

Risk Management in the Extractive Industry: An Empirical Investigation of the Nigerian Oil and Gas Industry

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NLNG Ltd was founded in 1989 to harness the vast natural gas resources in Nigeria, one of the highest-risk areas of the world. Any company that is successful in Nigeria has much acumen to offer other firms. Extant literature, NLNG Ltd policy manuals and responses to a questionnaire provided empirical data for this study. The risk-management practices of NLNG Ltd include: a carefully balanced ownership structure, profit satisficing balanced with national aspirations and risk-management policy, health, safety and environmental practices that conform to international standards, appropriate insurance coverage, and an employee structure that is extraordinarily reliant on temporary employees.

INTRODUCTION

When compared with most other sectors, resource firms (including oil and gas) face such high risk that risk management (RM) is an essential tool for their sustainability and prosperity. While risk is an unavoidable fact of life, risk management can help individual and organizations mitigate the many risks associated with achieving their objectives, goals and vision (IRM, 2012). The increased demand for resources, arising mainly as a consequence of rapid growth in emerging economies such as Brazil, Russia, India and China (BRIC) combined with a relatively limited supply of resources, has resulted in high and rising global commodity prices over the last two decades and have encouraged large scale investments to expand output in mining, oil and liquefied natural gas (LNG) worldwide. Rising commodity prices have, over the last few decades, made many nations dual economies—e.g. Australia where, mining and resources contribute enormously to the nation's wealth generation and power supply, but are contrasted with slow growth and volatility in the non-mining sector. The value of Australia's resource exports has grown rapidly and contributes about 57 percent of Australia's total exports. However, high risk in the mining and resource sector can rapidly cascade into issues in the overall Australian economy that make Australia highly vulnerable to sudden upsets and other surprises (e.g. environmental harm). Thus, the use of RM is a social imperative in Australia's resource sector.

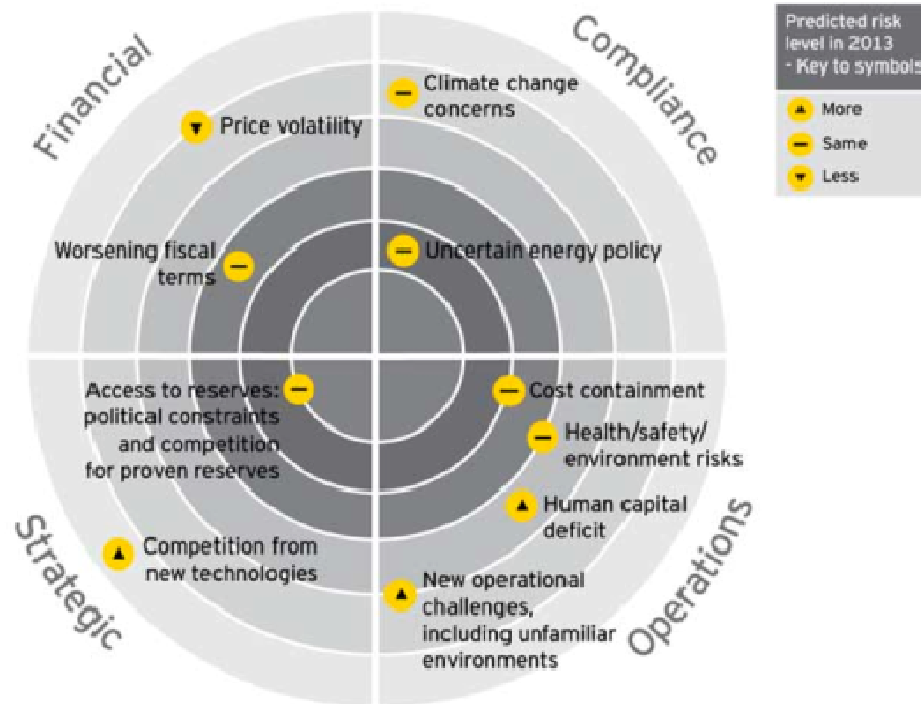
While oil and gas (O&G) production is of rising importance for the commercial world, inherent risk in that industry is making the community more aware of that risk and how it should be managed. This study examines risk management in the O&G industry in a relatively high risk business environment by evaluating risk management practices in the Nigerian O&G industry. This study continues and follows-up an earlier study, as part of providing insight on the risk-management issues affecting the growing cohort of O&G firms across the world.

History of LNG: Liquefying natural gas makes its transportation cheaper and easier. Specially designed tanker trucks, rail cars, tanker vessels are used to transport LNG over (respectively) short land hauls, long land hauls, and great distances by sea. The first (US) patent was awarded for LNG handling/shipping in 1914 (Petroleum Economist, 2004). Thus, the LNG industry was first shaped by the US and has for nearly a century been capturing what was once a waste product (e.g. often flared off from oil wells and landfills). The first commercial-scale LNG plant started up at Arzew (Algeria) and the African LNG industry is approaching half a century of operations (Jacob, 2011).

