

Review

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Review

Comprehensive Risk Management Strategies in the Construction Sector

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Abstract: In the construction business, which is known for its intricate and strategic nature, it is crucial to have efficient risk management in place. This is because various internal and external elements can cause disruptions to projects. Although the industry has had a historically negative reputation for risk analysis, the methodical process of identifying, analyzing, and managing risks has been more widely recognized and respected. This paper examines the historical progression of construction risk management, highlighting the need to identify and classify risks promptly. The study examines various risk factors related to finance, law, environment, and logistics. The study explores various risk management strategies, such as contract management, risk distribution, evaluation, mitigation, and sharing. The article discusses the significant impact of risk management software, such as Procore, PlanGrid, e-Builder, Autodesk BIM 360, and Oracle Primavera, on improving project results. The study finishes by highlighting the importance of proactive risk management in protecting against financial losses and maintaining a reputation in the construction business.

Keywords: risk assessment; financial risks; legal risks; environmental risks; physical dangers; political risks; completion risks; logistical risks; risk management software

1. Introduction

The intricacy and strategic nature of the construction industry has led to its reputation as a high-risk industry. There is a great deal of internal and external issues, as well as project stakeholders, that could potentially cause major problems. Unfortunately, when compared to other sectors, the construction business has a bad reputation in risk analysis (Laryea, 2008). One can either avoid, reduce, apportion, transfer, or accept risk. This fact is irrefutable (Latham 1994).

Risk is a multidimensional notion that is defined as the likelihood that a destructive event will occur in the project and affect its goals (Baloi and Price, 2003), although it is not always linked to unfavorable outcomes (Wang et al., 2004). Risk in the construction business refers to the possibility that something bad will happen at some point during the construction process. Since a building project has so many moving parts, determining dependencies, correlations, and causes can be challenging. As a result, these risks have a major impact on decision-making and can lower project output (Olsson, 2007).

Managing risks is a crucial part of any project, and most managers are aware of this. (Baloi and Price, 2003). The term "risk management" refers to the steps taken after a threat has been identified and evaluated to bring it down to an acceptable level (Tohidi, 2011). Then, project risk management's primary objective is to track down, assess, and deal with potential threats to the project's success. (Lee et al, 2009).

2. Construction Risks Management History

The method of identifying risk factors and evaluating them became a popular area of study in the 1990s. To examine and evaluate risks, several contractors created a set of thumb rules. Many building projects as a result fell short in terms of schedule, budget, and quality (Al-Bahar, 1988).

During the estimation phase of a project, a systematic strategy can be used to manage the risks and uncertainties in cost and time. Methods for mitigating risks are selected when their causes and potential outcomes for the project have been determined (Birnie and Yates, 1991). Therefore, the sources of risk were separated into two groups, those that were under the project manager's control and those that were beyond it. Considering this finding, numerous risk assessment models have been developed to examine and evaluate construction project hazards during the bidding process (Mustafa and Bahar, 1991).

Few efforts have been undertaken to identify and evaluate building project risks prior to the year 2000. Therefore, there was no standardized method for locating and controlling hazards in building projects. Environment, industry, client, and project risks were identified as four distinct categories in research (Chapman, 2001). Financial, legal, managerial, market, policy, and political risks are the six types identified by another research (Shen, 2001). Risks to the project's budget were classified into resource factors, management factors, and parent factors (Chen et al., 2004). Risk factors can be broken down into human, location, material, and equipment categories (Zeng et al., 2007).

The number of papers on risk identification and assessment published after 2010 increased dramatically. To include risk assessment into a more thorough decision-making framework, researchers have built more complex models. Risk factors were divided into external, legal, and internal (Rezakhani, 2012). The internal risk was broken down into two categories: non-technical, controllable, and technical and uncontrollable. On the other hand, external risk was broken down into unpredictable and uncontrollable. Four major phases of a project's life cycle are Planning, Design, Procurement, Construction, and Handing Over. Each of these contains its own unique set of risks that were discovered by Goh et al. (2013). Several methods have been tried to portray the interdependencies between project risks and the complexity of the environment in which the project is situated (Lazzerini and mkrtchyan, 2011). According to Hwang et al. (2014), small construction projects are less likely to apply risk management because they have fewer resources, a smaller profit margin, and a higher opportunity cost. The findings showed that small projects' quality, cost, and schedule performance all improved after risk management was put into place.

