

**ASSESSMENT OF RISK FACTORS AND THEIR
CASCADING IMPACT ON THE PROJECT LIFECYCLE
INCLUDING MEGAPROJECTS**

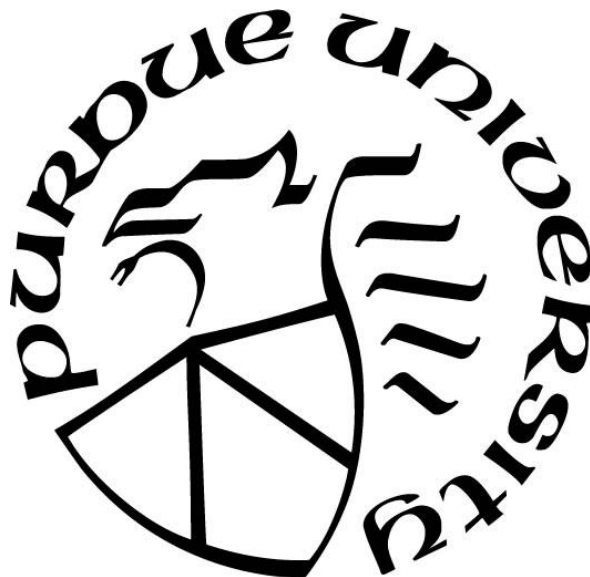
by

Oluwaseun Ogundipe

A Thesis

*Submitted to the Faculty of Purdue University
In Partial Fulfillment of the Requirements for the degree of*

Master of Science in Civil Engineering



Lyles School of Civil Engineering

West Lafayette, Indiana

November 2023

ABSTRACT

The high stakes and complexities of infrastructure projects and megaprojects (IPMP) involves substantial financial investments, resources, time, construction experts and provide economic benefits to the host communities. They are a coherent story that forms the basis and source of employment, infrastructure development, job creation, efficient and sustainable amenities, and regional competitiveness. Despite the numerous benefits of megaprojects and their drive for economic growth, they have experienced consistent failures resulting in financial loss, cost overrun, time extension, environmental disruption and impact on financiers and stakeholders. These failures are indicative of the level of assessment and management of risk, and the undertaking of inadequate control processes leading to the failures.

Previous studies have established the risks factors responsible for IPMP failures and have subsequently identified the management processes for risk identification, impact assessment and the mitigation responses. The studies have been credibly presented and relied on by construction professionals. However, a gap in the risk management suggests a need to further investigate risks factors and their influence on project lifecycle. This research investigates the risk factors impacting the lifecycle of projects and megaprojects leading to their delays, cost overrun, quality and other project challenges. It also presents the different categories of risk factors such as Political Risks, Economic & Financial Risks, Planning & Design Risks, Construction Management, Safety, & Quality Risks, Contracts & Legal Risks, Resources & Technology Risks, and Health & Environment Risks that occur in every project's lifecycle (Pre-planning, Planning, Execution and Closeout). A research survey was developed, and responses were requested from construction professionals. The responses were analyzed with two methodologies to meet the needs and objectives of the study.

Firstly the research identified the risks factors, their categories, and the level of occurrences throughout the project's lifecycle. In addition to the risk occurrences, a ranking analysis using relative importance index was also used to assess the ranking of the risk categories. In the first objective, the research concluded that certain categories of risk occur more frequently than others at different phases of projects and megaprojects. This result will enable the proper planning at every phase of construction projects. It also assists stakeholders' preparation on the likely risks at every phase of the project.

Furthermore, this research investigates the cascading behavior of risks factors in project phases. The multinomial logistics regression was used to analyze the progression of risk factors from

one project phase to another leading to constraints and disruption in cost, schedule, quality and safety. The analysis presented observations that while all risk factors may navigate through all the projects phase, some risk factors have greater impact from one phase to another. This research noted that certain categories of risks factors will navigate from pre-planning to planning to execution to closeout, some will progress from planning to execution to closeout while some will originate from the pre-planning phase and cause more impact on the execution and closeout phase. This objective and the inference will aid the monitoring of identified risks factors in all project phases. It will be a veritable tool for the management of risk impact on the project outcomes.

This research analyzed the data collected from experts in the industry and the details were used to present results for the research objectives. Using the relative importance index, the first research objective was analyzed, and the result shows the occurrence and impacts of risk factors at each phase of a construction project. Having categorized the examined risk factors into different categories, the first research objective noted that construction, quality and safety risk factors predominantly occurs and impacts all phases of construction projects and megaprojects. Results from the second objective indicate that risk factors progress on a different path prior to impacting the project metrics (cost, time, quality & safety). One of the results explains that if shortage of labor and resources is not adequately planned at the project pre-planning stage, this risk factor will mostly affect the project execution and affect the cost of the project. If the same risk factor is not addressed at the planning stage, it will impact on the execution and affect the project schedule.

Generally, this research highlights the importance of proactive risk management in all projects and megaprojects. It addresses the unnoticed risk challenges leading to incessant failures in the construction industry. Adopting proactive and holistic risk management, project team members and stakeholders can predict potential threats and develop workable plans to minimize these impacts. The research emphasizes that failures in the construction of megaprojects are not pre-defined, and a successful construction process can be achieved through comprehensive and proactive risk management practices. Understanding the existing project challenges and leveraging on a proactive risk assessment process will foster the delivery of IPMP while minimizing negative impacts on cost, schedule, quality, safety and stakeholders' interests.