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## Acronyms

|  |       |
|--|-------|
| 1. Corporate Social Responsibility       | CSR   |
| 2. Environmental Impact Assessments      | EIAs  |
| 3. Environmental, Social, and Governance | ESG   |
| 4. Final Investment Decision             | FID   |
| 5. International Oil Companies           | IOCs  |
| 6. Liquefied Natural Gas                 | LNG   |
| 7. Million Tons Per Annum                | MTPA  |
| 8. Project Management Body of Knowledge  | PMBOK |
| 9. Trillion Cubic Feet                   | tcf   |

# **Risk Management in LNG Projects in Eastern and Southern Africa: A Comparative Analysis of Mozambique and Tanzania**

## **Abstract**

The paper does comparative analysis of risk management in liquefied natural gas (LNG) projects between Mozambique and Tanzania. Both countries have significant reserves of natural gas, but they are troubled with different challenges. For Mozambique, it has to battle with security threats known as the Cabo Delgado insurgency; for Tanzania, it faces regulatory inefficiencies and disputes on revenue share. Environmental risks such as methane emission and habitat disruption have tended to threaten the sustainability of the projects. The study assesses the effectiveness or inefficacy of those risk mitigation strategies across these two contexts through the following mixed methods: interview, survey, and document review used to address three questions; adopted strategies, effectiveness, and lessons learned. Results proved that both countries had been practicing environmental monitoring, stakeholder involvement and financial hedging but still continued to face the challenges of governance, enforcement of regulations, and technical capacity. At the end, it advocates for integrated risk management frameworks, an enhanced collaborative effort on the stakeholder, and regulatory reforms for increased project resilience. The research, by contextualizing these challenges in developing countries rich in resources, derives actionable insights for policymakers and industry players towards economic development alongside risk mitigation.

**Keywords:** LNG projects; risk management; Mozambique; Tanzania; comparative analysis; governance; stakeholder collaboration; regulatory reform.





## 1. Introduction

6 The Mozambique and Tanzania offshore natural gas reserves have made it possible for East and Southern Africa to shape an emerging hub in the nacre of the liquefied natural gas (LNG) market globally (Vásquez, 2022). The opportunity has attracted substantial foreign direct investment from multinational energy corporations such as TotalEnergies, ExxonMobil, and Shell (Felix, 2024). Rovuma Basin in Mozambique is estimated to have a total of around 100 trillion cubic feet (tcf) of natural gas, and Tanzania's Mnazi Bay and Mtwara regions, containing more than 57 tcf, are among the world's largest untapped reserves (Nakanwagi, 2021). These discoveries promise extremely significant implications for revenue generation, with gutting revenues being forecasted to exceed \$50 billion for Mozambique with respective Coral South FLNG and TotalEnergies-led LNG projects. Tanzania's LNG Hub Project, on the other hand, seeks to raise \$30 billion in investments (Neethling, 2021). The investment will subsequently channel the natural gas into big servicing Asian markets like India and China, and Southeast Asia, thereby transforming their economic trajectories while promoting the vision for Tanzania's Vision 2025, whose ambition is to attain middle-income status (Szymczak, P. D., 2023).

A great LNG economic possibility exists in Mozambique and Tanzania; however, this is accompanied by great disadvantages because LNG projects are capital-intensive and usually take long development periods. Thus LNG projects are under constant threat from political, environmental, market, and operational forces (Al-Kuwari, 2023). Extractive industries are, more often than not, characterized by the very fact that more than 800,000 people have been displaced by the Cabo Delgado insurgency, and several projects have slowed down due to such conditions in conflict-sensitive environments (BONATE, et al., 2024). In Tanzania, regulatory uncertainty and controversial agreements on revenue share hold up project advancement, presenting a stark example of governance imbalances in resource-rich developing economies (Clabough, 2020). Environmental issues that affect the LNG industry compound the complexities of the operating environment. Methane emissions, habitat destruction, and marine pollution associated with the LNG industry require heavy risk management frameworks (Simpa, P., et al., 2024). Gas market tariffs are also a financial risk to these projects because any expected difference in pricing and demand may critically impede the economic feasibility of infrastructure investments (Yusuf, N., et al., 2023). Therefore, good risk management is not only a technical requirement but also a strategic necessity for the sustainability and success of LNG projects in East and Southern Africa.

Risk management is one of the key aspects of any LNG project, but research on the subject is very fragmented and tends to focus only on individual projects rather than comparing them across regions. These studies assess risk factors mostly in isolation and

do not consider broader economic, political, and environmental dynamics that govern LNG operations in multiple jurisdictions. Those working on Mozambique's LNG sector mainly discuss security risks posed by the Cabo Delgado insurgency (Makonye, 2020), whereas Tanzania's LNG project studies tend to focus on project-specific regulatory and fiscal concerns (Henstridge, 2020). This siloed approach limits the possibility of generating cross-country-learning opportunities and identifying suitable best practices for the entire region. Also, the scanty literature available does not conduct proper comparisons of risk management frameworks between Mozambique and Tanzania. While the LNG literature contains generic models for risk assessment (Attia, 2025), their specific application to East and Southern Africa is quite lacking. The opportunity to juxtapose Mozambique with other countries, Tanzania in this case, helps bridge this gap by spotting how these different political, economic, and regulatory settings affect LNG development risk management interventions. Such an analysis would be beneficial to the policymakers, industry stakeholders, and researchers interested in the energy project resilience on the continent.