3. Types of Risk and management techniques in Construction Projects

Types of Risk

There are numerous classifications for risks in construction. External and internal risks were identified by Tah et al. (1993) for projects. Inflation, currency exchange rate fluctuations, technology change, politics, climate, and natural catastrophes are all examples of external risks. They are difficult to manage, therefore it's important for businesses to monitor and plan for potential risks all the time. On the contrary, internal risks differ from project to project and tend to be more manageable. Uncertainties in areas like labor, plant, material, subcontractors, resources, and site circumstances are all considered internal risks.

Numerous researchers have identified several risk factors. These factors are divided into various categories depending on the type of risk they pose, including physical, environmental, design, financial, contractual, legal, construction, political, and delay risk (Mustafa, 1991; Wang et al., 2010; Razakhani, 2012; Goh et al., 2013).

Risk management techniques

Risk identification, risk analysis, and risk response are the three components of a systematic approach to risk management in the construction business. Analyze means to look over the contract, find the problematic terms, and try to negotiate them as much as you can. React is to detect issues early and provide immediate written notice. It also means to keep an eye out for the problematic clauses once the task is underway. Manage refers to keeping an eye on issues once they have been identified to minimize risk or optimize recovery. Some strategies to minimize risks on construction projects are given below.

Contract management

In essence, there are two chances for contractors to recognize, manage, and eliminate construction hazards. The first and best opportunity is during the precontractual or negotiation stage, and the second opportunity is during the administration or performance of the contract stage. Depending on how successful he was in the first stage, which involved contract negotiation, will determine how much work the contractor will need to put into problem identification, management, and resolution in the second stage, which is throughout the job. The astute, cautious contractor will understand that paying close attention to his contract before signing it will make job performance simpler and significantly less risky.

Risk Allocation

By transferring risks to those who can manage them best, contractors can reduce their risks. For instance, the contractor can transfer some risks to the owner, architect, or other parties by incorporating suitable indemnification terms in contracts. Three factors—contractual structure, payment structure (price fixing), and risk management in partnership projects—were highlighted by Osipova and Eriksson (2011) as the foundation for evaluating risk allocation in construction projects. Capability risks, contractual and legal risks, economic risks, physical-factor risks, and political and societal risks are the five key groups that Lam et al. (2007) identified. The authors adhered to the idea that risk should be distributed to the contracting party most qualified to manage it.

Risk Assessment

The initial identification of the pertinent and probable hazards connected to the construction project serves as the beginning of the risk management procedure. Since only identified potential risks may be used in the process of risk analysis and response management, it is of utmost relevance. By thoroughly assessing the risks before beginning the project, contractors can reduce their exposure to them. As a result, it will be easier to recognize potential hazards and develop and carry out plans to reduce or eliminate them. As a result, the contract serves as the first line of defense in cases involving construction law. Andi (2006) argues that it is critical to accurately identify significant risks and properly assign them to the contractual parties in order to manage risks in building projects.

Risk Mitigation

Risk reduction is achieved through either reducing exposure to it or merely minimizing the expected harm (Brown and Chong, 2001). By taking steps to lessen the likelihood or impact of risks, contractors can lower their exposure to risk. The use of quality control methods, emergency preparation, or job scheduling to avoid hazardous weather conditions are a few examples of such tactics. Contractors should select how to handle or treat each risk and develop appropriate risk treatment techniques or mitigation measures within a framework of risk management. These risk-mitigation strategies often consider the nature and probable outcomes of the risk. The primary goal is to reduce potential effects as much as possible and to maximize risk control. The goal of the risk management process is not to eliminate all hazards from a project. Its goal is to create a structured framework to aid in helping decision-makers effectively and efficiently manage risks, especially the important ones (Perry and Haynes, 1985).

Risk Sharing

Contractors can reduce risks by splitting them with other project participants, such as suppliers, subcontractors, or insurance firms. Sharing risks can reduce the influence of any one party and help spread out the expense of risk management. Wieland and Meinholz (1983) sought to demonstrate that: "If risks are shared, the contractor can reduce the amount for contingency expenses which he puts in his bid." By assigning some risks to insurance firms through the acquisition of suitable insurance policies, contractors can reduce their risks. This can shield the contractor against monetary

costs brought by unanticipated occurrences such claims of property damage, bodily harm, or professional malpractice.

