



# A Study of Construction Management in Bangladesh: An Engineering Analysis

<sup>1</sup>Engr. Md. Ziaul Hoque, P. Eng., <sup>2</sup>Engr. Pankaj Kumar Nath, P. Eng.,  
<sup>3</sup>Engr. Khandaker Rafiqul Islam Kallal

## ABSTRACT

When a doctor makes a wrong, then one person is affected or may be died but when an engineer makes a wrong then huge peoples may be affected or died. So the construction (Civil) management is a very important subject in all over the world especially in developing countries as Bangladesh. Construction management is a combination of Engineering, Technology and Management. Actually, construction is the area of execution. In Bangladesh, the field of Civil construction-most of the cases we find result as “more time than expected which causes more expenses and on the other hand buildings, bridges & roads failure & collapse which causes of life safety & huge losses of money”. This paper presents an in-depth analysis of construction management practices in Bangladesh surveyed more than 50 of govt. & private construction projects of Buildings, Bridges & Culverts and Pavements (Roads) both Flexible & Rigid, Power Plant etc., highlighting the critical challenges and opportunities within the industry from an engineering perspective. The study explores key issues such as the prevalence of unskilled project managers, inadequate project planning, the involvement of technically unqualified personnel, and the impact of unskilled labor on project outcomes. It also examines the weaknesses of regulatory bodies, the lack of awareness about Health, Environment, and Safety (HES) standards, and the negative effects of excessive interference by project owners in operational activities. Through this analysis, the paper aims to identify the root causes of inefficiencies in construction management in Bangladesh and propose actionable recommendations for improving project execution, ensuring compliance with safety and environmental regulations, and enhancing overall industry standards. The findings underscore the need for systemic reforms, including the development of skilled professionals, strengthening of regulatory frameworks, and fostering a culture of safety and quality in construction projects across the country.

**Keywords:** *Construction Management, Bangladesh, Engineering Analysis, Project Planning*

## INTRODUCTION

Construction management in Bangladesh is a critical aspect of the country's infrastructure development, as the nation continues to experience rapid urbanization and industrialization in government and private sector. This engineering analysis explores the key components of construction management in Bangladesh, focusing on the challenges, opportunities, and best practices within the industry. The development of infrastructure is an important activity of a country involves huge amount of money & peoples and creates a considerable amount of risk in a project. Due to the multiplicity of works and organizations involved in construction project, the clients are encountered frequent risk to terminate the project successfully. Construction personnel have to pay attention to minimize risk because it has great influence on cost and time overruns of the project (Akintola & Malcolm, 1997). Risk can be considered as both negative and positive aspect (David, 2002). Project monitoring and control by assessing risk in proper way might good omen for diminishing probability of time and cost overruns or even project failure. The term risk management can be defined as the systematic processes of identifying and analyzing the risk to find out way forward (Project Management Institute, 2004). The risk management process begins with the initial identification of the relevant and potential risks associated with the construction project. It has considerable importance since the process of the risk analysis and management are performed to identify potential risk. In addition, risk analysis and evaluation is the intermediate process between risk identification and management. Once the

risks of a project have been identified and analyzed, an appropriate method of treating risk can be adopted. Within a framework of risk management, contractors also have to decide how to handle each risk and formulate suitable risk treatment strategies or mitigation measures.

The process of risk management does not aim to remove completely all risks from a project. Its objective is to develop an organized framework to assist decision makers to manage the risks, especially the critical ones, effectively and efficiently. There are many researches, for example, Elikington and Smallman (2002), Lyons and Skitmore (2004), Akintola & Malcolm (1997), etc. have been studied worldwide to assess and manage the project risk. Since, the risk associated with a project depends on its type, size, complexity, location, and involvement of parties, number of concurrent activities, type of contract, administrative systems and skilled etc. which are not universal globally and there is no such research found in Bangladesh, it was very important to conduct study in this field. Besides, Bangladeshi construction industries are facing various risk to finish the project within due time and money, that is why, the study objectives were to evaluate and assess the risk associated with BD construction projects, ranking of risk level on the basis of probability of risk occurrence and their impact, and conclude the most severe risk factors depending on the outcomes of questionnaire survey.

Bangladesh's construction industry has witnessed significant growth in recent decades, contributing around 7.81% of the national GDP in 2022. From housing and commercial complexes to large-scale infrastructure projects like bridges, highways, and power plants, the sector is a major contributor to employment and economic activity. However, despite this growth, the industry faces several challenges that impede its progress, including inadequate project planning, cost overruns, delays, poor quality control, and environmental concerns etc.

The complexity of construction projects in Bangladesh requires a comprehensive and organized approach to management that integrates engineering principles with modern management techniques. Construction management is the process of overseeing a project from inception to completion, ensuring that it meets engineering & technology, time, budget, and quality requirements while also addressing safety and sustainability concerns. This discipline is critical in optimizing resource use, reducing waste, and improving overall project efficiency.

This study aims to provide an engineering analysis of the construction management practices in Bangladesh, focusing on the factors influencing project success and the challenges that hinder optimal project delivery. By examining both successful and struggling construction projects, this study seeks to identify best practices, highlight common pitfalls, and propose recommendations for enhancing the efficiency and effectiveness of construction management in Bangladesh. The analysis will also explore how technological advancements, regulatory frameworks, and capacity-building initiatives can contribute to better project outcomes in the country's construction sector.

## TYPES OF CONSTRUCTION SECTOR IN BANGLADESH

The construction sector is divided into three main segments:

- **Public Infrastructure:** Roads, bridges, railways, and government buildings.
- **Private Construction:** Residential, commercial, and industrial projects.
- **Development Projects:** Foreign-funded projects such as those sponsored by the Asian Development Bank (ADB), Islamic Development Bank (IDB), UNICEF, World Bank and foreign NGOs.

## OVERVIEW OF THE CONSTRUCTION INDUSTRY IN BANGLADESH

The construction industry in Bangladesh has been growing steadily, driven by both public and private sector investments in infrastructure, housing, and commercial projects. The government has prioritized infrastructure development through projects like the Padma Bridge, Dhaka Metro Rail, and various road networks and apartment & buildings projects, which have significantly boosted the construction sector.

## KEY COMPONENTS OF CONSTRUCTION MANAGEMENT

### A) Time management:

1. **Project Planning and Scheduling:** Effective project planning and scheduling are vital for timely completion. In Bangladesh, many projects suffer from delays due to inadequate planning, frequent changes in design, and lack of coordination among stakeholders.