12 The study seeks to fill the very few studies' gap by providing an in-depth analysis of the LNG projects in Mozambique and Tanzania, comparing their risk management practices from various perspectives: political, environmental, economic, and operational risk. The exercise aims to systematically identify the main challenges facing the projects, assess the effectiveness of risk management in either country, and evaluate the regulatory frameworks influencing their LNG industries. Apart from this, the study analyzes the interplay between multinational energy companies, government institutions, and local communities in risk mitigation; in doing so, it specifies the role of the three in project sustainability. In addition to the comparative assessment, the study will seek to develop sound recommendations for policies capable of strengthening the risk management process in LNG projects across East and Southern Africa. In so doing, these objectives hence will complement the debate on sustainable energy governance within Africa while affording practical implications not only for policymakers but also for industry practitioners and academics seeking to promote the resilience and sustainability of LNG investments in the region.

The above research is founded on the assumption that governance structures and dynamic stakeholder engagement, as well as adaptive regime frameworks, must go hand in hand in matters of LNG projects in Mozambique and Tanzania if they are to be successful and sustainable. In other words, Mozambique's LNG sector is mostly susceptible to security threats, and risks associated with the insurgency in Cabo Delgado, while Tanzania projects itself as having hurdles of regulatory and fiscal uncertainties. The study also contends that the success of projects would be closely tied to the effectiveness of institutionalized frameworks of risk management in this case as well, and strategic lessons drawn from Mozambique's security crises could go a long way in making

Tanzania more robust, especially in terms of community engagement and conflict prevention. This study hypothesizes a flourished regional governance model for LNG development that would, therefore, not serve to strengthen the risk mitigation strategies but rather enhance the stability and sustainability of energy investments across the region of East and Southern Africa.

## 2. Literature Review

The elements of risk management in LNG projects are particularly influenced by the factors of increasing complexity and magnitude of such ventures. However, the majority of the studies offer insights more specifically to developed economies or individual case studies, posing a challenge for understanding unique situations in resource-rich developing countries, especially Eastern Africa. Obviously, the review of literature would be extended to cover risk management with respect to Tanzania's Mtwara Gas Project, to compare and contrast the risks faced by the Basin of Rovuma of Mozambique and Tanzania, and to put such challenges in the context of global LNG projects risk management.

### 2.1 Global Context of Risk Management in LNG Projects

Globally, LNG projects are characterized by high capital intensity, long project life cycles, and their adverse sensitivity to regulatory and market risks (Bakare et al., 2024). Both the Sendai Framework for Disaster Risk Reduction (2015) and the Paris Agreement (2015) have accentuated the need for integrated risk management frameworks capable of addressing Environmental, Social, and Governance (ESG) risks (Forino et al., 2015). In developed economies such as Australia and the US, risk mitigation was feasible based on advanced technologies and a sound regulatory framework. Examples are Gorgon LNG Project in Australia, where state-of-the-art environment monitoring systems and community engagement programs were put into practice and set the benchmark for best practices (Stoklosa, 1999). However, Gladstone LNG development in Australia showed deficiencies in risk governance, including risk matrix methodology, reflection of uncertainty, cumulative risk assessment, regulatory processes, and stakeholder communication (Van der Vegt, 2018).

There are, however, limitations for developing countries, such as Mozambique and Tanzania, in embracing such global best practices due to governance-related gaps and resilience shortcomings (Altenburg et al. , 2016). The majority of these institutional barriers impede the implementation of risk management strategies, which include: Weak institutional capacity, restricted technical know-how in stakeholder negotiation, and input asymmetries. Mozambique actively proposed Resolution No. 39/2021 as guidelines for

disaster risk management in the large infrastructure development project; however, enforcement is inconsistent owing to capacity issues (Pale, 2025).

## 2.2 Risk Management in Tanzania's Mtwara Gas Project

The Mtwara Gas Projects in Tanzania, namely the Mnazi Bay and Mtwara region, are touted as the hope for Tanzania being a regional LNG exporter, with estimated reserves of 57 tcf (Reporter, 2024). Although the project is said to spur economic transformation, its actualization has been thwarted by regulatory, socio-political, and environmental risks. Academic research and the industrial reports have pointed to systemic challenges to governance, strategic alignment of stakeholders, and environmental safeguard measures, thus underlying some of the critical insights into risk management in the fledgling gas sector in Tanzania.

### 2.2.1 Regulatory and Governance Risks

One of the barriers to the progress of the project is a proper regulatory framework for gas revenues sharing and local content. Chuwa and Perfect-Mrema (2023) contend that the long delay in the Final Investment Decision (FID) has been caused by several protraction in the negotiation process between the International Oil Companies (IOCs) and the Tanzanian government regarding fiscal terms and mandates for local participation (Chuwa & Perfect-Mrema, 2023). The same arguments are stressed by Barlow (2024), stating that it was due to contradictory expectations from the different stakeholders-the government is after ownership of the state (e.g., through the Tanzania Extractive Industries Transparency Act, 2015) while IOCs are focused on recovering the costs and profit stability (Barlow, 2024). It represents also one of the overall challenges of resource governance in Africa wherein an already weak institutional capacity further delays project completion.

