

Full Length Research

Investors Risk Assessment in the Oil and Gas Sector

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This study aimed at identifying the significant risk that impact various investors in the oil and gas sector in Nigeria and the best method to assess such risk. The method used in this study is purely exploratory. It is a library research which was based on empirical literatures survey and secondary information. The study reveals that in assessing investor's risk, a quantitative method is preferable as it reduces the subjectivity and bias associated with the qualitative method. The study also revealed that Environmental risk, political risks including force-majeure due to militants attack, gas flaring, gas leakage and oil spillage, risk to ground water during drilling operations and armed conflict are significant to both potential and existing investors. The study recommend that proper risk evaluation and management should be carried out by both potential and existing investors in order for them to be able to ascertain the minimum acceptable risk in the sector and government should also come up with ways to assess and evaluate the impact of investors risk in oil and gas to the society, so that necessary compensation can be demanded by the citizenry.

Key Words: Investors risk, volatility, probability, risk impact, government rule, environmental incident, qualitative assessment, quantitative assessment, geological/pipeline risk, economic/political risk

INTRODUCTION

Investors routinely deal with risk and uncertainty in making decision concerning where and how to invest and will continue to do so in the face of climate change, policy, environmental, technological, and political uncertainty. They normally want to maximize return as such want to work in risk free zone however the higher the risk associated with a particular investment, the higher the potential return and also the higher the potential loss. Investors need to consider a number of aspects of investment risk when taking or building investment portfolio. Oil and gas operations are divided into two sectors: the upstream sector which take care of the exploration and production of crude oil and natural gas and the downstream sector in which the crude oil and natural gas are processed in refineries and petrochemical plants, marketing and ensuring that they are readily available for used or sold.

Oil and gas development projects are characterized by large capital investments which include a clear

determination of the risks and rewards of each investment opportunity. Adenikinju and Oderinde (2010) noted that the trend in fiscal terms is an important consideration in the assessment of the viability of an oil exploration and production investment project, particularly with the peculiar industry risk of the oil sector and the inherent uncertainty of the international oil market condition. With different forms of contractual arrangements in place, the Nigerian oil and gas sector provides large opportunities to foreign investors and local companies with know-how and technical capacity to contribute with added value in joint ventures. However, Nigeria is a difficult market to operate in and one of the most important single factors to ensure success in this oil and gas projects is by thorough risk assessment and management (Mohammed and Bukola, 2009). Activities in oil and gas sector involve high risk and a composite of many functions ranging from the search for crude oil and gas in its natural underground reservoir to the marketing of refined products, which is the combination of upstream and downstream activities in the petroleum industry. These activities with high risk impact investor's decision.

In line with the aforementioned this study examines

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investors risk assessment in the oil and gas sector in Nigeria

The objective of the study is to identify the significant risks that impact various investors in the oil and gas sector in Nigeria and the best method to assess such risk. The method employed for this study is purely exploratory.

LITERATURE REVIEW

Conceptual Framework

Investors Risk

According to business dictionary (2010) risk is a probability or threat of damage, injury, liabilities, loss, or any other negative occurrence that is caused by external or internal vulnerabilities, and that may be avoided through preemptive action. When viewed from finance perspective is the probability that an actual return on an investment will be lower than the expected return. Insurance see risk as a situation where the probability of a variable (such as burning down of a building) is known but when a mode of occurrence or the actual value of the occurrence (whether the fire will occur at a particular property) is not. Risk is the possibility of an adverse deviation from a desired outcome that is expected (Agbadudu and Unugbro, 2009). In its broadest sense, the term risks include all situations in which there is an exposure to adversity. In some cases, the adversity involves financial loss, while in others it does not. Grabowski (2006) defines risk as the probability and severity that a certain event will occur, the event which has occurred or going to occur has some unwanted outcomes which can be positive or may be negative. The events which are going to be occur has some ranges which vary from minor to disastrous, which mainly depends upon the condition. The term risk is used in a technical sense to describe the probability of occurrence of a known event, i.e. either beneficial or damaging. The informed or sensible determination, prediction and mapping of both outcomes, be they beneficial or damaging, is assumed in such probabilities (Ingwe, Bessong and Uwanade, 2013)