2. **Resource Management:** Managing resources, including labor, materials, and equipment, is essential for maintaining project timelines and budgets. In Bangladesh, the construction sector often faces challenges such as labor shortages, fluctuating material costs, and limited availability of modern construction equipment.

#### B) Risk management:

1. **Quality Control and Assurance:** Ensuring the quality of construction is critical to the safety and durability of structures. In Bangladesh, quality control is sometimes compromised due to inadequate supervision, lack of skilled labor, and use of substandard materials.
2. **Safety Management:** Construction sites are prone to accidents, making safety management a priority. However, in Bangladesh, safety practices are often not strictly enforced, leading to a higher rate of workplace accidents.
3. **Cost Management:** Controlling project costs is a significant challenge in the construction industry. In Bangladesh, cost overruns are common due to inflation, unexpected delays, and poor financial planning.
4. **Sustainability and Environmental Considerations:** Sustainable construction practices are gaining importance globally, including in Bangladesh. However, the adoption of green building techniques and environmentally friendly materials is still in its nascent stages.

#### LITERATURE REVIEW

In general, construction projects in developing countries fail to reach target regarding predefined budget and time with desired quality due to proper & approved structural design, weak project management & scheduling, inactive project manager, failure of identifying and estimating unanticipated risk etc.

Analytic Hierarchy Process (AHP) was introduced by Mohammad & Jamal (1991) as an approach for assessing risk at initial stage of project instead of traditional methods. They conducted the research of using AHP to calculate the riskiness of a Jamuna bridge construction project in Bangladesh and concluded the project as low risk one. Besides, research found AHP is a useful method of risk administration for the project manager to make conclusion for bid appraisal, selection of equipment and staff, business performance and challenge etc. According to Leung et al. (1998), “an effective risk management approach can provide a framework for project managers to identify and assess potential risk factors and take response actions in order to achieve the desired objectives of a given project”. Leung et al. (1998) applied knowledge-based technique and developed a model for discovering probable risk of a project by using previous experience and proved its feasibility for risk management in real field. Robert (2001) discovered that the effectiveness of risk analysis depends on the process of risk identification and assessment as well as proposed the most effective sequences of risk management system as “knowledge acquisition, selection of the core design team, presentation of the process, identification, encoding and verification”.

Chris C. (1997) has provided a summary of risk management process which was the synthesized of methods and concluded that risk management is the right of the project itself depending on objectives, assigned task and system of project delivers. Usually, risk is viewing as negative aspect and meaning financial loss, occurrence of hazard, adverse effect etc. However, research finds out the beneficial use of risk assessment. Although, procedures available for risk experts are mostly to pay attention in negative side, David (2002) studied to widen the possibility of risk process using project opportunity administration. S C Ward (1999) studied the inadequacies of ranking risk factors based on probability and impact method. He concluded that management will be most effective if both size and probability of occurring impacts are distinguished with response timely. Since risk factors are varied in project to project, associated risk also varied. But project manager frequently worked with common and even irrelevant issued for risk minimization which are proved ineffective and intentionally avoid most effective causes of risk for difficulties. For effective risk management, it is necessary to discover most important relevant as well as irrelevant information to give emphasize and exclude respectively (Elmar & Mark, 2010).

Efficiency of current practice of management to minimize the project risk. That study collected data from multinational industries from different countries and regions. The research found that the level of risk and its intensity varies with respect to above contexts and proper planning of risk management are adequate to diminish risk for successful project completion. Martin (2007) has been studied post mortem analysis for risk assessment which is commonly used in software-based management system. This analysis found most efficient for providing detailed information to enhancement capacity of the project future and evaluated the



value of participating all categories project personnel to know how best management techniques. Paul & Clive (2002) studied the practices of risk management system available in British utility service projects and found the inefficiency of frequently used Price2TM method for handling project risk. This research suggested, first to identify causes of risks, then estimate, evaluate and finally take protective action which is a continuous process.

A research survey was conducted by Terry & Martin (2004) within senior executive of Queensland construction industry regarding the commonly used techniques of risk handling. Research identified higher practice of risk management in planning and implementation stage of project than starting and ending phases; priority given to identify and assess of risks prior to action taken, for assessing and reduction of risk, qualitative and response method were commonly used practice respectively. A questionnaire also has been done by Nabil & Saied (2001) through largest construction industries in Kuwait from the view of contractors to evaluate the action taken for time and cost related risk management. The study presented two types of methods for risk control such as preventive method at planning stage and remedial action for the phase of during construction. Besides, in Kuwait, research found that contractors were eager to receive legal and agreement related risk and application of proper risk analysis practice was limited. However, a new concept in identifying and assessing potential risk concurrently by applying multi-attribute group decision making (MAGDM) in construction project of both qualitative and quantitative approach was introduced by Mohammad et al. (2010) and found very successful for risk management in Iranian construction project.

Accuracy of risk assessment in construction fully depends on the method of risk analysis and management. There are numerous systems such as brainstorming, Delphi, nominal group technique etc. available for risk analysis. Robert (1998) used Charles Handy model to make comparison of those process and found brainstorming as mostly applicable technique but has severe drawbacks. A more advance fuzzy approach was introduced in risk management of construction project by Carr & Tah (2001), where the study has been developed a qualitative risk assessment model for describing a hierarchical risk breakdown structure and revealed relationship within risk factors and subsequent effects by using fuzzy method.

## METHODOLOGY

This study employs a multi-faceted methodology to analyze construction management practices in Bangladesh from an engineering perspective. The methodology includes a combination of qualitative and quantitative approaches to ensure a comprehensive understanding of the challenges and opportunities within the industry. The following steps outline the methodological framework used in this analysis:

### Data Collection

- **Surveys:** Structured surveys were distributed to a diverse group of stakeholders, including construction managers, project owners, contractors, and regulatory officials. The surveys aimed to gather quantitative data on current practices, challenges faced, and perceptions of regulatory effectiveness.
- **Interviews:** Semi-structured interviews were conducted with key industry experts, including experienced project managers, engineers, and representatives from regulatory bodies. These interviews provided qualitative insights into specific issues such as unskilled labor, project planning deficiencies, and the impact of owner interference.

### Case Studies

- **Selection:** A selection of construction projects, more than 50 govt. & private construction projects of Buildings, Bridges & Culverts and Pavements(Roads) both Flexible & Rigid, Power Plant etc., in Bangladesh was analyzed as case studies. These projects varied in size, scope, and type, including residential, commercial, and infrastructure projects.
- **Analysis:** Each case study was examined to understand how project management practices, regulatory compliance, and labor quality influenced project outcomes. Key factors such as delays, cost overruns, safety incidents, and quality issues were assessed.