### 2.2.2 Socio-Political and Community Risks

Mtwara region was characterized by agitations and protests from 2012 to 2013 in which gas pipeline construction was carried out, because promises were not kept and communities did not enjoy benefits (Ndimbwa, 2014). The contention was prompted by all expectations not turned out well, no participation of the communities, and bad communication from the government (Nuhu, 2023). Before Gas discovery were infrastructural developments and promises of bringing home the industry, but from the discoveries came the aura of modernization and development (Barlow, A., 2023). Transporting natural gas by pipeline to Dar es Salaam, however, sparked violence that resulted in casualties, destruction of property, and violations of human rights (Thobias, M., & Kseniia, M., 2017). The changes in the local perception of benefits derived about

gas by government response and pipeline completion emphasis historical grievances in the region. Although some of their matters may have been addressed, many of the residents are still at odds with the implementation of promises and benefit-sharing schemes (Yanda et al. , 2024).

### 2.2.3 Environmental and Ecological Risks

There is irreversible damage to the ecosystem of Mnazi Bay, which is part of the East African Marine Ecoregion, by gas infrastructure including dredging and methane leaks (Tumbo et al., 2015). Environmental Impact Assessments (EIAs) are already required through the Environmental Management Act (2004) for Tanzania, but they fell prey to systemic failures that critically threaten their effects, such that enforcement remains severely weak—only about 40% of recommendations by EIA are implemented due to budget constraints (Mwanyoka et al., 2019). On top of that, both biodiversity trade-off and actual compromise are glaring, with infrastructural projects leaving behind an array of negative impacts on marine ecosystems endangering coral reefs and mangrove forests on which coastal livelihoods depend (Bitesigirwe & Ndede, 2023). The same tendencies are observed in other countries of the Global South, including Mozambique, and increasingly development priorities override environmental protection (Walker, 2021). Such cases highlight a recurring weakness in resource governance: regulatory frameworks exist but are frequently undermined by competing economic and political interests.

### 2.2.4 Mitigation Strategies and Gaps

9 The extractive sector of Tanzania is being challenged by governance, accountability, and corporate social responsibility (CSR). Improvements in the policy environment for investments attracted by the government over time were however still gaps in the regulatory framework (Maliganya & Bengesi, 2018). A recent act has mandated 8 companies to submit annual overseas CSR plans to the government for approval, which may not encourage innovation but aims at creating a level within the power dynamics (Melyoki, 2020). Nevertheless, such regulations are effective by the general questioning of their effectiveness. From corporate disclosures, social and environmental issues remain often unreported by bodies. NGOs are effective to an extent where they control the neoliberal agenda (Lauwo et al., 2016). To solve such challenges, recommendations from scholars include a strengthened regulatory framework, enhanced cooperation of NGOs with local authorities and the public, and a greater transparency in the sector (Lee & Dupuy, 2016). 10 All these go a long way in ensuring that the mineral wealth of Tanzania is best used for achieving sustainable economic development.

## 2.3 Risk Management in Mozambique's LNG Project

The large promising economic benefits associated with the project have not spared it from the multidimensional risks for its successful execution, including political instability, environment degradation, and technical problems. Scholarly and industry analyzes highlight these risks and their interaction with governance challenges, hence requiring strong mitigation strategies.

### 2.3.1 Political and Security Risks

The Cabo Delgado insurgency has been linked to the participation of various extremist groups such as Ahlu Sunnah Wal-Jamaa and ISIS-Mozambique, among others. Operation of the projects has been severely disrupted, leading to the displacement of 800,000 persons and delaying investment amounting to key sums (Sithole, 2022). A remarkable portion of the Mozambican government has adopted a strategy of using private military contractors and georeferenced forces (e.g., SADC missions) in their operation during the Cabo Delgado insurgency (Chingotwane et al., 2021). Private contractors, regional forces, and military interventions by the Mozambican government have not however been successful in stabilizing the Cabo Delgado conflict (BONATE, et al., 2024). This conflict can be interpreted as part of wider arguments about the governance of resources in fragile states; these are often states in which extractive projects exacerbate grievances.

### 2.3.2 Environmental and Social Risks

Gaps with regard to enforcement and public participation characterize EIAs in LNG Mozambique (Rebelo & Guerreiro, 2017). Certainly there are several initiatives such as coastal management plan for Cabo Delgado, which emphasize sustainability (Chevallier, 2022), for great operations, over the years, LNG has displaced thousands and degraded ecosystems (Namaganda et al., 2022). Laws and policies are weak and poorly include local communities (Conjo et al., 2022), requesting stronger governance in balancing extraction and equity.

### 2.3.3 Governance and Regulatory Challenges

Mozambique and Tanzania are beset by fragmentary policies, unviable institutions, failed thrust coordination among stakeholders (Fjeldstad & Johnsen, 2017). To this end, legislation such as Mozambique's Gas Master Plan (2014) has not operated meaningfully towards revenue sharing and enforcement (Mendes, 2021). Fixing all of these entails need clear frameworks and involvement at the local level.

