Risks in the Construction Project Procurement Process and the Mitigation Methods
การบริหารความเสี่ยงในกระบวนการจัดซื้อจัดจ้างโครงการก่อสร้าง

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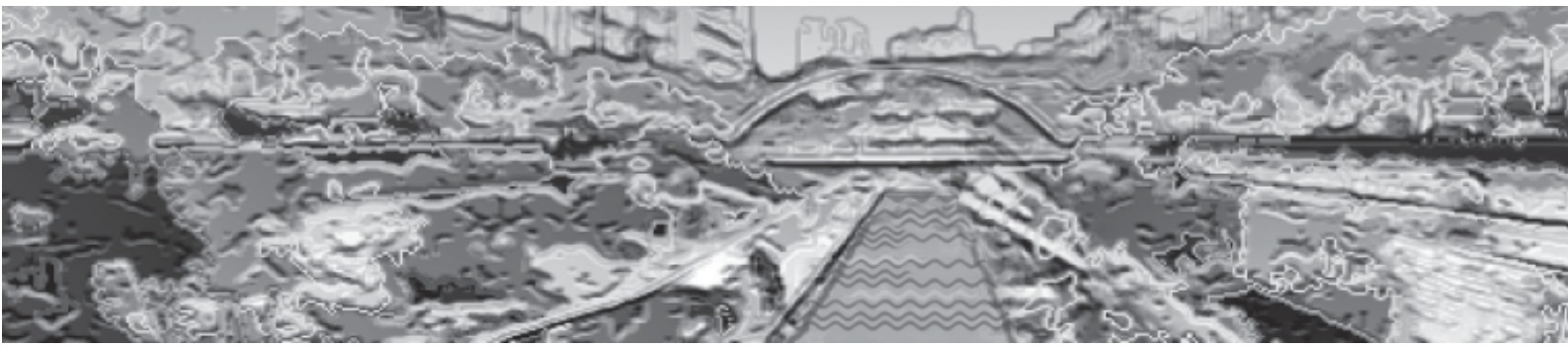

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Abstract

Risk management in construction projects is considered as an important part of the management process. Since risk in construction projects associated with three major principles, which are Time, Cost and Quality. Those risks and uncertainties are caused by performance of workers, material and parts quality, delays in supply of important materials to site, project budget and cost control, or the complexity of project procurement processes, which may threaten the project objectives. This article will emphatically focus on risk, that is caused by the complexity of the construction procurement process. In addition, the appropriate risk identification methods will be also introduced in this article. Suggested methods shall start with setting up a risk profile, avoidance of risks, basic risk assessment and useful risk mitigation actions for project management participants, particularly architects or project managers to understand risks associated in construction procurement process including how to mitigate those risks.

บทคัดย่อ

การบริหารความเสี่ยงในโครงการก่อสร้าง เป็นกิจกรรมสำคัญประการหนึ่งของกระบวนการบริหารโครงการ เนื่องจากความเสี่ยงของโครงการก่อสร้างจะเกี่ยวข้องและส่งผลกระทบกับหลักการบริหารโครงการในด้านระยะเวลาของโครงการ ต้นทุนและค่าใช้จ่ายของโครงการ รวมไปถึงคุณภาพงานของโครงการด้วย นอกจากนี้ ความเสี่ยงยังอาจทำให้โครงการเกิดความล่าช้า งบประมาณบานปลาย ส่งผลให้โครงการก่อสร้างนั้น ๆ ไม่สามารถบรรลุจุดมุ่งหมายที่ตั้งไว้ได้ ความเสี่ยงหรือความไม่แน่นอนในโครงการก่อสร้าง อาจจะเป็นสิ่งที่สามารถควบคุมหรือเป็นเหตุสุดวิสัยที่ไม่สามารถควบคุมได้ เช่น ความล่าช้าในการขนส่งวัสดุก่อสร้างมายังสถานที่ก่อสร้าง งบประมาณ และการควบคุมต้นทุนค่าก่อสร้าง หรือความเสี่ยงอาจจะเกิดได้จากความยุ่งยากซับซ้อนของกระบวนการจัดหา จัดจ้าง และการทำสัญญาก่อสร้างได้ บทความนี้นำเสนอการบริหารจัดการและป้องกันความเสี่ยงอันเกิดขึ้นจากความยุ่งยากซับซ้อนของกระบวนการจัดหา จัดจ้าง และการทำสัญญาก่อสร้าง ซึ่งเป็นกระบวนการชี้วัดความสำเร็จของโครงการก่อสร้างด้วย นอกจากนี้ จะนำเสนอวิธีการจัดระดับความสำคัญของความเสี่ยง การจัดการและบริหารความเสี่ยง รวมทั้งเสนอแนะวิธีการป้องกันและบรรเทาผลกระทบจากความเสี่ยงที่เกิดขึ้น โดยมุ่งนำเสนอไปยังบุคลากรที่เกี่ยวข้องกับการบริหารงานก่อสร้าง โดยเฉพาะอย่างยิ่งสถาปนิกและผู้จัดการโครงการให้เข้าใจความเสี่ยงอันเกิดจากความซับซ้อนของกระบวนการจัดหา จัดจ้าง และการทำสัญญาของโครงการก่อสร้างต่าง ๆ รวมทั้งวิธีการบรรเทาผลกระทบจากความเสี่ยงประเภทนี้ด้วย

