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   - Maritime education and training;
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The Journal is a multidisciplinary publications aimed at influencing policy and practice in the Maritime industry via theory and in-depth theoretical and applied research and analysis in a global context, with emphasis on the West and Central African sub-region. The Journal also publishes conference details and book reviews that are deemed relevant to its aims.

2. Manuscript Format
   The title of a manuscript should be as succinct as possible. Manuscript should be written using Microsoft Word with single line spacing (except before each major heading, in which case double spacing is required) on A-4 paper (8.5 x 11). The page limits are 8 to 12 pages (3000 – 5000 words), which include figures, tables, reference list and any other additional material. Manuscript should be written using Times New Roman font with 14 point for manuscript titles and 12 point for the main text (including headings). All headings should be in bold letters. Paper margins should be 1 inch (25 mm) each from top, bottom, left and right. Manuscript must be written in English. Author may use either American or English spelling, but not a combination of the two.

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4. Abstract
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5. References/Citations

All references and in-text citations should be APA 5th style for all articles except legal articles. Examples:

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6. Manuscript Submission

Manuscript should be submitted in soft copy, including all figures, tables and pictures in Microsoft Word as an e-mail attachment to: research@rmu.edu.gh. A hard copy should also be sent to the Research and Consultancy Unit, Regional Maritime University, Box GP-1115, Accra-Ghana
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i. Final Admission onto all programmes is based on successful completion of physical and medical examination at the Regional Maritime University.

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Editorial

Is Local Content a Sustainable Policy in the Petroleum Sector of Emerging Oil Producing Countries of Africa?

Nowadays, local content in the petroleum sector has become very topical. Most countries, including African countries, are enacting laws to make local content mandatory for all stakeholders of the sector. Evident examples are: Nigeria’s Oil and Gas Content Development Law, 2010; Norway’s Procurement Policy, 1972 and Petroleum Law, 1965; Venezuela’s Organic Law of Hydrocarbons, 2001 and Organic Law of Gaseous Hydrocarbon, 1999; Ghana’s Petroleum Exploration and Production Law, 2011; and Angola’s Degree 20/82, just to name a few. But, what is local content, and why has it become such a burning issue in the petroleum sector? Is it a sustainable policy for emerging oil producing countries of Africa?

Local content is the development of local skills, technology transfer, and use of local manpower and local manufacturing. Practically, local content is building a local workforce that is skilled and a local competitive supplier base. By using local content policy, National Government (NG) desires to promote local industries by offering local products and services; to promote local workforce through hiring and training by International Oil Companies (IOC), and to promote social responsibility by ensuring that IOC provide services to the local communities. The overall objective of local content is to avoid capital flight and keep money in the national economy for the expansion of local consumption and investment. Local content has therefore becomes a critical policy issue for NG. Consequently, local content enables NG to ensure control of the exploration, exploitation and production activities in the petroleum sector and to harness the potentials of this strategic sector in order to generate more value addition through local participation and creation of jobs for its citizenry in the sector.

Regrettably, local content, in itself, is not a sustainable policy for emerging oil producing countries of Africa without the consideration of a number of factors for its implementation and realization.

However, it is worth emphasizing that local content is a laudable policy, especially as it relates to increasing indigenous participation in the petroleum sector by prescribing minimum thresholds for the use of local products and services and the employment of indigenous to promote value addition and economic growth without compromising standards. The policy mitigates the challenge that the most lucrative export product (Oil and Gas), is explored, exported, transported and dominated by foreign companies in joint venture with National Oil Companies (NOC). Local content policy is indeed a positive development. Accenture (2010) pointed out that through such policy Norway has built an advanced technological oil and gas service industry, while Brazil has developed a globally renowned competence in deepwater exploration.

Historically, the genesis of local content policy is the establishment of NOC as a vehicle for the promotion of the indigenization policy in the petroleum sector. But to be sustainable in emerging oil producing country of Africa, a number of factors, as stated above, stand in need of consideration. For example: Availability of skills, access to and affordability of finance, technological capacity, defining the role of IOCs, establishing a monitoring and implementation body, establishing a fund to support the implementation of the policy, amongst others.

Central to all national economic policies is job creation and promotion of economic growth. In the case of local content policy, jobs will be created and economic growth promoted if only NG invest in human capital to build the capacity of its citizens in order to obtain the requisite skills for the petroleum sector. In this regard, NG should partnership with tertiary institutions to offer courses both at the undergraduate and postgraduate level in
relevant areas of the petroleum sector. In the absence of such requisite skills employment of indigenous in the sector will only be an illusion. An example of such an illusion, as mentioned by Azaah (2012), was in October 2010, when in Ghana, service providing agencies like Menergy Oil, O & L Trinity and Sea World, registered by the Ghana National Petroleum Corporation to employ artisans such as motormen, floor men, caterers, crane drivers and badge masters for oil rigs operating in the oilfields, rather employed foreign nationals instead of local artisans due to lack of skills.

On the other hand, the petroleum sector is capital intensive in all of its operations. Consequently, local businesses servicing the sector require a sound financial base in order to be competitive in service delivery. Unfortunately, many local companies are not in a comfortable financial position to meet demand. The only way out of such situation is to source funding from local non-energy banks which could affect the quality and efficiency of goods and services provided; or form partnership with foreign companies to boost their financial capabilities, which in all intend will defeat the purpose of the policy. To mitigate such financial challenge, the formation of Energy Bank in host country cannot be overemphasized. The establishment of such bank willspecially meet the financial demand of the energy sector.

Apart from the availability of skills and sound financial base, technological capability is also a setback to making local content policy a realization. The lack of technological capacity for local companies to provide services for offshore installations, which requires the acquisition and operation of vessels such as supply boats, tug boats, anchor handling vessels and air-crafts, is a further manifestation of the policy not being sustainable. This sad situation, according to Azaah (2012) led Tullow Oil Ghana Limited, one of the three oil companies that discovered and operating in Ghana’s Jubilee oil field, in Feb 2010 to abrogate its contract with a Ghanaian-owned company, City Link Airline, in favor of NoordzeeHelikoptersVlaanderen, a Belgian company for the transportation of personnel and cargo to the offshore jubilee platform due to City Link Airlines inability to meet the challenge.

Based on the experience of other oil producing countries, for example Brazil, Norway, Malaysia, Trinidad and Tobago and Nigeria, emerging oil producing countries of Africa need to establish a Local Content Commission with the task of monitoring and ensuring the successful implementation of the local content policy. Primarily amongst the task and functions of the Commission will be to develop guidelines and strategy for the successful implementation of the policy. One of such guidelines will be to develop acceptable ways and means that will actively monitor progress in the implementation of the policy by all stakeholders. Such guideline will track both the outcomes and results of the local content program as well as the quality of the programs. NG also needs to establish a Local Content Implementation Fund, funded by a stipulated percentage of every contract awarded to any operator, contractor, sub-contractor, alliance partner or any other entity involved in any project, operation or transaction in the petroleum sector to be deducted at source. Such fund could be managed by the Commission and expended for projects, programs and activities directed at increasing local participation in the petroleum sector. Accenture (2010) underscored that the establishment of such fund in 2002 in Angola resulted to a USD$30 million local content development scheme-Projecto de Desenvolvimento da ParticipaçãoNacional- for the training of a local workforce and capacity building for local companies.

Finally, the role of IOCs operating in emerging oil producing countries of Africa needs to be re-accessed with the view of contributing and participating in the successful implementation of local content policy. IOCs must work with NG to identify and select target disciplines and technical competencies as well as build a world-class knowledge diffusion and capital management program for the local workforce. This will make the availability of local skills initiatives go beyond the traditional piecemeal approaches that target limited short-term results. The participation of IOCs will make the process of local skills availability comprehensive, multifaceted (including training, development, internship and placement programs), coordinated, and focused on long-term
success. IOCs should also collaborate with NG to develop a national infrastructure. Such collaboration entails the development of a medium- to long-term program for implementing a national infrastructure agenda to complement capacity-building initiatives identified by local content policy. Initially, NG and IOCs can establish complementary national infrastructure rehabilitation or upgrading programs alongside the local content agenda that would facilitate or stimulate the growth of the national economy and increase the standing of IOCs operating in the region under discussion. Furthermore, IOCs in collaboration with NG need to build local collaborative stakeholder networks around suppliers, service providers, operators and other key participants in the petroleum sector. Such network will help promote a strong and cohesive stakeholder collaboration model and participatory framework to guide local content implementation. According to Accenture (2010), such collaboration resulted to the formation of an association of oil- and gas-related suppliers in Brazil, which provides necessary data that helped in implementing some of Brazil’s National Oil Company (Prominp’s) programs for the petroleum sector.

In conclusion, it is important to note that the issue of local content vis-à-vis local participation in the petroleum sector, especially in emerging oil producing countries of Africa, has become a crucial issue for the maximization of national value creation through the value chain by way of employment, value-addition, technology transfer and the acquisition and transfer of knowledge. But the policy, as mentioned above, is not sustainable in the region under consideration. The need to give legal teeth to such a policy cannot be overemphasized, hence the need to establish a Local Content Commission for the monitoring and implementation of the policy, as well as the establishment of a Local Content Implementation Fund for the execution of projects, programs and activities for increase participation of indigenous in the sector. Furthermore, NG needs to re-access the role of IOCs with the view of involving them in the successful implementation of local content policy.


## Research at RMU

This column is introduced to present at a glance ongoing research activities at the Regional Maritime University. The column, as it is named, is intended to expose to our reading audience the nature and state of research at the university and to create the awareness of future articles to be published.

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<td>National Maritime Policy: A Case Study of Ghana</td>
<td>Captain William Amanhya, Lecture, Master Mariner, MSc. Maritime Management &amp; Maritime Transport, FIATA certified trainer – International Freight Forwarding</td>
<td>This research aims to examine the need for a national maritime policy by exploring the inadequacy of the existing integrated transport policy of Ghana. The research will also make comparative analysis of Ghana integrated transport policy with maritime policies of other countries in an attempt to recommend an appropriate national maritime policy of Ghana. It is expected that the findings of this research will enhance RMU's contribution to the continued development or optimization of the maritime industry in Ghana and West Africa.</td>
<td>Ongoing</td>
<td>Nautical Science</td>
<td>Findings will be published in journal</td>
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<td>Designing a prototype of a solar and wind operated ship</td>
<td>Dr. Gibril Jaw, Deputy Rector; PhD in Engineering Physics specializing in heat science and solar energy</td>
<td>This research aims at using alternative (and greener) sources of energy to operate ships. Theresearch will focus on the design and construction of a prototype ship. Data will be acquired from one coastal site in Ghana for the purposes of modeling with a view to applying the model to different data sets in other locations. Successful completion of the research will be of value in contributing to knowledge in the field, especially in the sub-region, and will enhance RMU’s reputation as a research University. It is expected that the findings of this research will also underpin the future exploration of the cost effectiveness and positive environmental impacts of such green systems over existing industry technology.</td>
<td>Completion Stage</td>
<td>Marine Electronic/Electrical</td>
<td>Portion (Using a Cold Battery With Icy Water as an Alternative Method of Air-Conditioning in a Ship) is published in this edition. Others will be published in subsequent editions</td>
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<tr>
<td>Examination of Ghana’s Oil Sector: Need for a New Paradigm of Oil Revenue Management for Sustainable Socio-economic Development</td>
<td>Dr. Robert G.M. Nyemah, Head, Research and Consultancy, MSc. in Economics and Management; PhD in Macroeconomic Analysis, Post Doctorate Certificate in Management of Higher Education.</td>
<td>The aim of this research is to assess the oil sector of Ghana, the state of oil revenue management policy in Ghana, as well as to assess the role of Ghana National Petroleum Corporation. The research also intends to analyze various existing models of oil revenue management, and to propose a new paradigm of oil revenue management for sustainable socio-economic development in Ghana as a model for emerging oil producing countries of West Africa. It is expected that the findings of this research will bring RMU to the forefront to play a visible role in policy formulation in the emerging oil industry in Ghana and other emerging oil producing member states of the RMU such as Sierra Leone and Liberia.</td>
<td>Completed</td>
<td>Research and Consultancy</td>
<td>Findings are published in this edition</td>
</tr>
<tr>
<td>Analysis of Waterborne Freight Transportation and Landside Access in Ghana</td>
<td>Mr. Richard Fiadomor, Lecturer; BSc., Post Graduate Diploma, MSc. In Maritime Affairs and Port Management</td>
<td>This research aims at building a research data base on waterborne freight transportation and landside access to serve the maritime industry of Ghana.</td>
<td>Ongoing</td>
<td>Port and Shipping Management</td>
<td>Findings will be published in journal</td>
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The Evolution and Future Direction of Supply Chain Management

George KobinaVanDyck

Abstract

Supply chain management (SCM) has received a lot of attention in the past two decades, as it is continuously being viewed as an effective tool in achieving competitive advantage in business and reducing system-wide costs. The study aims to research into the evolution of supply chain management, in particular determining the origins of SCM, looking at the current focus of supply chain management and projecting the future direction of supply chain management. This research was exploratory in nature and thus was carried out by means of a hybrid traditional and structured literature review methodology. The merits of both literature review systems were combined in order to broadly focus on available literature but also to eliminate research bias. Other processes involved a scoping study to narrow down and focus the research due to its broad nature; search for material from databases, publications and online sources, using key search words and strings; assessing the quality of materials and synthesizing the data to form one cohesive document. The research revealed that although it is difficult to determine the exact origin of supply chain management, its origins can be traced back to the origins of trade. Current supply chain thought and practice is linked to earlier concepts of logistics and distribution, which are viewed as components of the wider supply chain concept today. The study also determined the fundamental and key emerging supply chain disciplines today. With respect to the future direction of supply chain management, the research established that SCM is strategic, dynamic and customer oriented, therefore, the supply chain network must focus on issues that continue to affect the supply chain like supply chain disruptions and risk, supply chain leadership, managing delivery of goods and services in a timely manner and product innovation management including further IT applications.

Key Words: Supply chain, supply chain development, supply chain evolution, supply chain history

1. George KobinaVanDyck (MA) is a Lecturer at the Port and Shipping Department, RMU
Introduction

As business evolves in the 21st century, Supply Chain Management (SCM) has emerged as one of the major management approaches fuelling many organisations (Brewer and Speh, 2000). Supply chain management has transcended the view of being a mere logistics vehicle for organisations. It is viewed by many organisations now as an important management technique to ensure smooth business operations and functions, both within an organisation and externally across its business networks. Thus the evolution of business is in sync with the evolution of supply chain management (Horvath, 2001). This paper attempts to provide a holistic view on the evolution and potential future direction of SCM through a structured timeline.

Literature Review

Burgess et al (2006) explains that SCM has become very popular in recent years and is evidenced by the increase in attention by both practitioners and academia. It is associated with several names in literature and practice including network sourcing, supply pipeline management, value chain management and value stream management (Croom et al, 2000). It has also been identified as physical distribution, logistics, materials management and rhocrematics (Ballou, 2007).

Supply chain management has evolved over many years and spans a variety of disciplines and historical events. One school of thought is that the concept of SCM is relatively new (Gibson et al, 2005). Another school of thought attributes SCM’s origins to the concept of military logistics before the 1950’s (Ballou, 2007). Van Creveld (2004) asserts that there are three distinct periods of logistics history in modern times: the age of standing armies when military forces where magazine-fed, the second embraces Napoleonic “predatory” warfare, and the third, opening in 1870-1871, is marked by a system of continuous supply from base. Early references to logistics can be found in an article as early as 1898, where logistics is discussed as a strategy in war (Simpson and Weiner, 1989) as cited by Lummus et al (2001). The authors (Lummus et al, 2001) also state that SCM as a concept can trace its early beginnings to the textile industry with the Quick Response Programme (QRP) and later to Efficient Consumer Response (ECR) in the grocery industry. New and Westbrook (2004) are of the view that SCM has been influenced by political, economical, technological and theoretical developments spanning several decades starting in the 1940’s. Croomet al (2000) however state that the origins of SCM are unclear, but attribute its development to disciplines like physical distribution and transport. Thus, there is clearly no consensus on the specific origins of SCM.

It is however clear that the concept of SCM is a combination of many disciplines, theories and techniques spanning marketing, finance and production (Ballou, 2007). In the traditional sense, SCM has been the “melting pot” of various disciplines including logistics, transportation, physical distribution, operations management, information technology (IT), marketing and materials management (Jain et al, 2010). The philosophy of SCM embraces all of these functions (Croom et al, 2000).
In order to trace the origins of supply chain management, and study its evolution, it is important to trace the origins of the more popular earlier concepts and disciplines like logistics and physical distribution. These earlier disciplines are closely linked to the supply chain concept and are integral components of it. Understanding the past and observing the present allows an extrapolation to what might be in store for SCM in the future (Ballou, 2007).

**Evolving Terminologies**

Supply chain management was first used as a term in its popular sense by Oliver and Webber (1982) as cited by New and Westbrook (2004, pg1). Since then, a variety of articles have been published describing the nature of SCM and in particular, the cross-organisational management of materials.

A scoping study undertaken by the author revealed that the terminologies relating to SCM have changed over time for a variety of reasons. Gibson *et al* (2005) state that although SCM over the years has remained a term applied in both business and academia, its definition is varied between authors and regions. In addition, Ballou *et al* (1999) state that the terminology associated with SCM has developed in an uncontrolled manner. Ross (1998) notes that discussions on SCM are often characterised by complicated terminology which in effect, limits managements’ understanding of the concept and its effectiveness for practical application. Generally, the scoping study has shown that it is used to visualise the flow of materials but there have been arguments that such terminology does not offer a proper view of what SCM actually is. Christopher (2005), in support of the aforementioned view, mentions that the term SCM is too simplistic and should be seen as a supply network or web. This is because chains are more linear whilst networks are complex combinations of different activities, synonymous in character with supply chains.

SCM has been associated with specific areas of business. Through such association, and to place emphasis on its peculiar role, SCM has been given a variety of synonyms. It is sometimes referred to as Operations Management within certain firms to identify product and service processes; Value Chain Management to emphasize value adding operations; Logistics Channel to stress a marketing function of logistics and Demand Chain Management to focus on the complex demand side of business. From a historical perspective, SCM has been termed more commonly as logistics and physical distribution.

Therefore, as a terminology, SCM has been shown to differ depending on the particular business process or activity being stressed upon. Logistics on one hand deals with internal processes within a firm whilst SCM deals with both internal and external processes.
Methodology

Research Design
The research was primarily desk-based and as such most of the information gathered by the researcher was drawn from journals and articles from selected international academic databases (EBSCO, ABI, and EMERALD), notable supply chain (and related) text books and publications, websites and online sources, and interviews.

Research Perspective and Type
The research was qualitative and descriptive in nature, but also had an explanatory element to it. Many people dismiss descriptive research as “mere description” but good description is fundamental to research enterprise (nyu.edu, 2011). Good description provokes the “why” questions of explanatory research. Therefore, the research is seeking to determine “what has happened” and “why has it happened”. It will also seek to explain “what will happen”.

Research Methods
Due to the qualitative nature of the research, an initial assessment was undertaken to determine the alternative research methods that could be utilised to achieve specific objectives. Two research methodologies were identified; the Structured Literature Review (SLR) and the Traditional Literature Review (TLR) methods. A hybrid form of both were utilised in order to remove rigidity in information search but also to ensure quality of information and reduce bias.