Contract Review

Verifying that the stated contract sum is the price that was agreed upon between the contractor and his customer is only one aspect of reviewing a construction contract before it is signed. When doing a contract review, the contractor must concentrate on a few clauses that are present in almost all construction contracts and may have a significant financial impact. No-damage-for-delay agreements, condition precedent payment clauses, indemnity clauses, dispute resolution processes, notice requirements, and claim submission processes are a few examples of these clauses. Although every clause in the contract should be thoroughly examined, many of them are routine in nature and, barring extremely rare circumstances, offer almost no risk to the contractor. The contractor can take significant steps to reduce the likelihood of construction-related legal issues he will encounter once work on the project begins by concentrating on a few important provisions, comprehending how they operate, and negotiating them skillfully.

Risk management through Software

Risk management software is one of the instruments frequently used in the modern construction business to control hazards. Construction businesses can better manage project risks, improve project outcomes, and complete projects more quickly and effectively using potent tools like Procore, PlanGrid, e-Builder, Autodesk BIM 360, and Oracle Primavera. Although the cost of deploying and maintaining these software solutions can be high, many construction businesses believe the investment is beneficial because the software can help cut costs related to project delays, cost overruns, and quality problems.

Procore software can manage, save, access, and share data from a single, encrypted, cloud-based data source protected by industry-leading security procedures. With PlanGrid, stakeholders may keep tabs on hazards in real time, have open lines of communication with the project team, and take preventative or mitigating action. On the other hand, Autodesk BIM 360 provides a consolidated platform for managing risks across the lifecycle of a construction project by providing stakeholders the tools to detect, evaluate, and manage risk successfully. (Balakrishnan, 2018). Whereas, e-Builder enables the measurement and management of the whole capital project delivery process, including planning, design, procurement, construction, and operations. Finally, Oracle Primavera's sole function is as a tool for managing projects. Primavera P6 is utilized in the phases of preparation, scheduling, monitoring, and implementation.

4. Management in Different types of risks

Key risks include finance flow, political, completion, environmental, and logistical risk. Some of their management strategies are given below.

Cash Flow risk management

Consistent reporting on the project's financial status might help to spot cash flow problems and plan for their resolution. Preventing cost overruns and minimizing cash flow concerns can be accomplished through proper cost management, which includes the implementation of cost controls and accurate cost forecasts. Preventing payment delays and minimizing cash flow concerns can be achieved through the implementation of solid contract management systems, such as the establishment of clear payment terms and dispute resolution mechanisms. (Abd El Razek et al., 2014).

Political risk management

Political risks can be reduced by conducting a thorough risk assessment to identify possible political hazards and their influence on the project. Political risk insurance is a viable option for protection against financial losses resulting from political risk. (Cheng et al., 2018). The potential for

legal conflicts can be reduced by adhering to local regulations. According to Bonner (1981), multinational enterprises should only put money into "safe" locations, avoiding those with a higher-than-average risk profile. Transferring or dividing up risks amongst other companies is one way to lessen their impact.

Completion risk management

Project delays and cost overruns can be reduced with careful planning that takes risks into account and lays out defined milestones. (Kokkaew & Wipulanusat, 2014). By keeping tabs on the project's progress and communicating openly and often, problems can be spotted and fixed before they have a chance to cause significant delays or cost overruns. Contractors can be encouraged to meet deadlines and quality standards by including contractual safeguards like these in their contracts, such as liquidated damages, performance bonds, and warranties. (Kokkaew & Wipulanusat, 2014).

Environmental risk management

An environmental impact assessment is a useful tool for foreseeing and addressing potential environmental concerns. Maintaining environmental responsibility during construction can be aided by adhering to applicable environmental regulations. The negative effects that construction has on the environment can be lessened using waste management strategies like sorting waste, recycling, and properly disposing of hazardous items (Dione et al., 2005).

Logistical risk management

Identifying potential logistical hazards and creating appropriate mitigation techniques can be achieved through careful project planning. Timely and effective delivery of goods and equipment can be ensured by establishing trustworthy supply chains, which include contingency plans for unexpected disruptions. (Sullivan et al., 2011).

5. Conclusion

Effective risk management tactics can assist contractors reduce potential negative outcomes and guarantee the successful completion of building projects. Contractors can effectively manage project risks using risk identification, analysis, and response methods, as well as through the management of contracts, allocation, assessment, mitigation, and sharing of risks. The purpose of risk management is not to eradicate all potential dangers, but rather to provide a systematic approach to dealing with them. Software specifically designed for risk management can also aid in the practical application of risk management techniques. By putting risk management first, contractors can safeguard themselves from financial losses and establish themselves as trustworthy and accountable business associates.

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