Identifying and Classifying Investors Risks in Oil and Gas Sector

According to Kabir (2012), the level of risk in oil and gas operations can be both significant and wide in scope, and the location of new site even in already established field encompasses high level of uncertainties. Exploration operations are risky because oil is hidden underground and the only confirmation of its presence is through drilling. In this case a geological risk of drilling and hitting

a dry hole abide. Other risk that are paramount in the oil and gas sector includes, market risk (the risk of not finding an outlet for production at a satisfactory price), sovereign/political risk (the risks of nationalization of operations, currency devaluation, licensing and exploration agreements), partner risk (the risk of partner default, distrust, unwillingness, inability or delay in paying due shares of cost of exploration and development), youth militancy risk (the risk of kidnapping of personnel and vandalism of equipment's by militant youths) and tax risk (the risk of unexpected change in tax provisions). Ajao (2009) notes that risks are generally classified into two: (i) systematic risk and (ii) the unsystematic risk. Isenmila, Eragbhe and Ogiedu (2010) state that systematic risks are imposed by the market and therefore cannot be diversified away and they are caused by such general factor in the environment such as inflation, economic problems, political problems, fluctuation in exchange rates, changes in taxation rules. Ajao (2009) claims were in line with Isenmila et al. (2010) that these types of risks are caused by factors external to the firm or investor and are uncontrollable and undiversifiable in nature. This type of risk influences a large number of assets, each to a greater or lesser extent. He further opines that because systematic risks have market wide effects, they are sometime called market risk. Is the type of risk that investors would like to pay for in order to avoid e.g. purchasing risk, interest rate risk, inflations risk, and economic meltdown, the unsystematic risk is also called apha risk, specific risk or non-market risk. Unsystematic risk are caused by factors which are internal to company or individual investors. Ajao (2009) state that these risks are avoidable, controllable and can be diversified away by investors through efficient or proper portfolio management, unsystematic risk may arise as a result of managerial inefficiency, nature of investment, poor advertising, technological changes, labour union problem (strikes), changes in consumer preference, competition.

Economic/Political risk: Economic and political factors play an important role in the performance of investment markets. Economic factors include economic growth, inflation, employment, interest rates and business sentiment and change in any of these factors can constitute a risk to an investor. Political risk includes changes in government, political uncertainty and international conflicts (Vanguard Asset Management Limited, 2013). According to Boshoff (2009), political risk can help assess how the business can be impacted under varying political scenarios. As multinational businesses operate in a particular political environment, the phenomenon of risk must be assessed in a political context. Political risk is a type of risk that investors, multinationals, foreign-based organizations and governments face as a result of a political related situation, an unforeseen occurrence or environmental incident. Political risk can be seen as a related concept to

risk, being the analytical process that uses particular variables to forecast the probability of events that may or may not affect an investment. Political risk can be regarded as any political change that alters the expected outcome and value of a given economic action by changing the probability of achieving business objectives (Price Waterhouse Coopers, 2006). Political risk involves assessing whether an irregular political event will occur, and if so, whether it is likely to affect the existing or the potential business. Examples of political risk include government rule, shifts in power, terror, insurrection, war and civil conflict, health and environmental situation, infrastructure, business trends, corruption and environmental changes. On the other hand, a political change can also improve the business climate, such as when the Chinese opened for economic reform and foreign trade, initiated after 1978, the country began to generate significant and steady growth in investment. Political risk analysis can therefore contribute to identify and capitalize on unexploited opportunities (PWC, 2006).

Geological risk/ Pipeline risk: Involves the geologist making a prediction based on historic statistics and analogues of other basins and plays with similar geological characteristics, of the chance of there being any hydrocarbons in the prospect. This chance can be successful estimate or unsuccessful estimate (Fiona, 2000). Gas pipelines are environmentally sensitive because they cross varied fields, rivers, forest, populated areas, desert, hills and offshore. Gas transmission in order to deliver the economic and almost clean energy from producing sources to final consumers is one the most important tasks. Pipelines represent a linear risk source that can create controversial challenges in gas industry of the country. Therefore, pipeline risk assessment is one of the sciences that have been developed due to pipelines growth (Hamid, Saeed, Gholamreza, Mousa and Nasim, 2011).