Origins of Supply Chain Management
Supply Chain Management ‘thought and practice’ can be traced back historically to elements of distribution, which have always been fundamental to the storage and movement of goods (Ruston and Oxley, 1991). SCM and its components have played a fundamental role in development across the globe for more than 5000 years. For example, around 2700 B.C, material handling (technology), an important element of logistics was used in the construction of the Egyptian pyramids. Heavy blocks of stone were transported and assembled at the building site for the construction of enormous pyramids with such precision that it is still a wonder today (dhl-discoverlogistics.com, 2011). Another important example of earlier forms of supply chain management is when trading posts were set up in East Asia in 300BC by Caesar to grow trade in the area. This has been said to be the first retailer supplier relationship and led to the establishment of a silk route in India (Bouchier, 1921).

The profile of logistics itself was raised by military campaigns. There are many examples in history of success achieved in wars due to timely supply. Supply of materials in war could actually determine whether a war was won or lost. This was illustrated by Napoleon, a great military strategist’s remark that “An army marches on its stomach” and Eisenhower’s comment that “battles, campaigns and even wars have been won or lost due to logistics” (Waters, 2009). These remarks were made in reference to the famous 1805 campaign of Napoleon
and the American Cold war respectively. In 1812, Napoleon lost the war in Russia largely due to inadequate logistics. His strategy was for his men to feed off the land as they advanced but this proved difficult as the Russian terrain was not only undeveloped, but also barren. Food supplies quickly ran out and his men and horses died at a fast rate, leading to the war being lost (Van Creveld, 2004).

At present, SCM continues to play an influential role in military campaigns. There is a strategy employed in the United States-led war in Afghanistan known as “Operation Enduring Freedom”. This strategy is to choke all “supply lines” to terrorism organisations therefore limiting their access to funds and logistics to carry out terrorist acts (globalsecurity.org, 2011). This shows how supply chain strategy is being applied in the military today, transcending from the norm of ordinary logistics functions of supply within an army to a more external form of strategic warfare.

The barter system, one of the earliest forms of trade can be said to have evolved as an answer to requirements of trade. Can this be said to be the first supply chain? Is the academic view that there is no single point that marks the origin of supply chain management true? Croom et al (2000) support this assertion stating that the origins of SCM are unclear, but its development was initially along the lines of physical distribution and transport.

Christopher (2005, pg5) defines SCM as:

“The management of upstream and downstream relationships with suppliers and customers to deliver superior customer values at less cost to the supply chain as a whole”.

Inherent in this definition and of ultimate importance is the offer of a service or product to a customer at a particular stage(s) in the supply chain, to deliver value. This is a basic characteristic of trade: the exchange of goods and services to deliver value. The author is of the view that the origins of SCM can be traced back to the origins of trade. Trade has been defined by the oxfordadvancedlearnersdictionary.com (2011) as:

“The action of buying and selling goods and services”

In order to fulfil the requirements of a trade, in the form of a service or product, it is required that goods or services are made available for such a transaction to occur. Acquiring goods or services to fulfil a trade requirement would require certain activities or processes to be fulfilled. For instance, sourcing the product from a supplier or transporting a product to the point of sale. In the past, evolving into the present, collectively these activities have had various terminologies leading up to Supply Chain Management today. The importance of the “trade facilitation process” cannot be overstated, i.e., making sure that the product or service is made available to the trading partner in its correct form and at the right place and time, in order to complete the transaction.
Slightly in support of the above ideology, and stressing the link between trade and logistics, Kent and Flint (1997) put forward the idea of being able to view transportation and distribution (major components of SCM) as the main focus of marketing (major function of trade) beginning with ancient times. The authors stated the fact that business has always borrowed from other disciplines and that marketing as well as logistics are very much economics-oriented components of business.

**Evolution and Historical Timeline View of Supply Chain Management**

The timeline study, with respect to the evolution of supply chain management, has been achieved by identifying the major drivers of the evolution process, the subsequent emergence and development of key contributory concepts, theories and disciplines. The information was gathered by undertaking a thorough search through data bases for related information in academic papers (Ballou, 2007; Kent and Flint, 1997). Some information was also compiled from text books (Christopher, 2005; New and Westbrook, 2004; Parker, 2005; Ruston and Oxley, 1991; Zuckerman, 2002) to supplement the non-exhaustive online data. Further credible websites provided pertinent information as support. Table 1 below summarises the information gathered.
<table>
<thead>
<tr>
<th>Era</th>
<th>Year/Period</th>
<th>Supply Chain Characteristic</th>
<th>Period Characteristics and Drivers of Change</th>
<th>External Influences of change</th>
<th>Emerging, theories, concepts and disciplines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dispersion</td>
<td>Before the 1950’s</td>
<td>warehousing, transport and distribution</td>
<td>Rapid growth, resource scarcity, inflation, need for rapid response and transportation</td>
<td>1st and 2nd World War</td>
<td>total cost model, physical distribution and transportation, operational research, logistics, game theory</td>
</tr>
<tr>
<td>Logistics Thought</td>
<td>1951 – 1970</td>
<td>Logistics, warehousing and physical distribution</td>
<td>Unplanned distribution systems, economic growth, wealth creation, process innovation, need for transport in expanding markets, labour and consumer power, warehousing and packaging.</td>
<td>cold war, Vietnam war, 1st digital computer for commerce installed in 1952 (in General Electric)</td>
<td>industrial dynamics, contingency theory, total cost approach, systems theory</td>
</tr>
<tr>
<td>Supply Chain</td>
<td>1981 – 1990</td>
<td>Supply chain management, integrated</td>
<td>need for integration and cost reduction leading to deregulation of industries, emphasis on quality, globalisation, EDI,</td>
<td>End of Soviet Union, ICT advances, production of PC's</td>
<td>transaction cost economics,</td>
</tr>
<tr>
<td>Thought</td>
<td>logistics and physical distribution</td>
<td>networks, mergers and alliances</td>
<td>Supply Chain Practice</td>
<td>1991 – 2000</td>
<td>supply chain management (integrated supply)</td>
</tr>
</tbody>
</table>

**Source:** Author
Key Supply Chain Disciplines

Through the evolution of supply chain management, more disciplines have emerged that have become key to the implementation and success of the concept in both industry and academia. There are the fundamental disciplines that make up the core of the earlier fragmented notions of logistics, and there are the emerging disciplines through the path of evolution that have contributed to the success of cross-border enterprise collaboration and coordination in business.

The key supply chain disciplines have also evolved as technology has advanced. Some of the technological advancements have themselves, propelled and changed the nature of disciplines whiles others have had such a daunting impact on supply chains that they have become key disciplines that facilitate the supply chain concept.

Although each supply chain has its own peculiar market demands and operating challenges, there are basic areas within the supply chain that remain essentially the same. Companies basically make business decisions concerning production, inventory, storage, transportation, information and communication.

There are many disciplines contained within the supply chain management concept. Combinations of these disciplines have allowed firms to capture value for customers today. Figure 1 is a pictorial example of supply chain management disciplines and how they have evolved through the times to become on holistic SCM concept, as captured by Rodrigue (2011).
Historically, marketing, transportation, warehousing, purchasing and inventory management have been the bedrock of supply chain management thought and practice. It is these fundamental disciplines that were recognised as functions that could be linked together to reduce cost and increase competitive edge by proper sharing of real time information and a seamless connection of physical activities.

Emerging through the years has been the application of advances in IT and strategic planning which have probably made the integration of activities truly possible (Rodrigue, 2011).

**Key Emerging Disciplines in SCM**

Supply chain evolution has greatly been affected by the advancement of applicable technology over the years. Information technology has contributed greatly to supply chain evolution since the application of computers commercially in the 1950’s. Work has been put into creating a seamless process to give companies a competitive edge. Supply chain sustainability has also become embedded in the supply chain management process with the move to build robust systems that take economic, social and environmental issues into account. In addition, there is a
move by organisations towards investing in management of the people that run these processes as the human factor is the weakest link in most systems.

Future Directions for Supply Chain Management

The integral value of supply chain philosophy is that a total performance of the entire supply chain is enhanced when we simultaneously optimise all the links in the chain as compared to the resulting total performance when each individual link is separately optimised (Burke and Vakkaria, 2002). SCM today is categorised by three major traits; it is strategic, dynamic and customer oriented. The supply chain network must be optimised to anticipate and react to supply chain uncertainties and demand variability.

An extensive report prepared by Melnyk et al (2006) forecasts various issues that will continue to affect supply chain management in 2010 and beyond, and thus present an opportunity for future research:

1. Supply chain disruptions and risk
2. Supply chain leadership
3. Managing delivery of goods and services in a timely manner
4. Product innovation management
5. Implementation of appropriate technology to enhance information exchange within the supply chain.

The report concludes by mapping the future of supply chain management as summarised below:

- The shape of the supply chain will continue to evolve from one that is basically order-oriented, cost-driven and execution-focused to one that is strategic, dynamic, innovative and driven by multiple objectives.
- Supply chains (strategic) will tend to focus more on total costs than on direct costs as we see today. However, the problem with this is that many accounting systems are unable to quantify total costs borne out of strategy, and resulting from activities such as New Product Development (NPD), risk management and Early supply Involvement (ESI) to name a few.
- Supply chain management is evolving to draw on the capabilities of the modern firm including accounting, finance, engineering, marketing as well as the three corporate functions of purchasing, logistics/transportation and operations management.
SCM will continue to encourage researchers and practitioners to think in terms of managing processes across enterprise boundaries.

SCM will further shift from management of processes to the design and redesign of processes. This is quite evident today.

The future may see a change in terminology like Supply Network Optimisation (SNO) or Value Network Systems (VNS).

Some academics are of the view that the issues of managing knowledge and expertise in the supply chain are the key to continuing the evolution of supply chain both in theory and practice (Bessant et al, 2003). Therefore, to achieve true collaboration between network partners requires development of knowledge sharing.

It is important that further research is undertaken into determining the future direction of SCM evolution. This is dependent upon academia undertaking the forefront in looking at SCM as an area warranting strong scholarly research and industry seeking result-oriented benefits from the research undertaken.

**Discussion and Conclusion**

On the basis of the study alone, it is difficult to establish the true origin of the concept of supply chain management. Although the researcher has concluded that trade seems to be the evident source of supply chain thinking and practice, there is very little evidence to support this assertion. There is a general theme across many articles that suggest that the birth of SCM progressed naturally from existing disciplines within the sector and from their need to integrate in order to add value.

The evolution of the supply chain concept has not been at a steady rate. The main factor for supply chain change and evolution seems to be economic in nature. Evidence suggests that new ideas and concepts have been introduced to business during periods of difficulty. For instance, the concept of logistics was borrowed from the military after the two world wars and used in business as a means of coordinating efforts to achieve enterprise goals. Also, during recessions in the past, businesses have strived to find ways of reducing cost. This has lead to the implementation of measures that have not only reduced cost, but eased the process of conducting business. These measures have changed the way business is done across many industries and have become part of the network integration philosophy. Notable is the world recession in the 1980’s which may subtly suggest that companies became aware of SCM in the 1980’s probably due to this very reason. Another school of thought suggests SCM was created out of academic
interest to merge various disciplines and create a chain of activities that could be managed wholly. There is a lack of research in this particular area that may enable stakeholders to understand the cause and effect of the evolution process.

There are many disciplines that make up the concept of supply chain management. They include constituents of both the inbound and outbound side of logistics in addition to strategic planning, IT and marketing. The key supply chain disciplines discussed are the major contributory disciplines that continue to drive supply chain evolution. Warehousing continues to change and although considered the dustbins of industry, is vital to ensuring that firms are responsive enough to the ever dynamic and unpredictable nature of business. Inventory management techniques continue to be developed and purchasing has evolved with the advancement of IT and strategic thinking. Technological advancements especially in information technology have greatly contributed to the evolution process by removing barriers to information sharing and communication that are vital to supply chain success. Without information technology, the ideal concept of supply chain management may never be achieved.

The future direction of supply chain management can be said to be progressing according the supply chain issues being faced today. Thus, more researchers are becoming more pro-active by anticipating supply chain issues. Although complete network integration has not been achieved by many firms, supply chain management is moving towards the management of risk in order to reduce uncertainties. Therefore research is guided by this principle. Human beings have always been the weakest link within the business environment. Most managers are now focusing on people issues with respect to proper training and guidance. Although the right systems may be put into place, it is important that the people that are responsible for and run those systems are well trained and up to the task. It is envisioned by the researcher that this will continue to be a major area of concentration in supply chain concept development in the following years.
Reference List
"Research Design", available

"Trade", available at:


Historical Developments of Logistics available:


The Causes and Nature of Forklift Injury in the Ghanaian Port Environment
Edem M. Azila-Gbettor¹ Stephen AfenyoDehlor²

Abstract
Organizational Health and Safety (OHS) practices are essential for not the survival of organizations but also for the avoidance of injury at the work environment and other legal consequences. The absence of OHS regulatory framework in Ghana has a significant implication for the conduct of organizations in providing a healthy working environment for employees. This paper examines the nature and causes of forklift injury in the Ghanaian port environment in the absence of effective OHS policy. The researchers employed both the historical and descriptive research methods during the project. A total of 250 questionnaires were administered using convenience sampling techniques. The research revealed that a number of both human and workplace factors are responsible for workplace forklift injury. The most significant human factors include fatigue, alcoholism and stress whilst workplace factors include load handling and forklift visibility. Considering the nature of accident the study revealed that falling load, crushing and forklift overturning accounts for nearly half of all the accidents associated with lift trucks. The study further reveals that injuries which occurred in relation to forklift vehicle incidents (wounds and sprain) appear to be less severe than other forms of work related injuries. From the research it was recommended that there is the need for the relevant sector Ministries to review the current OSH standard to meet the WHO standards for adoption and implementation; establish clear communication processes to help maintain safe working practices and to publicize and raise industry awareness on major findings and develop strategies to improve the safety of forklift operations and reduce the incidence and severity of injury in the port environment and other workplaces.

Introduction
The evolution of forklift trucks has largely replaced the manual handling of goods either at the port, warehouses and other manufacturing installations. Forklifts offer many economic benefits, such as a reduced need for manual handling of materials and improved operational productivity to facilitate speedy and efficient movement of materials of all descriptions. Aside this benefit, the safety of forklift trucks operations have long been a concern in many countries and Ghana is no exception. Internationally, forklift trucks are inherently hazardous and have been identified over a number of decades as a significant contributor to the toll of both serious and fatal industrial injuries (Male, G.E. 2003, Ellis, P. 2003, Horberry et al. 2004). According to the USA National Traumatic Occupational Fatalities, (NTOF) Surveillance system, 11,530 workers died from forklift related accidents between 1980 and 2001. Review of the literature pinpointed to several human and workplace factors as causes of these accidents and the nature of these injuries are also well documented (Rechnitzer& Larsson 1992, Collins et al., 1999, Rimmö 2002, Norris et al

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¹Edem M. Azila-Gbettor (MA) is a Lecturer at the Department of Accountancy, Ho Polytechnic, Ghana
²Stephen AfenyoDehlor (MA) is the Deputy Registrar, RMU and a Doctoral Student, University of Leicester, UK.
Despite efforts made over the years in preventing or reducing the incidence of forklift injuries, these vehicles still cause a significant occupational hazard. Industrial accidents and incidents involving forklift trucks however are still common in the world of work. For example, each year in Australia records 200 deaths which are associated with power trucks at the workplace (NOHSC, 2003). The need for safe forklift operations cannot be overemphasized, because the cost of providing resources for safety programmes or control measures can be far less than the consequences of safety inadequacies. Powered industrial trucks play a very critical role in nearly every aspect of Ghana’s ports operation but unfortunately, the desire by employers to provide safe working environment for employees is seemed to be lacking. This is compounded by lack of comprehensive national OHS policy to be adopted by organizations operating in such environment. Successive governments have shown little commitment and support for bold occupational health and safety policies. This is evident in the fact that out of the seventy (70) conventions of the ILO that are OHS related, only ten have been ratified by the government of Ghana (i.e., Conventions 45, 81, 89, 90, 103, 115, 119, 120, 147 & 148). Surprisingly the four core conventions on occupational health and safety (i.e., Conventions 155, 161, 170 and 174) have all not been ratified. Furthermore ISO standards regarding industrial truck operation which aimed at possible minimization of forklift injuries are not in place. Each year there have been isolated reports of injuries relating to forklift trucks and companies losses in damaged products, equipments and personnel. More also there is inadequate and consistent literature on forklift injuries in Ghana. Against the backdrop described above, these study aims to provide information on likely causes and nature of forklift injuries that might be useful for providing safety at the workplace. This paper will draw on previous research findings from other jurisdictions to determine the relevant factors and nature of forklift injuries in the Ghanaian port environment.

**Literature Review**

Forklift trucks have seen a tremendous evolution when it was first design with a power hoist, by Baker R&L later renamed Baker Raulang Company (Linde, 1999). The time line of significant accomplishment started in 1917, which started with only electric industrial trucks through 1930, when the first lift trucks with a seat was developed. In 1989, the first powered trucks with 9000-lb capacity hydrostatic drive, pneumatic tire models was developed and in 1985 first trucks with capacity up to 35,000 lbs was introduced (Linde, 1999). The continuous evolution of forklift is to meet increasing industry needs and limit occupational injuries. Today, forklift trucks vary in shape and configuration significantly and their capacity ranges from 1 ton, handling small pallets of goods, to large forklift trucks with 40 ton capacity moving shipping containers. Their versatility is further enhanced by the use of a whole array of attachments which transform the fork of a forklift into mechanical arms suited to handling specific goods. As observed from literature, major steps were taken over the years to reduce the effects of forklift injury through the enhancement of operational efficiency of the mechanic device however, injuries associated with forklifts still occur. Occupational Safety and Health Administration (OSHA) of USA estimated that approximately 95,000 injuries occur each year due to forklifts.