Risk factor in the Liquefied Natural Gas: Liquefied natural gas (LNG) is increasingly important to the world, as a relatively clean fossil fuel—the “...combustion of natural gas emits almost 30 percent less carbon dioxide than oil, and just under 45 percent less carbon dioxide than coal” (Naturalgas.org, 2014). Liquefied natural gas (LNG) consists mainly of methane and ethane (purified by removing water, carbon dioxide, mercury and heavier hydrocarbon components) and shrinking it 600-fold by progressively cooling the gas until it reaches -160°C, where it is liquid at atmospheric pressure. Ernst & Young (2012a and 2012b) explains risk via a “risk radar” (see Figure 1) that identifies key risks and opportunities for businesses in the O&G sector. The definitions of risks and opportunities vary from sector to sector and from firm to firm. The radar is meant to provide a simple image of *four key* risks in oil-and-gas-sector with 10 sub risk factors (Ernst & Young, 2011). The risks at the center of the radar (dark portion) are those risks posing the greatest challenge to O&G firms in the years ahead. Arrows on the outer layers indicate whether those risks are expected to rise or fall in importance over the next year. The risk radar is divided into quadrants that correspond to the Ernst & Young Risk (2012a, 2012b) Universe Model where:

- **Compliance risks:** arise in politics, law, regulation, corporate governance and/or social expectations;
- **Financial risks:** arise from volatility in markets, macro-economic factors and/or regulation;
- **Strategic risks:** are related to customers, competitors and investors; and
- **Operational risks:** are due to issues in the processes, systems, people, environment, and value chain of the firm (Ernst & Young, 2011).

FIGURE 1
PREDICTED CHANGE OF FOUR KEY RISK CATEGORIES COMMON TO LNG AND
OTHER EXTRACTIVE-ENERGY INDUSTRIES



Source: Ernst and Young, 2012a and 2012b.

Managing an Inherently risky industry in a Higher risk Environment

While historically Nigeria has been viewed as a relatively very harsh environment for business and other activities (Christopher, 2011), the increasing global demand for O&G means suppliers are increasingly expanding their operations into ever more remote and risky regions. As a result, the experiences of the Nigerian O&G firms may provide valuable insights for O&G suppliers, policy makers and business sector in general on managing risk involved in O&G exploration, production, and export. This study reviews and evaluates the use of risk management by Nigeria Liquefied Natural Gas Ltd (NLNG) to achieve its objectives and add value to its stakeholders and suggests how NLNG might be an exemplar for other firms in the O&G sector.

Nigeria Liquefied Natural Gas Limited

NLNG was founded in 1989 to operate in a region (West Africa) that outsiders have historically seen as being high risk. However, the region is so wealthy in terms of natural resources (oil, gas, diamonds, bauxite, gold, etc.) that companies are continually being drawn into this quagmire of risk, wealth, and corruption (TI, 2012). Any company that can make a go of it in such an environment has a lot that it can offer to other companies.

NLNG Ltd, at total cost of \$9.348 billion 2012 USD, is one of the largest firms in the African energy sector and is owned by four partners (Nigeria LNG 2012): The Nigerian Federal Government (via the Nigeria National Petroleum Corporation (NNPC)), Shell Gas BV (Shell), Total Gas Nigeria Limited, and ENI own, respectively, 49.0, 25.6, 15.0 and 10.4 percent.

The objective of this paper is to reviews the past and current literature in this rapidly evolving area of risk management (i.e. in the extractive industry sector) to identify the gaps and examine research

questions to find insight into the effectiveness of RM practices and techniques in the extractive industry sector.

The remainder of the paper proceeds as follows: Section 2 will discuss the significance of the paper, while providing a literature review and brief outline of the research questions based on literature, past research and industry concern; Section 3 discusses the methodology, develops hypotheses; section 4 provides data analysis, results and discussion while Section 5 brought the study to a close with its conclusions and the recommendations for future studies.

SIGNIFICANCE OF THE STUDY, LITERATURE REVIEW AND RESEARCH QUESTIONS

The extractive industry sector is one of the world's most capital-intensive sectors. Although, the sector has been implementing RM practices and techniques for decades, very little research had taken place in properly measuring how effective these techniques and practices have affected the sector. Despite advances in risk planning and mitigation tools, new capital projects in the sector continue to experience a high rate of failure in the sector (Schroeder & Jackson, 2007). Given the fundamental and profound impact that RM tends to have on the extractive industry sector worldwide, this is a timely study.

While the current economic contribution of extractive industry sector is substantial, the future contribution is expected to be even greater, especially with the rising demand for relatively clean fuels driving the emergence of new LNG projects throughout the world. This research also provides significant insight as to how to best facilitate and create new opportunities and foster sustainability via effective RM. Further, flow-on effects from the rising demand and supply of commodities can, via rising trade between nations, potentiate growth and development throughout the world.

LITERATURE REVIEW

The role O&G sector plays in promoting national wealth places it at the center of vital economic and socio-political issues (Vlady et al., 2008). RM is integral to today's O&G business activities and firms in that sector face risks to their social license, ranging range from volatile commodity prices, to increased health, safety and environmental pressures, to a history of major accidents that negatively impacts the industry image (Bilgliani, 2013). The presence of large volumes of toxic and flammable materials, the use of high pressures and temperatures, the high capital cost of plant and equipment, maintenance of facilities, and a potential for off-site impacts to affect many kilometers beyond plant boundaries, all mean that RM is an essential strategy for the survival of the O&G sector (Danaher, 1994).