Keywords (คำสำคัญ)

Risks (ความเสี่ยงที่เกิดขึ้นในโครงการก่อสร้าง)
Procurement Processes (กระบวนการจัดหา จัดจ้าง)
Contract (สัญญางานก่อสร้าง)
Risk Mitigation (วิธีการลดความเสี่ยง)
Risk Management (การบริหารความเสี่ยง)

1. Introduction

Risk and uncertainty occur in every project type, and as such, each project must be considered individually and should not be underestimated. In focusing on construction industry itself, it was found that maximum possible risk to the contractor occurs in the Lump Sum contract in which the extent of the work is moderately well identified and the cost of the work is tendered as a non-possible change project. In the case of project prices rising due to economic factors and/or the extension of construction duration due to industrial action, inclement weather or materials shortages, these are a great disadvantage to the contractor.

Risks in construction procurement process have been considered in relation to the separation of design from construction, lack of integration, poor communication, uncertainty, changing environment and economic changes such as inflation and deflation, regional economic crisis, etc. including greater competition in the construction sphere [1]. These factors have led the construction industry to seek alternative procurement strategies such as management contracting; design and construction come together in an improved process designed to mitigate the risks as stated above.

There are many risks and uncertainties inherent in all construction works and in every project size. The size of the project can be a risk factor due to its complexity, and it can also become unstable in political or commercial planning. On the other hand, there are some risks that cannot be quantified and are, therefore, sensibly priced. Risk is generally covered in construction contracts as follows:

- *Fundamental Risk* is risk such as war, chaos or similar events. These risks are all covered by government and construction contracts, which usually refer to, and place the effects of them if they occur. Anyway, the typical construction contract does not cover this risk and no insurance is normally required within the contract for risk, or in fact could normally be obtained.
- *Pure and Particular Risk* The examples of this kind of risk are personal injury and damage to neighbouring building during construction, or similar events. Construction contracts usually require the contractor to compensate employers against some of the effects of occurrences. Contractors are also generally required to take out relevant policies as protection against such events.
- *Speculative Risk* is risk that can be varied in its incidence between each project participant.

2. Risk Identification

Risks in each construction project have been identified by the project management level using brainstorming techniques or expert panel discussions. However, risks are defined as events that could arise and affect the critical factors of the project. Some of the major risks usually found in construction projects include:

- delay in letting contract
- obtaining appropriate approvals
- poor tenders
- technological improvements
- construction material delays
- construction equipment delays
- material quality and specifications
- industrial action
- inclement weather
- occupational, health, welfare and safety.

In regard to the construction procurement process, the sources of risks in this procurement

or contractual process can be summarized as:

- client/government/regulatory agencies
- funding/fiscal
- definition of projects
- project organization
- design
- local rules or conditions
- permanent supplier/plant
- construction contractors or subcontractors
- construction materials
- labour
- logistics
- estimating data
- some national economic indicators such as inflation, currency exchange rate or consumer price index
- force majeure or unforeseen events
- construction plant
- lack of procurement experience [2].