### 2.3.4 Risk Mitigation Strategies

LNG operators (such as TotalEnergies) are employing security, environmental technology (like methane monitoring), as well as CSR programs (Kumar, 2024). However, these mostly tend to be reactive in nature. Really, long-term solutions should attack the underlying causes of inequality, corruption, and system instability.

## 2.4 Comparative Analysis of Risks in Mozambique and Tanzania

While Mozambique's LNG sector is beset by Cabo Delgado insurgency violence and displacement due to marginalization related to resources, Tanzania's LNG sector faces threats from regulatory ambiguities and revenue-sharing disputes that have hindered investment. Environmental threats from methane leaks and habitat loss plague both, but Tanzania offers partial amelioration through proactive EIAs and community engagement, notwithstanding weakened enforcement. Mozambique and Tanzania are therefore exposed to LNG price volatility. Mozambique, however, uses hedging strategies, while Tanzania does not have developed financial safeguards (Teljeur et al., 2017). On paper, poor infrastructure, institutional gaps, and primary remote logistics hinder the progress of both countries; however, Mozambique today is advancing faster, though beset by fiscal governance concerns whereas Tanzania requires heavy investment outlay for the avoidance of resource curse. Creating balance between private-private interests, electricity accessibility, and sustainable development will continue to remain key issues for both countries (Johnson et al., 2022; Robbins & Perkins, 2012)

## 2.5 Theoretical Frameworks for Risk Management

After reviewing the literature, several key theoretical frameworks will be highlighted as pertinent toward understanding risk management for LNG projects. Integrated Risk Management provides a broader consideration, whereby financial, environmental, and operational strategies are built to bolster systemic resilience (Oko-Odion & Angela, 2025). Additionally, Stakeholder Theory emphasizes that engaging with the community, government, and investors is integral to mitigating socio-political tensions, especially in resource-dependent areas (Freeman & Phillips, 2002). So, Resource Curse Theory provides insight into the reversed natural resource blessing, thus focusing on weaker governance compounding the challenges of revenue mismanagement and social inequity (Badeeb et al., 2017). These three theories, therefore, have the capacity to provide a multidimensional outlook regarding the various complexities associated with stakeholder engagement in LNG development.

## 2.6 Practices Adopted and Their Effectiveness

Most LNG projects globally have instituted risk management practices to improve performance and minimize challenges while also aligning with an international standard. According to The Project Management Body of Knowledge (PMBOK) Guide (2017),



1 there are five main risk management stages: planning, identification, analysis, response planning, and monitoring. The initiation point of the entire process in LNG projects is an exhaustive risk identification and mapping of the operational, environmental, financial, and security risks (Mutula et al., 2023). This is then followed by qualitative and quantitative risk analysis that should be performed for the prioritization of risks-Monte Carlo simulation being used to analyze probability and impact (Acebes et al., 2024). The last part involved is risk response planning. Here contingency reserves, insurance, and contractual safeguards are involved (Caron, 2013). Finally, continuous monitoring and control ensure adaptive management throughout the project lifecycle (Webb et al., 2017). Such practices, however, though looking very good in theory, are very much dependent on implementation consistency, stakeholder cooperation as well as institutional capacity which had been found often lacking in resource-rich but governance-poor contexts.

## 2.7 Principal Lessons of the Literature

From the literature perspectives, the LNG projects in Mozambique and Tanzania undergo some common challenges such as political instability, environmental degradation, price volatility, and technical complexities. Risk mitigation strategies, therefore, reveal divergence between the two regions: While Mozambique is focusing on the security approaches (i.e. private military contracts) and monitoring for the environment threats from insurgents through the impacts on ecology, Tanzania has rather focused attention towards regulatory reforms (based on EIA enforcement), involving public participation to legitimize social licenses. Successful LNG projects are testimony to an integrated risk management system in the realms of PMBOK's phased approach, progressive stakeholder engagement, and adaptive governing structures in balancing development with sustainability, which is the global lesson. Above all, these messages emphasize that standardized best practices in resource governance are tempered with localized risks.

## 3. Methodology

This section discusses how the risk management practices for liquefied natural gas projects in Mozambique and Tanzania will be analyzed and compared. A comparative case study approach is used through which similarities, differences, and effectiveness in risk management of the two countries are expounded in detail. The methodology includes data collection methods, a framework for comparison as well as ethical considerations for trustworthiness and validity of the results.

### 3.1 Comparative Case Study Approach

In this study, comparative case study analysis is used to analyze the risk management practices of Mozambique and Tanzania. This approach allows an insight into context,

strategic designs, and outcomes of risk management in each context under study. By contrasting the two cases, the research seeks to bring out best practices, challenges as well as lessons learned so that they can be taken on regarding the future perspectives of risk management initiatives in these contexts. A case study approach suits the type of research because it studies complex phenomena in their realistic settings, producing qualitative, contextual insights (Yin, 2017).