According to Miller (1988), a large proportion of workplace transport accidents are caused by environmental factors. A number of factors have been highlighted in the literature and recommendations have been made in terms of the vehicle, the workplace and human factors. Literature on control advocates for standardization (Robertson, 1969; Larsson and Rechnitzer, 1994) and non-standardization of control could be risky especially when individual drivers have to operate different trucks, which may limit the driver’s skill development, speed and accuracy in
normal operation. The act of mounting and dismounting the vehicle exacerbated by the presence of landing on wet or greasy patches said to cause significant number of accidents (Collins et al., 1999). Collins et al. (1999) indicated further that it is important to improve workers awareness at times when a vehicle is operating near them by using audible beepers, flash lights and alarm systems. Rechnitzer and Larsson (1992) emphasize the need to improve the load handling system of forklift trucks. Challenges highlighted with load handling include awkwardly shaped loads, load slippage from forks, and load stacking. Miller (1988) describes forklift trucks like seesaws, indicating that balance between the ballast and load is essential in order for the vehicle not to tip forward. A number of authors emphasize the role that poor workplace layout, as in workplace vehicle accident causation (Collins et al., 1999; Larson and Rechnitzer, 1994; Miller, 1988; and William and Priestley, 1980). The need to separate pedestrians and vehicles is frequently highlighted (Larsson and Rechnitzer, 1994) and has to be a long standing issue, as Booth (1979) pointed out that inadequate workplace planning is a major causal factor in forklift truck accidents. There is the need to separate site transport from pedestrians and make adequate provision for manoeuvring space. Other researchers support this assertion and make recommendations in improving workplace layout. Miller (1988) makes specific recommendations for reducing workplace transport accidents by focusing on lightening levels, noise levels, working surface, traffic control signs whiles Horberryet al (2004) advocates for the development of a number of traffic engineering interventions based on the notion that vehicles and pedestrians should be separated. Human factors covered an enormous collection of issues at the individual, job and structural level (HSE, 2004). Literature in relation to human factors in workplace transport accident is limited; however the study had explored other characteristics and traits that are general to transport accidents. Individual differences, in terms of age and gender, have been comprehensively studied in relation to overall driving behaviour. For example, Rimmö (2002) suggested that variation in age and gender are differently related to abnormal driving behaviour types. In terms of driving behaviour, literature had (Begg and Langley, 2001 & Jones and Dickety, 2004) shown that younger drivers are at a greater risk of involvement in general road traffic crashes than those in older age groups and the fatality and injury rates for young drivers was higher than other groups, with teenagers and those in their early twenties (20s), especially young males, having the highest crash involvement rate of any age group. On general driving behaviour, men are more likely than women to be involved in accidents (Norris et al,2000 & Waller et al, 2001). Norris et al(2000) suggested that males' greater accident risk could be at least partially accounted for by their greater tendency to disregard speed limits and traffic rules. This may be a result of males being more optimistic when judging their driving skill, and perceiving their unsafe behaviours as generally less serious and less likely to result in an accident (DeJoy, 1992).

Studies on personality and accidents indicated a number of factors that affects safe working environment. The main dimensions of personality reviewed by Hansen (1988) uses five meta-analysis of personality dimensions: Extraversion/Introversion, Agreeableness, Conscientiousness, Emotional stability: low Neuroticism, and Openness to Experience - Intellect/Imagination. Eysenck (1970) proposed extrovert's who have lower levels of vigilance would be more likely to have accidents. The evidence for this link between extroversion and accidents is generally supported by research findings from literature. However, there are some contradictory findings (Hansen, 1988). Lawton and Parker (1998) had similar findings, but again they stated that it was not conclusive due to methodological reasons.

A relationship between prolonged driving and fatigue was also discovered (Hakkanen and Summala, 2000; McCarttet al, 1999; Dicketyet al, 2004). Prolonged working hours imposes extra demands on individuals and Rosa (1991) has stated reduced performance and increased fatigue after 7 months of 12-hour shift working. Sharpe and Wilks (2002) suggested that the cause of
fatigue include psychological stresses, such as loss or grief; and social stresses, such as problems at work. Norris et al (2000) observed that job stress was one of the best predictors of future accident involvement. A link between stress and being involved in a motor vehicle accident was also found by Dobson et al. (1999). The authors found that there was an increase in the rates of accidents where participants felt rushed and where they exhibited lower life satisfaction scores.

The importance of training, competence and selection in workplace safety is highlighted by Male (2003). Williams and Priestley (1980) endorses this view and further suggested that a competent driver should be able to overcome most problems they are faced with, including poor factory layout and unexpected hazards. Booth (1979) also identifies role of training in overcoming deficiencies in plant layout. Lancaster and Ward (2002) concluded that there seems to be a reduced risk of at-fault accidents with increased experience of the driver. Several studies have found improvements in driving behaviour (Dorn & Brown, 2003) and reductions in accidents (Gregersen et al, 2003) as a result of formal training. For example, Steemson (2000) cites a number of case studies where adequate training would have prevented the injuries sustained in lift truck incidents. However Collins et al (1999) found that drivers of vehicles that receive less comprehensive training were more likely to have accidents.

Research into workplace transport and more specifically lift trucks injuries can be traced back to the 1960s (Rechnitzer and Larsson, 1992). Literature had shown that mechanical handling removes most of the hazards of man-handling but the accident rates increased again as more and more goods was handled at increasing speed and these introduces new dangers or injuries which are more severe (Astley and Lawton 1971; Svensson & Ostberg, 1973). Literature on the nature of accidents identifies two main groups of casualties of workers: pedestrians or adjacent workers (Booth's 1979) and drivers. Williams & Priestley (1980) who reviewed serious injuries associated with forklifts supported Booth's conclusions which stated that most of the injuries happened tonon-drivers. A further work by Male (2003) indicates pedestrian workers were involved in majority of crashes involving forklift equipment.

Lamentably, the problems associated with the type of vehicle seem to have remained relatively unchanged, in terms of the type of people who are involved in accidents and the types of injuries they receive. Research around the world, i.e. Australia, America, Europe and the UK, had shown consistency across countries in terms of the type, pattern and severity of injuries which occurs. The studies found that most frequent injuries were contusions, sprains/strains, lacerations, burns, foreign bodies in the eye, and abrasions (Collins et al. 1999 & Stout-Wiegand, 1987). It was noted that fractures and amputation were less frequent. The most commonly injured body parts were the foot or ankle, lower leg or knee and back (Collins et al. 1999). The most frequent fractures were the toes, feet and ankles. Miller (1988) indicates that the literature on patterns of accidents pointed to the two major causes of forklift accidents as (i) struck by forklift, and (ii) load dropped or shoved onto employee. A further investigation into the pattern of accidents concludes that majority of fatalities occur due to the vehicle overturning, being struck by a moving truck, being struck by falling loads, trapping/searing/crushing accidents and falling from vehicle (Male 2003, Ellis 2003, & Miller 1988).

**Methodology**
The survey was conducted in the Port Environment in Ghana. The choice was based on the fact that the port environment is one of the places where there is a heavy use of Forklift trucks. The research strategy employed was both descriptive and quantitative. Descriptive strategy was adopted because the researchers want to identify and obtain information on the characteristics of a particular issue, thus to measure the conditions and relationships that exist. A total of 250 samples were drawn from the forklift drivers using the accidental sampling technique. Primary data for the study was collected using standard survey questionnaires which were interviewer-
administered questionnaires. Questionnaires were used because each participant responds to the same set of questions in a predetermined order. The choice of interviewer administered questionnaires was to explain the questionnaires to participants who have a lower background in education hence could not by themselves read and understand it. The response rate for the study was 98% which is considered to be high. The high response rate was due to the large number of interviewer questionnaires that were administered. Close-ended and dichotomous questions were adopted in the research instrument to enable quick responses and less writing.

Results and Discussions

Two hundred and forty-five (245) out of two hundred and fifty (250) respondents provided answers for the analysis. Table 1 summarizes both human and workplace factors that causes forklift accidents in the Ghanaian port environment. On human factors, out of the nine (9) items listed, respondents indicated that age and gender differences has a minimum effect on forklift accidents at workplace (port environment) representing 19.59% and 8.16% respectively. Fatigue; (85.30%), alcoholism; (96.32%) and stress; (94.28%) were considered by the respondents to have a maximum effect on forklift accidents at the workplace. Other factors such as Personality education and experience, workplace transportation training and driver selection accounts for 23.67%, 55.10%, 33.87% and 42.85% of accidents. From the study it was evident that all the factors considered have a significant impact on forklift injury; but, fatigue, alcoholism and stress remain the major human factor that causes forklift accident in the port environment. With regards to the relationship between fatigue and workplace transport accidents, the study was consistent with (HSE, 1999) findings which indicated that fatigue could be dangerous and is one of the highest risks for workplace transport accidents to occur. It was observed that, fatigue develops slowly and can drain the mental concentration of a driver which may not always be visible to those concerned. Norris et al (2000) further observed that job stress was one of the best predictors of future accident involvement. This argument also supports the findings of research which indicates that 94.28% of accidents were caused by stress. A link between stress and being involved in a motor vehicle accident was also revealed by Dobson et al, (1999). The authors found that there was an increase in the rates of accidents where participants felt rushed at work. Employees with high intoxication at the workplace demonstrate lack of poor monitoring by supervisors before and during work. High alcohol intake has the capability to blurred drivers vision and makes them to have inadequate control over the steering. In Ghana some jobs were regarded masculine and therefore reserved for men. This phenomenon explain the absence of women in this area hence might influence respondents low rating of gender as a factor.

Out of the seven (7) items listed and evaluated under workplace factors, the study revealed that, all but except intelligent transport system were considered by the respondents as a major workplace factor that causes accidents at the workplace. Thus vehicle control (73.06%), mounting and dismounting the vehicle (74.29%), load handling (91.83%), forklift ballast (62.04%), visibility (89.39%) and workplace layout (81.63%). However, load handling, visibility and workplace layout ranks higher. These findings were consistent with literature. For example Collins et al. (1999) emphasises the visibility of the forklift, Rechner and Larsson (1992) identifies highlighted awkwardly shaped loads, load slippage from forks, and load stacking. Booth (1979) pointed out inadequate workplace planning as major factors that can either cause or reduce accident at the workplace. However, the findings of the study reported a higher incidence as compared to previous studies in literature.

Table 1: Human and Workplace Factors That Causes Forklift Accidents

<table>
<thead>
<tr>
<th>Factor</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age and gender differences</td>
<td>19.59%</td>
</tr>
<tr>
<td>Fatigue</td>
<td>85.30%</td>
</tr>
<tr>
<td>Alcoholism</td>
<td>96.32%</td>
</tr>
<tr>
<td>Stress</td>
<td>94.28%</td>
</tr>
<tr>
<td>Personality education and experience</td>
<td>23.67%</td>
</tr>
<tr>
<td>Workplace transportation training and driver selection</td>
<td>55.10%</td>
</tr>
<tr>
<td>Stress</td>
<td>94.28%</td>
</tr>
<tr>
<td>Vehicle control</td>
<td>73.06%</td>
</tr>
<tr>
<td>Mounting and dismounting the vehicle</td>
<td>74.29%</td>
</tr>
<tr>
<td>Load handling</td>
<td>91.83%</td>
</tr>
<tr>
<td>Forklift ballast</td>
<td>62.04%</td>
</tr>
<tr>
<td>Visibility</td>
<td>89.39%</td>
</tr>
<tr>
<td>Workplace layout</td>
<td>81.63%</td>
</tr>
</tbody>
</table>

25
Table 2 summarizes the pattern and nature of injury forklift trucks. It is clear from the table that on the pattern of accident, 93.87% indicated that falling loads from truck as one of the major causes of accident. Vehicle overturning accounting for 66.53% of accidents, crushing accidents accounting for 68.16 and trapping accounting for 61.22%. The rest of the factors considered were a moving truck, steering accidents and worker fall from forklift accounts for 53.06%, 52.65% and 44.89% respectively. In terms of patterns of accidents, all the factors considered were significant in causing accidents, however, the study reveals that majority of the injuries occurs due to falling load, crushing and overturning. These types of accidents accounts for nearly half of all the accidents associated with lift trucks. These findings were consistent with the study of Ellis (2003) & Miller (1988).

The study also showed a consistent trend on the nature of injury, when compared to previous studies Collins et al. (1999). Thus 90.20% of the injuries sustained were bruises, 82.04% were sprain, 79.59% were wound and 64.08% were burns. Fracture and dislocation constitute 8.16% and 14.28% of injuries respectively. The nature of injury revealed that the major component and most frequent injuries were minor and less severe and includes bruises, sprain, wound and burns. Fracture and dislocation constituted an insignificant component of injuries.

### Table 2: Pattern and Nature of Accidents

<table>
<thead>
<tr>
<th>Pattern of Accidents</th>
<th>Frequency/Percentage</th>
<th>No</th>
<th>Nature of Injury</th>
<th>Frequency/Percentage</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle overturning</td>
<td>163 (66.53%)</td>
<td>82 (33.46%)</td>
<td>Sprain</td>
<td>201 (82.04%)</td>
<td>44 (17.95%)</td>
</tr>
<tr>
<td>Struck by a moving truck</td>
<td>130 (53.06%)</td>
<td>115 (46.93%)</td>
<td>Wound</td>
<td>195 (79.59%)</td>
<td>50 (20.41%)</td>
</tr>
<tr>
<td>Struck by falling loads</td>
<td>230 (93.87%)</td>
<td>15 (6.13%)</td>
<td>Burns</td>
<td>157 (64.08%)</td>
<td>88 (35.91%)</td>
</tr>
<tr>
<td>Trapping accidents</td>
<td>150 (61.22%)</td>
<td>95 (38.77%)</td>
<td>Fracture</td>
<td>20 (8.16%)</td>
<td>225 (91.83%)</td>
</tr>
<tr>
<td>Searing accidents</td>
<td>129 (52.65%)</td>
<td>116 (47.35%)</td>
<td>Dislocation</td>
<td>35 (14.28%)</td>
<td>215 (85.71%)</td>
</tr>
<tr>
<td>Crushing accidents</td>
<td>167 (68.16%)</td>
<td>78 (31.83%)</td>
<td>Bruises</td>
<td>221 (90.20%)</td>
<td>24 (9.79%)</td>
</tr>
<tr>
<td>Worker fell from forklift</td>
<td>110 (44.89%)</td>
<td>135 (55.10%)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Field Survey 2011

### Conclusion and Recommendations

Health at work and healthy work environment are among the most valuable assets of individuals and organizations. Observation of occupational health is important not only to ensure the health of workers and significant for reduction of occupational injury, but also to contribute positively and effectively to productivity, work motivation, job satisfaction and thereby to the overall quality of life of individual workers. It is a well-known fact that OHS issues are not given adequate attention in developing countries. Occupational Health and Safety hazards which are
common in many developing countries including Ghana persist because of non-existent of legislation, inspection, weak infrastructure for monitoring and shortage of expert manpower and institutions.

The importance of human and workplace factors in workplace accidents is well established within the general health and safety literature; however the literature relating to specific areas in human factors are not extensive. It has been noticed from the research that human and workplace factors are largely responsible for accidents at the workplace especially in the ports environments. In considering human factors, fatigue, stress and alcoholism are more likely to have a greater impact on vehicle and workplace accidents. The percentage of alcoholism was very high indicating lack of supervision at the workplace. In the case of workplace factors, load handling, visibility and workplace layout are likely to cause vehicle accidents. Even though the impact of the rest of factors considered was minor, it does not mean they are not significant in the context of this study.

The economy of Ghana is projected to grow between 12-15% in 2011 and at a constant rate of 10% for the next 10 years. It is expected that the ports of Ghana will become busier with the use of forklift trucks. It is recommended that (a) The Organizations in Ghana should as a matter of urgency encourage government through the appropriate sector ministry to review the current OSH standards to meet the WHO standards for their adoptions and implementation; (b) to institute continues practical training programmes to enhance the skills of workers in handling forklifts in the ports environments; (c) to establish clear communication processes to help maintain safe working practices; (d) to publicize and raise industry awareness on major findings and develop strategies to improve the safety of forklift operations to help reduce the incidence and severity of forklift injury in the port environment.

**Limitation**
The study was carried in only one of the ports environments in Ghana. The study is limited in terms of coverage hence generalization for other sectors and should be done with caution since they may have other characteristics.
References


Is the International Safety Management Code an Organizational Tool to Discipline the Human Element?

Capt. Dallas Eric Laryea

Abstract
The birth of the International Management Code for the Safe Operation of Ships and for Pollution Prevention (hereinafter ISM Code) is said to be a reaction to the sinking of the Herald of free Enterprise on 6th March 1987. The human element is said to be a generic term used to describe what makes humans behave the way they do and the consequences that result. The author would seek to analyse the ISM Code if it is a management tool that disciplines the human element. Though, the ISM Code leads more towards structured safety measures and to an upgraded concern for the responsibilities inherent in every rank and functions of the shore staff and vessel crew, can it be said to be a management tool to discipline the human element? Since it has limitations, such that the personnel onboard and ashore, who are involved in its implementation through a Safety Management System (hereinafter SMS), should understand, be motivated, willing to own and implement the SMS, just to mention a few. Again the ISM Code does not prescribe punitive actions against the person who fail to follow a company’s SMS. Again, it’s been said that, the completing of checklists and paper work that comes with the SMS does not necessarily prove actual physical action taken.

The ISM Code may be a good management tool to discipline the human element, if the personnel involved would own the system and willingly make it work by giving a purposeful attention to the performance of assigned tasks.

Introduction
The disaster of the “Herald of Free Enterprise” on the night of 6th March, 1987 like other maritime disasters, is generally regarded as the shipping disaster that gave birth to the ISM Code and brought to the fore the imbalance in focus between human element and technology. It was adopted by IMO on November 4th 1993 and incorporated into the Safety of Life at Sea Convention 1974 (hereinafter SOLAS 74) on May 1994”, (Grime, 1995, p. 1) in which for the first time the IMO seek to place responsibility on shore management right up the highest level of management in respect of responding to the needs of ship board personnel in safety and environmental protection matters.

The ISM Code represents the cornerstone of the International Maritime Organization’s approach towards a safety culture, with the emphasis on the human element(Alert, 2004, p. 1).

In looking at the topic ‘ISM code: a management tool to discipline the human factor’, one need to clarify the word ‘discipline’. This paper will be akin to the Webster’s dictionary definition of discipline as ‘a systematic, willing and purposeful attention to the performance of assigned tasks’ as oppose to ‘punishment by one in authority especially with a view to correction or training.

The ISM code requires that the company should among other things ‘continuously improve safety management skills of personnel ashore and aboard ships, including preparing for emergencies related both to safety and environmental protection (ISM Code, 1994, 1.2.2.3). Though, the ISM Code leads more towards a structured safety measures and to an upgraded concern for the responsibilities inherent in every rank and functions of the shore staff and vessel crew (Martinez de Oses & Ventikos, 2003, p. 8) and may be said to be a management tool to discipline the human element, it has limitations such that the personnel both onboard and ashore, who are involved in its implementation through a Safety Management System (hereinafter SMS), should understand, be motivated, willing to own and implement the SMS, just to mention a few.
Again the ISM Code does not prescribe punitive actions against the person who fail to follow a company’s SMS. Again, it’s been said that, the completing of checklists and paper work that comes with the SMS does not necessarily prove actual physical action taken unless the crew shares in the ownership of the SMS.

**Background of the ISM Code**

A number of very serious accidents which occurred during the late 1980’s were manifestly caused by human errors, with management faults also identified as contributing factors. Lord Justice Sheen in his inquiry into the loss of the “Herald of Free Enterprise” famously described the management failures as "the disease of sloppiness" (IMO, ., 2011, p. 1) because the bow door was not closed before the ship left port, that lead to the massive flooding of the car decks causing it to capsize and sink. This disaster brought to the fore the need for improved safety of Ro/Ro ships”, this, coupled with the need for a proactive quality assurance which puts responsibility on the owners/managers of the ship resulted in the coming into existence of the ISM Code. The ISM Code adopted by IMO as Resolution A. 741(18) was initially not mandatory but became mandatory by virtue of the entry into force under the Convention’s tacit acceptance procedure on 1stJuly 1998 of SOLAS chapter IX, as amended, entitled” Management for the Safe Operation of Ships” for passenger ships, oil tankers, chemical tankers, gas carriers, bulk freight vessels, and high speed craft but for cargo ships and mobile offshore drilling units of 500 gross tonnage and above by July 1st, 2002 (Rodriguez & Hubbard, p. 5). The ISM Code was a paradigm shift from detailed rule-making by the IMO from predominantly technical perspective to solve promotion of safety at sea, to an increase focus on the “human factor”. The ISM Code is intended to improve the safety of international shipping and to reduce pollution from ships by impacting on the way ships are managed and operated and establishes an international standard for the safe management and operation of ships and for the implementation of a safety management system (SMS) (IMO, ., 2011, p. 1).