Operator Risks: Offshore oil and gas exploration and production is an inherently dangerous process fraught with risk that requires a significant amount of human labor to carry out. The nature of offshore rigs and platforms put humans in close proximity to volatile substances and chemicals. While processes and procedures have been developed to mitigate all types of risks, frequently the human condition of offshore workers (and also design flaws in the technology they use) can expose those risks. While the offshore oil and gas industry has spent significant sums of money in the name of creating a safety conscious culture on offshore rigs and platforms, operator related risks due to error and negligence still exist (Dismukes and Christopher, 2011)

Environmental Risks: Ayoade (2011) opines that the concept of environmental risk refers to both hazardous outcome and a probability of its occurrence as a

consequence of man's activities in the environment. Dismukes and Christopher (2011) states that Environmental risks include blowouts, fires and explosions, spills, unintentional discharges, pipeline strikes and failures, and platform strikes and failures. Environmental related risks can be considered the most serious due to the interaction of consequences and the probability of an event. Three specific offshore environmental accidents help define the extreme environmental and financial damages that can result from accidental discharges from offshore accidents

Transportation Risks: According to Fowler and Sorgard (2000), transportation risk arises in a number of forms, from vessels supplying offshore platforms to the transportation of mobile offshore drilling units. Transportation risk is a major concern within the offshore oil and gas industry. Mobile offshore drilling units and offshore platforms are constantly tended by a number of vessels with specific duties. Crew boats are made specifically to shuttle workers from shore to rigs and platforms, while offshore supply vessels (OSVs) handle both shuttle crew and supplies. OSVs shuttle drilling fluids, cement, fuel, water, bulk cargo, and chemicals to rigs and platforms. The nature of handling fuel itself introduces a special risk to operating an OSV (Antonsen, 2009). Bulk cargo, especially which is loaded and unloaded by crane, can introduce additional risk to personnel and the vessel itself.

Equipment Risks/ Volatility risk: Equipment-related risks are also an important factor of offshore oil and gas activity and the insurance industry associated with it. Crane accidents and equipment defects and malfunctions create hazards for operating crews as well as the insurance companies that insure oil and gas companies against those risks. VAML (2013), stated that volatility risk is the fluctuation of investment value over a period of time and it can be used to assess the potential risk associated with an investment

Financial risk/ Business risk: Financial risk is associated with the method, an investors or a firm adopt in financial a project or its operations. Is the risk that a geared or levered company or investors (company or investors with debt in its capital structure) may not make sufficient profit after paying debt interest to finance the priority demand of its creditors. It can also be refers to the variability of income to the equity capital due to debt capital (Ajao, 2009). Business risk is the risk that the potential variability of earnings is caused by the nature and type of business operations. It arises from the inability of a firm to maintain its competitive edge and the growth or stability of its earnings due to the operating environment of the business. The elements in business risk which influence the investment forecast of decision maker or investors are: general economic conditions

which include events that influence the general level of business activities which could be internal and external economic and political situations, monetary and fiscal policies. Industry factors: the inherent risk of the industry. This category of events may affect all companies in an industry. They include change in material cost or operational cost and technological changes. Company factor: this category of events may affect only company. Event such as change in management, strike, natural disaster such as flood or fire may affect directly a particular company (Pandey, 1999) as cited in Ajao (2009)

Methods for Assessing Investors Risk in the Oil and Gas Sector

According to trade union congress (2008) Risk assessment is the process used to identify hazards in the workplace and assess the likelihood that these hazards will cause harm to employees and others. Risk Assessment is the essential part of risk management as it entails the overall process of risk identification, risk analysis, risk evaluation. It therefore means that in the oil and gas industry characterize with a lot of working equipment and technology, high risk working environment, investors must assess the level of risk associated with their investment, infrastructure in order to provide a mitigating measure. Risk assessment is carried out to identify these risks associated with investment, infrastructure and to develop remedies to mitigate those risks. The purpose of the risk assessment is to "identify those investment, infrastructure items, components, systems, and hazards that demonstrate the greatest probability for a failure which would lead to negative impacts to overall safety, the environment, or reliability.