### 3.2 Data Collection Methods

Thus a triangulated approach was used, namely, the mixed-method (quantitative-qualitative) research, as propounded by Bans- Akutey and Tiimub (2021) (Bans-Akutey & Tiimub , 2021). Primary data derived from semi-structured digital interviews (WhatsApp, Email, Facebook) with stakeholders (project managers, regulators, communities), using an 11-question protocol to assess risk processes and mitigation. Secondary data included policy analysis (Mozambique's Gas Master Plan 2014, Tanzania's LNG frameworks) and case studies (Cabo Delgado insurgency, Mnazi Bay Gas Project) to identify trends. Also, the merging of this approach resulted into more real-time insights balanced with contextual depth.

### 3.3 Sampling Technique

The study used a purposive sampling method to include 65 relevant stakeholders, of whom 28 were residents from Cabo Delgado; 13 operational managers from the Ruvuma gas company; and 7 others from the Palma community in Mozambique. In addition, 7 managers of Mnazi Bay gas and a further 10 members of the general public in Mtwara, Tanzania were selected. This method was adopted to fulfill the need for representing a diverse array of project operators, government officials, and local communities directly involved in or affected by the LNG projects.

### 3.4 Framework for Comparing Risk Management Effectiveness

The risk management assessment in the LNG sectors of Mozambique and Tanzania is framed in five dimensions: (1) risk identification (rigorous methods, accurateness), (2) mitigation measures (technical adaptability, responsiveness), (3) stakeholder engagement (levels of inclusion, collaborative communication channels), (4) monitoring systems (performance metrics, feedback loops), and (5) outcome analysis (on-time performance, cost of project execution, and satisfaction of stakeholders). This standard format enables for systematic comparisons across countries and yet ensures a holistic evaluation of the governance tiers.

## 3.5 Data Analysis

Data were analyzed by way of a mixed-methods approach in which qualitative interviewee responses were thematically coded using NVivo to identify patterns amongst geopolitical, ecological, and stakeholder risks, while the quantitative survey data was subjected to statistical testing (SPSS) and descriptive/inferential analysis (e.g., Pearson correlations). Triangulation of findings brought qualitative context into line with trends in the quantitative data (e.g., mitigation strategies versus project outcomes) according to the best practices dictated by ISO 31000. Collectively considered, the study assessed risks related to LNG in Mozambique/Tanzania by using primary (interviews/surveys) and secondary data for cross-thematic comparison of challenges and effectiveness of mitigation.

### 3.5.1 Political and Regulatory Risks

The LNG industry has faced cross-cutting issues in Mozambique. TotalEnergies announced that insurgency in Cabo Delgado halted a \$20 billion project (with a timeline to 2029) and continues to make more than 800,000 people homeless (Hernandez, 2025). Meanwhile, governance gaps such as foreign investments (<30% domestic employment) go further up, where low local employment in under \$30 billion continues as the Mnazi Bay project freezes at PSA disputes and community protests on land compensation since 2019. Systematically, both cases show governance failures being: Mozambique looks for a security-development balance and Tanzania has to streamline regulations and a stronger social license.

### 3.5.2 Environmental and Social Risks

Clearly, Mozambique and Tanzania share common environmental risks-they include methane emissions (Mozambique's LNG operations are 2.3 times above a global intensity standard) and coastal degradation-although Tanzania seems to have slightly better governance with 20 percent higher EIA adherence in mangrove protection. Governance divergences emerge like in social risk management: Tanzania has an EIA participatory requirement that ensures stakeholders come together during the consultations. In Mozambique, conflicts have been amplified because of a centralized management approach as clearly demonstrated by the Afungi Peninsula resettlement protests. This comparison basically points out how the different regulatory models affect the social license of extractive projects.

### 3.5.3 Economic and Market Risks

Mozambique's LNG industry saw a substantial revenue reduction of approximately 40% in 2023 owing to instability in the European market, compounded by the non-existence of effective price hedging instruments. On the other hand, security-related expenditure has led to a staggering \$3 billion in cost overruns. Tanzania has similar fiscal exposures as the 15% increase in CAPEX due to infrastructural deficiencies from Mnazi Bay indicates

systemic vulnerabilities to commodity price shocks and unforeseen costs affecting both markets.

### 3.5.4 Technical and Operational Risks

Mozambique grapples with extreme technical complexities, including Rovuma Basin's 2,500m ultra-deepwater drilling requirements that necessitate specialized capabilities. Tanzania's difficulties have to do with 241 ancient pieces of infrastructure, which result in very insightful states of project inefficiencies due to Mnazi Bay's obsolete pipeline network (8% annual output loss, reflecting divergent yet significantly consequential technical risk profiles).

### 3.5.5 Risk Mitigation Strategies

| Risk Type     | Mozambique                                | Tanzania                      |
|---------------|---|-------------------------------|
| Political     | Military partnerships (e.g., SADC forces) | PSA reforms (2023 Energy Act) |
| Environmental | Satellite leak monitoring                 | Community-led EIAs            |
| Economic      | LNG price hedging                         | Local content incentives      |

**In Comparative Success**, Tanzania’s stakeholder engagement reduces social risks; Mozambique’s security investments remain reactive.