The code is not necessarily introducing any new sets of rules and regulations, but rather provides a requirement that the SMS should be structured, such that it can check and verify compliance with all the various rules and regulations. Such rules and regulations include, by way of examples, Load Line Regulations, Radio Regulations, COLREG, MARPOL, SOLAS, Classification Society Rules, STCW and host more (Anderson, 1998, p. 18).

The ISM Code was amended in December 2000 by resolution MSC.104 (73), and these amendments entered into force on 1 July 2002. It was further amended in December 2004 by resolution MSC.179 (79), and these amendments entered into force on 1stJuly 2006. It was further amended in May 2005 by resolution MSC.195 (80), and these amendments entered into force on 1stJanuary 2009. The ISM Code was again amended in December 2008 by resolution MSC.273 (85). This resolution was adopted on 1stJanuary 2010, and the amendments entered into force on 1stJuly 2010.

**The ISM Code and the Human Element**

“The human element is at the very centre of the approach recommended by the ISM Code” (Chauvel, 1994, p. 63). Various definitions have been given for the human element such as; a relationship between humans and their environment, procedures and machines they use, and ‘human behavior and psychology factors, in various aspects, for example, all human beings are prone to error. The IMO states that ‘the human element is a complex multi-dimensional issue that affects maritime safety and marine environmental protection. It involves the entire spectrum
of human activities performed by ships' crews, shore based management, regulatory bodies, recognized organizations, shipyards, legislators, and other relevant parties, all of whom need to cooperate to address human element issues effectively (IMO, 2011). The IMO recognizes the importance of the human element in achieving the objectives of the Code when at its 20th session in November 1997, the IMO Assembly adopted resolution A.850 (20), which has been updated by resolution A.947 (23) on the human element vision, principles and goals for the Organization, which among other principles states that, crew (human element) performance is a function of individual capabilities, management policies, cultural factors, experience, training, job skills, work environment and countless factors (IMO, 2011). It is said that ship carries about 90% by volume of the world commodities, the safety, protection of the marine environment does not only depend on the professional and competency of the seafarer but also his well being. ISM is considered a prime vehicle to introduce solid safeguards and acknowledge useful practices for the day-to-day ship and company routine. ISM addresses the responsible party for every task, brings forward structured checklists for every action done onboard vessels and generally creates a safety net for the sea and shore personnel (Martinez de Oses & Ventikos, 2003, p. 17). Therefore, should the Code as it exist in text, be implemented strictly as a management tool or it need to be adapted and implemented in a co-ownership way among all crew and shore based personnel? The latter case should be the case, so that, as the ISM Code seeks to discipline the human element by forming a ‘safety culture’ on board ships through their respective SMS, it would be embraced by the master and crew as well as the company’s designated person ashore and his team. The SMS can only work if those who are involved in its implementation actually want it to work, rather than being prescriptive rules and regulations (Anderson, 1998, p. 3). Effective implementation of the ISM Code should lead to a move away from a culture of "unthinking" compliance with external rules towards a culture of "thinking" self-regulation of safety - the development of a 'safety culture'. The safety culture involves moving to a culture of self-regulation, with every individual - from the top to the bottom - feeling responsible for actions taken to improve safety and performance (IMO, 2011).

The human element should be higher up on the list of priority right at the design stage of ships in respect of ergonomics, for example, positioning of equipment and their controls to reduce the mistake of pressing the wrong button. ‘Safe crew run safe ship’ is a slogan used regularly in the industry. Again, it is not just about having an understanding of and implementing the various rules and regulations, and being aware of human capabilities and the influence of the designed environment, although these are important, it is also about good leadership, effective two-way communication, teamwork and empowerment from the top to down, both shore and onboard (No Author Cited, A, 2011, p. 1). Though the ISM Code through the SMS cannot standalone to bring about improvement in safe management and operation of ships and pollution prevention without the acceptance and active participation of the human element, yet the controls it brings as a management tool cannot be over looked because ‘where it is left to human nature to get on with the job, without controls or with only limited supervision, discipline will naturally deteriorate and performance standards will fall, however good intentions’ (Sohmen, 1990, p. 76).

The ISM Code compels the shipping companies to engage qualified, medically fit and certified personnel on their ships as captured in chapter 6 of the ISM Code. ISM forces the shipping companies to document their screening procedures, in order to prove that they comply with STCW 95 (e.g. Chapter II, Regulation II/3, Section AII/3, Deck department: Minimum mandatory requirements for officers in charge of navigational watch). Hence, it is expected that the recruitment standards will improve, resulting to qualified crews on-board vessels (Martinez de Oses & Ventikos, 2003, p. 15).
The ISM Code seems to have managed to reduce the bureaucracy between those on board and the company in terms of the safety and pollution-prevention aspects of the operation of ships under chapter 4 of the Code (ISM Code, 1995).

**Human Element in Maritime Accidents**

Wherever there is a human interacting with a system there is a Human Element issue. Modern technology has revolutionized the way in which a ship is operated, but lack of attention to the human system interface, in terms of the design, layout, and integration of systems, and training in their use, is the root cause of many accidents today (No Author Cited, A, 2011, p. 1).

The UK P&I Club in 1991, report concluded that human error accounted for 58% of all claims and ‘it is received wisdom that four out of five ships casualties – 80% are due to human error…’ (Anderson, 1998, p. 15). ‘Again, human error costs the maritime industry $541m a year, according to the UK P&I Club. From their own analysis of 6091 major claims (over $100,000) spanning a period of 15 years, the Club has established that these claims have cost their members $2.6bn, 62% of which is attributable to human error. The Club asserts that latent failures frequently stem from decisions higher up, and that such failures stem from among others procedures, hardware, design, maintenance management, communication and training. It is not surprising that each of these categories includes the human element(UK P&I, Club, 2003, p. 3).

The ISM Code seek to provide a managerial tool in addressing the human element in these categories as captured under various sections of the Code, such as, Functional Requirements for a safety management system, Resources and Personnel, Shipboard Operations, Maintenance of Ship and Equipment among others, to reduce human error if not eliminate it, which would therefore have a corresponding effect on accident occurrences. The Code seeks to do this by clearly defining the shore management responsibilities and that of the ship board personnel responsibility through the company’s SMS, which seek to achieve continuous improvement of the SMS, by reporting and recording of non-conformities, near misses and accidents. It should however be noted that, the presence of an SMS detailing procedures, checklist etc, alone does not guarantee acceptance and compliance by the master and crew, let alone to reduce accident. Both the on board personnel and shore management should be treated as a team and co-owners of the management system then, in my opinion they would be motivated to accept their responsibilities and contribute to the improvement and success of the SMS. Pacific Basin shipping Ltd captures this sentiment well by stating that “While every near miss, defect and accident must be investigated, it has to be done without individual blame; a ‘No Blame Culture’ is fundamental to successful ship operations and for encouraging near miss and defect reporting. We promote the ‘22 Crew Owners’ principle; this takes the mandatory reporting of accidents and incidents under the ISM Code to much higher level, and gives each seafarer a sense of ownership and belonging to the company”(The Team - Pacific Basin Shipping Ltd, 2011, p. 7). “But for many in a traditional, hierarchical industry like shipping, accepting seafarers as equal partners is a strong proposition. It is no wonder, the ISM Code has not lived up to expectations and is almost doomed to remain a blunt tool” (Bhattacharya, 2011, p. 2).

In implementing the ISM Code, if human element is not taken into consideration in the preparation of the company’s SMS, in terms of the volume of paper work and check list which can be time consuming, etc. The paper work might be done in haste without the actual process given the needed attention. This may resort to filling in forms and writing reports on watch, at the expense of maintaining a proper lookout and attending to the navigation of the vessel, as an example of one, the accident prone situation that might come up. Such a practice can be considered as a potential contributing factor to marine accidents that are usually characterized as human-driven accidents. Accordingly, Phil Anderson warns: “… this is not only an ill-advised, highly dangerous practice, but has to be the ultimate irony as far as the wholephilosophy
of ISM is concerned. From human element point-of-view, extra paper work can point to additional workload (which leads to fatigue, etc.), or even negligence of prescribed duties; circumstances that are able to lead to marine accidents attributed to human related aspects (Martinez de Oses & Ventikos, 2003, p. 12).

The ISM Code does not give the management, be it onboard or ashore, such disciplinary powers like that in the royal navy. For instance, a seafarer cannot be incarcerated for breaking instructions, nor could he be easily sued for negligence or breach of contract. Labour unions and tribunals do not take kindly to cuts in wages and salaries as a punitive, or indeed even as a reforming measure. Proper education, graduated financial incentives to make the distinction between outstanding and average behaviour the basis for individual motivation among other reward systems would encourage the seafarer to buy into the ‘safety culture’, the spirit of the ISM Code (Sohmen, 1990, p. 76).

Conclusion
In conclusion, it is the view of the author that, the human element in shipping is very important if not the most important and therefore the ISM Code may be a good management tool to discipline the human element, if the personnel involved would own the system and willing to make it work by giving a purposeful attention to the performance of assigned tasks. As such; in the preparation of any SMS, among other consideration that should be taken into account is the human element on board and therefore, the SMS must be realistic and practical. Personnel on board the ship should be seen by shore management as being members on the same team with the shore personnel because “the human element in shipping is as important at the top as it is at the bottom of the pecking order. The setting of goals must come from top management but needs to be implemented all along the line, right down the lowest rank person on board the ship. The author believes that if the suggested views are considered, it would be a step further in achieving the objectives set out in the ISM Code.

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SOCIAL IMPACT ASSESSMENT OF OIL AND GAS EXPLORATION IN THE WESTERN REGION OF GHANA: A CASE STUDY OF SEKONDI/TAKORADI METROPOLIS

Gabriel S. Akakpo

Abstract

This study discusses social impacts of offshore oil and gas development on human communities in the Sekondi/Takoradi Metropolis in the Western Region of Ghana. Current study attempts to do a social impact assessment of the oil find on the people of Sekondi/Takoradi Metropolis. In all 95 respondents with varied educational background were sampled for the study using a multiple sampling approach. Questionnaires and interviews were the main research instruments applied to the study. The study revealed that the people had high expectations prior to the commercial production but these expectations were not being met fully. The study showed people’s awareness that aside the benefits of oil find such as growing employment, business and/or investment opportunities, there are also some social costs that associate with it. These include the increasing cost of living, human and vehicular congestion and other social vices. The study recommends some measures such as education and training, good governance together with strong media watch-dogs to be put in place to mitigate the social costs. It was concluded that though the oil find has brought some social benefits to the indigenes of Sekondi/Takoradi Metropolis, the social costs far outweigh these benefits due to the frequency and rate of their occurrences.

Key Words: Social Impact Assessment, Social Costs, Social Benefits.

Introduction

Oil is a resource commodity with special characteristics. These include its unique role as both common natural heritage of a country and the motor of global industrialization; its price volatility and consequent boom-bust cycles (which can be beneficial or detrimental); its high capital intensity and technological sophistication; its enclave nature; and the exceptional generation of profits that accrue to the state and to private actors. The combination of these factors produces what has been called the “paradox of plenty” (Karl, 2007). As a lucrative commodity, it has empowered many countries that produce it for export, in terms of improving the lives of the populace and increasing their political power among other nations.

For Batekega (nd), Oil and gas industries bring risk and opportunities which require mitigation by the key stakeholders such as government, regulators and operators. Oil and gas exploration and production business generates significant revenues for national economies in addition to the potential energy supply, employment generation and purchasing power for those involved.

1. Gabriel S. Akakpo (MSc.) is a Lecturer at the Marine Engineering Department, RMU

Africa has historically been known as a continent with rich natural resources but with high levels of poverty. Undisputedly, Africa is considered to be well-endowed with minerals including fossil fuels but the exact potential of these resources has been insignificant in some countries. The existence of these resources in a country can accelerate growth and social development, if used strategically.
Indeed, countries lucky enough to have oil can base their development on such a resource looking at the potential benefits from enhanced economic growth, the creation of jobs, increased government revenues to finance poverty alleviation programmes, the transfer of technology, improvement of infrastructure and to the encouragement of related businesses. But with regards to the case of Africa, these benefits are insignificant. Unfortunately, the positive perceptions tend to be negative in real facts. In other words, the negatives out-weigh the positives. These negatives include slower than expected growth, barriers to economic diversification, poor social welfare performance, and high levels of poverty, inequality and unemployment.

Furthermore, “countries dependent on oil as their major resource for development are characterized by exceptionally poor governance and high corruption, a culture of rent-seeking, often devastating economic, health and environmental consequences at the local level, and high incidences of conflict and war. In sum, countries that depend on oil for their livelihood eventually become among the most economically troubled, the most authoritarian, and the most conflict-ridden in the world”(Karl, 2007).

According to African Development Bank, 2009, Nigeria has been exploiting oil resources for the last 50 years and is now the world’s fourth largest oil exporter. Yet, its human and physical capital development is assessed to be 400 percent lower than it would have been if the oil revenues had flown into public funds, and if such funds had been utilized in the public interest to generate economic opportunities for all (African Development Bank, 2009).

UNDP (1996) noted that human security implied safety from chronic threats such as hunger, disease and oppression and also protection from sudden and hurtful disruption in the patterns of everyday life. “Human security is achieved when and where individuals and communities have option necessary to end, mitigate or adapt to threats to their human environmental and social rights, have the capacity and freedom to exercise these options and actively participate.”

Due to the enormous financial resources that can accrue from this industry, the discovery of oil in any location, particularly developing countries, is greeted with great optimism. However, the discovery and exploration of oil requires good governance which provides fair legal framework that needs to be enforced impartially. It requires protection of human rights particularly those in the minorities and by so doing errors committed in other sectors of the economy will be minimized or alleviated.

The movement of people into the region as a result of the oil discovery, exploration and production, has led to some consequences on the human population, altering the way in which they live, work, play, relate to one another and generally cope as members of the society. The impacts of oil and gas exploration take different shapes. While significant benefits flow forth from different development actions, there is need to also identify and evaluate the associated negative externalities. Such changes may affect employment, income, production, way of life, cultural practices, community participation, political systems, environment, health and well-being, individual rights as well as property rights, fears and aspirations as well as change in ethnic composition. These impacts can be positive or negative or both. Such impacts do not only need to be identified and measured but also need to be managed in such a way that the positive externalities are magnified and the negative ones minimized.

**Problem Statement**

Due to the great optimism associated with the discovery, exploration and production of oil, exploration and production activities may introduce a wide range of social implications which is
very significant to the host communities and must be considered as one of the priorities. For example, the insurgence in Nigeria, Angola, Sudan, and many other countries which have made those countries a chaotic haven for armed gangs with daily violence as a result of dissatisfaction over oil proceeds to the citizenry, has caused so many social unrest. This study therefore aims at identifying through a Social Impact Assessment (S.I.A), the likely positive and negative implications as a result of the oil find; and come out with measures in mitigating/addressing these effects in Sekondi/Takoradi Metropolis.

**Objectives**

The following were objectives set for the study:

a) To find out the **expectations** of the indigenes of Sekondi/Takoradi Metropolis following the news about oil find.

b) To identify the **social benefits** of the oil and gas exploration on the people of Sekondi/Takoradi Metropolis.

c) To identify the **social costs** of the oil and gas exploration on the people of Sekondi/Takoradi Metropolis.

d) To **recommend** the appropriate measures that can be put in place in mitigating and/or addressing the social implications of the oil and gas exploration on the people of Sekondi/Takoradi Metropolis.

**Research Questions**

i. What are the expectations of the indigenes following the news on the oil find?

ii. What are the social costs of the oil and gas exploration on the people of Sekondi/Takoradi Metropolis?

iii. What are the social benefits of the oil and gas exploration on the people of Sekondi/Takoradi Metropolis?

iv. What are some of the measures that can be put in place in order to sustain/maximize the positive impact?

v. What are some of the measures that can be put in place in order to reduce or prevent the negative impact?

**Justification**

The results of this study will provide useful data for the people living in the Metropolis as well as the oil companies and the general public with regards to:

i. Educating the people on how to manage their huge expectations concerning the oil discovery and exploration.

ii. Identifying opportunities for socio-economic development.

iii. Serving as reference for future use.

**Scope of the Study**

The study considered the social impacts that have set in since the time of the oil exploration period, through the discovery up to the production period. More specifically, the study covered the period between 2007 and 2011, so as to aid in assessing what happened, what is happening and what is yet to happen. Since SIA is a participatory study, the research was centered on people living (indigenes) in the Sekondi/Takoradi Metropolis. This is because they are believed to have direct exposure to the social implications of the oil discovery and production.
Literature Review

Ghana had always wished to find oil in commercial quantities since independence but it was not until the 1970s that commercial levels of offshore oil reserves were discovered. In 1983, the government set up the Ghana National Petroleum Corporation (GNPC) to promote exploration and production. In 1990 production begun even though it was insignificant to qualify the country as an oil producing nation. The GNPC entered into several agreements with oil producing companies to prospect for oil in the offshore blocks. In fact, the prospects in the Tano Basin led to a production of about 6,900 barrels of oil a day by 1992 (Adam, 2010).

The 2007 new oil discovery at the Mahoga ny-1 Exploration Well was struck by Anadarko Petroleum Corporation on the deepwater Kosmos Energy’s West Cape Three Points Block, while Ireland’s Tullow Oil announced the findings of its nearby Hyedua-1 well in the adjacent deepwater Tano license. This deepwater find with about 800 million barrels of recoverable oil shows that there still exist huge potentials in Ghana’s oil story (Adam, 2010).

Social Impacts are the changes that occur in communities or to individuals as a result of an externally-induced change. In a journal article, IOCPG (2003: 231) defines social impacts as ‘the consequences to human populations of any public or private actions that alter the ways in which people live, work, play, relate to one another, organize to meet their needs, and generally cope as members of society’. The term also includes cultural impacts involving changes to the norms, values, and beliefs that guide and rationalize their cognition of themselves and their society.” Social impacts are both positive and negative.

Vanclay (1999) finds that one misconception in the SIA literature relates to the lack of distinction between social change processes that are caused by projects such as dams, and social impacts that are actually experienced. In this conceptualization, an impact must be an experience (either real or perceived) of an individual, family or household, or a community or society. According to Vanclay, resettlement (relocation of a community), for example, is not a social impact, but causes social impacts such as anxiety and stress, uncertainty, disruption to daily living, potential change to family structure, as well as impacts such as homeliness.

