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A systematic quality assessment of Environmental Impact Statements in the oil and gas industry

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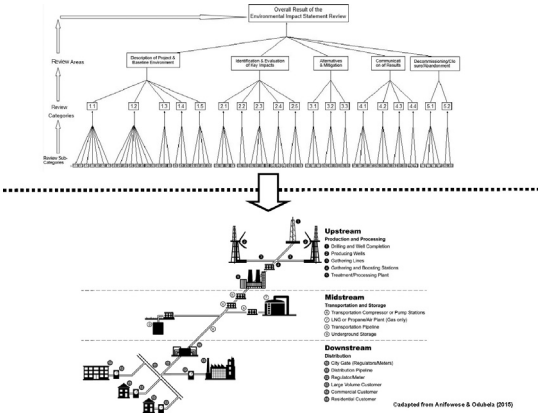
HIGHLIGHTS

- First study ever of the quality of EISs for both onshore and offshore oil & gas projects with tested hypothesis
- We developed a modified Lee & Colley model & applied it to assess 19 EISs, across 5 review areas & 67 subcategories
- 47% of the EISs were unsatisfactory; in particular, the key impact prediction and decommissioning areas need to be improved
- We found no statistically significant evidence ($p<0.05$) of improvement in the quality of EISs over time
- We recommend systematic and independent periodic review of EIS quality every 3 to 5 years

GRAPHICAL ABSTRACT



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ABSTRACT

The global economy relies heavily on oil and gas resources. However, hydrocarbon exploitation projects can cause significant impacts on the environment. But despite the production of numerous Environmental Impact Statements (EISs) to identify/mitigate such impacts, no study has specifically assessed the quality of EISs for both onshore and offshore oil and gas projects, with tested hypotheses. To address this research gap, our paper, for the first time, develops a modified Lee and Colley evaluation model to assess the quality of 19 sampled oil and gas project EISs produced from 1998 to 2008 in Nigeria. Our findings show that Project Description and Communication of Results are the main areas of strength. However, Environmental Impact Prediction, and Project Decommissioning, were among the key areas requiring attention. A key finding, though, is that Mann-Whitney tests suggest that there is no evidence that the quality of EISs for the latter period (2004–2008) is higher than that of the earlier period (1998–2004). We suggest that periodic systematic review of the quality of submitted/approved EISs (c. every 3–5 years) should be established to monitor trends in EIS quality and identify strong and weak areas. This would help to drive continual improvement in both the EIA processes and the resultant EISs of technical engineering projects. Such reviews have the potential to illuminate some of the underlying problems of, and solutions to, oil and gas exploration, production and transportation, and their related environmental

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impacts. This suggested change would also be useful internationally, including for the burgeoning exploration and production of unconventional hydrocarbon resources.

1. Introduction

1.1. Importance of the problem

Much of the world economy is underpinned by the international oil and gas industry which is moving into a new phase of unconventional resources and competition from renewables (e.g. see Torres et al., 2016; Moustafa, 2016). However, environmental impacts of oil and gas activities on air, water, soil and ecosystems have been well documented (e.g. Lawler, 2005; Skierszkan et al., 2013; Anifowose and Odubela, 2015; Barcelo and Bennett, 2016; Landis et al., 2016).

Lawler (2005) found that poorly defined environmental changes, relevance and data quality issues were the major problems facing water resource management in oil-rich Azerbaijan and Georgia. A study of contaminants from Canada's Alberta heavy oil revealed some metal (i.e. arsenic, cadmium, nickel, vanadium) enrichment in soil samples within 20 km of oil facilities in the Cold Lake area (Skierszkan et al., 2013). In the US state of Colorado, where active shale wells as of March 2015 are about 53,288, it is estimated that a minimum of 500 million m^3 of water is required for hydraulic fracturing; and in 2013, up to 600 spills of produced water chemicals were reported (Barcelo and Bennett, 2016). Meanwhile, Werner et al. (2015) argue that health impacts studies linking environmental health hazards with shale gas activities lack methodological rigour. However, new data have suggested that macroinvertebrate communities in north-central Arkansas are impacted by different levels of gas activity thereby prioritising the need for quantitative analyses of cumulative freshwater impacts from oil and gas projects (Johnson et al., 2015). In Cyprus, a study on liquefied natural gas (LNG) and pipeline network found key environmental impacts to include the release of particulate matter, odour/smell, noise and declining soil conditions as well as job opportunities (Papadopoulou and Antoniou, 2014).