Risk can be assessed qualitatively or quantitatively. Qualitative risk assessment is the process of prioritizing the risks by assessing the probability of occurrence and impact while quantitative risk analysis is the process of numerically analyzing the effect of the identified risks on the investment objectives. There is no single method of risk assessment that covers all types of oil and gas investment risk or workplaces risk. Different risk analyst employed different methods. However, every method involves decisions being made on how acceptable a risk is. This, whatever management may say, is not a scientific process but instead is one based on the value that they place on the safety of their investment and health of their workers.

Qualitative risk assessment method: Lone (2012), look at qualitative method in assessing political risk and stated that some political risk agencies operate solely with qualitative method and apply them in model and matrices. He further states that many political risk analysts attempts to quantify traditionally subjective

political, economic and social phenomena and apply them into mathematical models. Strauss and Corbin (1991) describe qualitative method as a method which end product arrived at does not use statistical procedure or other means of quantification. Holme and solvang (1998) observes that qualitative methods have the advantage of presenting the sum of various variables which gives an increase understanding of the context and relationship. If political risk for examples that is engulfed with large amount of variables that are interrelated is assessed with qualitative method it will have the tendency and advantage to set these variables apart in resolving the variables individually in more effective and efficient manner.

It is noted that qualitative method is by nature exposed by subjectivity of the person using it and the result may depend on the sensitivity and experience of the person conducting such assessment (lindeberg and Morndal 2012). According to TUC (2008), health services executive called HSE approach enable people to successfully carry out risk assessment in workplace. This HSE approach include five steps which entails the following

- i. Identification of risk area or hazard
- ii. Decide who might be harmed and how
- iii. Evaluate the risk and decide on precautions
- iv. Record your findings and implement them
- v. Review your assessment and update if necessary

It is important to carryout risk probability assessment and risk impact assessment once the risk has been identified. According to Bangsgaard (2010) the risk probability assessment is the investigation on the likelihood that each risk will occur and the risk impact assessment is the investigation of the effect from each risk on the objectives or the safety. The priority of the identified risks can be determined by combining the probability of risk and the impact on the risk. For example

$$\text{Risk rating} = \text{risk probability} * \text{risk impact}$$

Probability and impact matrix (Table 1), like the example, is used to determine the importance of the rated risks; as such the various risk are classify as low, medium or high in order to ascertain if such risk is of importance and priority. The risk ranking helps when further analysis and responses has to be made, to determine that the high ranked risks requires priority action and aggressive responses, whereas the medium and low ranked risks might be put at a monitoring list. That a risk is ranked as low does not necessarily mean that no action will be made towards it. If the probability for the risk to occur is small but the impact is high (or the other way around) the need for response can be there. For instance if a project is done close to a volcano, there is only a small risk that the volcano will erupt, but if it does the consequences will

Table 1. Probability and impact matrix.

		Probability			
9	9	27	45	63	81
	Low	Medium	High	High	High
7	7	21	35	49	63
	Low	Medium	Medium	High	High
5	5	15	25	35	45
	Low	Medium	Medium	Medium	High
3	3	9	15	21	27
	Low	Low	Medium	Medium	Medium
1	1	3	5	7	9
	Low	Low	Low	Low	Low
Impact	1	3	5	7	9

Source: TUC, 2008

be severe, so a response plan has to be made ready, if it should occur. (Bangsgaard, 2010)

Quantitative risk assessment method: According to Ting (1988) quantitative approaches to risk assessment is any analytical procedure that is based on data that can theoretically lend themselves to statistical or mathematical operations. Ding (2002) states that quantitative method for risk assessment attempts to assign independently objective values to the component of the risk assessment and to the assessment of the potential loss. Bangsgaard (2010) opine that the quantitative risk assessment is performed on the risks that are prioritised from the qualitative risk assessment and is the process that analyses the numerically effect of the identified risks impact on the overall objectives. The numerically effect could be measured in monetary value, for the effect on the cost objectives, and with time (hours, days, weeks etc.). What is more difficult is to quantify quality, since quality is more relative and subjective. Some risk might also correlate on the impact on the objectives, if the time schedule is exceeded then it might cost more, and if a quality control is not accepted it might take longer and cost more to fix it, etc., so one risk might affect all of the objectives. If we take political risk for example: quantitative risk assessment method will be based on conducting quantitative data into mathematical variables According to Lindeberg and Morndal (2002) it is challenging or sometimes unattainable to quantify political risk because of the difficulty of controlling all the variables and replicating the original conditions However, for the sake of systemizing and gaining a more comprehensive overview of the political risk, quantitative research is more feasible.