Danaher (1994) notes that safety management in the O&G industry can be organized into occupational safety and process safety, each of which necessitate a different RM approach. Specifically:

- **Occupational safety** refers to incidents and situations where the outcome is injury to an individual or relatively minor property damage. These type of incidents have or may have a relatively high frequency but often have a low severity, and
- **Process safety** refers to incidents and situations where the nature of the hazard is intrinsic to the process itself and where the potential consequences are major. They are those incidents or situations that have or may have a relatively low frequency but very high severity. An example of this later type of accident would be the mud flow eruptions that occurred after test drill holes for natural gas were abandoned in Porong, Sidoarjo in East Java, Indonesia (Davis, et al., 2011).

Thus, there is relationship between the two types of safety management in the O&G industry and understanding the relationship between the two is important in order to effectively handle RM techniques and processes in the O&G sector (Danaher, 1994).

Aven & Kristensen (2005) note that, recently, there has been rising public concern over many aspects of risk in the O&G industry (e.g. oil spills, damaged land, accidents, fires, air and water pollution and groundwater contamination). A survey by Ernst & Young (2011) suggests that access to reserves is a

crucial risk for the O&G sector, especially when political constraints and competition for proven reserves are factored into the analysis. Uncertain energy policy is the number two risk and this remains in a continued state of flux for many key countries with natural resources (Ernst & Young, 2011). As the sector moves into the new territories and new forms of energy (e.g. LNG, *Shale* gas, *Coal-seam* gas and *Tight* gas), there has been much discussion about the need to maintain a social licence to operate. Safe operations, environmental safety, transparency and disclosure are now key issues. Ineffective RM in the O&G industry has a serious consequence and in most cases can lead to loss of the social licence to operate and/or exploit publically owned reserves (Ernst & Young, 2011).

Mitchell et al. (2012) added that the future of the O&G industry is in flux and, as a result, the RM techniques and strategies have to also be adaptable. The application of traditional risk models and management principles has proven deficient in preventing devastating failures in the O&G sector (Bergin, 2010; Davies, 2011). Currently, the operating paradigm for the O&G sector views RM to be a key input in achieving corporate and strategic objectives. The focus of firms in the O&G sector is on managing all their risks to achieve their objectives and that task is more daunting than ever (see, Oracle, 2011). Finally, The goal of many firms in the O&G sector is to manage risks effectively so as to preserve and sustain their bottom line. In recent years, massive capital costs and everchanging government policies and regulations have affected the O&G industry and created new RM challenges. It appeared that, from the past research and literature, the following research questions are important to get information from the case study company NLNG Ltd. in identifying the proper avenues for RM in extractive companies.

RESEARCH QUESTIONS

From the past research, literature and the information within the NLNG firm the following research questions are considered in this study:

- Is there a clear resolution to basic start-up risks?
- Is there a viable balance between its profit-oriented and its national aspiration goals?
- Is there capacity to use its organizational and/or employee structure and other means to mitigate its high risk environment?

While the above three questions are considered under descriptive analysis and deductive logic the following questions are considered with a quantitative analysis based on the questionnaire response:

- What is the company's policy on RM?
- What is the extent of the risk exposures in NLNG?
- How are they managed and administered?
- What loss prevention and control measures are undertaken in NLNG?
- How does Nigeria LNG improve the safety consciousness educate and communicate risk awareness to its employees and community?

METHODOLOGY:

This study focuses on NLNG Limited as its empirical case study. The Company's three locations in Lagos, Port-Harcourt and Bonny were considered in the population which consisted of 18,000 employees (casual and permanent, the breakdown is given in Table 1). In 2005 a field survey was conducted and questionnaires were sent out to the three groups as shown below:

TABLE 1
EMPLOYEE STRUCTURE OF NLNG LTD.

Category of Employee	# in Category	% of Total	% of Permanent
Casual/Contract Workers	17,600	97.79 %	n/a
Junior Staff	197	1.09 %	49.25 %
Senior staff	150	0.83 %	37.50 %
Management Staff	53	0.29 %	13.25 %
Total	18,000	100.00 %	100.00 %

Source: Field survey (throughout this study the field survey refers to the field survey conducted in 2005)

ANALYSIS, RESULTS AND DISCUSSION

Descriptive Analysis

(a) *Start-up risks:*

Supply and demand are not an issue for NLNG Ltd., specifically, natural gas:

- Supply – with proven reserves of 197 trillion cubic meters (estimated to last 109 years) and unproven reserves of about 600 trillion cubic meters (estimated to last about 300 years), Nigeria, with seventh largest gas reserves in the world, is not challenged in terms of gas supply (Gowon, 2012). Due mainly, to the lack of a gas infrastructure, 75 percent of associated gas is flared and 12 percent re-injected. Nigeria, after setting a target of zero flare by 2010, provided incentives for the production and use of gas (Mbendi, 2013).
- Demand – Although there is a low risk of volatility in the demand for O&G, the suppliers do not have the control of the global demand. However, the global consumer request for substitute energy sources is likely to continue to expand significantly as more countries seek cleaner fuels to mitigate the environmental harm from economic growth. At an annual growth rate of seven percent over the last decade, LNG is the fastest-growing component of the global natural gas market.

(b) *A Viable ownership/control structure for NLNG Ltd:*

It took over 30 years for NLNG to progress from the first negotiations into operations. The Nigerian government had to redesign the firm by shifting it from public to private sector and then to reduce its control from 60 to 49 percent¹. Thus, it appears that: while the private sector firms were unwilling to invest in the project in the absence of major government involvement, they were also unwilling to get involved if the Nigerian government had absolute control.

