



Risk Management in Libyan Engineering Projects: Challenges, Strategies, and the Tripoli West Ring Road Case Study"

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Abstract

The aspect of risk management is a core element in the successful implementation of engineering projects especially in a place where there is a politically unstable situation and weak institutions like in Libya. The engineering and construction industries in Libya have experienced an extreme strain in the last ten years since the country has been affected by unremitting conflict, inadequate governance, unstable oil revenues and lack of coordinating institutions. Such circumstances have resulted in a complicated risk environment which spans across the conventional technical and financial aspects into political, social and environmental aspects. This paper examines issues, approaches and uses of risk management in Libyan Engineering projects using qualitative research methodology of literature review, documents analysis and case study of a leading infrastructure project in Tripoli. The analysis reveals the most essential risk types, such as political, financial, technical, environmental and social, and assesses how each of these risks affects the performance of the project, i.e., costs, schedule, and quality. The results indicate that the most common and the most severe risks are political and financial ones, which explain the most frequent project failures and cost increase. In addition, lack of standardized risk frameworks and the paucity of institutional capacity also leads to the inconsistent results of projects. The paper also considers how global standards including the ISO 31000 and the PMBOK Guide can be adapted to the fragile Libyan environment. It finds that risk management in Libya will necessitate not only technical equipment but also governance change, involvement of stakeholders, and capacity building of institutions. The study suggests that a national risk management framework that is specific to Libya challenges should be developed, with the focus on proactive planning, online risk management, and cross-sectoral cooperation. These can contribute to resilience and better implementation of projects and provide the foundation to sustainable development of infrastructure in vulnerable settings.

Keywords: Risk Management, Engineering Projects, Libya, Fragile States, Project Governance, Infrastructure Resilience.

1. INTRODUCTION

Any engineering project irrespective of the size or scope is bound to be subjected to risks. Project risks refer to uncertain events or conditions that can affect the achievement of project objectives, including cost, schedule, quality, and safety. These risks can be

technical, financial, environmental, social, or political in nature. In fragile or unstable contexts, such as Libya, political instability and institutional weaknesses significantly increase project uncertainties. Understanding and identifying these risks is essential for proactive planning and effective risk



management throughout the project lifecycle. In more developed and politically stable nations, these risks can be limited to technical, financial, or environmental aspects which are somewhat predictable and can be handled through a set of organized procedures (Kerzner, 2018). But in weak systems like Libya the risk environment is much more complicated. In this case, the risks will be not only engineering but also become connected with the failure of governance, economic fluctuations, political instability, and repetitive security outages (Amara and Jreisat, 2019; World Bank, 2021). Risk is an operational challenge, then, not only, but an operational variable which defines the project as a project, given the possibility of a successful project delivery. Libya as a country with rich oil deposits and strategic position in North Africa has long

been regarded as a country with great development opportunities. After the 2011 uprising, the reconstruction of infrastructure was a national and international agenda. They were roads, energy facilities, construction of residential houses, and water systems, which were recognized as urgent needs, and billions of dollars were spent on reconstruction (UNDP Libya, 2021). However, ten years later, some of these projects are left behind or unfinished. This is a trend of poor performance that is strongly connected to the lack of efficient risk management systems that would allow predicting and preventing the obstacles before they increase (Hillson, 2017). Risk management is an important aspect of engineering management that can be applied to make sure that project goals, including cost, time, quality and safety are fulfilled within reasonable uncertainty levels.

