which constitute an integral part of the Ph.D. dissertation. [23]

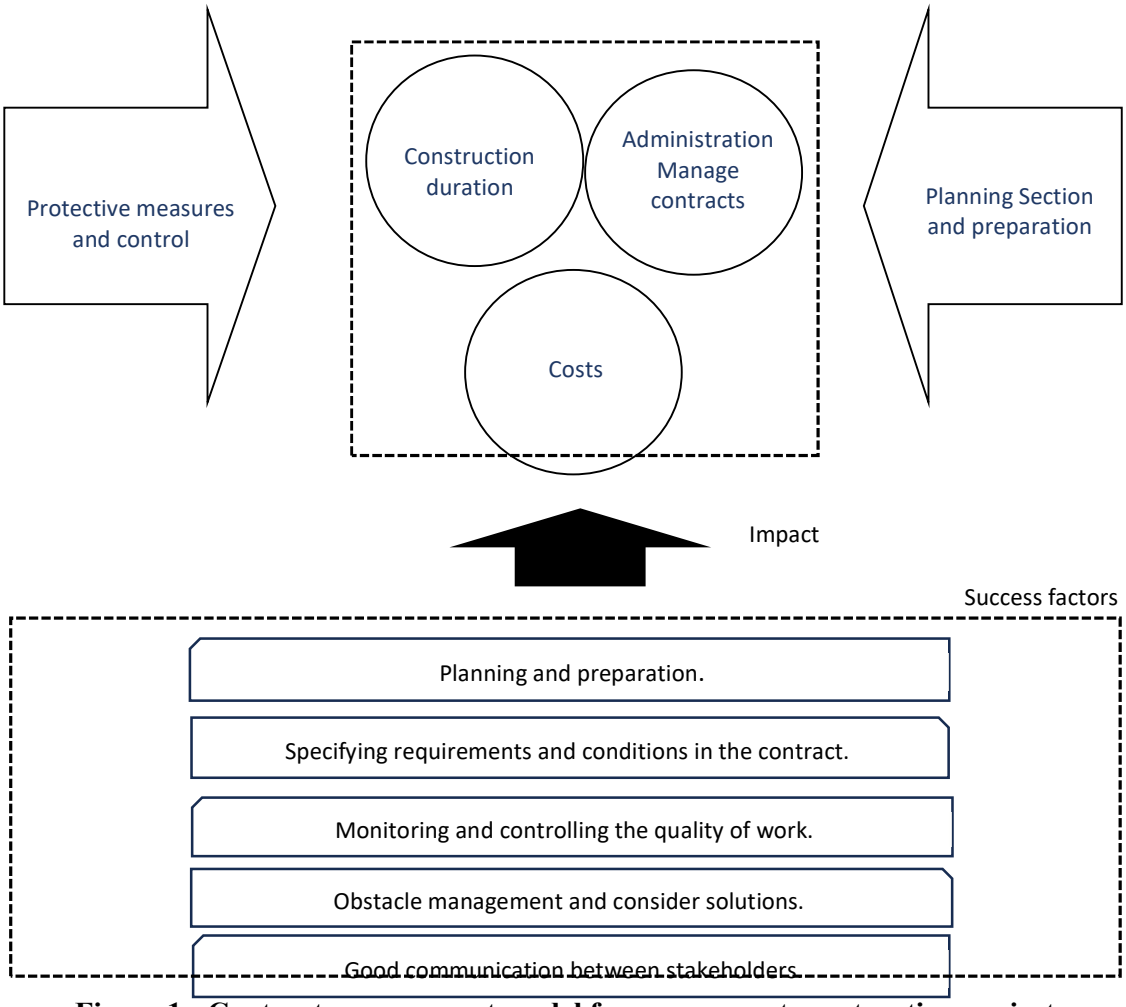

Figure 1: Contract management model for government construction projects environmentally friendly.

Acknowledgement

This research owes its success to the invaluable contributions and support from Assistant Professor Dr. Waranon Kongsong, Dr. Chaiwat Pooworakulchai, Assistant Professor Dr. Korrakoch Taweesin, Associate Professor Dr. Seree Tupragay, Dr. Sumath Roygulcharoen and along with the personnel associated with the Graduate Program in Engineering Law and Inspection, Faculty of Engineering, Ramkhamhaeng University. Their generosity and assistance were pivotal in enhancing the completeness of this research, which is an integral part of the Ph.D. dissertation, aligning it with its objectives.

References

Asmah Alia, MB. (2022). Government intervention through collaborative approach in promoting the adoption of green procurement for construction projects. *international journal of sustainable construction engineering and technology,* 13, 68-82.

Ayisha PY. (2023). Determination of contractor strategies in delivering construction projects in Oman. *Journal of Construction in Developing Countries,* 28, 293-23.