Other start-up risks involve: Meeting the requirements for Federal Environmental Protection Agency (FEPA), now Federal Ministry of Environment regulations and standards with:

- Environmental Baseline Studies (EBS),
- Environmental Impact Assessment (EIA),
- Environmental Evaluation Report (EER),
- Environmental Sensitivity Index Mapping (ESI),
- Contingency, Planning & Drills, and
- Remediation promises.

Also, NLNG Ltd had to work within other Nigerian safety legislation for industries which include Factories Act of 1990 which replaced the factories decree of 1987 and the Factories Act of 1958. Subsidiary legislated details and guidance are collected under the factories Act and include the:

- Factories (Sanitary Accommodation) regulation, 1957
- Factories (wood working machinery) regulation, 1958
- Docks (safety of labor) regulation, 1958
- Docks (sanitary of labor) regulation, 1958
- First Aid Boxes (prescribed standard) order, 1958

NLNG Ltd.'s ability to resolve the forgoing issues is proven by the company's major milestones in the first few years of operations as follows:

- Incorporation of the firm in May 1989 with corporate office in Lagos,
- Start of construction of the LNG plant in 1995 on the Bonny Island, Rivers State,
- First LNG shipment by NLNG Ltd in Oct/99 (120,000 M³ of LNG to Italy), and
- Subsequent expansions to the LNG plant and additions to the fleet of LNG-tanker vessels.

Thus, on the basis of deductive logic we assert that NLNG Ltd. has been able to affect a clear resolution to the basic start-up risks.

(c) *Viable balance for conflicting goals:*

Along with generating profits for its joint-venture partners, NLNG Ltd. has the social purpose of: acquiring and growing a major share of the international gas market for Nigerian natural gas, via the promotion, implementation and efficient operation of a gas transmission system, an LNG plant and a shipping fleet.

Balancing these two often conflicting goals potentiates the business risk NLNG Ltd faces. Specifically, NLNG Ltd encompasses the hopes and aspirations of the people of the second wealthiest nation in sub-Saharan Africa. Also, NLNG Ltd. is a key employer in that country with over 18,000 employees. Further, as the fifth largest producer in the Organization of Petroleum Exporting Countries (OPEC), Nigeria is an important player in world energy markets and is likely to become more important as its energy output rises.

In a politically and socially unstable region like West Africa, the desirability for significant government involvement in a large business with highly-vulnerable fixed assets and transportation lines (e.g. pipelines, trucks, and roads) and an inescapable dependence on a national resource (i.e. gas fields and gas separated from oil) is very clear. However, government involvement creates a potentially massive moral hazard. Specifically, once the private investment is committed and difficult to withdraw, some future government (elected or by military coup) may choose to expropriate the private value (in whole or in part) and redirect it to some goal.

While there have been clear statements of intent and of shared values, such fine sentiments are only words that always have a risk that they may or may not be followed, thus questioning the likelihood of NLNG Ltd.'s position on having viable balance between its profit-oriented and its national aspiration goals.

(d) *Use of organizational and/or employee structure and other means to mitigate high risk:*

NLNG Ltd has been very creative in managing its affairs to control risk.

- **The ownership and investment structure** commits the Nigerian Government to a 49 percent stake in the firm. This becomes especially important as NLNG Ltd increases the share of its assets that are outside of the national boundaries of Nigeria (e.g. tankers, LNG inventory in transit, receivables, and long-term contracts to supply LNG).
- **The employee structure** (See Table 1) gives NLNG Ltd extraordinary flexibility in terms of when, where hires, it minimizes the cost of an unexpected shutdown, and it provides a core/nucleolus of well-trained professionals on which to build the firm.

It should also be noted that the hiring of mostly casual/contract Workers (97.79 percent of the total) enables NLNG Ltd to use temporary employment to offset consequences of temporary harm to the surrounding communities (e.g. reduced availability of fish due to dredging, such effects only lasted a few years and were offset by increased demand and rising prices for fish, once the NLNG plant and harbor were in full operation). The casual/contract employment jobs can be adjusted into a number of more permanent positions to offset the more permanent difficulties that arise from the full-operation of the NLNG plant and harbor.

Based on the forgoing review this study asserts that NLNG Ltd (appears) to have the means to use its organizational and/or employee structure and other means to mitigate a high risk environment.

(e) *An effective RM policy:*

NLNG Ltd. has clearly enunciated:

- Shared Values for: Health, safety and environment; Discipline and professionalism; Commercial orientation; Partnering with host communities; and Team-work, trust and mutual respect.
- Published policies on: Sustainable development; Smoking; Alcohol and drugs; and Health safety and environment.

However, these stated shared values and policies have limited meaning if they are not applied. This important issue is answered by the following observations:

- NLNG Ltd has implemented many programs to meet the ongoing responsibilities it owes the Bonny Island host-community. These programs seek to improve the living standard and conditions of the people of the community and has had a number of major successes.
- During the construction and operational phase, NLNG Ltd assisted and continues to assist local communities in adjusting to the socio-economic impact of the LNG project. The programs established and maintained to help the communities realize benefits from the project on a long-term, sustainable basis range from health, education, and employment through to economic/infrastructure development, including participation and assistance in government diseases-prevention programs (e.g. immunization and malaria rollback).