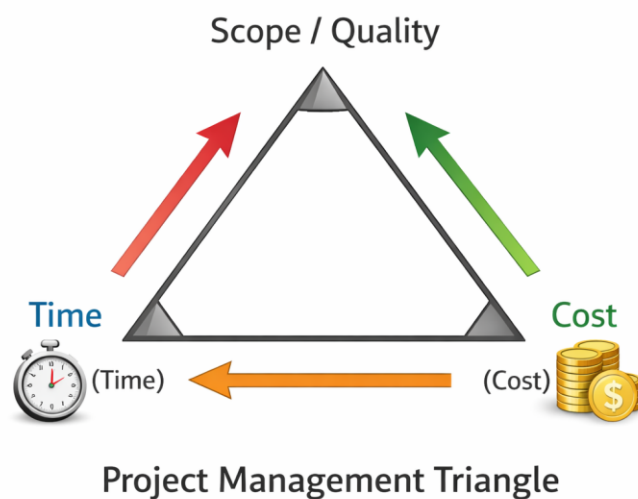


Figure1 Project Management Triangle
(Relationship between Time, Cost, and Scope/Quality)



It is a scientific process of identifying, evaluating, and managing risks during the project life cycle (PMI, 2021). These systematic approaches are not strong or consistently used in Libya. Most engineering companies do not have detailed risk registers, contingency plans and decision-support systems and their projects are prone to immediate shaking in terms of funding, security and governance frameworks.

In addition to that, the lack of coordination between the public and private sectors, institutional fragmentation, and the everchanging oil revenues complicate the challenge of establishing strong risk management frameworks (AfDB, 2020). Regulatory oversight has also been compromised by political division and periodical war which also discourages foreign contractors which further diminishes the ability to deliver the projects effectively. As a result, the Libyan engineering projects are highly prone to cost overruns, schedule overruns, and quality shortfalls, problems that are systemic of larger scale risk systems as opposed to those that plague individual projects. To meet these challenges, the contextualized approach that would bring international risk management standards and local realities together is needed. The strategies should be efficient taking into consideration the political risk, security instability, and logistical limitations as well as capitalizing on the local experience and strength building systems that have been acquired over years of working in uncertainty. This research will seek to focus on how risk can be proactively rather than reactively managed with an aim of achieving more sustainable infrastructure projects in the weak environments by studying the issues,

measures, and uses of risk management in Libyan engineering projects.

2. LITERATURE REVIEW

Risk management within the engineering field 29 has been actively examined under a variety of different settings, both developed and emerging, both, industrialized and war-torn economies. Chapman and Ward (2011) proposed some underlining principles of project risk management with particular focus on the systematic approach to risk identification, assessment, and response. Their framework continues to be one of the pillars of the current project risk practices. Kerzner (2018) has extended this argument by emphasizing the fact that organizational integration is critical, where risk management processes are integrated in all stages of the project lifecycle instead of considering them as isolated tasks. This combined outlook highlights the fact that risk management should be proactive and ongoing in order to promote project success.

2.1 Adversity in Frail surroundings.

Risk in fragile and post-conflict conditions takes complex and multidimensional forms which are not always reflected in the traditional frameworks. Amara and Jreisat (2019) claim that the ineffective governance systems in Libya increase the risks of the projects, since the dysfunction of the institutions and political instability erode the regulating systems, accountability, and decision-making. As Hillson (2017) also observes, risk management strategies have to be dynamic in the volatile environments, that is, they must be able to respond to the changes in socio-political and economic conditions.



According to the World Bank (2021), the ongoing conflict and political fragmentation in Libya has interrupted institutional continuity, which causes uneven project funding, low transparency, and lack of stakeholder confidence. These problems have led to the delays of the projects, overruns of their costs, and termination of important infrastructure projects. The African Development Bank (2020) indicates that the dynamic security situation and the changeability of oil revenues further limit the government in terms of its capacity to make regular investments in the engineering and construction projects. This supports the idea that the project risk in Libya is not confined to technical areas, rather it is deep-rooted in political and economic instability.

2.2 Effective Risk management Strategies.

In solving the aforementioned issues, researchers have insisted on the need to have context-responsive risk management measures. Hillson (2017) recommends the use of flexible and adaptable risk management models capable of changing with the changing conditions. In a similar vein, both PMI (2021) and ISO 31000 encourage an integrated and holistic view of risk and emphasize active mitigation, constant monitoring, and stakeholder engagement as primary aspects of effective practice.