In Nigeria, the focus for this paper, an examination of 200 locations, 122 km of pipelines and heath records of 5000 community members found significant environmental and health impacts following inadequate maintenance and decommissioning of oil and gas facilities in Ogoniland (UNEP, 2011). Giwa et al. (2014) report that communities adjacent to gas flaring sites in Nigeria often utilise the heat generated from the flare to dry farm produce and clothes; and to roast fish and maize. This increases the exposure of local people to noxious gases and other by-products emitted through the flaring processes, which can result in environmental impacts and health problems including asthma, cancer, blood disorder and bronchitis, amongst others (see Davoudi et al., 2013). Nigeria has a long history of oil exploitation, spillage and pollution, particularly in the Niger Delta (UNEP, 2011; Webb, 2011; Anifowose et al., 2012a). In addition, human injury and fatalities resulting from pipeline incidents are common here (e.g. Anifowose et al., 2012a). Ma'anit (2011) and Webb (2011) estimated that 9–13 million barrels of oil were spilt in the Niger Delta over the past 50 years (equivalent to one Exxon Valdez oil spill every year).

Environmental Impact Assessment (EIA) is a proactive methodical process that investigates and predicts the potential direct, indirect and cumulative impacts of proposed project activities on environmental receptors, ideally from project initiation to decommissioning, and offers mitigation strategies. Produced as part of an EIA process, the Environmental Impact Statement (EIS) is a key document for reporting anticipated impacts of projects, their mitigation and management plans. In most countries, the EIA process is part of the project permit or project approval procedure stipulated by the relevant authorities. Financial institutions like the World Bank, European Bank for Reconstruction and Development and the International Finance Corporation also require the submission of a detailed EIS as part of environmental due diligence for project financing (e.g. see Lawler and Milner, 2005). Just as the "cradle-to-grave" life cycle assessment of products provides a comprehensive assessment of environmental impacts of goods (see Pérez-López et al., 2016), a strong EIA should do the same for oil and gas projects.

Over the years, significant awareness of environmentally sound processes and sustainable development have been promoted by EIA practice in large-scale infrastructural projects (Gilbuena et al., 2013; Cesar et al., 2014). The relevant national requirement which supports decision-making in granting project permits/approval or development consents is predicated on the assumption that (i) an EIA study, including fieldwork and laboratory analysis (where necessary), has been undertaken; and (ii) the subsequent EIS is of high quality, and contains an 'accurate' assessment of the environmental impacts. However, EIS appraisal studies show that quality is not always satisfactory (e.g. European Commission, 2009). Lawrence (1997a) and Cashmore (2004) argued that EIA practice has evolved without coherent conceptual theoretical and methodological foundation. Backlund (2009) stated that the quality of impact assessments in the EU suffered from applications of overly simple methodologies, and incomplete assessment of environmental impacts. Furthermore, in the US, Eilperin (2010) and the National Commission (2011) found that major oil and gas projects (e.g. BP's Macondo well drilling) were exempted from environmental impact analysis.

The effectiveness of an EIA system can be evaluated against the quality of the resultant EISs (Heinma and Poder, 2010), and/or regulatory compliance, adequacy of information and methodology, presentation of information and communication, objectivity, fairness and transparency (HMSO, 1996; Glasson et al., 1997; EC, 2001). A systematic quality review of EISs involves the sampling and methodical evaluation of several approved project EISs, using a set of review criteria (see Section 2.1c). Such quality reviews are common in non-oil and gas project sectors such as road construction, power and dam installations, manufacturing, mining activities and green-field developments. Performance review of EISs can help to strengthen quality control within EIA systems (e.g. Lee and Colley, 1992; UNEP, 2002; European Commission, 2009) especially when evidence-based methods are used (Backlund, 2009). There is a strong link between EIA process and EIS quality (Zhang et al., 2013).

Therefore, if the full strengths of EIA processes are to be realised, we suggest here that critical independent periodic systematic reviews of the quality of EIA report (i.e. EIS) samples are essential. This should identify strengths and weaknesses which can be disseminated to encourage and share best practices in oil and gas developments and minimize negative project impacts (Anifowose et al., 2011). However, such reviews for the oil and gas industry are very rare.

1.2. Research gap

Several EIS quality review studies have been reported for non-oil and gas project sectors (see Table 1). Following periodic EIS quality review (at country or sector-level), a common feature of these studies is the hypothesis that project EISs tend to show improvement in quality over time.

However, the only known evaluation of EIS quality for oil and gas projects is the useful study of Barker and Jones (2013), commissioned by the then UK Department for Business Enterprise and Regulatory Reforms (DBERR). This focused solely on UK *offshore* petroleum production. Based on literature search from publicly accessible databases, our