Given the:

- ✓ Above mentioned policy and literature review and
- ✓ Questionnaire responses from 225 of 300 permanent employees sent questionnaires on satisfaction with the NLNG Ltd RM, the *satisfied-or-very-satisfied* proportion for satisfaction with:
 - Policies was 80 percent,
 - Housekeeping was 73 percent,
 - Community RM was 80 percent, and
 - Other Practices was 74 percent.

(f) *Health, safety, & environmental efforts meet international standards*

NLNG Ltd also has a well-articulated health, safety and environmental (HSE) policy which states that the company seeks to "... conduct its activities in such a way as to take foremost account of the health and safety of its employees and of other persons and to give proper regard to the conservation to the environment". NLNG Ltd aims to be among the leaders in the LNG industry in these matters. Further, training and education programs reduce HSE issues and prepare employees to respond to those issues that do occur.

In terms the HSE Efforts of NLNG Ltd conforming to international standards, 74 percent of the responding NLNG Ltd permanent staff agreed or strongly agreed. The above review asserts that NLNG Ltd. health, safety, and environmental efforts meet international standards.

(g) *Adequate insurance to cover its expected risks*

NLNG Ltd has various insurance policies which include third party liabilities as a way of mitigating the problems and claims which might arise in the course of carrying out its liquefied Natural Gas (LNG) project. The firm's protection and indemnity cover provides coverage to third party to the tune of \$5 billion dollars. While there are a variety of policies to cover most aspects of the NLNG Ltd operations, insurance is only one method of controlling the risks of an unknown future. In many cases the type of risk and/or moral hazard mean there is no insurance coverage or the available insurance coverage is prohibitively costly. In such cases, it is sensible for the risks to be managed either alone or in conjunction with partial coverage.

RM has been defined as the planning, arranging, and controlling of activities and resources so as to mitigate the impact of an uncertain event/s (Diacon & Carter, 1992). RM embraces all techniques involved in reducing or minimizing the impact of uncertain loss events and the treatment of same to the best economic advantage of an organization (Chapman, 1989).

In terms the insurance coverage of NLNG Ltd being adequate, 69.8 percent of responding NLNG Ltd permanent staff agreed or strongly agreed. Based on the forgoing review, we assert that NLNG Ltd appears to have adequate insurance to cover its expected risks.

HYPOTHESES

The Brymann & Bell (2011) top down approach is applied to this study. The null hypotheses (H_0 , 1 to 3, below) are drawn from basic risk-management literature and so structured that their confirmation would be indicative of poor or nonexistent RM:

Hypothesis 1: *Nigeria LNG does not have effective RM policy.*

Hypothesis 2: *Health, safety and environmental efforts of Nigeria LNG do not conform to international standards*

Hypothesis 3: *Nigeria LNG does not have adequate insurance cover as a risk RM mechanism.*

Data and Methodology

After eliminating the casual and contract employees in the three locations, the others the permanent employees (400 in total) are grouped into three categories, namely junior staff (JS) with 197, senior staff (SS) with 150 and the Management staff (MS) with 53 employees respectively. These 400 are considered as the true population sample. Using the famous Taro Yamane's formula on sample size for finite population:

$$n = N / (1 + Ne^2) \quad (1)$$

Where: n = desired sample size

N = Population size

e = Maximum acceptable margin of error

An acceptable sample size from the population of 400 permanent staff of NLNG Limited would be computed as follows (allowing a 5% margin of error)

$$\text{Sample Size 'n'} = 400 / 1 + 400(0.05)(0.05) \quad (2)$$

From the result of the above calculation, a sample size of 200 would be considered representative enough. While the selection of the sample size is arbitrary, in order to achieve a wider coverage, adequate representation and higher level reliability, 300 questionnaires were administered constituting 75 percent of total population instead of the 200 which is 50 percent obtained from the result of the Taro Yamane's formula as computed above. Stratified random sampling procedure is employed in this study. It is believed that this sampling procedure is quite appropriate and representative as it first identified some characteristics that are being researched and then using these characteristics as a basis for further random sampling of the entire population.

Questionnaires with 53 questions were sent to gather data. Administered in Lagos, Port-Harcourt and Bonny offices and were completed by their employees (personnel) ranging from management to junior cadre. Some were specially addressed to production managers, construction managers at sites, insurance managers, health and safety managers and administrative managers in the various departments.

Data was collected from the following addresses: Nigeria Liquefied Natural Gas Company Limited (Head Office), C&C Tower, Plot 1684 Sanusi Fafunwa Street, Victoria Island, Lagos; Bonny LNG Plant, Nigeria Liquefied Natural Gas Company, LNG Plant Complex, Bonny Island, Rivers State; and Nigeria Liquefied Natural Gas Company Limited (Port Harcourt office), Amadi Creek, Off Eastern by-pass, Port-Harcourt, Rivers State.

The various department considered are: Managing Director; Legal Department; Expansion Coordinator Department; Corporate Planning Department; London Office.

To ensure a fair distribution the allocation was based on the proportion of each stratum to the entire population as shown in Table 2. The bulk of the unreturned questionnaires were those sent to stations outside Lagos (Bonny and Port Harcourt). However, the average response rate of 75 percent is impressive and adds to the credibility of the study findings.