Gary & Karl, (2003) summarise that the exploitation of long-known oil reserves in Sudan has only added fuel to the fire of the country’s long running civil war. Over 2 million people have died and 4 million have been displaced during the last 20 years of the war between the government of Sudan and the main-rebel movement based in the south, the Sudanese Peoples Liberation Movement. During the 1990s, Africa’s newest producer has controversially attracted some Western Oil Companies as well as Malaysian and Chinese concerns. (U.S. companies are barred from doing business in Sudan because of U.S. government sanctions). Activists have especially targeted Talisman, a Canadian oil company, which, being under pressure from NGOs and churches, recently sold its shares in the Greater Nile Petroleum Operating Company. As some countries have made bad strides after discovery of oil, others too made good strides out of the same resources. A good case to point is Norway. In a discussion paper by Darkwah, (2010), Norway was known to be the poorest country in Scandinavia at the end of the 1960s but rose to be the wealthiest by the end of the 1990s as a result of the discovery of oil in 1969. This success was achieved due to the country’s ability to prevent rent-seeking and corruption which, undoubtedly, have been identified as the basis of the resource curse. Other key elements to Norway’s success include the existence of policymakers and politicians who refrained from dipping their hands into the government kitty, a highly efficient judicial system that prosecuted the few recalcitrant rent-seekers in an expeditious manner, a transparent reporting system that provided information to every Norwegian citizen about exactly how much revenue has been
generated from the oil industry through both newspapers and the internet as well as a strong media that served as a watchdog. In addition, Norway’s public sector employed the majority of the citizenry with no discrimination, especially towards women in this respect. By so doing, the government was able to channel some of the oil wealth into salaries that went directly into the pockets of citizens (Darkwah, 2010).

Research Methodology

Study Area
The study area covered was the Sekondi/Takoradi Metropolis, because as the regional capital, it serves as the industrial and commercial hub where all business and corporate activities are centered. As a result of the discovery, all the Jubilee partners operating on the Jubilee Oil Field located at West Cape Three Points (near Effasu, Axim) have subsidiaries of their companies established in the region. Other companies (especially logistics companies) involved in the oil and gas industry have their offices, warehouses, and plants pool located also in some parts of the region, with Sekondi/Takoradi being the dominant area.

Due to the discovery of oil, the influx of different groups of people from different geographical and sociological backgrounds in Ghana and other parts of the world in search of job and livelihood has caused changes in the society especially an increase in population.

Population and Sample
The target population of the study is mainly the indigenes of Sekondi/Takoradi Metropolis. The selection of respondents for the questionnaires was guided by a sampling procedure which involved the identification of the sample frame and the appropriate sample size. In determining the sample frame, the basic criterion was people who were staying in the Sekondi/Takoradi Metropolis before the oil find and are still staying in the Metropolis. The minimum period of stay in the metropolis before the oil find used in determining the sample frame was three years. Out of the target population, a sample size of 95 indigenes was selected using multi-stage (multiple) sampling method.

Sampling technique
In all 95 respondents were sampled for the study using a multiple sampling approach. The respondents were mainly grouped into three major social groupings (strata): ‘Professionals (35), Self-employed (29), and Unemployed’ (31), with majority of them falling between the youthful ages of 18-30, and also majority of them being women (53).

Research Design and Instrumentation

Questionnaires
100 Structured questionnaires were distributed to the sample in order to give them the opportunity to air the views concerning the social impacts arising in the Sekondi/Takoradi Metropolis as a result of the oil find in the western region. The questionnaires involved both open and close ended questions and this allowed the respondents to give subjective and objective opinions relative to each particular question. In all, 70 out of the 100 distributed questionnaires were completed and hence, retrieved from the sample.

Interviews
Interviews were applied in cases where the respondents had inadequate time to respond to the questionnaires by way of writing, and to confirm their opinions based on their emotions and expressions. In all, 25 out of the 95 respondents were interviewed.
Data Analysis and Discussions
The questionnaires contained a number of questions aimed at identifying the respondents’ views and perceptions on the social impact on the people of Sekondi/Takoradi Metropolis following the discovery and commercial production of oil in the western region. The findings of the survey are as follows:

a. Expectations of the respondents since the commercial discovery of oil
The study took into consideration the expectations of the respondents with regards to the oil find in their region. Interviews were conducted in order to allow the respondents to express their opinions concerning their expectations since the oil find has made Sekondi/Takoradi the hub for the oil and gas activities.

According to the respondents, majority of them expected the following:
i. Local participation in the oil and gas operations and activities through awarding of contracts, training of indigenes to be acquainted with the oil and gas industry and its operations
ii. Creation of more jobs which will contribute to revenue generation thereby leading to improved standard of living.
iii. Infrastructural developments such as construction and expansion of roads to alleviate the growing human and vehicular congestion
iv. Super structural developments such as estate developments, construction of modern towers for offices and shops to support the upcoming business and investment opportunities.
v. Building of schools and hostels to support the existing educational infrastructure, together with the award of scholarships to some students based on the set criteria.

Among the few expectations that have been met are creation of more jobs but with less number of indigenes employed. Some hostel facilities and scholarship schemes are said to have been introduced in certain public educational institutions whilst some other respondents with the requisite qualifications have also been selected and are undergoing training outside the country in oil and gas upstream and downstream activities.

b. Social benefits of Ghana’s oil find on the people of Sekondi/Takoradi Metropolis
   i. Employment Opportunities
The study revealed that there are a lot of employment opportunities emerging as a result of the oil and gas find. These opportunities are not found only in the oil and gas industry but also in other sectors which have been given less attention. In other words, there are oil-related employment opportunities and non-oil-related employment opportunities. But the majority’s attention is directed towards the oil-related employment opportunities due to the perception by the indigenes that oil job generates higher income as compared to jobs found in other sectors of the economy.

In an interview with a 50 year old self-employed respondent, he said: “...the oil find has brought a lot of employment opportunities in the Metropolis. The oil companies are offering different ranges of jobs by recruiting people into the engineering, management, security and safety departments. People who have the knowledge and the expertise in these areas have already taken their share of these opportunities whilst others are now on the move. Aside that, big catering service providers have also emerged with the aim of providing catering services to the giant oil production and exploration companies who have masses of employees to feed during working hours as part of their norms. These catering service providers have engaged some youth who were unemployed but qualify to be employees of such companies to aid in its functions”.

Moreover, hotels, restaurants, banks and other financial institutions and insurance companies are
emerging rapidly and of course they do require the qualified human resources. This means people are also getting employed in the above mentioned areas. Although some of these companies were in existence before the oil and gas find their sizes are increasing rapidly in the Metropolis as a result of the oil find.

ii. Business and investment opportunities
The respondents, in their opinions, said the oil find has resulted in increased population. “The population is increasing daily; people are coming from other parts of the country while others are also coming from foreign countries all because of the oil find. This has given businessmen and investors the opportunity to invest in attractive and lucrative businesses. Modern hotels and restaurants are constructed in order to take advantage of the increased population”. Those were the words of a 35 year old respondent.

In an interview with another respondent, it was realised that Small and Medium scale enterprises are emerging rapidly in the Metropolis due to the opportunities associated with an increase in population and other opportunities as a result of the oil and gas find. All kinds of trading activities are also growing, with traders increasing their market shares. “Some few years back, some businesses were not common in our Metropolis but were commonly known in some parts of the country like Accra (the capital city of Ghana) and Kumasi”.

Some products were not found in the Metropolis because their respective markets were not attractive and lucrative due to the respective sizes of these markets and the price sensitivity of the markets. But now, it seems these products have gradually gained their positions in the market as the population increases and the economy thereby booms. “There is money in the system, people are buying more than they used to, we flood the market with all kinds of products yet, these products do sell at the end of a market day. As the people become more, so we do sell more and gain more profits”, said by a trader. This is just not happening in the product market but also the service providing markets.

iii. Improved Standard of Living
Further in the studies, improved standard of living was highlighted as one of the benefits the oil find has brought. Taking the views of some respondents they said, fortunately for those who are employed in the oil and gas sector, it has clearly been seen that their standard has improved since they earn better salaries, allowances and incentives from their jobs. This in turn has aided them to cater and afford certain things they lacked some few years back.

A taxi driver, from Effia-Kuma (a suburb of Sekondi/Takoradi), shared his views on the matter concerned. He disclosed in an interview that; “I can see there has been some improvement in my standard of living. This is because, as the population increases, the number of people who board vehicles has also increased and I exceed my sales target most often. I can now pay my utility bills, buy expensive clothes and foods I could not afford before and even take care of my girlfriend, without much stress. Meanwhile, before the oil find, the population was minimal and I often run at lost because there were only few passengers to pick”.

Also, another respondent who operates a restaurant commented on the same matter, saying “since the oil find I see so many people crowded in my restaurant, all in the quest to buy food. They buy to the extent that sometimes I even have to exceed my normal working hours by making sure my customers are served but this is all money even though my employees and I get stressed up. The more sales I make, the more the profit I make. Therefore, I am able to provide certain needs I have long been wishing to have”.

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Clearly, it can be seen that people employed in the oil and gas sector and those who operate their own businesses have their standard of living improved as they take advantage of the oil employment opportunities and the increased population respectively, as a result of the oil find.

iv. Development of Infrastructure
Development of infrastructure was one of the issues highlighted as a benefit gained from the oil and gas find. Sekondi/Takoradi Metropolis is gradually transforming into a modern city as more developmental projects are on-going, with others underway. These developmental projects include renovations, new buildings and construction of factories. Majority of these projects are meant to be used as offices, hotels and guest houses where most oil companies, banks and other companies have already occupied the completed ones.

A respondent who was contacted in an interview said: “The rate of developments in the Metropolis now as compared to some few years back (before the oil and gas find) is unbelievable. Everywhere is changing; a lot of old houses are now renovated into modern offices for companies (oil and non-oil related companies) and banks as well as other financial institution, even though some residents have lost their homes following these projects. We used to see certain types of buildings mostly in the greater Accra region but now we the people of Sekondi/Takoradi can also boast of such buildings. At least it is making our town look like a modern city”.

c. Social costs of Ghana’s oil find on the people of Sekondi/Takoradi Metropolis
i. High Cost of Living
The issue of high cost of living was a major challenge to the majority of the residents of Sekondi/Takoradi Metropolis. Many of the residents are worried about the fact that their cost of living in the Metropolis has risen significantly as compared to the cost of living before the oil find. Most of the respondents who highlighted high cost of living as a problem were more emphatic on issues such as high rent charges for homes, shops/stores and offices of which landlords or property owners are extorting money from interested persons. Also, another key issue raised by the respondents was increasing price of commodities and items which do not have their fixed prices tagged on them, coupled with unrealistic prices of some foods which are being sold, making living in Sekondi/Takoradi Metropolis now very expensive.

In an interview with another respondent, he said “the oil find has brought a lot of changes to our Metropolis but the only problem we are facing now is the cost of living. Everything has gone up, mostly rent charges. Some of us can no longer pay our house rent with the kind of salaries we earn because our landlords have raised the rent charges making it very uneasy for some of us to afford; all of this is because of the oil find. Greedy landlords have the oil workers as their target and are frustrating us with high rent charges in order to vacate us from their premises so that they can then rent it out for people who can afford. It may be unbelievable that sometimes, one would be asked whether he or she is working in the oil industry before the house may be rented out”.

The interview report above implies that food in the metropolis is now for the rich. Before one can fulfil a basic physiological need like food, he or she must be rich enough to be able to afford but food is a basic need that must be so cheap for every individual to afford.

ii. Increase in Social Vices
Despite the significant benefits that were outlined by some respondents in their responses, others were worried about some forms of social vices that have been on ascendancy since the oil find. These social vices include prostitution, homosexuality, fraud and crime. These can be attributed to the fact that different people from different cultures having different missions have converged
in this Metropolis.

On the issue of prostitution, a concerned respondent who voiced out his opinion said, the oil find has brought quite a number of expatriates, mostly foreigners into Sekondi/Takoradi Metropolis. These expatriates are men and definitely have sexual desires but since they are away from their wives and girlfriends, they just go in for substitutes on contract basis where sex is exchanged with money (prostitution).

In an interview with a young lady, she disclosed that, “Prostitution has become very high in our Metropolis. Since the oil find, a lot of women from other parts of the country and outside the country have trooped into the Metropolis with prostitution as their profession. They come and mix up the already exiting prostitutes thereby, multiplying their number. They believe trading with the ‘whites’ is more profitable than trading with the local men, so since the oil find has brought many of these whites who are expatriates in the oil and gas industry to work over some period of time. This is how they are also getting their share of the oil money. We are praying this will change because we fear for the future of our upcoming ladies”.

Homosexuality was another social challenge raised by some respondents. Most of the foreigners are from countries and areas where the practice of homosexuality is very common though not legalised. As they leave their homes for a different location, so do they leave their homosexual partners and for that matter, they need to find new partners to represent their partners in the wake of satisfying their homosexual desires. Unfortunately, some innocent locals are being lured by the wealth generated from these acts and put themselves in the same game thereby increasing the existing number. Moreover, another challenging issue raised by some respondents is the emergence of armed robbery attacks. The study revealed that armed robbery used to be a strange crime in the Sekondi/Takoradi Metropolis but now it is surging up gradually.

A respondent expressed his feelings over this issue: “Just about a year ago, some series of robbery attacks went on in some areas like Anaji Estate, Kansawerodo and its extension where most of the expatriates reside as well as some renowned personalities in the Metropolis. I don’t remember the last time I heard about any robbery attack in our Metropolis until this oil find. People think there is money in the system now so they have to find which ever means to get their share of the oil money but I confirm if these robbery attacks are carried out by some unscrupulous respondents or some foreign criminals”.

iii. Congestion

Through the researcher’s observations as well as the data collected from the various respondents, it became clear that the issue of congestion in the Sekondi/Takoradi Metropolis is surging at a faster rate as a result of the influx of other nationals as well as Ghanaians migrating from other regions, cities and towns to the Sekondi/Takoradi Metropolis.

Again, traffic congestion is another social cost which has escalated as a result of the fact that banks and other corporate financial entities in the Metropolis are offering soft loans to taxi drivers and this has increased the number of taxis in town hence causing intense vehicular traffic congestion in the Metropolis. Aside that, some of the migrants moved to the Metropolis with their vehicles as other seasonal residents also have their vehicles moving along, all competing with the existing vehicles on the narrows roads of the Metropolis.

Another issue of congestion raised by the respondent through an interview segment was that, there are many heavy duty trucks that queue along the roadside with the intention to providing haulage services for oil companies downstream. These trucks end up causing heavy traffic on our roads and sometimes even cause accidents to other vehicles and pedestrians plying the road.
The following is a complaint from a respondent: “We do not know where all these people and cars are coming from. All of a sudden our town is already choked with foreigners and cars because most of the people who find their way here also come with their own cars in addition to the already existing cars here in Sekondi/Takoradi Metropolis. The influx of other nationals as well as Ghanaians from other regions, cities and towns results in scrambling of jobs and other opportunities more especially around the market circle arena. But all things being equal, we hope things will get better in the near future”.

iv. Others
Aside the above issues distinctively outlined as social costs (in other words problems or negative effects), some other issues raised by some respondents were insecurity and inequalities, increased pressure on social amenities, as well as increasing rate of waste generation. Some of these problems have significant effects on the residents especially with increased waste generation posing health and sanitation threats to the residents as other residents panic because they feel their lives are unsecured looking at the growing social vices. Surely “dirt grows with an increased population”.

Also, the increasing population is as well increasing pressure on some social amenities and public utilities causing insufficient utility distribution leaving the residents frustrated and anxious. On the other hand, there are some forms of inequalities in their system since the oil expatriates in the Metropolis are given priorities in terms of acquisition of certain things and the enjoyment of some individual rights.

Conclusions and Recommendations
Summary of Findings: From the data presented and analysed, it is concluded that:

i. The respondents of Sekondi/Takoradi Metropolis (the capital city of the western region) following the oil find in the region had high expectations in terms of job creation, improved standard of living, developments of public infrastructure like roads, schools, and many others since the oil resource has been a blessing to many economies by transforming these economies from under-developed to developed in the world. Even though some of these expectations have been met, they are not to the satisfaction of the respondents.

ii. The rate of occurrence of the negative impacts is higher and faster compared to the rate of occurrence of the positive impacts which take quite a longer and slower pace to materialise. Negative impacts such as increase in congestion, high cost of living, prostitution, homosexuality and crime are happening just within a short-term with a faster pace unlike employment opportunities and improved standard of living which take slower pace to occur over quite a long period of time.

iii. More attention is given to the oil-related jobs due to the lucrative nature of the oil-related jobs with less attention given to the non-oil related jobs, instead of giving optimal attention on both because there are other growing job opportunities in the latter which are equally lucrative as the oil-related jobs. This is not only in the employment sector but also, the business and investment sectors are faced with same problems.

iv. Foreigners both outside the western region and beyond are given more priority than the respondents, in applying for the few jobs available. This was because the indigenous applicants were under-skilled and mostly lacked the basic qualifications.
Conclusion
The introduction of the oil and gas since its discovery in 2007 has placed Ghana in the international markets of oil producing countries. This has really had undisputed remarkable social impact on the city of Sekondi/Takoradi, the capital city of the western region where most of Ghana’s oil and gas activities are centred. However, with emphasis on the objectives set it was concluded that Ghana’s oil find in the western region has introduced mixed bag of ‘blessings and curses’ producing both positive and negative impacts into the Sekondi/Takoradi Metropolis with the negative impacts outweighing the positive impacts as revealed by the study.

To begin with, some of the positive impacts include contribution to the improvement of standard of living of the indigenes of Sekondi/Takoradi; infrastructural and super structural development; employment, business and investment opportunities while the negative impacts include high cost of living, social vices, congestion, poor sanitation and some few others that were outlined in the findings. Again the frequent occurrence of the negative impacts is becoming unbearable as these impacts keep on increasing rapidly compared to the rate of occurrence of the positive impacts which take gradual processes before manifestation.