In carrying out quantitative risk assessment there is need to quantify safety risk which according to Lone (2012), the risk that threaten the safety of an investment should have the most attention and highest priority. Though a lot of things can be done to prevent the occurrences of such risk but there will always be a risk

especially in oil and gas project due to the nature of the industry. According to Ding (2012) the advantages the quantitative risk assessment method has over the qualitative method are

- i. It is more objective in its assessment
- ii. It offer direct projection of cost/benefits
- iii. It can be fined turned to meet the needs of specific situations
- iv. Can be modified to fit the needs of specific industries
- v. Much less prone to arouse disagreement during management review
- vi. Analysis is often derived from some irrefutable facts.

According to Croker (2003) the objective of QRA is to be able to prioritise which risks should the company plan to prepare for urgently and which are less pressing: moving through the spectrum from urgent / important to non-urgent / non-important. A simplified but rigorous technique such as HAZOP, fault tree analysis, FMEA, HACCP) can be used. QRAs can be used to assess transport and storage risk. It is used to demonstrate the risk caused by the oil and gas activities and to provide the competent authorities with relevant information to enable decisions on the acceptability of risk related to developments on site, or around the establishment or transport route. The basic process involves five steps:

1. Identify hazards and initiating events
2. Identify mitigating safety measures
3. Trace possible chains of events
4. Quantify all individual probabilities and severities
5. Aggregate probabilities and severities, and calculate risks

Theoretical framework

Rational choice theory: Rational choice theory is an economic theory or principle that assumes that individual

investors always make prudent and logical decisions that provide them with the greatest benefit or satisfaction that are in their highest self-interest. Most investment decision is based on this theory. Green (2002) states rational choice theory is conceived as a normative model of an idealized decision maker and not a description of the behaviour of real people, it helps to understand and forecast why certain choices are taken. Brink (2004) Rational Choice theory simply means that a person acts upon balancing costs against benefits in order to arrive at a result that maximizes advantage. Rational Choice Theory generally begins with consideration of the choice behaviour of one or more individual decision-making units which in basic economics and business are most often consumers, investors and firms. Rational choice is therefore rather a logical analysis than a psychological analysis of risk and value. The standard arguments for using this normative analysis to forecast and explain actual behaviour, is first of all, that people are generally thought to be effective in pursuing their goals, especially when they have incentives and opportunities. Rational choice can therefore be described as a maximization process competition which favours rational individuals and organizations. Optimal decisions increase the chances of survival in a competitive environment, and a minority of rational individuals can sometimes impose rationality on the whole market Risk analysis adds value to the maximization process by outlining the potential costs versus benefits. If an investor is uncertain of the best option to invest, political risk analysis contributes to manage such uncertainty. Brink (2004) states that political risk analysis, once conducted, draws the decision maker's attention to the various problems that political risks might pose to the profitability of the investment. Political risk analysis, in its attempt to manage uncertainties for the investor, can be seen as a rational attempt at problem solving (Brink, 2004)

Preference theory: Fiona (2000) states that the underlying assumption is that a decision maker will want to choose the selected course of action by playing the averages, on all options, regardless of the potential negative consequences that might result, to choose the course of action that has the highest expected value of profit. The preference theory also takes into account the executives natural conservatism and suggests that he takes the seismic test first and drill only if it is favourable. The seismic test then is a form of insurance policy, which is good for the conservative decision maker in this case, but not worth its price to the averages player. To implement preference theory, assume that the decision-makers preference curve has been ascertained. Convert all of the end positions of the decision tree into preferences. Find the decision-makers preference for an event fork by taking the mathematical expectation of the preferences values at the end position of the fork. For each act fork, the decision-maker or analyst then selects

the act with the highest preference. Continue backwards through the tree, repeating steps 2 and 3 until the base of the tree is reached. The analysis using preference theory therefore indicates the decision-makers best strategy is to take the test and, if it gives a favourable result, drill; if it produces an unfavourable result, do not drill.

