### Enhancing Environmental and Social (E&S) Gap Analysis with Generative AI



### Simone Gurrieri, I. Vaccari, E. Desogus, E. Napoli, E. Schirinzi

**RINA** Consulting

Italy

https://www.linkedin.com/in/simone-gurrieri-582007232/

https://www.rina.org/it/



## PRESENTATION OVERVIEW

### 1. CONTEXT & OBJECTIVE

2. METHODOLOGY

3. GAP ANALYSIS CASE STUDY

4. RESULTS

**5. FUTURE STEPS** 

# What is E&S Gap Analysis?

### **Purpose and Scope**

E&S Gap Analysis identifies differences between local E&S legal frameworks and international standards (like IFC PS and EHS Guidelines) to ensure environmental and social compliance in projects.

### Why it is important

It allows project developers and lenders to evaluate regulatory gaps, define corrective actions, and minimize reputational and operational risks.



## CONTEXT AND STUDY OBJECTIVE

### The Role of E&S Gap Analysis

E&S Gap Analysis in ESIA and ESDD ensures alignment between national laws and international standards, like IFC PS and EHS Guidelines, identifying regulatory gaps and mitigation needs.

### **Challenges of Manual Comparison**

Manual comparisons are time-consuming and prone to errors due to legal complexity, document volume, and language differences.

### **Study Goals**

Our goal is to test the effectiveness of Generative AI in enhancing the E&S Gap Analysis by comparing speed, accuracy, and usability against the manual process.

Can AI reduce time without sacrificing accuracy?



## METHODOLOGY



#### Phase 1 – Data Preparation

Key information was extracted from IFC PSs, IFC EHS Guidelines, and national E&S laws using LLM engine.



#### Phase 2 – Gap Analysis

Using embeddings and semantic matching, AI linked international requirements with the most relevant legal articles to assess alignment and discrepancies and identified the gaps.



## Phase 3 – Comparison of the results

Al-generated output has been compared with the manual gap analysis outcomes, to evaluate the quality of Al-based results.

## **GenAl integration with Gap Analysis process**



## Case Study: Real Gap-Analysis Project in Algeria

To evaluate the effectiveness of the AI-based methodology, a previous Gap Analysis conducted by RINA was partially replicated and used as a case study benchmark



#### **Documentation Analyzed**

The study involved comparing IFC PS3 and IFC EHS General Guidelines with 445 articles from 8 Algerian laws related to environment, health, and safety.

#### Semantic Approach

Embedding was used to semantically link international standards with national legal texts, filtering irrelevant content and improving comparison quality.

### Pron

#### **Prompt Engineering**

Tailored prompts enabled precise extraction of regulatory elements, enhancing AI output structure and interpretability.

### INTERNATIONAL STANDARDS

- IFC Performance Standard 3 (14 requirements)
- IFC General EHS Guidelines (Ambient Air Quality Guidelines and Noise Level Guidelines)

### NATIONAL STANDARDS

• Algerian Legislative E&S Framework (8 laws, including 445 specific articles)







## Quantitative

Qualitative

## Results: Quantitative Comparison

Preparation and uploading of relevant regulatory documentation package in the Tool	5 minutes
Extraction of IFC PS3 requirements	1 minute
Extraction of local regulatory texts	15 minutes
Comparative analysis of IFC PS3 vs. local legislation	5 minutes
Comparative analysis of extracted IFC General EHS Guidelines tables vs. local legislation	3 minutes

### **TIME EFFICIENCY**

Al process took under 30 minutes in total, while manual analysis required 3 working days.



Results: Qualitative Comparison AI is effective with clear and numeric standards, like emission limits, but gives more generic results when dealing with broader, qualitative rules like IFC PS3.

Avoidance, reduction, recovery and reuse of hazardous and non-hazardous waste		
Identified Gap from GenAl Tool	Identified Gap from Manual Aprroach	
The comparison indicates a partial alignment between the IFC requirements and Algerian laws on waste management, particularly in the areas of waste prevention, environmental protection, and public awareness as outlined in Algerian Law 01-19, Articles 2 and 11. However, discrepancies arise due to the lack of measurable standards and the limited scope of waste management practices, as noted in Article 4, which excludes certain waste types. Additionally, while Article 19 prohibits the transfer of hazardous waste to unauthorized facilities, it fails to provide comprehensive guidelines for its treatment, potentially conflicting with the IFC's stringent standards. To enhance compliance with IFC standards, Algerian regulations should incorporate specific measurable technical parameters and detailed guidelines for hazardous waste management. Addressing these gaps will facilitate a more robust alignment with international standards, thereby promoting sustainability and environmental health.	Because of the risks to the environment and the ever- increasing costs and liabilities associated with the management and/or disposal of waste material, PS3 requires clients to investigate options for waste avoidance, waste recovery and/or waste disposal during the design and operational stages of the project. Local legislation embeds the principles of waste minimization at the source, waste reuse and recovery, and environemntally sound treatment of waste and no major gaps in terms of local requirements. The level of effort to address this requirement depends on the risks associated with the waste materials generated by the project.	
HUMAN VS AI JUDGMENTS		
OUTPUT ACCURACY	Al excels in structured data, yet	

Al is accurate with numbers, but less precise with general standards Al excels in structured data, yet remains conservative in final compliance decisions - expert review remains essential

## Results: Qualitative Comparison

**Al Output**: Consistent and structured but more conservative for complex standards.

•

Human Experts: More capable of nuanced and interpretive assessments, particularly when standards are open to interpretation.

Thus, AI enhances speed and consistency, but it **cannot fully replace expert evaluation,** at least not yet

## How AI Adds Value to E&S Gap Analysis







**Speed:** AI processes large volumes of regulatory texts in minutes instead of days.

**Structure:** Al provides consistent and structured outputs, enhancing review clarity. Scalability: AI can be extended to multilingual, crossjurisdictional reviews for different gap-analysis projects.

## LIMITATIONS AND FUTURE STEPS

Al challenges and limitations: Al often avoids strong compliance judgments, particularly when standards are qualitative or open to interpretations. Its outputs are structured, but lack expert nuance.

**Path to Improvement:** Advanced models like reasoning LLMs or AI agents may enhance interpretive capacity and accuracy in future applications.

**Full Workflow Integration:** Next steps include exploring automated document retrieval, enabling AI to support the entire E&S Gap Analysis process end-to-end.



## Let's continue the conversation!

Message me your questions or comments in the IAIA25 app.

**Simone Gurrieri** 

RINA Consulting, Italy

simone.gurrieri@rina.org

https://www.linkedin.com/in/simone-gurrieri-582007232/

https://www.rina.org/it/