Empirical research in developing nations proposes localization of globalization is paramount. Kwak and Anbari (2012) discovered that frameworks like PMBOK and ISO 31000 offer excellent theoretical material but their applicability relies on how it co-exists with the local governance structures and cultural values. Albogamy et al. (2013) reported that risk management is not used in the Middle East and North Africa (MENA) region because of absence of institutional

support, training, and ineffective data systems to assess risks. As a result, capacity-building, policy reform, and institutional collaboration have been mentioned as the key methods to enhance project resilience in weak situations.

3. ENGINEERING PROJECT USES.

The use of risk management in engineering is still in its infantile state in Libya. According to the reports by UNDP Libya (2021), a significant number of infrastructure projects run without a proper risk assessment framework and contingency planning. The engineering companies tend to depend on the response actions instead of the active detection and prevention. Lack of uniform risk management policies that are applicable in the ordinary institutions also hampers the uniform application of best practice.

Still, there are new instances of improvement. Certain Libyan oil and construction firms (with international partners frequently on their side) have started to incorporate structured risk analysis instruments, e.g., qualitative and quantitative evaluations, Monte Carlo simulations, and stakeholder risk mapping, into project planning phases. Kerzner (2018) emphasizes that the practices are better incorporated into organizational culture to increase project predictability and performance, despite the inability to predict the environment. Also, the combination of recent digital applications, including Building Information Modeling (BIM) and risk analytics based on data can help to enhance the warning systems and decision making in complex engineering projects to a large extent (Aven, 2016).

4. METHODOLOGY

The research methodology used in this study is a qualitative research methodology that incorporates literature review, document



analysis, and case study evaluation. The main sources of information can be primary (project reports, government evaluations and engineering evaluations), whereas secondary sources are peer-reviewed academic articles and international risk management models (Yin, 2014). Triangulation is also used to enhance the validity of results through cross verification of data.

The case study used is the road construction project in Tripoli which was selected on the basis of the representative challenges of the road project including security disruptions, supply shortages, and conflict amongst the stakeholders. Through the case study, the research indicates how external risks (e.g., political violence) and internal projects risks (e.g., contractor inexperience) interact. The methodology focuses on situational analysis to know how risk framework can be designed to fit weak environments such as Libya.

The engineering and construction industry of Libya is dominated by state-led investments mostly on oil and energy, housing, and transportation. Nevertheless, in the years following 2011, the mass construction of infrastructure was stalled due to political fragmentation, lax regulatory control, and lack of a unified national vision (World Bank, 2021). The demands of urbanization and deterioration of infrastructure have added to the necessity of resilient and adaptive planning (UNDP Libya, 2021). The international partnerships are present but tend to be politically oriented, whereby they concentrate on the priorities of the donor and not domestic needs (Eljarh, 2020). What is left is an industry that is full of inefficiencies, duplication of projects and general dumping.

5. A-RISK IDENTIFICATION IN THE LIBYAN ENGINEERING PROJECTS.

The engineering projects of Libya are vulnerable to a broad risk range: political, financial, environmental, technical, and social. Political violence has been one of the prevailing factors, and armed groups have often interfered with the construction activities. Financial risks are due to the oscillating oil revenues and the late payments of the state institutions. The inexperience of the contractor, bottlenecks in the procurement process, and unskilled workforce aggravate technical risks (Smith et al., 2020). Sand encroachment, desertification and mismanagement of ground water, especially in south areas are some of the environmental dangers. The social risks are caused by the resistance of community, the land disputes and ineffective public engagement strategies. Most of these dangers go unreported because there are no monitoring mechanisms and official records (Alashhab et al., 2020).

B-Case Study: Tripoli Road Construction.

The Tripoli West Ring Road was initiated in 2018 to provide access to the industrial area by the residential areas. But the project had significant delays, such as 18 months delay caused by shortages of cement, contractors feuds and militia threats. First, there was no well-built risk management plan that was inculcated in the project. Consequently, premature disruptions had significant effects on project timelines and budgets. . After the delays, new precautions were implemented: finding alternative suppliers, working with local security escort and weekly review meetings with stakeholders. These changes enabled the recovery to some extent and prevented excess expenses. This example demonstrates the importance of active and dynamic risk management activities in weak settings (PMI, 2021).