TABLE 2
DISTRIBUTION AND THE RESPONSE

Serial #	Status	Total #	#of questionnaires	Returned & Validated
1	JS	197	147	110
2	SS	150	113	85
3	MS	53	40	30
	Total	400	300	225

Data Analysis -- Descriptive Analysis

TABLE 3
NLNG PROCESS AND METHODS OF IDENTIFYING RISK EXPOSURES

Risk Identification process in Nigeria LNG					
Serial #	Option	JS	SS	MS	Total
1	Safety Inspection	100	75	30	205
2	Accident Investigation	10	10	-	20
3	Fault Tree Analysis (FTA)	-	-	-	-
4	Hazards Operationability Studies (HAZOPS)	-	-	-	-
	Total	110	85	30	225
Methods of Identifying Risk Exposures					
Options*	Junior	Senior	Mgt.	Total	Percentage
A	-	-	-	-	0
B	-	-	-	-	0
c	-	-	-	-	0
D	110	85	30	225	100
E	-	-	-	-	-
Total	110	85	30	225	100

*See Note 2 for the option details.

TABLE 4
RESPONSES ON:

GOOD-HOUSEKEEPING AS A RM EFFORT IN NLNG		
Options	No. of Respondents	Percentage (%)
Very Satisfied	165	73
Satisfied	-	-
Not satisfied	60	27
Undecided	-	-
Total	225	100
COMMUNITY RELATIONS POLICY RM EFFORTS IN NLNG		
Option	No of Responses	Percentage %
Very Satisfied	95	42
Satisfied	85	38
Not Satisfied	40	18
Undecided	5	2
Total	225	100
NLNG'S FEDERAL EPA'S ENVIRONMENTAL MANAGEMENT STRATEGIES		

Options	No of Respondents	Percentage %
Very Satisfied	105	47
Satisf	62	27
Not Satisfied	54	24
Undecided	4	2
T	225	100

Table 4 shows respondents' information on good house-keeping as a RM; response on community relations policy; responses on Nigeria LNG Federal Environmental Protection Agency's Environmental Management Strategies. Under the RM process, the economic control of risks could be handled from two basic perspectives and these are the physical and financial control. The financial control aspect could either be retained or transferred through insurance mechanism.

Table 5 depicts the respondents' information on level of satisfaction on claims, risk improvement and advisory services. Table 5, shows that Nigeria Liquefied Natural Gas (NLNG) Company Limited enjoys good insurance services in terms of claim settlement, risk improvement and Advisory services from their underwriters (insurers) which are identified as National Insurance Corporation of Nigeria Plc (NICON) and Industrial and General Insurance Co. Ltd (IGI).

TABLE 5
LEVEL OF SATISFACTION ON CLAIMS, RISK IMPROVEMENT AND ADVISORY SERVICES OF NLNG INSURANCEⁱⁱ

Options	No of Respondents					
	Claims	%	Risk Improvement	%	Advisory Services	%
<i>Very Satisfied</i>	165	73	150	67	136	61
Satisfied				-	14	6
Not Satisfied	60	27	75	33	75	33
Undecided	-	-	-	-	-	-
Total	225	100	225	100	225	100

Source: Field Survey

Table 6 depicts the effective RM policy.

TABLE 6
EFFECTIVE RM POLICY OF NIGERIA LNG

Options	Junior Staff	Senior Staff	Mgt. Staff	Total
Satisfied	69	79	25	173
Not Satisfied	41	6	5	52
Total	110	85	30	225

Source: Field survey

The adequacy of Insurance Coverage was buttressed by the various responses to item 22 of the questionnaire which asked the respondents to outline the type of insurance cover Nigeria Liquefied Natural Gas (NLNG) Limited has. Respondents' responses reflected that the company has adequate insurance cover on Contractors All Risks (CAR); Computer Insurance; Motor Insurance (third party fire and theft); Public Liabilities; Fire and Special Perils; Marine Insurance (Hull Liabilities); Motor Insurance (Comprehensive); Goods in Transit; Workmen Compensation; Group Life Assurance Policy and Staff Retirement Benefit Scheme.

Statistical Testing

Simple percentages and chi-square test (χ^2) were used as a statistical instrument to test the various hypotheses formulated for this research. Chi-square test (χ^2) is applied when there are two variables drawn from independent samples each of which is categorized in two ways and there is no relationship between the two variables, for example “Yes” or “No” responses and when the data are expressed in frequencies.

Using this statistical technique, it is advisable to start by stating the null hypotheses that, in other word, the two variables are independent of each other. The following formula is used in computing the chi square value for the data:

$$\chi^2 = \sum_{j=1}^{nr} \sum_{k=1}^{nc} ((O_{jk} - E_{jk})^2 / E_{jk}) \quad (3)$$

Where O_{jk} = Observed Frequency
 E_{jk} = Expected Frequency
nr = Number of rows
nc = Number of Columns

Testing the Hypotheses

Hypothesis 1

Null Hypothesis H_0 : That Nigeria LNG does not have an effective RM policy

Alternative Hypothesis, H_1 : That Nigeria LNG has an effective RM policy

In applying the Chi-square to test the formulated hypotheses, we compared the "observed" cell frequencies with the "expected" cell frequencies. The expected cell frequencies are computed for the cell by multiplying their row total in which that cell appears by the column total in which the cell also appears and then dividing the result with the total number of observation in the entire contingency table.

For the purpose of this statistical test, the various options shown in the questionnaires have been compressed into two major options (categories) that is ‘Satisfied’ and ‘Not Satisfied’, especially for the questions adopted for the test. Expected cell frequencies are calculated using the equation below:

$$E_{jk} = n_j n_k / n \quad (4)$$

Where: E_{jk} = the expected cell frequencies;
 n_j = row total of the category in question;
 n_k = column total of the group in question; and
 n = the total responded in the sample.