Bancha TN, (2021). The factor of conflict to government construction project. *Engineering Journal of Research and Development,* 32, 77-88

Chaiwat PC, (2016). Case of delay in the construction project by relative importance index method. *The Journal of KMUTNB,* 29, 270-11.

Chanusda TC. (2021). Legal measures for the eco-friendly products and procurement of thailand's government sector. *Rajapart Journal,* 15, 101-12.

Channuwong, S., Chaetnalao, P., Tangsanga, B., Sudlapa, K., & Wongwean, B. (2023). Human resource management affecting organizational efficiency of state enterprises in Bangkok, Thailand. *Tuijin Jishu/Journal of Propulsion Technology,* 44(6), 2037-2042.

Channuwong, S. (2018). The relationship between good governance principles and organizational justice: A case study of Bangkok Government Officials. *Asia Pacific Social Science Review,* 18(3), 43-56.

Jeffrey Boob HY. (2023). Collaborative project procurement in the construction industry: investigating the drivers and barriers in Malaysia. *Journal of construction in developing countries,* 28, 171-181.

Jirayout SN. (2019). *Problems and obstacles of using government procurement and supplies Management ACT of 2017 by civil department Officers of Bangkok metropolitan administration.* Doctoral dissertation. King Mongkut's institute of technology Ladkrabang, Bangkok, Thailand.

Ministry of Finance. (2017). *Public procurement and supplies administration Act of .2017.* [internet]. 2017 [cited 2023 Dec 7]. Available from: http://www.gprocurement.go.th/.

Ministry of financial. (2021). *Regulation of the ministry of finance on public procurement and supplies administration Act of.2017.* [internet]. 2021 [cited 2023 Dec 7]. Available from: http://www.gprocurement.go.th/

Oluseyi JA. (2023). A meta-analysis of factors affecting construction labour productivity in the middle east. *Journal of Construction in Developing Countries,* 28, 193–30.

Pichamon KL. (2022). Confirm factor analysis in the good governance of procurement process of suppliers. *Interdisciplinary Studies Journal,* 21, 1-18.

Pollution control department. Enhancement and conservation of national environmental quality act to 1992. [Internet].1992 [cited 2023 Dec 7]. Available from: https://www.pcd.go.th/

Prawit CH. (2023). *Factors affecting the management of green building construction in the public sector. editors. NCSTR2R2023.* Proceeding of the national conference on science and technology and routine to research 2023; 2023 May 17-18, Udonthani. Thailand.

Prawit, CH. (2023). *Construction contract management for government projects that are environmentally friendly.* Dissertation, Doctor of Philosophy in Engineering Law and Inspection, Faculty of Engineering, Ramkhamhaeng University, Bangkok, Thailand.

Prawit CH. (2021). *Study the management of construction project contracts from government.* Proceeding of the ELI conference 2021 engineering law and inspection, 2021 May 15, Bangkok. Thailand.

Rozilah KS. (2022). Rating of knowledge management factors affecting construction company performance. *International Journal of Sustainable Construction Engineering and Technology,* 13, 134-136.

Songyot HM. (2020). *Causes of delay in the construction of underground conduit of electrical substations in Bangkok. editors. NCCE 25.* Proceeding of the 25th national convention on civil engineering; 2020: July 15 – 17, Chonburi, Thailand.

The National Economic and Social Development Council. (2022). The 13th national economic and social development plan (2023-2027). [Internet]. 2022 [cited 2023 Dec 7]. Available from: https://www.nesdc.go.th/

Thai Green Building Institute. (2020). *Thai's rating of energy and environmental sustainability.* [Internet]. 2020 [cited 2023 Dec 7]. Available from: https://tgbi.or.th/trees/

Thai Green Building Institute. (2022). *Thai's rating of energy and environmental sustainability.* [Internet]. 2020 [cited 2022 Sep 29]. Available from: https://tgbi.or.th/directory/project/

Thai green building institute (TGBI). (2022). Thai's rating of energy and environmental sustainability for new construction and major renovation [internet]. [updated 2022 Jun 22; cited 2023 Oct 18]. Available from: https://tgbi.or.th/wp-content/uploads/2021+/06/TREES-NC-v2-2020-Jan.pdf.

Vikas SR, Divya JT. (2023). A study on evaluation of quality management systems in construction projects. International Journal of Membrane Science and Technology 10, 2037-2051.

Weerawong, W., Kongsong, W., Snongtaweeporn, T., Thammapornram, C. (2023). Factors affecting business operators' decisions to establish fuel oil stations under building control and fuel control laws in the metropolitan Bangkok. *Onomazein,* 62(December), 1296-1305.

Wilailekha WK. (2020). *A study of financial management obstacles in construction projects. Editors, NCCE 25.* Proceeding of the 25th national convention on civil engineering, 2020 July 15 – 17*,* Chonburi. Thailand.