### Regulatory and Policy Review

- **Objective:** To evaluate the effectiveness of existing regulatory frameworks and policies in Bangladesh.
- **Approach:** An analysis of relevant construction regulations, safety standards, and environmental guidelines was conducted. This included reviewing regulatory documents, assessing enforcement mechanisms, and identifying gaps or areas for improvement.

## Data Analysis

- **Quantitative Analysis:** Statistical methods were used to analyze survey data and identify patterns or correlations related to project management challenges, labor quality, and regulatory effectiveness.
- **Qualitative Analysis:** Thematic analysis was applied to interview transcripts and case study findings to identify common themes, issues, and insights related to construction management practices.

## REASONS FOR POOR CONSTRUCTION MANAGEMENT IN BANGLADESH:

### 1) Right People are not in Right Place

Previously mentioned that, it is an engineering & technology-based operation and people's life safety is directly related with the sector. But in Bangladesh (except some mega project), most of the construction are done by with less qualified technical person even some people without any knowledge about the project.

In construction management, having the right people in the right roles is crucial for the successful execution of projects. When the placement of personnel is misaligned, it can lead to a variety of problems, impacting project outcomes, efficiency, quality and overall success. Here's a detailed look at the issues that arise when the right people are not in the right place, and how it affects construction management:

#### Inefficient Project Execution

- **Misaligned Skills and Responsibilities:** When individuals are assigned to roles that do not match their skills and expertise, it can result in inefficient project execution. For example, a project manager with insufficient experience may struggle with planning and coordination, leading to delays and budget overruns.
- **Lack of Specialized Knowledge:** Assigning tasks to individuals without the necessary technical or specialized knowledge can compromise the quality of work and lead to mistakes that require costly rework.

### 2) Unskilled Project Manager

An unskilled project manager can significantly impact the success and efficiency of a construction project. On the other hand, a skill Project Manager can complete his project in scheduled time or before the scheduled time by his performance except the war or any big natural disaster. Here are some of the key issues that arise when a project manager lacks the necessary skills and experience.

#### Poor Planning and Scheduling

- **Ineffective Time Management:** An unskilled project manager may struggle with creating a realistic project timeline, leading to delays. They might not accurately estimate the time required for various tasks, causing a ripple effect on the entire project schedule.
- **Inadequate Resource Allocation:** They might fail to allocate resources effectively, leading to shortages or underutilization of labor, materials, and equipment.

#### Inadequate Risk Management

- **Failure to Identify Risks:** An inexperienced project manager might not anticipate potential risks, such as material shortages, labor strikes, or unforeseen environmental issues. This can result in project disruptions.
- **Poor Mitigation Strategies:** Even when risks are identified, an unskilled project manager may not develop effective mitigation strategies, leading to cost overruns and delays when issues arise.

#### Inefficient Communication

- **Lack of Clarity:** Communication is key to the success of any project. An unskilled project manager may fail to communicate clearly and effectively with team members, subcontractors, and stakeholders, leading to misunderstandings and errors.
- **Inconsistent Updates:** They might not provide regular updates on project progress, leaving stakeholders in the dark and potentially causing a loss of trust.

### Subpar Quality Control

- **Neglect of Quality Standards:** Without the proper skills, a project manager might overlook important quality control processes, resulting in substandard work that could compromise the integrity of the project.
- **Inability to Enforce Standards:** They may also lack the authority or knowledge to enforce quality standards, leading to issues with workmanship and materials.

### Cost Overruns

- **Budget Mismanagement:** An unskilled project manager may have difficulty managing the project budget, leading to cost overruns. This could be due to poor estimation, uncontrolled spending, or failure to monitor expenses.
- **Inaccurate Forecasting:** They might also struggle with forecasting future costs, making it difficult to adjust the budget as the project progresses.

### Poor Decision-Making

- **Hesitation or Rash Decisions:** An unskilled project manager might either hesitate to make critical decisions or make them too quickly without proper analysis, both of which can lead to negative outcomes.
- **Lack of Problem-Solving Skills:** When issues arise, an unskilled project manager may not have the experience or knowledge to resolve them effectively, leading to further complications.

### Low Team Morale

- **Ineffective Leadership:** A project manager lacking in leadership skills can demotivate the team, leading to decreased productivity and higher turnover rates.
- **Poor Conflict Resolution:** They may not handle conflicts well, causing friction among team members and potentially leading to a toxic work environment.

### Failure to Meet Client Expectations

- **Inadequate Stakeholder Management:** An unskilled project manager may not effectively manage stakeholder expectations, leading to dissatisfaction and possibly legal disputes if the project does not meet agreed-upon terms.
- **Failure to Deliver on Time and Within Budget:** Ultimately, an unskilled project manager's shortcoming can result in the project being delivered late, over budget, and not meeting the desired quality standards.

### 3) Lack of Project Planning

Lack of project planning can severely hinder the successful execution of a construction project. Effective planning is the foundation upon which the rest of the project is built, and without it, projects can quickly go off track. Below are the key issues that arise from inadequate or nonexistent project planning:

#### Unclear Project Scope

- **Scope Creep:** Without a well-defined project scope, the project is vulnerable to scope creep, where additional tasks or changes are introduced without proper evaluation. This can lead to delays, budget overruns, and resource strain.
- **Misaligned Expectations:** Stakeholders may have different expectations about the project's outcomes, leading to confusion and dissatisfaction if the scope isn't clearly articulated from the beginning.

#### Inaccurate Budgeting

- **Cost Overruns:** Inadequate planning often results in poor budgeting, where costs are underestimated or unforeseen expenses arise. This can deplete resources before the project is completed, causing financial strain.
- **Resource Mismanagement:** Without proper budget planning, resources may be misallocated, leading to shortages or excesses in various project areas.

#### Inefficient Resource Allocation

- **Labor and Material Shortages:** Failing to plan for the necessary workforce and materials can cause significant delays. Projects may grind to a halt if the right resources aren't available when needed.

- **Equipment Downtime:** Inefficient planning can result in equipment being idle or unavailable at critical times, leading to lost productivity and increased costs.

### Project Delays

- **Unrealistic Timelines:** Without thorough planning, timelines may be overly optimistic, failing to account for potential delays such as weather conditions, permit approvals, or supply chain issues. This often leads to missed deadlines.
- **Coordination Problems:** Poor planning can result in a lack of coordination between different teams and phases of the project, leading to bottlenecks and unnecessary waiting periods.

### Inadequate Risk Management

- **Unforeseen Issues:** Lack of planning typically means that potential risks are not identified or addressed in advance. This leaves the project vulnerable to unexpected issues such as contractor disputes, regulatory changes, or technical challenges.
- **No Contingency Plans:** Without proper risk management, there are no contingency plans in place to handle problems when they arise, leading to reactive rather than proactive management.