Recommendations
Nonetheless, some of the measures envisaged by the study together with some measures suggested by the respondents for mitigating the negative social impacts include education and training, good governance and government policies, strong media watch dogs, incorruptible government officials and traditional leaders among others.

i. Education and training
Clearly, it can be seen that the oil find has brought various employment opportunities especially in the oil and gas sector. The study revealed that most of the indigenes do not have any in-depth knowledge, let alone some basic common knowledge/skills in the oil and gas industry, and for that matter; they are missing most of the employment opportunities arising from the oil and gas sector. This is because they do not even have the qualification to fill these available job vacancies. Therefore, there should be requisite training programmes for the youth with regards to oil and gas exploration and production both in the upstream and downstream activities. Again, it is recommended that seminars, short courses and other educational programmes be organised for the youth within Sekondi/Takoradi Metropolis to keep them abreast with some of the new developments related to the oil and gas operations that go on in the Metropolis. Moreover, the education must not only be on the oil and gas related employment and business opportunities but also the indigenes must be cautioned through education about the growing social vices with regards to ways that lessen these kinds of impacts. With these, the researcher thinks it would aid in managing the huge expectations of the people of Sekondi/Takoradi Metropolis with regards to the oil find.

ii. Good governance and government policies
The researcher believes that it is imperative for the government to provide adequate policies or legislation to protect the indigenes of Sekondi/Takoradi Metropolis regarding their participation in the activities that involve oil exploration and production. The local content policy framework instituted by the government should be passed so that it would encourage indigenes and other Ghanaians who would like to embark on oil and gas exploration as a career. Also, revenue management policies must also be put in place to ensure sustainable socio-economic development is achieved. However, in terms of good governance there should be revenue transparency by government, as well as revenue management schemes implemented and stabilization funds to mitigate price shocks. On the other hand, there should be fair and favourable policies put in place to attract investors into both the oil and non-oil sectors. Without
the formulation and implementation of reforms, the consequences of the negative impact will continue to manifest.

iii. **Incorruptible government officials and traditional leaders.**
The study envisaged that many at times corrupt officials turn to embezzle funds meant for public infrastructural development. Looking at the bearing that revenue has on socio-economic development, it is very important that government officials and traditional leaders are incorruptible. However, in order to mitigate some of the negative impacts that affect the Metropolis, there is the need to have strong instructional policies that would serve as deterrent for government officials who embezzle public funds. This can be achieved through the government’s ability to prevent rent-seeking and corruption which undoubtedly, have been identified in some oil producing countries as the basis of the negative impacts of the oil find in those countries. Other key elements include the existence of policymakers and politicians who refrained from dipping their hands into the government kitty, a highly efficient judicial system that would prosecute the few recalcitrant rent-seekers in the country. This will ensure that funds remitted for socio-economic developments are directed towards its purposes.

iv. **Strong media watch dogs**
A transparent reporting system that would provide information to every indigene in the Sekondi/Takoradi Metropolis and to all Ghanaians about exactly how much revenue has been generated from the oil industry through newspapers and the internet as well as a strong media that serve as a watchdog should be institutionalized. This will aid the indigenes to determine government’s ability or inability in funding certain developmental projects that will benefit the society and the country at large. Employment advertisements can be carried out through such media indicating the authenticity of the job in order to avoid or reduce some fraudulent activities regarding employment. Also, such media should ensure that the grievances of the indigenes are aired to the relevant authorities. At the same time, the media houses can serve as platforms through which the youth and other concerned indigenes can be educated on the growing social implications and advise them on the measures to take in addressing the social implications.
Reference


ABSTRACT
The objective of this research paper is to address the issue of oil revenue management in Ghana for sustainable socio-economic development, as a model for emerging oil producing nations in West Africa. To meet its objectives, the research was designed to answer some questions pertaining to oil revenue management. Data used for this research were collected from both primary and secondary sources. The tools used for the research were both a survey questionnaire and interviews with selected players in the Ghanaian oil sector. The research design employed was descriptive and the sampling technique used to collect primary data was Stratified Random Sampling, with a sample size of two hundred from the Western, Volta, Ashanti, Northern, Central and Greater Accra Regions. This research was necessitated by the fact that discovery of oil in many African countries has not produced the badly needed socio-economic development to deliver its citizenry from extreme poverty and improve the quality of lives. Oil discovery in Africa has therefore become a resource curse rather than a blessing. In this regard, the Jubilee Oil Field discovery in 2007 has presented Ghana with a new challenge—the management of oil revenue for sustainable socio-economic development. In light of that, to avoid succumbing to the “oil curse” and the failed experience of other African oil producing countries, Ghana passed into law in July 2010 its oil revenue management model. However, this research shows that Ghana’s oil revenue management law needs to be reviewed and amended to incorporate other important provisions based on our research and as a matter of practice in other oil producing counties.

Key Words: oil, revenue, management, model, act, petroleum, Ghana

Introduction
Currently Ghana is classified as a model for democracy in Africa (Abdula & Crawford, 2010). The latest example of the Ghanaian democratic model is the smooth transition of power after the death of its President, Prof. John Evans Atta Mills, on July 24, 2012. In the words of Doyle, (2012), the smooth handover to a successor-[H.E.] John Mahama-highlight how far Ghana has gone on the road to democracy. In less democratic era-in the 1980s or 1990s, Doyle, (2012) continues, the death of a Ghanaian leader would have caused fear and foreboding: was the death suspicious? Who would take over? Would the army step in? But it’s a measure of how the democratic process has become “normal” in Ghana that [H.E.] Mahama-the Vice President-was swiftly sworn in. In spite of this democratic credential, eyes are globally mounted on Ghana to see if she will transient beyond the concept of “paradox of plenty” which has resulted to an “oil curse”.

The discovery of the Jubilee Oil Field in 2007 has presented Ghana with a new challenge—the management of oil revenue for socio-economic development and sustainable economic growth. In many oil producing Africa countries, the discovery of oil has not produce the badly needed socio-economic development to deliver its citizenry from extreme poverty and improve social services and infrastructures. Oil discovery has therefore become a resource curse rather than a blessing.

1. Robert G. M. Nyemah (PhD) is the Head of Research and Consultancy, RMU and Editor of the RMU Journal.
2. Sarah Sackey (BSc.) is CEO, Data Pipe Line, Accra-Ghana
To avoid succumbing to the “oil curse” and the failed experience of other African oil producing countries, the Ghanaian Government, after the discovery of the Jubilee Oil Field in 2007, passed into law in July 2010 its oil revenue management model entitled: Petroleum Revenue Management Act 2010. Section 5 (Prohibited use of Petroleum Account) of this act states:

5. (1) The assets of the Petroleum Account shall not be used:
(a) To provide credit to the government, public enterprises, private sector entities or any other person or entity, and
(b) As collateral for debts, guarantees, commitments or other liabilities of any other entity.
(2) In order to preserve revenue streams from petroleum and ensure the object of this Act, there shall not be any borrowing against the Petroleum Reserves.

However, in April 2011 the Petroleum Revenue Management Act 2010 was reviewed and modified and became Petroleum Revenue Management Act 2011, No. 815. In particular, Act No. 815 provides for:

(1) A mandatory savings plan, by which no more than 70% of the revenues derived from petroleum each year, may be spent as part of the annual budget. The rest must be reserved for the benefit of future generations of Ghanaians or to cushion disruptions caused by unexpected oil price fluctuations. Statutory limits on “collateralization”—government borrowing against projected oil revenue. Specifically, the Act provides that the government may borrow against no more than the first ten years of petroleum revenues allocated to annual spending.

(2) Establishment of a "Public Interest and Accountability Committee" to be nominated by traditional and civil society constituencies rather than by the government.

From the foregoing, a major drawback has been introduced into Act No. 815—"collateralization”—government borrowing against projected oil revenue—which was prohibited in Act 2010, a practice that has driven many oil producing countries into bankruptcy and stimulated the concept of “paradox of plenty.” Apart from this being a major concern, the Ghanaian government’s actions since the passage of Act No. 815 threaten to undermine the act as evident by the 2012 supplementary budget. The 2012 supplementary budget contained a revised estimate of GHC1, 250.8 million of oil revenue which were directly added to the supplementary budget. The new funds were determined by revising oil price from USD$70 per barrel to USD$100 and production level from 79,945 to 84,737 barrels per day. These revisions resulted to a higher Benchmark Revenue (BR) of GHC1, 250.8 million as oppose to GHC584.0 million in the original budget. From the new BR 70% or GHC875.56 million was to be integrated into the Ghana National Annual Budget (GNAB) while the remaining GHC375.24 million should have been deposited into the Ghana Petroleum Funds as excess in accordance with Clause 2 of Act No. 815. In the language of the law, revenues in excess of the first annual budget funding amount are classified as excess revenues, and therefore do not form part of annual budget funding. Adam, (2012) terms this as a “slippery steps in oil revenue management”. Another example is the government’s action to collateralized fifteen (15) years of the nation’s oil reserves above the ten (10) years period provided for in Act No. 815. Evident of this is the USD$3 billion unconditional loan from the China Development Bank secured by a full 15 years’ worth of oil revenues (Ramos-Mrosovsky, 2012).

In light of the aforementioned, this research was designed to achieve the following:

- Give an in-depth overview of the oil sector of Ghana;
- Critically assess the role of Ghana National Petroleum Corporation in the sector;
- Make analysis of Ghana petroleum revenue management model and existence models of other countries; and on this basis,
- Develop an appropriate paradigm of oil revenue management based on Ghana’s specifics for sustainable socio-economic development as a model for emerging oil producing countries in West Africa.

The study was conducted in the Greater Accra, Ashanti, Central, Western, Volta and Northern regions. However, some of the industrial players and Jubilee Partners delayed in their response due to their busy schedules, while responses were not received form others.

**Literature Review**

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Regarding oil revenue management, the Government of Ghana on 16th July, 2010 passed a bill entitled “Petroleum Revenue Management Act, 2010” (now Act 2011, No.815). This bill, amongst other things, underscored the need to guide the efficient collection, allocation, and management of petroleum revenue for the benefit of current and future generations of Ghana. The bill also emphasized the need to ensure the overall management of petroleum revenue based on sound and sustainable fiscal policies that go beyond political regime.

Worldwide experience shows that proper responsible and transparent management of oil revenue is an essential tool to deliver the best possible oil wealth management result for sustainable socio-economic development in any oil producing nation. The available scarce works (research journal articles, research projects and other publications) on oil revenue management point to the need for a strategy choice in managing oil wealth in order to promote development and avoid the “resource curse”. In this light, in a joint research project by the African Development Bank and African Union (2009) it was found that oil and gas resources can be used to strategically accelerate economic growth in oil producing African countries but that requires a framework for a coherent future vision-management strategy- to help African government and oil and gas operators in their decision making. Furthermore, UNDP in a study conducted in 2006 defined resource curse as the inverse association between development and the abundance of natural resource [which we refer to as the “paradox of plenty’], and pointed out that the key issue in avoiding “resource curse” is how governments and policy makers administer resource wealth and how they use resource revenue. Furthermore, in a research journal article Nyemah(2011) pointed out that in order to avoid the “paradox of plenty’, which characterized the Nigerian experience in oil production, there is a need for emerging oil producing countries of West Africa to formulate a strategic oil revenue management policy for sustainable socio-economic development.

Similarly, in a study Kalyuzhnova (2006) underscored that oil wealth can be volatile, unpredictable, and ultimately exhaustible and can greatly complicate economic policy-making and economic management. According to the author, economic performance appears to suffer rather than benefit from the impact of natural resources endowment. However, the author pointed out that in order to tackle such management challenge, oil-producing countries must set up oil funds as a useful tool for oil revenue management in achieving long run socio-economic development. In another study Vugar-Bayramov et-al (2011) emphasized the finite life expectancy nature of oil wealth and pointed out that the Government of Azerbaijan must implement long-term macroeconomic strategy, fiscal rule and implementation mechanisms that ensure that oil money is saved in the most efficient way and that the benefits of the investments address high priority needs, and must be highly integrated and sustainable. Finally, in a publication by the Ministry of Finance of Norway in 2009, it was pointed out that the aim of the Norwegian government fiscal policy is to transform the volatile and temporary incomes from non-renewable natural resources into sustainable welfare gains for all Norwegian citizens. This, according to the publication, was to be achieved by establishing a Fund and supporting sustainable management of oil wealth. To this end, a Fund was established in 1990 to support sustainable management of the nation’s oil wealth for socio-economic development and improved quality of lives.

**Methodology**
The research was designed as a descriptive study to answer some questions pertaining to oil revenue management in Ghana for sustainable socio-economic development. To achieve this objective, the study draws heavily on primary data through the use of a survey questionnaire. The study also employed the use of secondary data. Before the final field work, a pilot survey was conducted to test if the objective of the study will be met with the response. In order to administer the survey questionnaire, Stratified Random Sampling Technique was used to collect the data with a targeted sample size of 200. Executives of some industrial players in the oil sector were in addition interviewed to ascertain the overview of the sector and the role of Ghana National Petroleum Corporation (GNPC). Returned questionnaires were checked for errors, completeness and corrected, where applicable, in the field. Responses to open ended questions were coded
Overview of Ghana’s Oil Sector

1. Discovery
Ghana in 2007 officially announced the discovery of oil in commercial quantity. The joy of this news led the then President of Ghana H.E. Mr. John Agyekum Kuffour to remark thus: “The discovery of the country’s first major oil deposit could turn the West African country into an African tiger. Even without oil, we are doing well. With oil as a shot in the arm, we are going to fly. Oil is money and we need money to do the schools, the roads, the hospitals” (Nyemah, 2011, p. 53). Exploration for the discovery of oil in Ghana started in 1896 onshore the Tano Basin due to the presence of oil and gas, seepages found by early explorers (Frimpong, 2011), but Ghana’s first offshore oil well was drilled in 1970 in the Offshore Saltpond Basin that led to the first discovery of oil, but production was considered negligible. This find generated hope which led to the establishment of Ghana National Petroleum Corporation (GNPC) in 1983 to promote exploration and production (Nyemah, 2011, p. 50). The discovery of oil and gas in Ghana is shown in table 1.

### Table 1: Current state of Oil and Gas Discovery in the Sector

<table>
<thead>
<tr>
<th>COMPANY</th>
<th>FIELD</th>
<th>BLOCK (BASIN)</th>
<th>YEAR</th>
<th>FLUID TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tullow/Kosmos</td>
<td>Jubilee</td>
<td>Deep Water Tano/West Cape Three Points</td>
<td>2007</td>
<td>Oil and Gas</td>
</tr>
<tr>
<td>Tullow/Interoil</td>
<td>Ebony-1</td>
<td>Shallow Water Tano</td>
<td>2008</td>
<td>Oil and gas</td>
</tr>
<tr>
<td>ENI</td>
<td>Sankofa-1</td>
<td>Offshore Cape Three Points</td>
<td>2009/2011</td>
<td>Oil</td>
</tr>
<tr>
<td></td>
<td>Sankofa-2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>GyeNyame 1 well</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TULLOW</td>
<td>Tweneboa</td>
<td>Deep Water Tano</td>
<td>2009</td>
<td>Oil and Gas</td>
</tr>
<tr>
<td>VANCO</td>
<td>Dzata-1</td>
<td>Deep Water Cape Three Point</td>
<td>2010</td>
<td>Oil and Gas</td>
</tr>
<tr>
<td>KOSMOS</td>
<td>Teak-1</td>
<td>West Cape Three Points</td>
<td>2011</td>
<td>Light oil field</td>
</tr>
<tr>
<td></td>
<td>Teak-2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>KOSMOS</td>
<td>Banda</td>
<td>West Cape Three Points</td>
<td>2011</td>
<td>Oil</td>
</tr>
<tr>
<td>Hess</td>
<td>Paradise Prospect</td>
<td>Deep water Tano Cape Three Points Block</td>
<td>2011</td>
<td>Oil and Gas</td>
</tr>
<tr>
<td>KOSMOS</td>
<td>Akasa-1 well</td>
<td>West Cape Three Points Block</td>
<td>2011</td>
<td>Oil</td>
</tr>
<tr>
<td></td>
<td>(previously Dahoma Up-dip)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Frimpong, 2011

2. Industrial Players In The Sector
Ghana’s Oil Sector, though being the youngest sector of the Ghanaian economy, has generated a lot of interest from both local and international partners for participation and has equally created many opportunities for participation in its upstream, midstream and downstream subsectors. In light of these opportunities and interest, there are many players, including state institutions, as shown in tables 2 and 3 according to their area of operations and roles.

### Table 2: Companies (Industrial Players) and Area of Operations

<table>
<thead>
<tr>
<th>PLAYERS (COMPANIES)</th>
<th>AREA OF OPERATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kosmos Energy, Anadarko, Tullow Oil, E.O. Group &amp; Sabre Oil</td>
<td>West Cape Three Points</td>
</tr>
</tbody>
</table>
Tullow Oil, Kosmos, Energy & Anadarko
Tullow Oil, Sabre Oil & Gas, Al-Thani Oil & Inter Oil
Vanco Ghana Ltd. and Lukoil
Amerada Hess Corporation
ENI/Vitol Upstream
Gasop Oil
AKER
AFREN/Devon Energy/ENI
Saltpond Offshore Producing Company (SOPCL)
TAP OIL & Partners

Source: Frimpong, 2011

Table 3: Players of the oil sector, their roles and sub-sector of presence

<table>
<thead>
<tr>
<th>PLAYERS (STATE INSTITUTIONS /COMPANIES)</th>
<th>ROLE</th>
<th>SUB-SECTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry of Energy</td>
<td>Policy Maker</td>
<td>Main stream / Down stream</td>
</tr>
<tr>
<td>Petroleum Commission</td>
<td>Regulatory Body</td>
<td>Main stream</td>
</tr>
<tr>
<td>Baker Hughes</td>
<td>Service Provision</td>
<td>Mid-stream</td>
</tr>
<tr>
<td>Ghana National Petroleum Corporation (GNPC)</td>
<td>Promotion of Exploration, Production and development</td>
<td>Main stream /Down Stream</td>
</tr>
<tr>
<td>Weatherford</td>
<td>Service Provision</td>
<td>Main stream</td>
</tr>
<tr>
<td>Halliburton</td>
<td>Service Provision</td>
<td>Main stream</td>
</tr>
<tr>
<td>Menergy International</td>
<td>Recruitment Agency</td>
<td>Midstream</td>
</tr>
<tr>
<td>Seaweld</td>
<td>Recruitment Agency</td>
<td>Midstream</td>
</tr>
<tr>
<td>Zormelo and Associates</td>
<td>Recruitment Agency</td>
<td>Midstream</td>
</tr>
<tr>
<td>Ghana Gas Company Ltd.</td>
<td>Disposal of Gas</td>
<td>Down stream</td>
</tr>
<tr>
<td>Ministry of Finance &amp; Economic Planning</td>
<td>Management of Revenue</td>
<td>Down Stream</td>
</tr>
<tr>
<td>Bank of Ghana</td>
<td>Custodian of Revenue</td>
<td>Down stream</td>
</tr>
</tbody>
</table>

Source: Generated by authors

3. The Jubilee Field And Expected Revenue

The Jubilee Field, which was discovered in the Deep water of West Cape Three Points and the Tano Block in June and August 2007 respectively by a Consortium of Companies: Kosmos Energy Ghana, Anadarko Corporation, Tullow Oil, E.O. Group, Sabre Oil, in collaboration with Ghana National Petroleum Corporation, came on stream on December 15, 2010, producing 50,000 barrel of oil per day (bpd). This level of production was later increased to 85,000 bpd and currently stands at 120,000 bpd, as phase 1. Accordingly, phase 2 will start in 2013 with an expected production level of 240,000 bpd (Frimpong, 2011). Since the start of production in December 2010, 9.5 million barrels of oil have been produced, accumulating total revenue of USD$903 million (Daily Graphic, 2012, p. 1). According to Revenue Watch, the Jubilee Field contains total oil reserves ranging from 800 million to 1.8 billion barrels. The field is also estimated to generate, on the average, about USD$1 billion annually in export revenue over the next 20 years (Ghana oil revenue, 2012).

Assessment of the Role of GNPC in the Sector

The establishment of Ghana National Petroleum Corporation (GNPC) in 1983 was to replace the Petroleum Department which was an agency under the Ministry of Fuel and Power, now Ministry of Energy. The department was responsible for the importation of crude oil and petroleum products for the Ghanaian economy, whilst the mandate for oil exploration was held by the Technical Directorate of the Ministry of Fuel and Power and the Geological Survey Department. The rationale for the creation of GNPC is to promote the Government of Ghana’s objective of supplying reliable and adequate petroleum for the country and the discovery of crude oil in the country. GNPC was established as a State-owned entity and given legal backing by two main statutes: PNDC Laws 64 and 84. The PNDC Law 64 of 1983 mandates the GNPC "to undertake
the exploration, development, production and disposal of petroleum", while PNDC Law 84 establishes the legal framework governing the contractual relationship between the State, GNPC and the prospective investor in upstream petroleum operations. These two statutes are supplemented by the Petroleum Income Tax Law, PNDC Law 188 of 1987.

An assessment of its mandate revealed that GNPC currently undertakes exploration and production activities via Partners; undertakes the disposal of petroleum through marketing activities and sale; generates revenue through taxation, production sharing and royalties (as shown in table 4) and depositing same into the Petroleum Account at the Bank of Ghana.