3. Setting up the Project Risk Profile

Building a Contract Risk profile is a useful method in assisting project managers to determine risk, and focus on his/her effort, as well as considering the contract risk for each contractor or subcontractor. The given criteria are effective for rating each contract, and to make these criteria more practical. A project manager should assign a ranking or risk factor to each criteria and calculate a weighted average to home in on those contracts with the highest risk. Therefore, criteria used to judge the risk profile are:

1. *Contract Pricing Structure*: Ranks the cost-plus contract are riskier than the Lump-sum, fixed-price agreement and changes.

2. *Change Order Profile*: Factors for consideration are cumulative cost, use of money compared with cost-plus, and timing frequency (more frequent changing order mean greater risk). If there are large timing lags between identifying the need and issuing the order change, heightens the risk. Project managers should assign a higher risk in cases where actual costs of changed work are close to estimate costs

3. *Claims*: More claims activity means that there is a higher risk factor and more reason to focus audit attention on the contract. Considering higher risk factors such as, the number, size, age, and assessed or committed liability increases for each contract.

4. *Contract Life Span*: Prolonged exposure to risk will create a greater chance of discrepancy and/or abuse.

5. *Upsets*: Ranking contracts as a higher risk if they have been cancelled during construction, delayed, or awarded on a staggered basis.

6. *Pricing Mixes*: The high risk in this matter is usually caused by combining numerous pricing techniques for the same contractor.

7. *Post-bid Negotiated Terms*: Project managers should consider on a contract when significant terms and conditions, particularly prices, are agreed upon or after the contract is awarded, they shall concern the contract risks which may occur after contract signing.

8. *Design Revisions*: The risk can be raised if there are numerous and frequent design changes or revisions.

9. *Personnel Movement*: A potential risk may occur if a key owner/representative switches employment to the contractor.

10. *Dealing and Trading*: The factors impact for a higher risk in this case are combined with:

- The labour-hour switching, where the owner provides some work that the contractor should have done or side deals are made to reconcile later.
- The cross-charging, this case always occurs when accounts are not open and the work

must be done, when price thresholds are exceeded. It includes a lack of control and potential for abuse.

11. *Growth in Owner Scope*: A potential risk in contract may occur if the owner's scope of work, or his/her responsibilities and liabilities increase.

12. *Audit Aging*: The longer the audit period since the last audit of the project, contract or contractor may encourage the higher risk.

13. *Extreme Schedule Pressure*: The higher the schedule sensitivity of a contract or its portion can cause the higher risk according to the pressure caused by the contract milestones and their conditions.

14. *Long-Term Relationships*: Project managers should be concerned that the higher risk may occur in a long-term relationship with the contractors. They might avoid some strict regulations to enforce their contractors.

15. *Owner Management and Staffing*: If a project owner has inexperienced staff or a few staff number, this should be taken into account as the higher risk. The higher risk should also be assigned if there is a great amount of turnover or organisational turmoil.

16. *Contract Management*: The project could obtain the low rank of risks if the experienced person handling all project major tasks, establishing the well maintained records, up-to-date documents and the contract management is being performed professionally. Vice versa, if that project has performed without the criteria described above, the higher risk may be assigned into the project immediately.

4. Risk Avoidance or Risk Reduction

Risk is of such serious importance as to occasionally warrant a project reappraisal, or complete replacement with another selection. Risk identification and analysis may indicate the need for redesign, more detailed design, or different methods of construction in order to reduce risk.

Then, the risk in construction contracts can be transferred between the project stakeholders to share the risks rather than the client shouldering the entire burden. Transfer routes of risk in construction projects are suggested as:

- client to contractor or designer
- contractor to subcontractor
- client, contractor, subcontractor or designer to insurer
- contractor or subcontractor to surety.