### Poor Quality Control

- **Inconsistent Standards:** If quality control isn't planned for, there may be inconsistencies in the work, with some parts of the project meeting standards while others fall short. This can lead to rework, additional costs, and safety concerns.
- **Substandard Materials:** Poor planning might also mean that the procurement of materials is rushed or not thoroughly vetted, resulting in the use of substandard or inappropriate materials.

### Communication Breakdowns

- **Lack of Clarity:** Without a well-defined plan, communication among team members, subcontractors, and stakeholders can become fragmented. This can lead to misunderstandings, duplicated efforts, or critical tasks being overlooked.
- **Delayed Information Sharing:** Critical updates may not be shared in a timely manner, leading to decisions being made without all necessary information.

### Legal and Regulatory Issues

- **Non-Compliance:** Poor planning can lead to non-compliance with legal and regulatory requirements, such as zoning laws, safety standards, or environmental regulations. This can result in fines, work stoppages, or legal disputes.
- **Permit Delays:** Failing to plan for the time and process needed to obtain necessary permits can delay the start or continuation of the project.

### Client Dissatisfaction

- **Unmet Expectations:** Without clear planning, the project may not meet the client's expectations in terms of scope, quality, timeline, or budget. This can lead to disputes, loss of reputation, and difficulty securing future projects.
- **Lack of Transparency:** Clients may feel out of the loop if there isn't a well-structured plan that outlines key milestones, deadlines, and deliverables.

## 4) Technical Person are not satisfactory qualified

When technical personnel in a construction project are not adequately qualified, it can lead to numerous issues that affect the overall success and quality of the project. The competence of technical staff is crucial for ensuring that engineering, design, and construction processes are carried out effectively and safely. Below are some of the key problems that arise when technical personnel lack the necessary qualifications:

### Design Flaws and Errors

- **Inaccurate Calculations:** Unqualified technical personnel may struggle with performing accurate calculations related to load-bearing structures, material strength, and other critical engineering factors. This can lead to design flaws that compromise the safety and functionality of the structure.
- **Poor Design Implementation:** They might not fully understand architectural and engineering drawings, leading to incorrect implementation of designs, which can result in costly rework or even structural failures.



### Safety Risks

- **Non-Compliance with Safety Standards:** Technical personnel who are not properly qualified may not be aware of or fully understand safety regulations and industry standards. This can lead to unsafe construction practices, increasing the risk of accidents and injuries on site.
- **Improper Material Handling:** A lack of technical expertise can result in improper handling or incorrect usage of materials, which can create hazardous conditions.

### Inefficient Problem Solving

- **Inability to Troubleshoot Issues:** When technical problems arise, such as unexpected ground conditions or equipment failures, unqualified personnel may lack the skills and knowledge to troubleshoot effectively. This can lead to delays and additional costs as they struggle to find solutions.
- **Poor Decision-Making:** Without the necessary qualifications, technical personnel may make poor decisions that exacerbate problems rather than resolving them, leading to further complications and potential project derailment.

### Quality Control Issues

- **Substandard Workmanship:** Unqualified technical staff may lack the skills needed to ensure high-quality workmanship, resulting in defects, poor finishes, and structural weaknesses.
- **Inconsistent Standards:** They may also be unable to maintain consistent quality standards throughout the project, leading to variable performance and the potential need for costly repairs or corrections.

### Project Delays

- **Slow Progress:** Unqualified personnel may work more slowly due to a lack of understanding or experience, causing delays in project timelines. This can have a knock-on effect, delaying subsequent phases of the project.
- **Frequent Mistakes:** Errors made by unqualified technical staff often need to be corrected, which can significantly slow down the project and lead to missed deadlines.

### Increased Costs

- **Costly Rework:** Mistakes made by unqualified technical personnel often require rework, which can be expensive and time-consuming. This increases the overall cost of the project and can lead to budget overruns.
- **Wasted Resources:** Inefficient use of materials and resources due to lack of expertise can result in waste, further driving up costs and reducing profitability.

### Inadequate Compliance with Codes and Regulations

- **Violations of Building Codes:** Unqualified technical staff may not be familiar with local building codes and regulations, leading to violations that can result in fines, legal disputes, or even the need to demolish and rebuild non-compliant structures.
- **Environmental Non-Compliance:** They may also fail to adhere to environmental regulations, such as proper waste disposal or minimizing environmental impact, which can lead to penalties and reputational damage.

### Communication Breakdowns

- **Misinterpretation of Technical Information:** Unqualified personnel may misinterpret technical documents, drawings, or instructions, leading to errors in execution and misunderstandings among the team.
- **Poor Collaboration:** They might struggle to communicate effectively with other professionals, such as engineers, architects, and subcontractors, leading to discoordination and fragmented project execution.

### Client Dissatisfaction

- **Failure to Meet Expectations:** Clients expect a certain level of expertise and professionalism in the execution of their projects. When technical personnel are not qualified, the project is less likely to meet these expectations, leading to client dissatisfaction.
- **Loss of Reputation:** Poor performance due to unqualified technical staff can harm the reputation of the construction firm, making it harder to secure future projects.



## 5) Unskilled Worker

Unskilled workers in the construction industry can have a significant impact on the efficiency, quality, and safety of a project. While unskilled labor is often necessary for tasks that do not require specialized knowledge, the presence of too many unskilled workers or the misuse of such labor can lead to several problems. Here are the key issues that arise when unskilled workers are heavily relied upon in construction projects:

### Reduced Work Quality

- **Poor Craftsmanship:** Unskilled workers may lack the training and experience needed to perform tasks to a high standard. This can result in poor craftsmanship, including uneven surfaces, improper installations, and overall substandard work.
- **Inconsistent Quality:** The work performed by unskilled labor is often inconsistent, leading to variations in quality throughout the project. This inconsistency can compromise the structural integrity and aesthetic appeal of the finished product.

### Increased Risk of Accidents

- **Safety Violations:** Unskilled workers may not be familiar with safety protocols and best practices, leading to an increased risk of accidents and injuries on the job site. This not only endangers the workers themselves but also other team members.
- **Improper Use of Tools and Equipment:** Without proper training, unskilled workers may misuse tools and equipment, leading to accidents or damage to the equipment. This can also cause project delays and additional costs for repairs or replacements.