REVIEW OF EMPIRICAL STUDIES

There are many instances of local and international, potential and existing investors, which have suffered loss due to high risk that characterized the oil and gas sector. This has led many researchers to undertake empirical studies to identify those risks which impact the decisions of investors.

In a study conducted by Kishk and Oladunjoye (2009) where they examined the significance of risks in oil and gas projects in Nigeria and their allocation, a sample was collected through a questionnaire distributed to a group of experts working in the local and international oil companies operating in Nigeria. The result revealed that Environmental and political risks areas including force-majeure due to militants attack, gas flaring, gas leakage and oil spillage, risk to ground water during drilling operations and armed conflict have were significant. They noted that other significant risks include the financial and technological risk areas such as cash call problems, inflation rates, cost overruns from budgeted cost, availability of capital, crude oil price, change in foreign interest rate, inadequacy of existing technology and equipment. However, geological and drilling risks have been found to be insignificant. They further states that International and Local experts are in general agreement as to the significant risks of oil and gas projects in Nigeria. However, their perceptions were different for the environmental risks. This might be due to the ease of project execution by the local companies relative to international companies in the oil troubled environment. Risks are largely shared between oil companies and the government representative (NNPC). This reflects the nature of various contractual arrangements which are in place for oil and gas projects in Nigeria. They opine that some of the risks are allocated to companies with only a few risks allocated to contractors.

In another related study, Ingwe, Bessong and Uwanade (2013) identify Risks and disasters in Nigeria's petrocapiatistic oil and gas industry using a pluralistic theoretical framework; the work shows that Nigeria's petrocapiatistic society adds more adversities, promoting conditions to existing thinking about the risk society, claiming that risks pervade minds of the global society. He examined risks as, susceptibility factors (including environmental, materialistic, and socio-cultural specifics) and selected disasters to justify the proposal of a pluralistic theoretical conceptual perspective for framing risk research programme in Nigeria. Dismukes and

Christopher (2011) opine that Hurricanes Ivan, Katrina, Rita, and Ike had significant implications for offshore oil and gas activities. These “Big Four” hurricanes significantly changed the perception of oil and gas industry’s exposure to weather-related risks. This study surveys historic (pre-storm) offshore insurance markets and investigates insurance-related changes occurring after the advent of the Big Four storms. Each major offshore insurance type has been examined including commercial insurance coverage, mutualization coverage, insurance-linked securities, and self-insurance. The research finds that, while considerable offshore insurance changes have been made, post-storm insurance markets reacted in relatively expected ways by changing total coverage limitations, coverage terms, risk-sharing terms, and premiums. The more significant unexpected change rests with the higher annual informational requirements for insuring offshore assets and the greater degree of asset risk assessment and modeling that is now commonplace in the industry.

Ming (2007) results indicate that climate policy risks may be brought down to modest levels compared to other risks if policy is set over a sufficiently long timescale into the future. One method for reducing the effects of uncertainty is to try to shift the expected policy change further out into the future (that is, to set policy over longer timescales). Investment risk premiums are significantly lower when the price jump representing the policy uncertainty is shifted from five years in the future out to 10 years in the future.

Ramos and Veiga (2009) Analyze the exposure of the oil and gas industry of thirty four (34) countries to oil prices risk and the result shows strong support view that oil price is a globally priced factor for the oil industry. Their study shows that the response of the oil and gas sector to changes oil prices is positive and larger for developed countries than for emerging markets. The industry response is asymmetric, with positive oil price changes having a greater impact on the oil sector returns than negative changes. They further noted that, local market index returns, currency rates and oil price volatility also have a significant impact on oil industry's excess returns. Finally, industry local sensitivities seem to vary with stock market activity and with levels of appropriation of industry revenues by governments. Results are robust to a battery of tests. Despite the growing interest of investors in global allocation, the empirical evidence does not provide a global picture of the importance of oil as a global risk factor. Up till now, most of the literature on the sensitivity of stock markets to changes in the oil price has been conducted on countries’ stock returns or limited to industries where the country’s economy is quite dependent on this natural resource.