The purpose for transferring risk is to ensure the client that the responsibility for initiating form of risk response therefore lies with the client, and ensure the best interests. It also includes the necessary consideration of both the client and other participants' objectives, the relative abilities of the parties to assume the risk, the degree of control over the situation, and potential gain or loss of incentive.

In regard to risk reduction in this construction procurement project managers should have the motivation to take responsibility for fulfilling a project's objectives. Project managers should be encouraged or supported by a client to play the role through:

- contributing to sound economic appraisal by producing realistic estimates of cost and time related to an appropriate and defined standard of functional performance.
- achieving efficient project implementation to establish a target of cost, time and performance.

In many projects, each of the three targets is subject to risk and uncertainty. A realistic estimate is one that makes an appropriate allowance for all those risks and uncertainties that can be anticipated from experience.

The organization's risk—response policies should be clarified to contain clear and definite proposals. Some policies may be too technically difficult to implement. On the other hand, other proposals should be concerned with managerial policies for risk reduction or risk transfer and risk control policies.

A risk management proposal should concentrate on the point of contract strategy, adjoined with the insurance proposals to ensure better risk reduction results.

The appropriate contract strategy requires the deliberation of:

- choice of organizational structure to control design, construction and their interface
- selection of the content, extent and sequencing of work package
- choice of contract's type
- contract selection method
- selection and preparation of tender documents including the conditions of contract, which are the primary guidelines for the risk allocation between client and contractors [2].

There are several considerations to be appreciated in the tender sums and the final contract value. Regarding the possibility of physical change, or design change to cope with physical change, contractors may have limited time to prepare tenders and may not be able to identify all potential risks in their analysis. The second is competition from other companies bidding for contracts. It is most unlikely that the lowest bidder has covered all the potential risks, since the lowest bidder always underestimates the true cost.

5. Risk Treatment Actions

Suitable plans to avoid risks occurring during projects should be developed in consultation with the project participants who are responsible for each identified risk. The risk treatment actions should include the following activities:

- risk description
- responsibility for action
- status of risk action planning
- further action required
- budget and resources required
- timing and reporting processes.

Details of the organizational structures and processes for the continuing management and monitoring of risk throughout the lifetime of the project should be developed by project participants or project manager, as well as specific details of strategies to deal with individual identified risks.

Another useful risk mitigation method is the 'Risk Matrix,' which was introduced by United States Air Force's Electronic Systems Centre (ESC) in 1995, and developed by the MITRE Corporation in 1998. Risk Matrix is easy to use, and identifies the risk that most critical to the project and resource requirements.

Risk Matrix could be divided into four phases as:

1. The initial phase is to identify all possible risks that may occur during a project together with focusing on the requirements–technology pair as the basis for identifying whether a risk exists to the project.

2. The second phase of the Risk Matrix process is to assess the potential programme impact of each risk and to assess the probability of each risk occurring, the input of this phase shall be in percentages (%) in order to clarify the potential risk impact to the project overall.

3. The following phase prioritizes the risks based on the impact and probability assessments. Project participants shall assess the impact of risk by ranking it into three categories as: 'H' for high, 'M' for medium, and 'L' for low. To assess the

impact of risk, the Borda method is encouraged when using this Risk Matrix, as the Borda's ranking depends on the impact of risks or level of seriousness to the overall procurement process.

4. The final phase of Risk Matrix process is to manage or mitigate each risk. Project participants or managers shall give brief descriptions of the mitigation method into Matrix. However, those mitigation methods shall be brainstormed and discussed amongst all project participants to find the most appropriate method suited to the situation.

The examples of Risk Matrix in Construction Procurement Process are shown in Table 1.

Table 1. Examples of Risk Matrix in Construction Procurement Process [3].