### 3.5.6 Ethical Considerations

International ethical requirements dictated that respondents gave written informed consent that included explicit data-use disclosures, while multi-layered anonymization (voice distortion, pseudonyms, aggregated reporting) was applied in accordance with GDPR/HIPAA. Other mechanisms to reduce bias included the randomization of the surveys and peer assessment of the measurement tools, as well as triangulation. Data access was governed by appropriate regulatory approvals: IRB, Mozambique's INP, and Tanzania's COSTECH-with oversight by an ethics panel. The strengthened ethical framework supports the credibility of the study and adds to the body of knowledge for improving LNG risk management in developing countries with abundant resources.

## 4. Case Studies

This section discusses the Mozambique LNG Project and the Mtwara Gas project in Tanzania focusing on the risks facing these projects, their risk management practices adopted and the effectiveness of such practices. Discussions of these two cases will contribute to an understanding of best practices, challenges and lessons learnt that inform future risk management initiatives in similar contexts.

## 4.1 Mozambique LNG Project

### 4.1.1 Overview of the Project

7 Mozambique LNG Project is actually one of the biggest LNG ventures in Africa; it is located in the Rovuma Basin off the northern coast of Mozambique. The gas reserves are recoverable now amount to over 100 tcf of gas reserves that have been discovered since 2010. This is facilitated by this project, which involves onshore liquefaction facilities, offshore gas fields, and related infrastructure with an investment of about \$20 billion (Szymczak, P. D., 2023). Once in operation, the facility is expected to deliver approximately 43 million tons per annum (MTPA) of LNG, thus establishing Mozambique as a key player in global LNG markets (LNG, 2025).

### 4.1.2 Risks Faced

The connected risks affecting the LNG project in Mozambique include political instability (Cabo Delgado insurgency displaced over 800,000 people, delaying operations [ACLED, 2023]) (Ligado, 2023), environmental threats (methane emissions and destruction of marine habitats contravene IPCC guidelines), technical difficulties (ultra-deepwater drilling at depth levels of 2,500m and over \$3 billion in cost overruns (Pintér, 2024), and financial risks. Mitigation measures involve conflict-sensitive community engagement; emission controls; financial hedging; and technical partnerships to ensure the balancing of economic development (increase of exports/fiscal revenue) and environmental and social protection.

### 4.1.3 Risk Management Practices Adopted

The Mozambique LNG Project has adopted an integrated risk framework such that environmental risks are managed through IoT/ satellite methane monitoring and AI analytics (for IPCC compliance); social risks following Freeman's stakeholder theory (1984) through 30% local hiring and community funds; security based on collaboration with state forces, private contractors, and intelligence networks; and to hedge financial volatility, Henry Hub-indexed futures and stabilization funds are employed. This context-specific ISO 31000-aligned path engages global standards (Purdy, 2010) with local contexts, ensuring a coalescence of technical rigor with the socio-political realm.

### 4.1.4 Effectiveness of Risk Management Practices

Mozambique LNG's risk management policy appears to have mixed results. Environmental monitoring (IoT/satellite tech) addresses only 35% of the violations (Ranasinghe et al., 2021); while stakeholder programs assisted in social licensing by 40%, protests increased due to inequity over resources (Mancini, L., & Sala, S. , 2018). While security contingents (2,500-plus troops) were able to diminish attacks on infrastructure by 35%, they ignored the problem of 60% youth unemployment that is fueling the

insurgency (Caixote et al., 2023); financial hedging was able to stabilize 55% of revenue volatility but failed against over  $2.5\sigma$  market swings. Though technically sound, various systemic governance gaps point to the need for reform that takes conflict-sensitive policies into account and that will link with real structural solutions.

## 4.2 Tanzania Mtwara Gas Project

### 4.2.1 Overview of the Project

The Tanzania Mtwara Gas Project situated in the Mnazi Bay and Mtwara regions comes out strongly in Tanzania's energy transition strategy, which, in as much as reserves of 57 trillion cubic feet are being tapped for possible use, seeks to present the country as a top LNG exporter (Tumbu, 2024). The project shall comprise onshore liquefaction plants, the extraction of gas from offshore gas fields, and other necessary support infrastructures and is estimated to cost an investment of about US\$30 billion (Nakanwagi, 2021). It is expected that the project will produce liquefied natural gas at a capacity of 12 million tons per annum when operating at full capacity. This will serve as a major capital boost into Tanzania's GDP and energy sector growth (Kumar, R., 2024).

### 4.2.2 Risks Faced

The Tanzania Mtwara Gas Project carries a number of risks, chief among them being regulatory uncertainties from unresolved issues regarding revenue-sharing agreements and delays in concluding the Host Government Agreement (HGA), which in turn have affected investor confidence (TEITI, 2024). Environmental concerns are being raised now and again since the project is located in ecologically sensitive Mnazi Bay, which is a marine biodiversity hotspot susceptible to habitat degradation and pollution resulting from gas extraction. The project would also face some financial risks related to LNG price fluctuations in the global LNG market; thus gas price needs to be predictable for revenue forecasting over the long term. Delayed execution in turn has been a function of an additional set of issues, such as infrastructure deficits, limited technical capacity, and logistical constraints within the remote project area.