### Higher Supervision Requirements

- **Need for Constant Monitoring:** Unskilled workers often require close supervision to ensure that tasks are being performed correctly. This places additional strain on supervisors and skilled workers, who must spend time overseeing rather than focusing on their specialized tasks.
- **Increased Likelihood of Errors:** Even with supervision, unskilled workers are more prone to making mistakes, which can lead to rework and further delays.

### Project Delays

- **Slow Work Progress:** Unskilled workers may take longer to complete tasks due to a lack of experience and efficiency. This can slow down the entire project, especially if they are involved in critical path activities.
- **Frequent Rework:** Errors made by unskilled workers often need to be corrected, leading to rework that consumes time and resources, further delaying project timelines.

### Increased Costs

- **Costly Rework and Repairs:** The mistakes and subpar work quality associated with unskilled labor can lead to significant costs for rework and repairs. This not only affects the project budget but can also impact the profitability of the project.
- **Wasted Materials:** Unskilled workers may misuse or waste materials due to a lack of understanding or improper handling. This can drive up material costs and lead to shortages, necessitating additional purchases.

### Impact on Skilled Workers

- **Disruption of Skilled Work:** Skilled workers may be interrupted or distracted by the need to correct the work of unskilled labor, reducing their own productivity and effectiveness.
- **Demoralization:** Skilled workers may become frustrated or demoralized if they feel that the quality of the project is being compromised by the presence of too many unskilled workers. This can lead to decreased morale and productivity.

### Difficulty in Meeting Standards

- **Failure to Meet Quality Standards:** Projects involving a high proportion of unskilled labor may struggle to meet industry quality standards, leading to issues with inspections and approvals.
- **Non-Compliance with Codes and Regulations:** Unskilled workers may not be aware of building codes and regulations, leading to work that does not comply with legal requirements. This can result in fines, legal disputes, or the need to redo non-compliant work.

### Client Dissatisfaction

- **Unmet Expectations:** Clients expect a certain level of quality and professionalism in construction projects. The involvement of unskilled workers can lead to results that do not meet these expectations, resulting in client dissatisfaction and potential damage to the company's reputation.
- **Delays and Cost Overruns:** Clients may become frustrated with delays and cost overruns caused by the inefficiencies of unskilled labor, leading to disputes and a negative impact on future business opportunities.

### Negative Impact on Project Safety and Durability

- **Compromised Structural Integrity:** If unskilled workers are involved in critical tasks, such as concrete pouring, welding, or electrical work, the structural integrity and long-term durability of the project can be compromised, leading to future safety hazards.
- **Increased Maintenance Needs:** Poor workmanship due to unskilled labor can result in a structure that requires more maintenance and repairs over its lifespan, increasing long-term costs for the client.

### 6) The Weakness of Regulatory Bodies

The weaknesses of regulatory bodies in the construction industry can have serious consequences, including poor enforcement of standards, compromised safety, and corruption. Regulatory bodies play a crucial role in ensuring that construction practices meet established standards and that projects comply with legal and environmental regulations. When these bodies are weak, the entire construction sector can suffer. Here are some of the common weaknesses of regulatory bodies:

#### Corruption and Lack of Transparency

- **Bribery and Favors:** Corruption within regulatory bodies can lead to the approval of non-compliant or substandard construction practices. Bribery or favoritism may allow certain contractors to bypass regulations, compromising the integrity of the construction process.
- **Opaque Processes:** A lack of transparency in decision-making and regulatory processes can lead to public distrust and create opportunities for unethical behavior. This can result in unequal enforcement of regulations, where some projects receive more scrutiny than others.

#### Insufficient Resources

- **Understaffing:** Regulatory bodies often suffer from a lack of adequate personnel to properly monitor and enforce regulations. This can lead to insufficient inspections, delayed approvals, and an overall inability to oversee all active projects effectively.
- **Lack of Funding:** Without adequate funding, regulatory bodies may not have the necessary resources to conduct thorough inspections, implement training programs, or invest in modern technologies that could improve their effectiveness.

#### Inadequate Training and Expertise

- **Lack of Qualified Personnel:** Regulatory bodies may employ staff who lack the necessary technical knowledge or experience to assess construction practices effectively. This can lead to poor enforcement of standards and the approval of subpar work.
- **Inconsistent Training:** Inadequate or inconsistent training for regulatory personnel can result in varying levels of enforcement and interpretation of regulations. This inconsistency can create confusion and lead to unequal treatment of construction projects.

#### Slow and Bureaucratic Processes

- **Delays in Approvals and Permits:** Regulatory bodies that are slow or overly bureaucratic can cause significant delays in the construction process. This can lead to frustration among contractors and developers, and in some cases, encourage them to bypass regulations altogether.
- **Inefficient Procedures:** Complex and inefficient regulatory procedures can bog down the approval process, making it difficult for projects to move forward in a timely manner. This can also increase the costs associated with compliance.

#### Poor Enforcement of Regulations

- **Inconsistent Enforcement:** Weak regulatory bodies may fail to enforce construction standards consistently. Some projects might be held to strict standards, while others may be allowed to proceed without meeting necessary requirements, leading to disparities in quality and safety.

- **Limited Penalties for Non-Compliance:** If regulatory bodies lack the authority or willingness to impose meaningful penalties for non-compliance, there is little deterrent for contractors who may cut corners or ignore regulations.

#### **Lack of Coordination and Communication**

- **Fragmented Oversight:** In some cases, different aspects of construction regulation (e.g., safety, environmental impact, zoning) may be handled by separate agencies that do not communicate effectively. This can lead to gaps in oversight and enforcement, where critical issues are overlooked.
- **Poor Information Sharing:** Regulatory bodies may struggle with internal communication or with sharing information between different agencies. This can lead to delays, duplication of efforts, and a lack of cohesive regulatory oversight.

#### **Resistance to Change and Innovation**

- **Outdated Regulations:** Regulatory bodies may be slow to update or adapt regulations to reflect new technologies, materials, or construction practices. This can hinder innovation and result in outdated standards that do not adequately address current industry challenges.
- **Inflexibility:** Resistance to change within regulatory bodies can also make it difficult to implement reforms or adopt more efficient processes. This can lead to stagnation and prevent the regulatory framework from evolving with the industry.

#### **Limited Public and Industry Engagement**

- **Lack of Stakeholder Involvement:** Regulatory bodies that do not actively engage with industry stakeholders or the public may miss out on valuable input that could improve regulations and enforcement practices. This can lead to a disconnect between the regulations and the realities of the construction industry.
- **Poor Public Awareness:** If regulatory bodies do not effectively communicate with the public, there may be a lack of awareness about safety standards, building codes, or the importance of regulatory compliance. This can reduce public pressure on the industry to adhere to standards.