Risk Number	Requirements	Resource Available (Responsible persons/teams)	Risk	Probability Percentage (%)	Borda Rank	Rate	Mitigation Method
1	Installation of Building Façade	Erection Team A	Façade materials such as tempered Glass 16 mm; spiders could not be on time due to the long lead time.	70%	4	H	• Select the other supplier, who can guarantee that all materials will be on site within the time limit. • Propose new alternated materials.
2	Installation of A/C Equipment in Atrium	M&E (HVAC)	• A/C accessories might not be match with interior design. • Some equipment could not be delivered to site due to custom's regulations.	30% 40%	1 2	L L	• Held a meeting between an Interior Designer and M&E Engineers. • Rush the procurement manager to follow up this issue.
3	Erection of Roof	Erection Team B	• Lack of necessary equipment (Crawler Crane 450 tonnes). • Metal sheets will be sold out in next month; those will affect to an erection schedule.	60% 60%	3 4	M H	• Plant manager shall prepare the request for equipment bill and urgently submit to project manager. • Select more metal sheet supplier who can ensure that all materials will be on schedule.

One of the best methods to solve and prevent risks in construction procurement process is to establish the Risk Analysis and Management (RAM). This RAM method is suitable for identifying all uncertainties which are associated with the work as well as developing the managerial methodology, since the purpose of RAM is to provide a summary of risks and their implementation on the project. RAM can be undertaken at the various stages of the project, particularly, at contract review stage, which also includes the bidding and tendering stage and RAM shall be undertaken in accordance with any risk assessment method such as the Matrix Method as discussed above.

Another simple risk assessment method can be initiated by setting up a Management Status and Management Action team. The function of management status is to analyze what tasks shall be required by management level to address risk, and a responsible person to combat those risks on behalf of the management. The management shall define the dateline for assignees in response to the risk mitigation, ensuring that the risk analysis is reviewed and an updated status of any risk identified earlier in the project, as well as any further actions required.

If a project is required to be assisted by RAM analysis system in regard to reduce risk in the project procurement process, the project manager could start RAM analysis with the following techniques:

1. *By Direct Observation*: Firstly, selecting the appropriate project participants to observe the existing procurement process. Then, the project manager shall brief those workers on the purpose of the observation, followed by setting up the Work Breakdown Structure (WBS) and rechecking WBS with the assignees. The assignee must record every step observed in the WBS.

2. *By Group Discussion*: Project managers shall select a group of participants who are experienced with the project procurement process, under the guidance of supervisor. The group would use its experience to identify known risks as well as any unforeseen events, related to it. The group shall also be responsible arriving at good solutions, thus reducing or mitigating the risks.

3. *By Recall and Check*: each project supervisors shall prepare their own risk analysis and management method, to be in accordance with project risk management plan [4].

Risk Management plan or analysis should be viewed constructively and creatively, and rigid application of a set techniques or procedures is not advocated or encouraged. Indeed, methodologies are, relatively speaking, in their infancy and are evolving with practice. The initiative for the application of risk management rests with clients and their professional advisors, particularly the project manager. Some changes in a normal policy and procedure for project procurement may be required, such as:

- building adequate time for risk management into the project programme
- project participant shall have training, both practical and theoretical, in using different techniques in accordance with good guidelines
- willingness to pay enhanced fees to consultants where they are required to encourage greater effort in appraising and estimating risk occurred in contractual or procurement strategies
- possible relaxation of fixed dates for submission of delivery or procurement programmes
- accounting or budgeting for non-single-figure estimate, must prepare the alternatives.

Regarding some clients, the above changes may appear impracticable to achieve. Persuasive and persistent arguments must be put foward to demonstrate the benefits, which are suggested in terms of more realistic estimates, a concrete procurement process, better control of

time and money, and the encouragement of creative and innovative solutions to project implementation [2].

The construction project managers must encourage project participants or team members to be aware of, and understand the risks inherent in the procurement process. Project team members shall be trained and taught to identify risks, quantify risks and define appropriate response and mitigation plans designed to prevent the risk occurring, backed up with a contingency plan. All these items are key to successful project and risk management . General Electric Chairman, Mr. Jack Welch inspired the company employees with the slogan *"Speed, Simplicity and Self-confidence"* this slogan could be implied to Risk Management as:

1. *Speed*—A team that executes itself as if it were on duty to respond to all risks, committed to other project members and dealing pre-emptively with risks to ensure that all members can reduce the risks.

2. *Simplicity*—Project plan and processes such as risk management that are common sense and include an easily visualized strategy for managing risks.