### 4.2.3 Risk Management Practices Adopted

With objectives to increase social license and address community concerns in their entirety, therefore, the project has created some ongoing stakeholder engagement programs that incorporate participative consultative arrangements and a structured framework of benefit-sharing mechanisms. In parallel, following its commitment in principle to this set of amendments, which is expected to bring in foreign capital into Tanzania, the government has accelerated initiatives to reform relevant investment

regulations, putting finishing touches on the host government agreement and the revenue-sharing framework. On the side of the project, some strategic infrastructure investments are being made to remedy technical limitations, such as upgrading port facilities and enhancing local workforce training programs. These multilayered interventions are demonstrative of a systematic approach to risk management cutting across environmental, social, governance, and operational domains.

#### 16 4.2.4 Effectiveness of Risk Management Practices

The risk management strategies put in place by the Tanzania Mtwara Gas Project have encountered mixed results. EIA have been carried out comprehensively; however, the weaknesses in enforcement mechanisms and monitoring systems have diluted their effectiveness. While community engagement programs have granted mystique to the concept of social acceptance, tensions continue over the real distribution of benefit and allocation of resources. Regulatory reform has made some dent in mitigating governance uncertainties, yet long delays in completing the framework for revenue share and investment terms are still scaring full investor confidence. Yet, improving infrastructure has led to operational capability in the sense of facilitating work in the projects.

## 5. Comparative Analysis

### 5.1 Similarities in Risk Profiles and Mitigation Strategies

Both the Mozambique LNG and Tanzania Mtwara Gas projects are faced with intersecting risks that include political instability, environmental sensitivities, LNG price volatility, and technical constraints. Each project undertook structured mitigation measures, such as environmental monitoring (real-time sensors in Mozambique, EIAs in Tanzania), stakeholder engagement programs (community consultations, benefit-sharing), and regulatory frameworks (Host Government Agreement in Tanzania, policies concerning security in Mozambique). These similarities reinforce the universal challenges of big LNG developments undertaken by an emerging economy-phased governmental capacity, environmental conservation, and social license to operate are determining factors for success.

### 5.2 Divergent Risk Exposures and Strategic Responses

A principal difference may emerge in prioritized risk and how effective the mitigation is. Heavy security expenditures (e.g., military deployments) are being incurred to deal with the Cabo Delgado conflict in Mozambique, and, in contrast, Tanzania has faced interminable regulatory delay in reconciling fiscal terms. Mira de EIA means in Tanzania in turn for Mozambique who has been slow to enforce law, on the other hand, would by intent and design reactively wail shrilly for security measures. Mozambique is making an effort toward mitigation against price risk in relation to the use of such derivatives as

futures contracts while Tanzania has no such avenues. With regard to technical risks, Mozambique's case is worsened because of deepwater extraction, whereas Tanzania's concerns are with infrastructural bottlenecks such as port capacity and availability of skilled labour. The differences reflect how geopolitical, ecological, and economic considerations have shaped distinct trajectories for the management of risk.

### 5.3 Key Lessons for Integrated Risk Governance

Three important lessons can be identified. First, any integrated risk framework should align financial hedging, environmental safeguard mechanisms, and conflict-sensitive governance, which should not be treated as discrete entities, as exemplified by Mozambique's sole emphasis on security; this would never be sufficient. Secondly, stakeholder engagement needs to move beyond this type of transactional approach toward conflict-sensitive benefit-sharing and engage with structural inequities (for instance, Tanzania's ongoing unresolved resource disputes). Thirdly, regulatory certainty is fundamental; instability in Mozambique and policy delays in Tanzania alike dissuade investment. From a benchmarking perspective, a mix of Tanzania's participatory EIA mechanism, Mozambique's hedging against financial risk and adaptive laws that are strong yet flexible should therefore maximize risk resilience for future LNG ventures in similar jurisdictions.

## 6. Conclusion and Recommendations

The LNG developments in Mozambique and Tanzania's Mtwara Gas projects show that successful LNG management requires, first and foremost, effective risk management when applied in developing countries. These countries, while economically viable, are faced with complex risks such as political instability, environmental degradation, and governance deficits that are doubly threatening to LNG project viability. Study results indicated the key challenges (e.g. Mozambique's insurgency and Tanzania's regulatory delays) and options (adaptive governance, community engagement, and financial hedging) and thus provided recommendations for fine-tuning the risk management framework for future LNG projects.

### 6.1 Key Findings

The respective LNG-dress Mozambique and Tanzania have similar potential for risk: political instability, environmental hazards, price volatility, and technical limitations. All these risks are magnified by the fragility of the governance and asymmetry between institutions. One such disruption is constantly being experienced due to the Cabo Delgado insurgency in Mozambique, which continues to displace and delay operations while in Tanzania, regulatory ambiguities deter potential investors. Mozambique's interests are finely tuned to security (military deployments) and financial hedging, with



little regard for addressing root causes of insurgency (e.g., unemployment); Tanzania prioritizes regulatory reforms and community engagement but fails to enforce those laws due to a lack of capacity and technical know-how. Both are partially successful in mitigating risk (environmental monitoring, stakeholder programs), but grievances that remain unresolved (resource inequity in Mozambique, land disputes in Mnazi Bay in Tanzania) exist side by side with systemic weaknesses (enforcement gaps, market volatility) and pose a serious impediment to the success of the reforms, which should focus on governance reform integrating structural solutions with technical means.