#### **Weak Legal Framework**

- **Inadequate Legislative Support:** Regulatory bodies may be hampered by a weak legal framework that does not provide them with sufficient authority or clarity to enforce regulations effectively. This can limit their ability to act decisively against non-compliance.
- **Judicial Inefficiency:** Even when regulations are enforced, a slow or ineffective judicial system can result in prolonged disputes and limited consequences for violators, reducing the overall impact of regulatory efforts.

### **7) Lack of Awareness about HES**

Lack of awareness about Health, Environment, and Safety (HES) in the construction industry is a significant concern, as it can lead to unsafe work environments, environmental degradation, and legal non-compliance. HES awareness is crucial for ensuring the well-being of workers, protecting the environment, and maintaining project integrity. Here are the key issues that arise from a lack of awareness about HES:

#### **Increased Risk of Accidents and Injuries**

- **Unsafe Work Practices:** Without proper HES awareness, workers may not follow safety protocols, leading to unsafe work practices such as improper use of machinery, neglect of personal protective equipment (PPE), and ignoring safety signs. This increases the risk of accidents, injuries, and fatalities on construction sites.
- **Failure to Identify Hazards:** Workers and supervisors who are not trained in HES may fail to identify and mitigate potential hazards, such as unstable scaffolding, exposed electrical wires, or unsafe storage of hazardous materials, further increasing the risk of incidents.

#### **Environmental Harm**

- **Improper Waste Disposal:** A lack of awareness about environmental regulations and best practices can lead to improper disposal of construction waste, including hazardous materials. This can cause soil and water contamination, harm to local wildlife, and other forms of environmental damage.

- **Pollution and Emissions:** Construction activities can generate significant air and noise pollution. Without HES awareness, construction companies may not implement measures to control emissions, leading to harm to both the environment and the health of nearby communities.

### **Non-Compliance with Legal Requirements**

- **Violations of Health and Safety Laws:** Regulatory bodies mandate specific health and safety requirements that must be followed on construction sites. A lack of HES awareness can lead to non-compliance with these laws, resulting in legal penalties, fines, or even project shutdowns.
- **Failure to Meet Environmental Standards:** Construction projects are often subject to environmental regulations designed to protect ecosystems and public health. Ignorance of these standards can result in violations, legal action, and damage to the company's reputation.

### **Reduced Worker Morale and Productivity**

- **Poor Working Conditions:** When workers perceive that their health and safety are not a priority, morale can suffer. This can lead to decreased productivity, higher turnover rates, and difficulties in retaining skilled labor.
- **Increased Absenteeism:** Workers who experience unsafe or unhealthy working conditions may take more sick days, leading to higher absenteeism and disrupting project timelines.

### **Higher Costs Due to Accidents and Environmental Fines**

- **Accident-Related Costs:** Workplace accidents can lead to significant costs, including medical expenses, workers' compensation claims, and legal fees. In severe cases, accidents can result in project delays, damage to equipment, and increased insurance premiums.
- **Fines and Legal Fees:** Non-compliance with HES regulations can lead to substantial fines and legal fees. Additionally, companies may face lawsuits from injured workers or affected communities, further escalating costs.

### **Damage to Company Reputation**

- **Negative Public Perception:** Companies that fail to prioritize HES may suffer from a negative public perception. Accidents, environmental harm, and legal issues can attract media attention and damage the company's reputation, making it difficult to win future contracts or attract skilled workers.
- **Loss of Client Trust:** Clients are increasingly concerned with the ethical and responsible conduct of their contractors. A lack of HES awareness can lead to a loss of client trust, resulting in lost business opportunities and long-term damage to the company's brand.

### **Inadequate Emergency Preparedness**

- **Poor Response to Emergencies:** Without proper HES training and awareness, workers and supervisors may be unprepared to handle emergencies such as fires, chemical spills, or equipment failures. This can lead to more severe consequences during an incident and hinder effective emergency response efforts.
- **Lack of First Aid Knowledge:** In the absence of HES awareness, workers may not know how to administer basic first aid or respond to injuries on-site, potentially worsening the outcomes of accidents.

### **Ineffective Risk Management**

- **Failure to Implement Safety Measures:** Companies that lack HES awareness may not implement necessary safety measures, such as regular safety audits, risk assessments, and safety training programs. This can lead to an increased risk of accidents and incidents.
- **Inadequate Monitoring and Reporting:** Without HES awareness, companies may fail to monitor safety performance, track incidents, or report hazards, leading to a lack of accountability and continuous improvement in safety practices.

## **8) Interfere of Project Owner into Project Activities**

The interference of a project owner in project activities can have various implications, both positive and negative, depending on the extent and manner of involvement. While project owners have a legitimate interest in ensuring that their investment is managed properly, excessive or inappropriate interference can lead to significant challenges. Here's an analysis of the issues related to project owner interference:



### Disruption of Project Workflow

- **Micromanagement:** When project owners overly involve themselves in day-to-day activities, it can lead to micromanagement, disrupting the natural workflow. This can undermine the authority of the project manager and demotivate the team.
- **Frequent Changes in Direction:** Owners who frequently change project requirements or goals can cause confusion and disrupt the planned course of action. This can lead to delays and the need to redo work, increasing both time and costs.

### Undermining Project Manager's Authority

- **Conflicting Instructions:** When project owners bypass the project manager and directly issue instructions to team members, it can create conflicting directives. This undermines the project manager's authority and can lead to confusion and inefficiency.
- **Erosion of Team Morale:** If the project manager's decisions are constantly overridden or questioned by the owner, it can erode the morale and confidence of the project team, leading to reduced productivity and engagement.

### Delays and Increased Costs

- **Scope Creep:** Owner interference often leads to scope creep, where additional requirements are introduced without formal approval or consideration of their impact on time and budget. This can lead to significant delays and cost overruns.
- **Inefficient Decision-Making:** When owners involve themselves in technical or operational decisions without adequate knowledge, it can result in inefficient decision-making. This can cause project delays and require additional resources to address unforeseen issues.

### Compromised Quality

- **Pressure to Cut Corners:** Owners who are overly focused on cost-cutting may pressure the project team to cut corners, leading to compromised quality and potential safety issues. This can result in long-term problems; such as defects or the need for expensive repairs.
- **Lack of Expertise:** Owners may lack the technical expertise needed to make informed decisions about certain aspects of the project. When they impose their preferences without understanding the technical implications, it can negatively impact the quality of the final product.

### Strained Relationships

- **Conflict with Contractors and Consultants:** Excessive interference by the project owner can strain relationships with contractors, consultants, and other stakeholders. This can lead to disputes, lack of cooperation, and even potential legal conflicts.
- **Reduced Collaboration:** When owners dominate the decision-making process, it can stifle collaboration and communication among the project team, leading to a less cohesive and effective working environment.