Udoh and Ekanem (2011) study, uses geographic information system based risk assessment of oil spill in the coastal areas of Akwa Ibom State of Nigeria. The study uses a combination of hazard and vulnerability data

layers which constitutes the GIS based risk assessment. Hazard was modeled in the study by sources of petroleum oil spill moderated by surface characteristics, while data on crop suitability, socio-economy, environmental sensitivity, accessibility, and settlement development, were used to model vulnerability. The resulting risk layer was classed into four Risk zones of very high, high, moderate and marginal risk. Iko and the environs were found to be in the very high risk zone. Based on the fact that increasing investments are being made in the petroleum oil sector in Akwa Ibom State, the study analysis the implications of the findings and stresses the need for a comprehensive GIS based oil spill contingency plan for the area.

Kishk and Oladunjoye (2009) opine that the Nigerian oil and gas industry is very active. New mega projects are coming on stream such as the exploration and production from the deep offshore as well as the construction of a Liquefied natural gas plant to increase gas utilization; various contractual arrangements are in place to woo local and foreign investors for exploration and development projects. However, the number, size and complexity of these projects are increasing resulting in achieving extra operational excellence and also placing more emphasis on the assessment and management of the associated risks. Kishk and Ukaga, (2008), state that Nigerian oil and gas sector provides large opportunities to foreign investors and local companies with know-how and technical capacity to contribute with added value in joint ventures. However, Nigeria is a difficult market to operate in and one of the most important single factors to ensure success in this oil and gas projects is by thorough risk assessment and management. Risk identification and analysis is a critical step in any investment decision, the project objectives, or the measure of the project success or failure, are often defined in terms of cost, schedule and technical performance (Hammoudeh and Li, (2004) the only exception is Nandha and Faff (2008) that analyze a set of industries at global level. They find that oil prices rises have a detrimental effect on industry returns in all sectors except mining and oil and gas industries.

In a study conducted in Ghana by Osabutey, Obro-Adibo, Agbodohu, and Kumi (2013) uses primary and secondary data in their analysis. The study identified risks confronting Tema Oil Refinery (TOR) as instability in global oil prices, depreciation of the cedi against major currencies, health and safety, political interference, environmental pollution, brain drain, shortage of crude oil, huge debts as a result of subsidizing of petroleum products by government and default on the part of oil marketing companies to pay for products and high operational risks. Other challenges as apathy on the part of staff to abide by safety rules was identified. TOR incorporates risk management in their strategic plan and have operations and Audit risk department but have been battling with effective implementation. Made recommendations to government and management of TOR on how

to overcome the problems in implementing risk management in order to achieve the goals of the only refinery in Ghana; however the recommendation was not started in the research work

Lyudmyla and Valerie (2010) perform econometric test, using the Arellano-Bond GMM technique. The result revealed that 'below ground' risks are statistically very important in deterring real investment. They opines that Companies are taking on increasingly complex geological challenges, which are putting upward pressure on production costs and are leading to greater project delays compared to the past. As many of these factors are expected to persist, supply constraints are likely to remain a dominant factor behind oil price fluctuations for several years to come

Conclusion and recommendation

The level of risk in oil and gas operations can be both substantial in amount and wide in scope, and locating new well sites even in already established field is surrounded with high level of uncertainties. This work is a conceptual review of investors risk assessment in oil and gas sector in Nigeria. Issues discussed include Economic/Political risk, Geological risk, Environmental risk, Transportation risk, Operators risk, Equipment risk, volatility Risk, Financial risk, and Business risk. The study concluded that in assessing investor's risk, a quantitative method is preferable as it reduces the subjectivity and bias associated with the qualitative method. The study also revealed that Environmental risk, political risks including force-majeure due to militants attack, gas flaring, gas leakage and oil spillage, risk to ground water during drilling operations and armed conflict are significant to both potential and existing investors

The study recommend that proper risk evaluation and management should be carried out by both potential and existing investors in order for them to be able to ascertain the minimum acceptable risk in the sector and government should also come up with ways to assess and evaluate the impact of investors risk in oil and gas to the society, so that necessary compensation can be demanded by the citizenry.

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