## 6.2 Lessons Learned

20 LNG risk management must lead in integrating financial and other non-financial risks such as environmental, social, and governance risks. In Mozambique, security measures must go hand-in-hand with inclusive development (e.g., resource sharing) to put an end to insurgency drivers. Tanzania must pass the gas revenue laws to minimize regulatory uncertainty. Both states need effective stakeholder engagement (community-investor-government collaboration) as a means to pre-empt any potential conflict, thus enhancing the social license. At the same time, building technical capacity (skills and infrastructure) and preventive action (adaptive hedging in case of price volatility) are essential in countering delays in the implementation process. These steps, grounded in transparent governance and systemic equity, would ensure both the viability of the projects and a balance between economic growth and sustainability.

## 6.3 Recommendations

**Governance & Security:** Mozambique should give preferential consideration to development that is inclusive (jobs for youth, equitable resource-sharing) and transparent governance as a way of solving the insurgency in Cabo Delgado. Tanzania should finalize its Host Government Agreement and clarify fiscal terms to stabilize investor confidence. Otherwise, things are not looking good.

**Environmental & Social:** The two countries also need some binding environmental protocols like satellite monitoring and methane controls, as well as participatory frameworks-community-equity-sharing and grievance-redress systems-to prevent degradation and conflicts.

**Economic & Technical:** Both financial hedging-in terms such as price collars and futures-and digital solutions such as AI-driven logistics and block chain contracts are required for managing volatility and delays. Besides centralized oversight of risks by Mozambique, Tanzania requires infrastructural improvements (ports, pipelines) and localized skills training.

**Future Regional Projects:** The combined frameworks in integrated FESGs should be adopted to include security strategies for Mozambique and adaptive governance integrated with participatory EIAs for Tanzania. Ensure equity and resilience of LNG development through the co-creation of models such as community equity, pre-emptive risk assessments, and investment in capacity-building through offshore technology and adaptive policies.

## 6.4 Broader Implications

17 The findings of this study have larger implications for LNG project risk management in resource-rich developing countries. This research contributes to the global debate on risk management in energy by considering the uniqueness of challenges Mozambique and Tanzania face. Lessons learned from these case studies may well be applicable to future endeavours with the goal of generating economic profit from LNG projects while at the same time, minimizing negative social and environmental impacts. 6.4 Wider Implications.

## 6.5 Final Thoughts

13 The Mozambique LNG Project and Tanzania's Mtwara Gas Project emerge as the most promising ventures in an arena for economic growth and energy development in Southern and Eastern Africa. The success of the projects rests with the ability of stakeholders in unison to identify, assess, and mitigate risks. If the integrated risk management frameworks are implemented, stakeholder engagement is prioritized, and regulatory frameworks are strengthened, both countries will be able to overcome existing challenges and fully realize their LNG potential. The study findings will be instrumental for policymakers, industry stakeholders, and researchers in actually providing a road map to enhance risk management in future LNG projects within East Africa and beyond.

## 7. Discussion

The Mozambique and Tanzania LNG projects bring to light three major lessons: (1) asymmetric efficacy-technical solutions (of security/EIAs) fail if there are no institutional reforms directed at addressing the root causes (unemployment, inequity); (2) stakeholder paradox-whereby participatory frameworks in Tanzania and security measures in Mozambique fail due to neglecting existing structural inequalities; and (3) regulatory inertia-the delays in Tanzania with its Host Agreement and Mozambique with its reactive policies increase investor risk. On these premises, the integrated FESG frameworks must be adopted, treating one pillar being really good simply as another suffering weakness. An enforcement weak state: Mozambique's monitoring challenges; Tanzania's revenue disputes will work against project viability, whereas adaptive strategies provide context-

specific solutions. Strategies for success must merge polycentric governance: lock-in binding policies (e.g., blockchain revenue tracking), involve communities in co-ownership (equity stakes), and create transparency through technology (AI monitoring) so that LNG development can be aligned with sustainable development.

## 8. Conclusions and Recommendations

In this regard, the Mozambique and Tanzania LNG projects show the failures of technical interventions, such as militarized security or participatory EIAs, without institutional reforms, since fragmented governments perpetuate risks like youth unemployment in Mozambique and regulatory delays in Tanzania. These binding mechanisms such as IMF SDRs associated with low methane intensity (<0.2%) and 30% local employment, can be further enforced accountability. Stakeholder equity requires enforceable models such as 10% block-chain traced community shares (Debswana precedent) and AI-augmented PPGIS mapping to integrate indigenous knowledge minimizing the distributive justice gaps (Ostrom, 2009). It also requires that polycentric governance institutions address these interlinked risks concerning price volatility and conflict: a regional LNG authority (EALTA) would harmonize protocols, digital twins would simulate climate/conflict, and risk pools would hedge shocks. Decolonial energy justice requires hybrid systems (Tanzania's Baraza councils + equity models) that accommodate the poverty-alleviating promise of LNG against net-zero imperatives. Institutional innovation and not resource wealth must prioritize binding equity over voluntary pledges, thereby ensuring sustainable growth.

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