<table>
<thead>
<tr>
<th>Table 4: Types of Revenue from the Jubilee Field</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>REVENUE TYPE</strong></td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td>ROYALTY</td>
</tr>
<tr>
<td>PETROLEUM INCOME TAX</td>
</tr>
<tr>
<td>CARRIED INTEREST</td>
</tr>
<tr>
<td>ADDITIONAL INTEREST</td>
</tr>
<tr>
<td>PRODUCTION SHARING</td>
</tr>
<tr>
<td>SURFACE RENT</td>
</tr>
</tbody>
</table>

*Source: Generated by authors*

The corporation also undertakes training and capacity building activities for Ghanaians (Role of GNPC in oil sector, 2012). Further, the assessment shows that the role of GNPC in the sector clearly manifest that the corporation functions to some extent, and have not matched modern international best practices for the establishment of a National Oil Company (NOC). 21st century NOC is to perform two categorical functions: Commercial and Economic Functions, where the commercial function is to effectively develop the petroleum sector. This includes finding and developing, producing and marketing petroleum, as well as, setting and meeting targeted profitability measures. GNPC to a greater extent perform this function but does not set targeted profitability measures. The economic function, on the other hand, is to contribute to overall social and economic development of the country. This function includes capital formation by generating profit and foreign exchange earnings from operations and making capital available to national government for the development of non-oil sectors, as well as, to constantly provide affordable energy to the citizenry. GNPC in this respect generates revenue as shown in table 4 above and brings foreign earnings from the export of petroleum, but GNPC is yet to add value to petroleum for affordable local consumption and turn petroleum into a commercial asset for rapid capital formation to support accelerated social and economic development of Ghana.

In order for GNPC, as the single largest local enterprise in the sector, to meet best practices standard and becomes a viable commercial entity and an economic player in the development of Ghana, its mandate needs to be reviewed to include some, if not all, of the following functions as shown in table 5:
Table 5: Selected Best Practices of NOCs functions

<table>
<thead>
<tr>
<th>COMMERCIAL FUNCTION</th>
<th>COUNTRY OF PRACTICE</th>
<th>ECONOMIC FUNCTION</th>
<th>COUNTRY OF PRACTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase production and create reserves</td>
<td>Brazil, Colombia, Mexico, Saudi Arabia</td>
<td>Maximize benefits from operations and place benefits to state disposal</td>
<td>Saudi Arabia</td>
</tr>
<tr>
<td>Increase investment in sector</td>
<td>Mexico</td>
<td>Make significant fiscal contribution to the state</td>
<td>Colombia</td>
</tr>
<tr>
<td>Improve operating efficiency using advanced business practices</td>
<td>Saudi Arabia</td>
<td>Maximize the creation of economic value</td>
<td>Mexico</td>
</tr>
<tr>
<td>Carry out transparent and successful operations in a deregulated market</td>
<td>Brazil</td>
<td>Maximize employment in the sector</td>
<td>Saudi Arabia, Qatar</td>
</tr>
<tr>
<td>Achieve internationally competitive business and technical expertise</td>
<td>Qatar, Saudi Arabia, Colombia,</td>
<td>Contribute to social, culture and economic programs</td>
<td>Colombia</td>
</tr>
<tr>
<td>Achieve and maintain oil and gas self-sufficiency</td>
<td>Brazil, Colombia, Mexico</td>
<td>Provide the state with reliable cash flow of maximum value from diversified business interest</td>
<td>Qatar</td>
</tr>
<tr>
<td>Improve and modernize productive infrastructure and operations</td>
<td>Mexico</td>
<td>Contribute to overall development of the country</td>
<td>Brazil</td>
</tr>
<tr>
<td>Reduce production cost, set target and meet targeted return on investment</td>
<td>Brazil</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

Source: Generated by authors

Survey Analysis and Research Findings

A total of 195 questionnaires were processed and analyzed out of a targeted number of 200 due to difficulties and time constraint in retrieving the others from top executives of oil companies in Accra. The survey was conducted in the Western, Volta, Ashanti, Northern, Central and Greater Accra regions of Ghana (Appendix 1). Demographic analysis of respondents (Appendix 2) shows that, in term of sex, out of the total of 195 respondents, 139 males and 56 females were surveyed, representing 71.2% and 28.7% respectively. Regarding age group, from the 195 respondents, 67 or 34.5% are between the ages of 18-35 years; while 108 or 55.3% are between the ages of 36-60 years, and 20 or 10.2% are between the ages of 60 and above. Relative to educational background, out of the 195 respondents 125 or 64.2% obtained Tertiary Education; 43 or 22.0% obtained Secondary Education, while 17 or 8.7% and 10 or 5.1% obtained Junior Secondary Education or its equivalence and Basic Primary Education respectively. Finally, in term of social status, out of the 195 respondents 152 or 77.9% and 123 or 63.0% are employed and married respectively; 32 or 16.4% and 65 or 33.3% are unemployed and not married respectively, while 11 or 5.6% are students; 5 or 2.5% are widowed and 2 or 1.0% are divorced.

Regarding saving and spending (Appendix 3), out of the 195 respondents, 106 or 54.3% suggested maximizing public spending and minimizing inter-generational equity as oppose to 89 or 45.6% who agreed to minimize public spending and maximize inter-generational equity. This analysis conforms to current practice where 70% of Ghana’s oil revenue is integrated into the National Budget, while only 30% is saved.

On the other hand, analysis of core survey questions (Appendix 4) shows that out of the 195 respondents 12 or 6.1% disagreed to have any framework of oil revenue management to avoid the oil curse; 177 or 90.7% agreed for an oil revenue management law to avoid the oil curse, while 6 or 3.0% are indifferent. Concerning the establishment of a separate (independent) body to manage oil revenue, analysis shows that out of the 195
respondents 165 or 84.5% agreed for the establishment of a separate body to manage oil revenue, while 23 or 11.7% disagreed and 7 or 3.5% are indifferent. On the issue of a special account to support regional development, analysis shows that out of 195 respondents 182 or 93.2% support the creation of a Regional Development Account, while 7 or 3.5% are not in support of creating a Regional Development Account and 6 or 3.0 are indifferent. Regarding using the assets of the Petroleum Accounts to provide credit to government, public institutions, etc., and as collateral, out of the 195 respondents 107 or 54.8% disagreed for the Petroleum Accounts assets to be used as guarantee or collateral to provide credit to government, public institutions or the like; 10 or 5.1% are indifferent, while 78 or 39.9% are in support. Similarly, out of the 195 respondents 131 or 67.1% are against borrowing against oil reserves; 51 or 26.1% support borrowing against oil reserves, while 13 or 6.6% are indifferent. Further, 84.0% of total respondents support the establishment of a Petroleum Fund as oppose to 6.5% and 9.2% who are indifferent. Another 74.8% of respondents support the establishment of a Stabilization Fund as oppose to 9.6% and 15.3% who are indifferent.

Propose Oil Revenue Management Model

Based on our findings, analysis of Ghana Petroleum Revenue Management Act, 2010 (now Act No.815) and the oil revenue management models of other oil producing countries, it is proposed that an appropriate oil revenue management model for Ghana, as a model for other emerging oil producing countries of West Africa for sustainable socio-economic development, is one that, amongst other provisions, should include the following:

1. **Establish an independent Petroleum Commission for the management of oil revenue**

   So far the management of oil revenue, according to Act No. 815, lies in the hand of the Minister of Finance and Economic Planning (see section 25, Obligation of the Minister, of Act No. 815). On the other hand, the Ghana Public Interest and Accountability Committee (see section 51 of Act No. 815) which could had serve as an independent oil revenue management body, functions only as oil revenue management advisory body to Parliament, monitors compliance with Act No. 815 and organizes public debates on whether or not spending and management of oil revenue addresses development needs.

   In line with our findings for the establishment of a separate independent body for oil revenue management and the limitation of the Accountability Committee, couple with the vast power given the Minister of Finance and Economic Planning, Ghana should establish an independent Petroleum Commission like the Chadian College de Controle; the Timor- Leste Petroleum Fund Consultative Council; the Saotomean Petroleum Oversight Commission, and the recently established Nigerian Petroleum Directorate, amongst others. When establish, the commission should be charged with verifying that oil revenue management complied with applicable laws, and with authorizing and controlling the disbursement of funds held in the Ghana Petroleum Funds. The commission should have broad responsibilities including an independent administrative power to investigate, require, and compel the production of documents and information, and to initiate and conduct investigations on its own motion or on complaints and ensure compliance by the government with the oil revenue management laws of Ghana. The commission should also be empowered to ensure that the use of oil revenue addresses socio-economic development needs. Membership of such commission should be drawn from the general civil society with representatives of all stakeholders.

   In a more rational way, the Ghana Public Interest and Accountability Committee could be upgraded to a Petroleum Commission or remains a Public Interest Committee but with inclusion of the above mentioned administrative powers.

2. **Establish a Regional Development Account**

   Petroleum revenue management laws, in some instances, are restricted to the receipt, management, and control of oil revenues without addressing expenditures. On the other hand, many laws establishing Petroleum Funds have specified areas for the use of oil revenue (see for example section 21 (3) of Act No. 815). However, in line with our findings that a Regional Development Account be established and practices
in other oil producing countries such as Sao Tome and Principe, Azerbaijan and Qatar, the need to establish a Regional Development Account for rapid and balanced national development as part of Ghana’s petroleum law cannot be overemphasized. The establishment of such account, when supported by long-term national development plan as in the case, for example of Sao Tome and Principe, will direct focus to the overall socio-economic development of the country’s regions, provide funding resources to regional leaders and serve as a necessary impute to promote even regional development, thereby making every region of Ghana to directly benefit from the nation’s oil wealth.

3. Use of oil revenue to be linked to long-term socio-economic development plan

Act No. 815 does not, as a law, link the use of oil revenue to long-term socio-economic development plan. The act, in the absence of such plan, gives priority areas for budgetary expenditure (see section 21 (3) of Act No. 815).

As a matter of practice in other oil producing countries, for example Sao Tome and Principe, Qatar, Botswana, Alberta, UAE, Azerbaijan, etc., oil revenue have been used in connection with long-term (10-15 or 10-20 years) national development plans, it is well incorporated in their oil revenue management laws. Long-term socio-economic development plan serves as a recipe to ensure sustainable development and directs public spending to planned targets.

To achieve rapid and sustainable socio-economic development using oil revenue, it is important for Ghana to incorporate the use of oil revenue being connected and well linked to long-term national development plan into her oil revenue management law and avoid prioritizing areas of oil revenue spending that are not aligned to any development plan. By doing so Ghana Annual Budget will be aligned with development planning and breathe new life into the existing but non-functional National Planning Commission of Ghana.

4. Establish mechanisms of good governance, accountability and transparency

The need for transparency and the establishment of mechanisms to ensure transparency are critical to oil revenue management laws. As a general rule, all oil revenue related information should be made public in line with Publish What You Pay, IMF 2005 Guide on Resource Revenue Transparency and the Extractive Industries Transparency Initiative campaigns. As a matter of rule, oil revenue management laws should provide a comprehensive list of items subject to transparency, and the name(s) of agency, unit or department responsible for making each piece of information public as a means of good governance and accountability. Regrettably, Act. No. 815 has no comprehensive list and the name(s) of agency, unit or department responsible for making each piece of information public, but says in section 8 that the Minister of Finance and Economic Planning shall publish, for the purpose of transparency and accountability, the records of petroleum receipts and total petroleum output lifted and the reference price. Further, section 49 ambiguously says that oil revenue management will be carried out with transparency, and where information is consider confidential, such declaration, with the approval of Parliament, will be made by the Minister of Finance and Economic Planning. Section 49 also ambiguously empowered the Minister of Finance and Economic Planning, Bank of Ghana, Investment Advisory Committee and Parliament to discharge their duties under the Act with transparency and free access to the public.

In light of our study, as a matter of practice in other oil producing countries, for example Sao Tome and Principe, Kuwait and Timor-Leste, Act No. 815 need to contain clear provision on transparency regarding oil revenue management as a factor of good governance and accountability. Such provision must specify who does what. Using the practice of the countries mentioned, Act No. 815 needs to stipulate the creation of an infrastructure that will serve as a central depository, as well as a public information office where all oil related information (contracts, payments, receipts, output lifted, reference price, etc.) is readily available for public consumption. In Sao Tome and Principe, for example, an office of such was created under the auspices of the National Assembly to serve as depository for oil-related information. For the same reason, Act No. 815, sections 8 and 49 needs to be reviewed and combined as one section since they are about transparency and
accountability in order to reflect the aforementioned without jeopardizing and undermining government’s confidentiality.

5. Avoid collateralization of petroleum reserves
A critical issue in any oil revenue management law is whether or not borrowing against oil reserves or the assets held in oil funds should be permitted. In the case of Ghana, Act No. 815 section 18 (7) stipulates that the Annual Budget Funding Amount (ABFA) may be used as collateral for debts and other liabilities of Government for a period of not more than ten years after the commencement of this Act. However, in line with our findings and an analysis of the Saotomean, Norwegian, Alaskan, and Timorese oil revenue management laws, borrowing against oil reserves and oil funds is non-acceptable. Consequently, while Act No. 815 provides for the collateralization of the ABFA for an exit period of 10 years from the commencement of the act, it does not provide restrictions on the total amount of debts that can be collateralized. On the other hand, loans to be contracted using oil reserves as collateral are not in any way recognized by Act No. 815 as petroleum revenues, and therefore the act cannot determine their management. Section 18 (7) of Act No. 815, as mentioned above, needs to be reviewed in order to reflect non-collateralization of Ghana’s ABFA. Such amendment will be necessary to avoid the accumulation of huge debts whose servicing could exceed Ghana’s petroleum revenue cycle. This will also prevent economic bankruptcy and stagnation of Ghana’s national economy, as was in the case of Nigerian 50 years on and reduce the risk of the “paradox of plenty”.

Conclusion
Ghana, West Africa’s newly emerged oil production country, is face with the challenge of avoiding succumbing to the “oil curse” and the failed experience of other African oil producing countries. In that regard, the Ghanaian Government, after the discovery of the Jubilee Oil Field in 2007, passed into law in July 2010 its oil revenue management law (model). In April 2011 the oil revenue management law was reviewed and modified. The revised version of the law in particular, amongst other stipulations, provides for the collateralization of the nation’s petroleum reserves with a statutory limit of no more than the first ten years of petroleum revenues allocated to annual spending. In spite of this statutory limit, the Ghanaian Government has received a US$3 billion unconditional loan from the China Development Bank secured by a full 15 years’ worth of oil revenues. According to our survey, out of the 195 respondents 107 or 54.8% disagreed with Petroleum Account assets been used as guarantee or collateral to provide credit to government. Similarly, another 131 or 67.1% of respondents out of the 195 are opposed to any form of borrowing against the nation’s petroleum reserves. The Ghanaian Government has further violated the revised law by not depositing excess petroleum revenue in the amount of GHC375.24 million according to the provisions of the law as evident by the government’s 2012 supplementary budget.

The aforementioned has raised eyebrows concerning the nation’s oil revenue management and the sincerity of the government that Cape Three Point will not be another Niger Delta. On this note, it will be a welcome idea if the Ghanaian Government can muster the courage and create the political will to re-review its petroleum revenue management law and the statutory mandate of GNPC in consideration of what has been proposed, as a way of listening to voice of reasoning.
References


## APPENDICES

### Appendix 1: Tabular Description of Data Collected

<table>
<thead>
<tr>
<th>Region</th>
<th>No. of Data Collected</th>
<th>People Interviewed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western</td>
<td>30 responses</td>
<td>Chiefs, Assembly members, Service partners, Industrial Players, Civil society.</td>
</tr>
<tr>
<td>Volta</td>
<td>30 responses</td>
<td>Chiefs, Assembly members, Civil society.</td>
</tr>
<tr>
<td>Ashanti</td>
<td>30 responses</td>
<td>Chiefs, Assembly members, Civil society</td>
</tr>
<tr>
<td>Northern</td>
<td>30 responses</td>
<td>Chiefs, Assembly members, Civil society</td>
</tr>
<tr>
<td>Central</td>
<td>30 responses</td>
<td>Chiefs, Assembly members, FOs, Budget Analysts, Civil society</td>
</tr>
<tr>
<td>Greater Accra</td>
<td>45/50 responses</td>
<td>Industrial Players, GNPC, FOs, Budget Analysts, Opinion Leaders, civil society.</td>
</tr>
</tbody>
</table>

### Appendix 2: Respondents’ Demographic Analysis

| Sex      | Male | Female | 18-35 | 36-60 | 60 & Above | Basic Education | JSS / MSLC | Sec. Sch. | Tertiary | Employed | Unempl. | Student | Married | Not Married | Widowed | Divorced |
|----------|------|--------|-------|-------|------------|----------------|------------|-----------|----------|----------|---------|---------|---------|----------|-----------|---------|----------|
| N        | 139  | 56     | 67    | 108   | 20         | 10             | 17         | 43        | 125      | 152      | 32      | 11      | 123     | 65       | 5         | 2       |
| %        | 71.2 | 28.7   | 34.5  | 55.3  | 10.2       | 5.1            | 8.7        | 22.0      | 64.1     | 77.9     | 16.4    | 5.6     | 63.0    | 33.3     | 2.5      | 1.0      |

### Appendix 3: Analysis of Spending and Saving Method Regarding Ghana Oil Revenue

<table>
<thead>
<tr>
<th>METHODS</th>
<th>NUMBER OF RESPONDENTS</th>
<th>PERCENTAGE SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimize(X) Public Spending &amp; Maximize(Y) Inter-generational equity</td>
<td>89</td>
<td>45.6</td>
</tr>
<tr>
<td>Maximize(Y) Public Spending &amp; Minimize(X) Inter-generational equity</td>
<td>106</td>
<td>54.3</td>
</tr>
<tr>
<td>Total</td>
<td>195</td>
<td>99.9</td>
</tr>
</tbody>
</table>
### Some framework of petroleum revenue management is necessary to avoid group capture and the resource curse.

- **A separate individual body should be established to manage the revenue from the oil.**
- **There should be a special account to support regional development.**
- **Stabilization Funds accommodate the effects of oil price volatility, as well as avoid procyclical spending, usually associated with macroeconomic instability.**
- **Establishment of the Petroleum Fund to cushion the impact on or sustain public expenditure capacity during periods of unanticipated revenue shortfalls whether caused by fall in the price or through adverse production is necessary.**
- **Direct distribution of oil revenue to the citizens is the most transparent model of revenue management.**
- **In order to preserve revenue streams from petroleum and ensure the object of this Act, there should not be any borrowing against the petroleum reserves.**
- **The assets of the petroleum account should be used to provide credit to the government, public enterprises, private sector entities or any other person or entity, and as collateral for debts, guarantees, commitments or other liabilities of any other entity.**

<table>
<thead>
<tr>
<th>Response Rate</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td>4</td>
<td>2.0</td>
</tr>
<tr>
<td>Disagree</td>
<td>8</td>
<td>4.1</td>
</tr>
<tr>
<td>Neutral</td>
<td>6</td>
<td>3.0</td>
</tr>
<tr>
<td>Agree</td>
<td>72</td>
<td>36.9</td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>105</td>
<td>53.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Appendix 4: Analysis of Core Survey Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
</tr>
<tr>
<td>Disagree</td>
</tr>
<tr>
<td>Neutral</td>
</tr>
<tr>
<td>Agree</td>
</tr>
<tr>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>
Using Cold Battery with Icy Water as an Alternative Method of Air-Conditioning in a Ship

Gibril Jaw\(^1\) and Biram Dieng\(^2\)

Abstract
The aim of this work is to reduce the energy consumption of a passenger ship by using an air conditioning system with a solar energy source. This technique is applied on ships with a cold room with a refrigeration unit. The work consists of using a central air conditioning system for which a heat exchanger is placed in the cold room for the production of icy water. The icy water is pumped in an air treatment chamber via copper wires for the cooling of the air that is supposed to be blown in the different rooms. The circulation pump and the fan of the air treatment chamber will be operated by a solar energy system.