### Lack of Accountability

- **Blurred Responsibilities:** When owners interfere excessively, it can blur the lines of responsibility and accountability. This makes it difficult to hold anyone accountable for mistakes or issues that arise, as decision-making becomes fragmented.
- **Diluted Focus on Strategic Objectives:** Owners who focus too much on operational details may lose sight of the broader strategic objectives of the project. This can result in a misalignment between project outcomes and the owner's overall business goals.

### Impact on Project Schedule

- **Frequent Interruptions:** Owner interference can lead to frequent interruptions in project activities, slowing down progress and making it difficult for the project team to maintain momentum.
- **Rework and Modifications:** When owners request changes after the project has already begun, it often requires rework and modifications to previously completed tasks. This not only delays the project but also increases costs.

### Legal and Compliance Issues

- **Violation of Contract Terms:** Excessive interference by the owner may lead to actions that violate the terms of contracts with contractors or suppliers. This can result in legal disputes and potential penalties.
- **Non-Compliance with Regulations:** Owners who push for faster completion or lower costs may inadvertently encourage non-compliance with safety, environmental, or quality regulations, leading to legal and reputational risks.

### Loss of Focus on Core Business

- **Diverted Attention:** Owners who spend too much time and energy on the project may lose focus on their core business activities. This diversion of attention can negatively impact the overall performance of the owner's business operations.

### 9) Unwanted Political Interfere into Project Activities

Political interference in construction projects can be a significant challenge in countries like Bangladesh, where governance structures and political dynamics heavily influence public and private sector initiatives. Unwanted political involvement often disrupts the smooth execution of projects, leading to delays, cost overruns, and compromised quality. This interference can manifest in several ways, including the allocation of contracts to politically favored parties, the exertion of pressure on project managers to meet unrealistic deadlines for political gains, or the misallocation of resources to satisfy vested interests.

In the context of Bangladesh, political interference in construction management is particularly problematic due to the country's complex and often volatile political environment. Decisions about project funding, contractor selection, and even regulatory approvals can sometimes be driven by political motives rather than technical or economic considerations. Such interference can undermine the integrity of the project, disrupt timelines, and inflate costs as political actors may demand deviations from the original project plan to suit their own interests.

## CHALLENGES IN CONSTRUCTION MANAGEMENT IN BANGLADESH

1. **Shortage of Qualified Civil Engineer:** In Bangladesh, qualified Civil Engineers are not properly evaluated. Most of the cases, they do not get proper remuneration, wages, even honor in a Bangladeshi organization. So, they go to outside of the country. The trends are continuing for long time. So, the projects are run by unqualified personnel. So, engineering rules & regulations are not followed properly.
2. **Shortage of Qualified Engineering Manager:** Construction is a team works and Engineering/Project manager is the head of all the activities. So an engineering (Construction/Project) manager should have proper Civil Engineering & Management knowledge, wisdom & skills to be a Manager of a construction project. But most of the project, it was found that the Manager did not have proper knowledge & Skills about engineering, construction or management. Even some construction projects were managed by non-technical person who have not any knowledge about engineering & management, he is managing the project by the related Mason. It is directly affecting the quality of the project activities and finally causes of the life safety of human.
3. **Conflicts of Architect & Civil Engineer:** In every construction, at first-a construction project is plan & designed by Architect & Civil Engineer, then it is come to execution means construction level. Especially in Building Construction sector-most of the cases, it is found the lack of combination knowledge (Building Code) of Architectural & Civil Engineering. It is affecting the safety of human life.
4. **Unwanted Interference by Company Owner:** In Bangladesh-it is a very common tendency in construction organization (especially private sector) the company owner tries to interfere in the activity of the project. The main theme of the interference is that "make the profit more at any cost". It is impacted the quality of the project.

5. **Lack of Professionalism & Integrity and Nepotism:** At modern age, everything has improved & developed. But in Civil engineering & Construction sector, we don't get any improvement (except few mega projects). Because most of the personnel of Civil engineering & Construction sector are interested to develop themselves. It is impacted the total Civil engineering & Construction sector. For personal benefit, we some unethical activities finally that impacted the environment and affect the climate as well.
6. **Unprofessional Construction Organization:** There are a lot of construction organization in Bangladesh which don't have any organizational infrastructures but huge construction works. As a result, most of the cases-they produce less quality output.
7. **Practicing Immoral Culture:** In Bangladesh-there is a lot of law & rules but we don't follow those law & rules for mostly our own benefits. But due to this reason, others peoples suffer badly.
8. **Government Policy and Regulatory Framework:** Government involvement is crucial to the development of a structured, transparent, and efficient construction industry. Key policies that need refinement include:
  - i. Land acquisition laws: Delays in land acquisition hinder large infrastructure projects. Streamlining these processes would improve project timelines.
  - ii. Building codes and zoning laws: Enforcing stricter adherence to building codes will ensure higher quality and safer construction practices.
  - iii. Environmental regulations: Implementing stricter environmental regulations will foster sustainable construction practices.
9. **Building Information Modelling (BIM):** One of the most transformative process in construction management globally, BIM integrates various aspects of the construction process into a unified digital model. Through BIM, stakeholders can visualize, simulate, and manage every element of the project in real time. Though still in its infancy in Bangladesh, BIM adoption could revolutionize how projects are planned, executed, and monitored.

**Benefits of BIM:**

  - Reduces errors in design and execution.
  - Enhances collaboration among architects, engineers, and contractors.
  - Improves cost estimation accuracy.
  - Allows for better time management and scheduling.
10. **Drones and Remote Monitoring:** Drones have become instrumental in surveying, inspecting, and monitoring construction sites. These technologies can provide real-time data and identify potential issues early in the construction process. It is rarely using in Bangladeshi construction projects.
11. **Regulatory Issues:** The regulatory framework in Bangladesh can be cumbersome, with lengthy approval processes, corruption, and bureaucratic inefficiencies. These issues often lead to project delays and increased costs.
12. **Skilled Labor Shortage:** There is a significant shortage of skilled labor in the construction sector, which affects the quality and speed of project completion. Vocational training programs are insufficient to meet the growing demand.
13. **Infrastructure Deficiencies:** Poor infrastructure, such as inadequate transportation and power supply, hampers construction activities, especially in remote areas.
14. **Corruption and Mismanagement:** Corruption is a pervasive issue in Bangladesh's construction industry, leading to misallocation of funds, substandard work, and project delays.
15. **Environmental Concerns:** Rapid urbanization has led to environmental degradation, with construction activities contributing to pollution, deforestation, and loss of biodiversity.