3. *Self-confidence*—Team members that know they have the trust of the leader, and have been trained to execute without constant review and direction. Success breeds higher levels of self-confidence and competence [3].

As earlier discussed in this article, the Risk Mitigation process begins by identifying the risks that occur in the procurement process, investigating their sources, level or rank according to the seriousness and impact on the project overall, setting up the appropriate strategy to suit to the conditions and level of risk. Finally, all risk in construction project procurement can be eased and mitigated by any of the suggested risk mitigation methods. As shown in this article, the popular methods to reduce risk are; the Risk Matrix, and Risk Analysis and Management (RAM). However, to implement the risk mitigation methods, it is accepted that each project members shall share their responsibilities and experience in reducing the occurrence of risks. The character of project members, who have to face the risks in construction projects shall be "*Speed, Simplicity and Self-confidence*" in order to ease and reduce any risk due to unfit procurement processes.

6. Conclusion and Suggestion

The Risk Management Process is concerned with identifying, analyzing, and taking action against project risks, which also includes maximizing the results of positive events and minimizing the consequences of adverse or uncertain events. In this regard risk management process shall incorporate risk identification, risk quantification, risk response development and risk response control in order to ensuring that risks will be mitigated within the closed cooperative atmosphere.

In the existing construction projects, the procurement process is a major concern for the vitality of the project since the procurement process is related to contractor performance, materials lead-time, etc. Project Managers should also clarify the major project procurement processes, which are: Procurement Planning, Solicitation Planning, Source Selection, Contract Administration and Contract Close-out. This will ease procurement problems and also help project managers to understand the following major project issues; "Scope of Works, Key Date or Milestones, Responsible Person, the Vendor, and Contract Condition". Risk management methods as discussed above could be involved in these processes in response to any risk, which may occur during the procurement process.

Innovative procurement processes shall be introduced in the future in order to reduce the adversarial nature of contracts and risk occurring in projects. Those concepts have been developed to involve all project participants such as the client, designer and contractors at an early stage, to promote the project's objective and create a win-win situation to conforming to the requirements of all parties concerned. New patterns considered to improve the effectiveness of project procurement are suggested as:

1. Constructability: This process allows the construction process to start while the documentation is still setting. This system aims to promote a teamwork approach to the entire process of design and construction. In addition, constructability also promotes time saving by allowing the overlap between design completion and construction commencing. This can assist the project stakeholders in cost saving due to the decrease in time.

2. Value Management/Engineering: The concept of this system is an advance tool in the government in an attempt to escape from the idea of awarding contracts on a 'cost only' basis. This system is a disciplined, programmed effort applied during the planning, design and construction phases. It analyses functional requirements of the materials and methods, components and subsystems of a project, including energy, for the purpose of achieving essential functions at optimal costs (initial, operation and maintenance) while maintaining necessary value.

3. Pre-qualification of Tenderers: The primarily advantage of this system is that to save time by selecting the most experienced contractor, or associate, with well-known qualifications. The contractor selected by this system should have the potential resources and skills to complete the contract conditions and fulfil client requirements. The other advantage of this system is that it can prevent unnecessary risk due to qualification problems.

4. Partnering: This is a method which can reverse the adversarial nature of project management in the engineering and/or building industry. Partnering can be summarised as the forming of a long term commitment between various groups, such as clients and the main contractor and/or subcontractors for the purpose of achieving specific business objectives by maximising the effectiveness of each participant's resources. Furthermore, partnering is not a formal contract; with the principle to seek and promote working relationships on trust and teamwork to reduce disputes and encourage cooperation.

5. Novation: This process allows the client to prepare their own preliminary design using their own consultants. The design consultancy contract is then awarded to the contractor who submits the best design and construction tender. This method also provides a competitive tendering process for the client's basic requirements.

The final part of this article discussed the risk treatment action and risk mitigation plans, particularly in the construction project procurement process. The article has briefly looked at the principles of the Risk Matrix and Risk Analysis and Management (RAM) only. However, construction project managers should apply the aforementioned methods in their response to projects, with input from actual situations, existing conditions, and brainstorm the best solution to ease the burden of risk to their project members.

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