6. DATA ANALYSIS & RESULTS

Project data analysis of the World Bank and UNDP has shown that almost 43 percent of the infrastructure projects in Libya since 2011 have not achieved their goals. Foreign-collaborative projects were proven 25 times more successful, and this risk control is the main reason and the need to meet international standards (World Bank, 2021). The cost overruns were averaged as 38, and the delay with the project was mostly longer than scheduled. In over 60 percent of the reviewed projects, there was none of the risk mitigation plans (Alashhab et al., 2020). A further revelation that emerged after interviews with engineers is that majority of local companies rely on informal risk identification frameworks like personal judgment as opposed to formal frameworks.

7. DISCUSSION

This research has indicated that the success of risk management in the Libyan engineering industry is still limited by structural, institutional and contextual factors. The findings validate the previous position of Amara and Jreisat (2019) and the World Bank (2021), who viewed the weak governance and political instability as the most significant sources of project uncertainty. With the Tripoli West Ring Road project, the lack of a well-organized risk management plan and emphasis on responding to risks was a reflection of a wider national norm where the projects are undertaken without effective risk frameworks. This confirms the claim made by Kerzner (2018) that, in the absence of organizational integration of risk management, the results of projects will be very unpredictable.

The major finding during the analysis is that the risk in the Libyan engineering projects is

interdependent and multidimensional. Financial disruptions are usually caused by political risks like militia interference, whereas technical and schedule risks are enhanced by supply problems and skills deficiencies. Such interconnectedness implies that conventional linear risk assessment models cannot be used in weak situations. Rather, more proper risk management frameworks are the adaptive and dynamic ones, suggested by Hillson (2017), and that better fit the context of high uncertainty and institutional instability.

In addition, the relative excellence of the projects that have foreign collaboration (25 per cent more successful) highlights the importance of international best practices and formal supervision systems. Projects that are under international supervision normally use formal risk registers, contingency budgets, and routine audit- all which are in large numbers not evident in projects that are managed locally. This is in line with the findings of Kwak and Anbari (2012), who postulate the necessity to match international standards such as ISO 31000 and the PMBOK with the realities of local governance in order to become more effective.

The other important lesson is related to the importance of capacity and institutional culture. It was found that the local engineering companies mostly rely on personal experience as opposed to formalized processes of risk identification and risk management. Such dependency on individual judgment is indicative of deficit of the institutional learning processes and highlights the necessity of systematic training and documentation processes. Embarking on the culture of risk awareness in the projects, as Albogamy et al. (2013) observe, requires the presence of capacity-building components and



institutional reform, especially in post-conflict or developing societies.

The case study also reflected that although very small adaptation steps, including coordination among the stakeholders, finding alternative suppliers networks, and local security provisions can significantly reduce the disruptions. These precautions demonstrate that the contextualized risk management does not always involve the use of advanced tools but instead it involves a flexible decision making, communicational and coordination of actors.

In a more comprehensive theoretical approach, the results support the idea that risk management in such weak conditions as Libya should not be limited on technical control but should also be seen in terms of governance, social interaction, and institutional resilience. Transparency, preparedness and constant learning can be used to transform risk into a manageable variable. The incorporation of digital tools, including BIM and risk analytics, helps to increase the predictive potential and accuracy of the decision-making process and contribute to the gap between the global approaches and the in-country execution.

Overall, the discussion shows that the issues that risk management in the Libyan engineering projects is having are systemic but not unsurmountable. Through institutional capacity building, regulatory uniformity and adaptive practices, Libya can have a more robust foundation of engineering project success despite the weak political and economic circumstances it faces.

8. RECOMMENDATIONS

1- Formulate a National Risk Management Framework:

The creation of a common structure adapted to the environment of Libya, combining the

international best practices (ISO 31000, PMBOK) with the domestic governance system to normalize the project risk assessment and mitigation.