From Table 6 the following expected frequencies are calculated for the categories of ‘satisfied’ and ‘not satisfied’ (see, respectively, Tables 7 and 8). The test statistics chi-square (χ^2) is computed, null hypothesis, H_1 is tested using equation (eq.2) as follows:

TABLE 7
EXPECTED FREQUENCIES FOR THE CATEGORY – ‘SATISFIED’

<i>Junior Staff</i>	<i>Senior Staff</i>	<i>Management Staff</i>
$(173 \times 110)/225 = 84.58$	$(173 \times 85)/225 = 65.36$	$(173 \times 30)/225 = 23.06$

TABLE 8
EXPECTED FREQUENCIES OF THE CATEGORY ‘NOT SATISFIED’ FOR

<i>Junior Staff</i>	<i>Senior Staff</i>	<i>Management Staff</i>
$(52 \times 110)/225 = 25.42$	$(52 \times 85)/225 = 19.64$	$(52 \times 30)/225 = 6.93$

Using Table 6, 7 and 8 and equation (2) we receive χ^2 of:

$$\begin{aligned}
 \chi^2 &= (69 - 84.58)^2 / 84.58 + (79 - 65.36)^2 / 65.36 + (25 - 23.06)^2 / 23.06 \\
 &\quad + (41 - 25.42)^2 / 25.42 + (6 - 19.64)^2 / 19.64 + (5 - 6.93)^2 / 6.93 \\
 &= 2.87 + 2.85 + 0.16 + 9.55 + 9.47 + 0.53 \\
 &= 25.43
 \end{aligned}$$

The Critical value of degree of freedom (df) of 2 i.e. $(2 - 1) (3 - 1)$ at a 0.05 level of significance is 5.99. Since the calculated value of 25.43 is greater than the critical value, the null hypothesis is rejected at 0.05 level of significance. Thus it can be concluded that the staff of Nigeria Liquefied Natural Gas (NLNG) perceive that it has an effective RM policy.

Hypothesis 2

Null Hypothesis, H_0 : Health, safety and environmental efforts of NLNG does not conform to International Standards.

Alternative Hypothesis, H_1 : The health, safety and environmental efforts of NLNG conform to International Standards. Using Table 9 below, the expected frequencies are calculated:

TABLE 9
CONFORMITY OF NLNG HEALTH, SAFETY AND ENVIRONMENTAL EFFORTS TO INTERNATIONAL STANDARDS

Options	Junior Staff	Senior Staff	Mgt. Staff	Total
Satisfied	68	71	27	166
Not Satisfied	42	14	3	59
Total	110	85	30	225

Source: Field Survey

TABLE 10
EXPECTED FREQUENCIES FOR THE CATEGORY ‘SATISFIED’ FOR:

JUNIOR STAFF	SENIOR STAFF	MANAGEMENT STAFF
$(166 \times 110)/225 = 81.16$	$(166 \times 85)/225 = 62.71$	$(166 \times 30)/225 = 22.13$

TABLE 11
EXPECTED FREQUENCIES FOR THE CATEGORY ‘NOT SATISFIED’ FOR:

JUNIOR STAFF	SENIOR STAFF	MANAGEMENT STAFF
$(59 \times 110)/225 = 28.84$	$(59 \times 85)/225 = 22.29$	$(59 \times 30)/225 = 7.87$

Using Table 9, 10 and 11 and equation (2) we receive χ^2

$$\begin{aligned}\chi^2 &= (68 - 81.16)^2/81.16 + (71 - 62.71)^2/62.71 + (27 - 22.13)^2/22.13 \\ &\quad + (42 - 28.84)^2/28.84 + (14 - 22.29)^2/22.29 + (3 - 7.87)^2/7.87 \\ &= 2.13 + 1.1 + 1.07 + 6.01 + 3.08 + 3.01 \\ &= 16.40\end{aligned}$$

Since the calculated value 16.40 is greater than the Critical value of χ^2 at degree of freedom (df) of 2 i.e. $(2 - 1)(3 - 1)$ at 0.05 level of significance which is 5.99 we reject the null hypothesis and the alternative hypothesis is upheld, that is health, safety, and environmental efforts of Nigeria LNG conforms to International Standards.

Hypothesis 3

Null hypothesis, H_0 : Nigeria LNG does not have adequate insurance cover as a RM mechanism.

Alternative hypothesis, H_1 : Nigeria LNG has adequate insurance cover as a RM Mechanism.

Using Table 12 below, the expected values are calculated as follows:

TABLE 12
ADEQUACY OF INSURANCE COVER ON NLNG ASSETS

Opinion	Junior Staff	Senior Staff	Management Staff	Total
Satisfied	66	62	29	157
Not Satisfied	44	23	1	68
Total	110	85	30	225

Source: Field Survey

TABLE 13
EXPECTED FREQUENCIES FOR THE CATEGORY ‘SATISFIED’ BY:

JUNIOR STAFF	SENIOR STAFF	MANAGEMENT STAFF
$(157 \times 110)/225 = 76.75$	$(157 \times 85)/225 =$	$(157 \times 30)/225 = 20.93$

TABLE 14
EXPECTED FREQUENCIES FOR THE CATEGORY ‘NOT SATISFIED’ BY:

JUNIOR STAFF	SENIOR STAFF	MANAGEMENT STAFF
$(68 \times 110)/225 = 23.24$	$(68 \times 85)/225 = 25.96$	$(68 \times 30)/225 = 9.07$

Using Tables 13 and 14, the χ^2 is computed as follows:

$$\begin{aligned}\chi^2 &= (66 - 76.75)^2/76.75 + (62 - 59.31)^2/59.31 + (29 - 20.93)^2/20.93 \\ &\quad + (44 - 23.24)^2/23.24 + (23 - 25.69)^2/25.69 + (1 - 9.07)^2/9.07 \\ &= 1.51 + 0.12 + 3.11 + 3.48 + 0.28 + 7.18\end{aligned}$$

= 15.65

Since the critical values of χ^2 at degree of freedom (df) of 2 (i.e. (2 -1)(3-1)) at 0.05 level of Significance is 5.99 and the calculated value is greater than the critical value the null hypothesis is rejected and the alternative hypotheses which states that Nigeria Liquefied Natural Gas Company Limited (NLNG) has adequate insurance cover as a RM mechanism is accepted.

CONCLUSIONS

As noted in the introduction, risk is an unavoidable and inevitability of life and business. Thus, effective RM is fundamental to the success of organizations and a basic expectation of most stakeholders (shareholders, employees, creditors, customers, neighbors, regulators, etc.). Where effective RM cannot be applied, projects are either not established or, if established there is a high likelihood that they will fail, often with catastrophic outcomes.

NLNG Ltd. is a most interesting case, it was successfully established in a high-risk environment with risks that ran the gamut from natural to moral hazard and ranged from: corruption (TI, 2012) to a business unfriendly environment to violence (including: piracy, insurrection and war). However, because Nigeria desperately needed the investment, wealth, capabilities, and services inherent in the firm, a corporate structure was evolved to operate and thrive in that potentially very risky and hostile environment. Any corporation which can operate and grow in such an environment has a lot that it can teach other firms and governments. Lessons from the success of NLNG Ltd include:

- 1) Investment in a country with high levels of corruption is always a great risk, but the government can draw private investors if it is willing to take an appropriate-sized stake in the desired project.ⁱⁱⁱ Specifically, the stake must be sufficient to sooth the fears of the private investors but not so massive that the private investor fear the government taking absolute control over the project. In the case of NLNG Ltd., the government stake of 49 percent was sufficient to give it the maximum level of effective control but less than the absolute control of 50+ percent. However, the level of control was sufficient that the three private investors would have to band together to wrest effective control from the government, something which is unlikely to happen as long as the government does not behave egregiously.
- 2) Significant government involvement in a project creates the need to balance the conflicting goals of profit *satisficing* (Simon, 1956, pp.129 and 136; Brown, 2004) with National aspirations. Where such a balance is not attained and sustained, a project is likely to be still born or to fail later in a spectacular and devastating way. While NLNG Ltd. Has been able to strike such a balance, the stability of that balance is questionable and represents one of the most important risks to that firm's future.
- 3) An effective corporate RM policy is crucial for the ongoing wellbeing of a firm and its stakeholders. NLNG Ltd., has wisely created such policies and in the process of creating them has identified and resolved many risks to the firm's founding and operations.
- 4) Health, safety and environmental efforts that meet international standards reduce the risk that the firm will be shut-down by a catastrophic accident and/or that the private investors will face legal action in international courts or in the courts of their own nations.
- 5) Adequate insurance is always a wise investment and self-insurance is no substitute for actual insurance coverage. While NLNG Ltd. has significant coverage, the firm recognizes that insurance is only a part of good RM practices.
- 6) Among the most important lessons from NLNG Ltd., is that its very structure (both financing/ownership and employee) can significantly reduce the risks it faces. For example, the ownership structure discussed in part 1 (above) provides investors with comfort about moral hazard issues. Comfort is also provided to the investors through the incredibly large proportion of temporary employees (97.79 percent) in that the firm can be rapidly shut down if the government

turns predatory. The high percentage of temporary employees also provides a means to offset temporary harm during the construction phase.

The χ^2 analysis of the questionnaire responses of NLNG Junior, Senior, and Senior-management staff perceive that NLNG has: 1) An effective RM policy; 2) Health, safety and environmental efforts that conform to International Standards; and 3) Sufficient insurance cover for insurance to be effective as a RM mechanism. The results tables appear to suggest that the more senior the position of the NLNG staff the less complacent their perceptions appear to be about the NLNG RM performance. Future studies should consider doing a cross-sectional comparison by position level to determine if the level of a staff member's posting affects their perception of their firm's RM performance.

In summary, NLNG can provide important insights on how corporations or projects can operate in very hostile environments and should be studied intensively over the next few decades, as it extends and expands its operations.

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ENDNOTES

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- ⁱ The ownership percentages are as follows: The federal Government of Nigeria through NNPC: 49.0%; Shell Gas BV (Shell): 25.6%; Cleag Limited (ELF): 15.0% and Agip International BV (Agip): 10.4%.
- ⁱⁱ Methods of Identifying risk exposures (options for table 5):
- a) On-site physical inspection of upstream and downstream projects,
 - b) Analysis of flow chart illustrates operational processes,
 - c) Examination of financial statements and documentation,
 - d) The use of experts from within and outside the country, and
 - e) Review of results from engineering surveys and questionnaires.
- ⁱⁱⁱ Ibid, note 1.