## OPPORTUNITIES AND FUTURE PROSPECTS

1. **Public-Private Partnerships (PPPs):** The government of Bangladesh is encouraging PPPs to attract private investment in infrastructure projects. This approach can help overcome funding constraints and bring in expertise from the private sector.
2. **Technological Advancements:** The adoption of modern construction technologies, such as Building Information Modeling (BIM), prefabrication, and automation, can improve efficiency and reduce costs in the construction industry.
3. **Skilled Workforce Development:** Investing in vocational training and education programs can help address the skilled labor shortage and improve the overall quality of construction projects.
4. **Sustainable Construction Practices:** There is growing awareness of the need for sustainable construction practices in Bangladesh. Implementing green building codes, using eco-friendly materials, and promoting energy-efficient designs can reduce the environmental impact of construction activities.

## CONCLUSION

Construction management in Bangladesh faces several challenges, including regulatory hurdles, skilled labor shortages, and environmental concerns. However, with strategic planning, adoption of modern technologies, and a focus on sustainability, the construction industry in Bangladesh has the potential to overcome these challenges and contribute significantly to the nation's development. By addressing these issues, the construction sector can ensure the timely and cost-effective completion of projects, ultimately supporting Bangladesh's economic growth & improving the quality and in finally ensure the safety of life for its citizens.

## RECOMMENDATION

To overcome this situation, some recommendations are listed here that will help to ensure successful project in Bangladesh:

1. Recruit the qualified Civil engineer and qualified engineering/project manager.
2. Intensive feasibility study should conduct before starting a project.
3. Construction organizations should be sincerer to maintain the quality control properly.
4. The regulatory body should be sincerer to observe the project activities.
5. Risk management should be considered a primary tool to assess the project. From the survey it is understood that risk management is not practiced in most of the companies and if followed, it is not done systematically. Immediate mitigation measure should be in place if a risk event happened.
6. During the planning stage, full scale risk assessment about the project should be made as effective measure to curb risk.
7. Financial part of the risk is a global phenomenon and this risk should be handled carefully using financial consultant since this cannot be handled by engineers alone.
8. Most of the company's management follow Top to Down approach which is a traditional approach, but Down to Top approach should be followed so that the employee's voice is heard.
9. Appointment of a risk management consultant in a project would be good option for assessing and managing the risks associated with the project.
10. Construction organizations should use the BIM process for represent the physical & functional characteristics and others physical assets of the projects.
11. Construction organizations should use Drones and Remote Monitoring for properly site monitoring.
12. Further research is needed to develop a more comprehensive understanding of the issue.

## REFERENCES

1. Akintola S A. and Malcolm J M. (1997), Risk analysis and management in construction, International Journal of Project Management, 15 (1), 31-38.
2. Artem A. (2001), Risk management of international projects in Russia, International Journal of Project Management, Vol. 19, 207-222.
3. Berkeley D., P. C. Humphreys, and R. D. Thomas (1991), Project risk action management, Construction Management and Economics, Vol. 9 (1) 3-17.
4. Carr V. and Tah J.H.M. (2001), A fuzzy approach to construction project risk assessment and analysis: construction project risk management system, Advance in Engineering Software, Vol. 32, 847-857.
5. Chris C. (1997) Project risk analysis and management--PRAM the generic process, International Journal of Project Management, Vol. 15 (5), 273-281.



6. David B. and Richard A. (2001), The risk ranking of projects: a methodology, *International Journal of Project Management*, Vol. 19, 139-145.
7. David H. (2002), Extending the risk process to manage opportunities, *International Journal of Project Management*, 20, 235–240.
8. Deviprasadh A. (2007), Risk assessment in Construction Projects, MS thesis, Anna University, Chennai. (<http://www.scribd.com/doc/1456533/13/overview-of-riskmanagement>).
9. Elmar K. and Mark H. (2010), Deliberate ignorance in project risk management, *International Journal of Project Management*, 28, 245–255.
10. Hamzah A. R., Siaw C. L., Chen W. (2012), Risk identification and mitigation for architectural, engineering, and construction firms operating in the Gulf region, *Canadian Journal of Civil Engineering*, 39(1), 55-71.
11. L. Y. Shen, George W. C. W., and Catherine S. K. N. (2001), Risk assessment for construction joint ventures in China, *Journal of Construction Engineering and Management*, Vol. 127 (1), 76-81.
12. Leung H., Kb C., Vm R. T. (1998), A Knowledge-based System for Identifying Potential Project Risks, *International Journal of Management Science*, Vol. 26 (5), 623-638.
13. Martin S. (2007), Post-mortem analysis on the analysis and evaluation of risks in construction project management, *Journal of Business Economics and Management*, Vol. 8 (2), 145-153.
14. Mohammad A. M. and Jamal F. A. (1991), Project risk analytic assessment using the hierarchy process, *IEEE Transactions on Engineering Management*, Vol. 38 (1), 46-52.
15. Nabil A. K. and Saied A. Kartam (2001), Risk and its management in the Kuwaiticonstruction industry: a contractors' perspective, *International Journal of ProjectManagement*, Vol. 19, 325-335.
16. Ofer Z. and Mark A. (2011), The effectiveness of risk management: an analysis of project risk planning across industries and countries, *Risk Analysis*, Vol. 31, (1), 25-37.
17. Paul E. and Clive S. (2002), Managing project risks: a case study from the utilitiesector, *International Journal of Project Management*, Vol. 20, 49-57.
18. Project Management Institute (2004), *A guide to the project management body of knowledge*, third ed. Project Management Institute, Pennsylvania.
19. Robert J C. (1998), The effectiveness of working group risk identification andassessment techniques, *International Journal of Project Management*, Vol. 16 (6), 333-334.
20. Robert J. C. (2001), The controlling influences on effective risk identification andassessment for construction design management, *International Journal of Project Management*, Vol. 19, 147-160.
21. S C Ward (1999), Assessing and managing important risks, *International Journal of Project Management*, 17 (6), 331-336.
22. S. Mohammad H. M., S. Meysam M. and Ahmad M. (2010), Project riskidentification and assessment simultaneously using multi-attribute group decisionmaking technique, *Safety Science*, Vol. 48, 499–507.
23. Terry L. and Martin S. (2004), Project risk management in the Queensland engineering construction industry: a survey, *International Journal of Project Management*, Vol. 22, 51-61.
24. Zhi H. (1995), Risk management for overseas construction projects, *International Journal of Project Management*, Vol. 13 (4), 231-237.