2- Enhance Institutional Strength:

Invest in training programs of engineers, project managers and government officials in order to increase their knowledge on risk identification, risk assessment tools, and risk mitigation strategies.

3- Increase Governance and Transparency:

Establish accountability systems within project management procedures to minimize corruption, to facilitate funds on time and to facilitate decision-making consistency.

4- Encourage Stakeholder Co-operation:

Enhance the collaboration between government agencies, non-governmental contractors, donors, and local communities to synchronize project goals and reduce conflicts and enhance communication in the event of crisis.

5- Embark on the use of Digital Risk Management Tools:

Use the technologies like Building Information Modeling (BIM), monitoring based on GIS, and analytics that is data-driven to improve the real-time risk tracking and predictive decision-making.

6- Foster Local-International Relationships:

Enhance the cooperation with foreign organizations and engineering companies that have a background of working in high-risk environments to share the knowledge and develop sustainable project management systems.

7- Make Continuous Monitoring and Evaluation an Institution:

Create a centralized risk database as well as regularly audit project performance in order to



be adaptive in learning and continual improvement in the engineering sector.

9. CONCLUSION

This paper has analysed the dynamics of risk management in the engineering projects in a volatile and fragile environment in Libya. This result shows that the risks associated with the Libyan engineering projects are not necessarily technical or financial, but rather are inseparably linked to political instability, poor governance, institutional weakness, and low levels of regulatory control. The case study of the Tripoli road construction showed that the lack of organized risk management systems contributes in great magnitude to the weaknesses of the project, which results in cost escalation, schedule slippage, and poor quality.

The discussion revealed that despite the fact that international standards like ISO 31000 and the PMBOK Guide have got all-inclusive procedures of identifying risks, evaluating and controlling them, their applicability in Libya is limited by context. Security insecurity, irregular funding, and the unskilled individuals are some of the difficulties that hinder the systematic implementation of these structures. However, as also demonstrated in the case study, the adaptive strategies (i.e. coordination among stakeholders, contingency planning, supplier diversification, etc.) can enhance resilience and to some extent counteract external shocks.

Conclusively, to manage risks successfully in the engineering sector of Libya, there is need to have more than mere compliance with the procedures but rather, contextual adaptation, institutional fortification and a proactive risk awareness culture. Risk management may be integrated into the initial design and implementation activities of engineering projects to convert the uncertainty into a

manageable part of the development process as compared to a hindrance to the development process.

10. REFERENCES

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Supporting Data and Visualizations

Risk Distribution in Libyan Engineering Projects

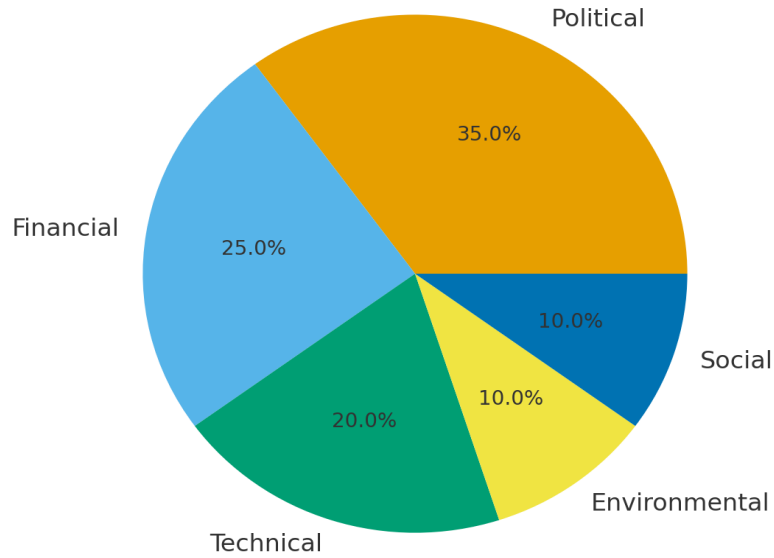


Figure 1 Distribution of Risks in Libyan Engineering Projects

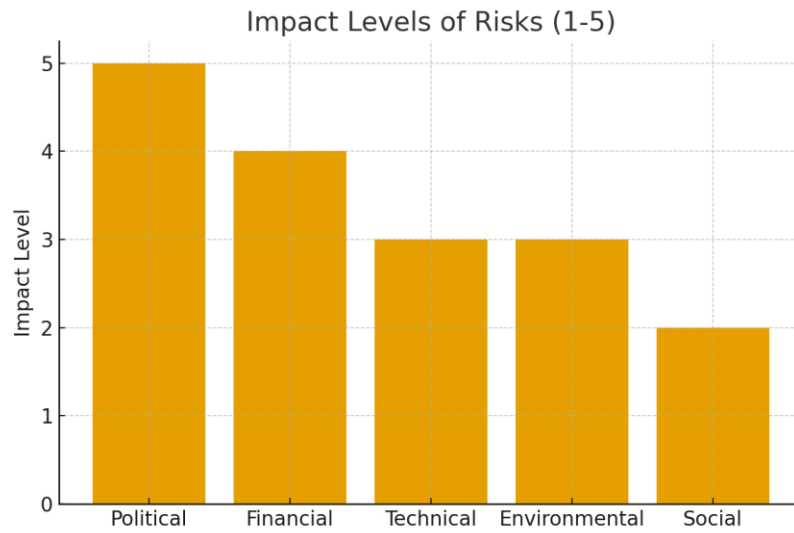


Figure 2 Impact Levels of Different Risks (Scale 1–5)

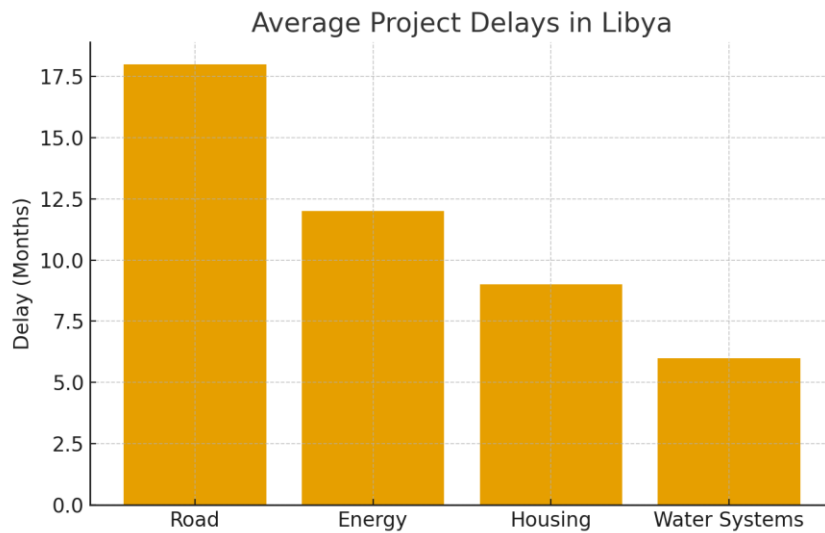


Figure 3 Average Delays in Libyan Projects by Sector



Table 1: Project Risks and Average Delays Data

Risk Type	Frequency (%)	Impact (1-5)	Project Type	Average Delay (Months)
Political	35	5	Road	18
Political	35	5	Energy	12
Political	35	5	Housing	9
Political	35	5	Water Systems	6
Financial	25	4	Road	18
Financial	25	4	Energy	12
Financial	25	4	Housing	9
Financial	25	4	Water Systems	6
Technical	20	3	Road	18
Technical	20	3	Energy	12
Technical	20	3	Housing	9
Technical	20	3	Water Systems	6
Environmental	10	3	Road	18
Environmental	10	3	Energy	12
Environmental	10	3	Housing	9
Environmental	10	3	Water Systems	6



Social	10	2	Road	18
Social	10	2	Energy	12
Social	10	2	Housing	9
Social	10	2	Water Systems	6