Key words: Energy, Central air conditioning, heat exchanger, pump, fan, refrigeration, air treatment chamber, copper pipe, solar energy.

NOMENCLATURE

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Surface</td>
<td>m(^2)</td>
</tr>
<tr>
<td>(c_w)</td>
<td>Specific heat of water at constant pressure</td>
<td>J.kg(^{-1}).K(^{-1})</td>
</tr>
<tr>
<td>(c_a)</td>
<td>Specific heat of air at constant pressure</td>
<td>J.kg(^{-1}).K(^{-1})</td>
</tr>
<tr>
<td>C</td>
<td>Heat Capacity</td>
<td>J/kg(^\circ)C</td>
</tr>
<tr>
<td>h</td>
<td>Specific Enthalpy</td>
<td>J/kg</td>
</tr>
<tr>
<td>(\dot{m}_w)</td>
<td>Flow rate of water</td>
<td>kg/s</td>
</tr>
<tr>
<td>(\dot{m}_a)</td>
<td>Flow rate of air</td>
<td>kg/s</td>
</tr>
<tr>
<td>U</td>
<td>Convective heat transfer coefficient</td>
<td>W.m(^{-2}).K(^{-1})</td>
</tr>
<tr>
<td>(\theta)</td>
<td>Temperature</td>
<td>(^\circ)C</td>
</tr>
<tr>
<td>(\Phi)</td>
<td>Heat flux</td>
<td>W</td>
</tr>
</tbody>
</table>

1. Gibril Jaw (PhD) is Deputy Rector of RMU and a Lecturer at the Marine Electrical/Electronics Department
2. Biram Dieng (PhD) is a Lecturer at the Department of Physics, University of Bambey, Senegal
Indices:

A: air

ai : relative to the air flowing into the cold battery
ao : relative to the air flowing out of the cold battery
wi : relative to the water flowing into the cold battery
wo : relative to the water flowing out of the cold battery
ext or e : relative to the air side of the heat exchanger
int or i : relative to the water side of the heat exchanger

I. Introduction

The cold battery with icy water is the main component of the central type air-conditioning systems with or without air treatment chamber or with fan coils. It will be constituted of a heat exchanger installed on the walls of a cold room and fan coils in cabins or an air treatment chamber.

The battery is conceived in such a way that the heat exchanger operates in the shell and tube. Heat exchanger in cross flow, these characteristics will be determined by the $h_{lm}$ and NTU-ε techniques [3;4] and for a given operating point.

I. Modeling of the Cold Battery

The cold battery is composed of several copper tubes connected to each other by elbow joints in order to create different flow paths. In this particular case the fluid flowing inside the tubes is water while air flows on the external surface of the tubes.

The air flux that flows across a section of the battery perpendicularly to the direction of water flow, is considered uniform in speed, temperature and relative humidity. The temperature inside the refrigeration chamber is also constant. In central air conditioning with icy water, the input and exit temperatures of water are usually known in advance and in most cases the input temperature is 7°C while that of the exit temperature is 12°C.


The $h_{lm}$ method is directly based on the temperature difference [SACADURA, 1993].

For a counter flow heat exchanger the logarithmic mean temperature difference is given by:
\[
\Delta h_{lm} = \frac{(h_{wi} - h_{wo})}{\ln\left(\frac{h_a - h_{wi}}{h_a - h_{wo}}\right)}
\]

And the power transferred for a cross flow where the fluids flow perpendicularly to each other is therefore given by:

\[
\phi = U.A.F.\Delta h_{lm}
\]

The determination of the correction factor F is done by using SMITH [BOWMAN, 1940] formulae for the tube heat exchangers. The expressions are derived from analytical calculations and the formulae of the NTU give the correction factor F.

That power could also be calculated by using the fluid w (water):

\[
\phi = C_W(h_{wo} - h_{wi})
\]

Where the heat capacity \(C_W = m_W C_{pw}\)

Combining equations 2 and 3 we can find the product \(U.A\) and knowing the characteristics of the materials used to build the battery we can easily determine the heat exchange surface to be installed.

The other method is based on the graphs of the efficiency coefficients which consists of determining the heat exchange surface after calculating the efficiency and the ratio of the thermal flow rates.

Therefore for the heat exchanger we are considering, which is a cross flow type the efficiency is given by:

\[
\varepsilon = 1 - \exp\left(NTU^{0.22}\right)X
\]

where:

\[
X = \frac{\exp(-R.NTU^{0.78}) - 1}{C}
\]
\[ NTU = \frac{U.A}{C_{\text{min}}} \]

\[ C = \frac{C_{\text{min}}}{C_{\text{max}}} \]

In this case \( C_{\text{min}} = C_a \) and \( C_{\text{max}} = C_w \)

The figure 1 shows the variation of the efficiency in terms of the global heat transfer coefficient and for several values of \( C \)

In figure 2 we have the variation of the power in terms of the length of copper tubes for a diameter of 5/8 inch.

The graphs shown in figures 1 and 2 will enable us determine the heat exchange surfaces that will be used to build this central air conditioning system in the ship. The figure 1 gives the product \( U.A \) while the figure 2 provides the length of copper pipe to use in order to build this battery.

The figures 3 and 4 give respectively the variations of water and air temperatures for the cold battery and for the fan coil or the air treatment chamber.
Figure 3: Temperature in terms of the length of copper wire for the battery.

Figure 4: Temperature in terms of the length of copper wire for the fan-coil and the air treatment chamber.
I.2. Determination of the Exit Conditions of the Two Fluids

The enthalpies of the two fluids (air and water) at the exit of the fan-coil and the air treatment chamber are given by the equations below (equations 8 and 9). The knowledge of these enthalpies gives automatically the temperatures of the fluids.

\[ h_{ao} = h_{ai} - \frac{h_{ai} - h_{wi}}{m_c} \left( -UF \left( \frac{1}{m_a} - \frac{1}{m_w} \right) A \right) \]

\[ h_{wo} = h_{wi} - \frac{h_{ai} - h_{wi}}{m_w} \left( -UF \left( \frac{1}{m_a} - \frac{1}{m_w} \right) A \right) \]

The input and output temperatures of the heat exchanger are the same but for the water its temperature is calculated using equation 9.

II. Application in a Ship

The main objective is to determine the power of the heat exchanger that we are supposed to install in the cold room and the fan coils to install in the rooms or in the air treatment chamber for the mixed system air/water. The electrical appliances: water pump, the fan coils or fans of the air treatment chamber will be powered by a photovoltaic system. A cost benefit analysis for this system is to be done in comparison with
the classical system. The ship considered is a passenger ship with an 18 kW air-conditioning system and a 6 kW refrigeration unit.

II.1. Main Task

We will apply this technique of air conditioning with fan coil or air treatment chamber to a ship with ten identical rooms with an average volume of 27 m³ each.

Assumption: there exists a cold room with temperature 0°C and relative humidity of 90% in the ship.

External conditions: Temperature 35°C and relative humidity 75%

Internal conditions: Temperature 22°C and relative humidity 50%

Table 1: Room Characteristics

<table>
<thead>
<tr>
<th>Quantities</th>
<th>Volume (m³)</th>
<th>Number</th>
<th>Heat to be extracted Q (KW)</th>
<th>Total heat to be extracted Q_{total}(KW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Room</td>
<td>27</td>
<td>10</td>
<td>1.8</td>
<td>18</td>
</tr>
</tbody>
</table>

- Water temperature at the entrance of the heat transfer battery: +7 °C;
- Water temperature at the exit of the heat transfer battery: +12 °C;
- Dry bulb air temperature: 25°C
- Humid bulb air temperature: 18 °C

II.2. Methodology

The method used to determine the power of the circulation pump and the fan of the air treatment chamber are the fluid mechanics and aerodynamics methods.

II.2.1. Characteristics of the Heat Exchanger

The table 2 gives the specific heat capacities for which the calculations are based on the choice of the diameters of the copper pipes (20mm) and the principal circular air duct (80mm) and the acceptable flow rate for water (0.69l/s) and air (Va=5m/s). The heat transfer coefficient and the calculation of the exit parameters are based on expressions 8 and 9.
Table 2: Thermo Physical Characteristics of the Fluids and the Heat Exchanger

<table>
<thead>
<tr>
<th>$\dot{m}_a$</th>
<th>$\dot{m}_w$</th>
<th>Ca</th>
<th>Cw</th>
<th>C</th>
<th>F</th>
<th>$\Delta h_{lm}$</th>
<th>E</th>
<th>$\frac{U.A}{C_w}$</th>
<th>$\theta_{a0}$</th>
<th>$\theta_{w0}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0,69</td>
<td>0,033</td>
<td>25,3</td>
<td>2884,2</td>
<td>0,1</td>
<td>0,95</td>
<td>9,3</td>
<td>0,82</td>
<td>0,032</td>
<td>18,43</td>
<td>6,94</td>
</tr>
</tbody>
</table>

Using the graph in figure 2 and this efficiency we find length of the 5/8 inch diameter copper pipe : 18.5m.

II.2.2. Determination of the Powers of the Pump and the Fan.

The choice of the fan for the air treatment chamber or a pump for the circulation of fluid depends on the following parameters:

- For the fan: the rate at which air should be blown out and the frictional losses.
- For the pump: the flow rate and the frictional losses

Obtaining these parameters we can calculate the powers of these equipment.

For the fan:

$$P_T = \frac{\dot{m}_a g \Delta h}{\eta}$$

$\eta$ being the efficiency of the fan and $\Delta h$ represents the frictional losses

For the water pump:

$$P_P = \frac{\dot{m}_w g \Delta H}{\eta'}$$

$\Delta H$ et $\eta'$ represent respectively the frictional losses and $\eta'$ (60 to 85%) the efficiency of the water pump.

Results

For our ship the length of the pipes for the circulation of water is estimated to be 100m and then the length of the air duct is 80m. The efficiency of the two machines is estimated at 80%.

These applications give us the following powers:
• For the fan of the air treatment chamber we have calculated a power of 750 Watt or alternatively ten fan coils of a power of 75 Watt each.
• For the water pump we have calculated a power of 400 Watt.
This corresponds to the total power of 1150 Watt.

II.3. Photovoltaic Solar Generator

A simulation done with the software PVsyst V5.59 shows that the circulation pump and the fan of the air treatment chamber could be operated continuously for a period of 48 hours with a solar system of 24 solar cells of 300Wp – 30V Si-mono and 32 batteries of 12V 296 Ah. The autonomy of the battery system is 4 days. The simulation was done using the latitude, longitude and solar radiation in Accra.

II.4. Benefits

With this solar system the total power of 24kW (18kW+6kW) is provided by the solar system. The total corresponding energy is: 576kWh which corresponds to 1440 kg of fuel daily. The annual savings on that is USD 759,200 on the operational cost and the amount of carbon dioxide that could have been sent to the atmosphere by the fuel is 2.7 tons.

III. Conclusion

The issues surrounding the maritime trade and transport could be improved by considering ships operated with alternative sources of energy. This will go a long way in reducing the cost of fuel and the amount of CO2 sent in the atmosphere. This alternative method of air conditioning will enable ship operators to make significant savings and promote maritime trade in the West African sub region.
Reference

B. Dieng: Thèse d'Etat Mai 2008 UCAD, Etude et réalisation d'une batterie froide à double échange pour l'amélioration du confort thermique dans l'habitat.


Risk Assessment and Safety Regulations in Offshore Oil and Gas Industry

Isaac Animah

Abstract
Risk management of which risk assessment is part, and safety regulations are common in the offshore oil and gas industry management system. The process of conducting risk assessment is mostly a challenge for operational personnel assigned to perform this function. The most significant problem is the decision to use the appropriate tool or technique in conducting risk assessment and evaluation. The safety regulatory authorities and standards agencies in various countries are making frantic effort to incorporate risk assessment into their laws to mainly help governments protect their environments as well as personnel’s life. This paper present a tool or technique used for effective risk assessment, the UK safety regulation perspective which was at the back of the Lord Cullen recommendation after Piper Alpha incident and practical approach for risk assessment. The methodology used was the review of the risk assessment conducted on the Escravo gas facility. The process included the use quantitative risk assessment technique which involved the use of checklist for risk identification and risk matrix for ranking of risk, based on probabilistic approach.

1.0 Introduction
The offshore oil and gas industry over the past decades has seen the utilisation of risk assessment to help improve safety of offshore facilities both on topside and subsea.

The concept of risk assessment became more prominent in the offshore oil and gas industry after the Piper Alpha accident in 1988 with subsequent publication of the Lord Cullen report in November 1990 after it inquiry into the accident(Cormer&Eades, 1991; HSE, 2008)

The lord Cullen report recommended that the principal regulation for safety should be in a form of goal setting based on the safety case regime rather than been prescriptive. The Cullen recommendations have changed the safety regulatory regime in the UK sector of the North Sea since it came into force in 1992(Olstad, 1992).

The Norwegian approach is largely similar to that of the UK sector of the North Sea. The Norwegian safety regulation came into force in January 1991. The most important point which is common to the two safety regulations is the use of risk assessment methods to demonstrate the levels of safety that can be achieved by offshore installations and its workforce during operations(Ciaraldi, 1992).

1. Isaac Animah (MSc.) is a Lecturer at the Marine Engineering Department, RMU
Risk assessment over the years has become a strong foundation for key safety decisions in the offshore oil and gas industry by both regulatory authorities and operators (McCulloch, 2002).

Some operating offshore oil and gas installations have demonstrated the use of risk assessment at all levels of their operations by understanding the principles, the challenges and the ways in which risk assessment should and should not be applied (HSE, 2008).

2.0 What is Risk Assessment?

Risk is a product of the likelihood and consequences of hazard (Aven et al., 2007; Flin et al., 1996). The means or techniques used in estimating likelihood and consequences of a risk are referred to as risk assessment. The assessments can be grouped into qualitative or quantitative or a combination of both.

According to Main (2002), risk assessment has become the fundamental tool in the safety community and has the benefit of implementing decisions regarding safety; accident prevention, performance improvement and identification & evaluation of hazards. For the purpose of this paper a quantitative risk assessment will be considered.

2.1 Quantitative Risk Assessment (QRA)

This is also known as probabilistic risk assessment and include a variety of different techniques such as HAZID, HAZOP, Event Tree analysis and Fault Tree analysis. The concepts of QRA has been utilised in the nuclear and aerospace industries to conduct safety and reliability assessment (Torabi et al., 2006). As indicated by ASME (2002) QRA has justified the continuous safe operation of nuclear power plants, space shuttles and other large transporters. Flin et al. (1996) also opined that QRA is very useful tool in safety management and the only tool capable of obtaining a numerical quantification of risk posed by a hazard.

QRA techniques are used to assess risk and establish priority areas for risk management actions. QRA may require the use of probabilistic risk assessment techniques such as Monte Carlo Simulation, human reliability analysis, reliability block diagram and distribution. QRA could answer questions such as (Arunraj et al., 2006):

- What can go wrong?
- How can it go wrong?
- How likely is its occurrence?
- What would be the consequence?

The technique is further useful for assessing risk of complex system such as offshore oil and gas platforms or FPSOs to ascertain the level of risk to safety systems, workers and the entire facility. It has also proven to be an effective tool in optimising maintenance and prioritising design modification in the offshore oil and gas industry and other industries such as nuclear, aerospace and shipping (Arunraj et al., 2007; Torabi et al., 2006; Wang, 2002).
After the Piper Alpha accident in the UK sector of the North Sea, QRA have gained more prominence in the offshore oil and gas industry. Cormer et al. (1991) suggested that QRA are meant to answer the following questions in the offshore oil and gas industry. These questions are:

- What accident can occur? – This depends on the scope of study and can be generated using checklists, HAZOP or previous study experience.
- How frequently does each accident occur? – A combination of failure rate and conditional probabilities.
- What are the consequences of each accident? – For example in terms of fire and explosion effects.
- What is the impact of these consequences on the platform or FPSO personnel and equipments?
- What is the efficiency of the safety critical component on the platform or FPSO?

The offshore oil and gas industry have benefited immensely from the use of QRA after the piper alpha accident. It has helped the industry to optimise preventive maintenance frequencies, prioritise process design modification, achieve higher safety levels and comply with safety regulations (Torabi et al 2006; Botto et al, 2011).

2.2 Safety Regulation: The United Kingdom’s Perspective

During the 1980’s the use of QRA was becoming popular with operators in the North Sea and other parts of the world (Barrel, 1993), however there was no law or obligation to compel companies to formalise safety assessment by the use of QRA in the UK sector of the North Sea. Companies and operators were addressing safety cases by the use of HAZOP, human factor reliability and other forms of assessment which involved consequences and frequency analyses, but all these were done in house by the companies with their own standards (Sefton, 1994).

These measures used by the companies gained weight and was formalised after the Pipe Alpha accident in 1988. The Lord Cullen commission of inquiry recommended strongly the use of QRA for safety case regime in the UK sector of the North Sea after the Piper Alpha accident. This recommendation has changed the phase of safety regulation and practice in the UK sector of the North Sea and most places in the world.

2.2.1 Safety Case Regime

Based on the Lord Cullen recommendations, the safety regulations in the UK sector of the North Sea was anchored on the safety case regime. The safety case regime has since been adopted by many regulators across the world to demonstrate safety and compliance with regulations. A safety case is a document, which provides evidence of duty holder or operator’s ability and means to effectively control the risk of major accident (Skogdalen et al, 2011). This regulation requires operators to submit a safety case to the regulatory agencies for approval. Lord Cullen in his accident report after the Piper alpha accident recommended the introduction of QRA in the UK legislation as part of safety case preparation for both existing and new offshore oil and gas installations (Vinnem, 2007). According to Ledsome (1994) the safety case regulation in the UK is a goal – setting approach and the key elements of the approach are;
Responsibility for health and safety rest with operators and owners of offshore installation and not the regulatory authority. The regulatory authority should set objectives to be achieved and is the duty of the operators and owners to determine the means to achieve the set objectives. The achievement of objectives should base on a process of hazard identification and risk assessment.

These key elements of the safety case regime proposed by Lord Cullen made the use of QRA’s popular in the offshore oil and gas industry.

2.3 Description of Piper Alpha Accident

The Piper Alpha disaster has been the worst offshore accident in the UK sector of the North Sea. This accident attracted a lot of attention in the offshore oil and gas industry and showed the extent of damage that could arise from fire and explosion on offshore installations. Piper Alpha platform was located 110 miles of Aberdeen and started production in late 1976 in 474 feet of water depth. It was owned by a consortium led by Occidental petroleum and provided facilities to drill wells, extract separate and process the reservoir fluids and provided accommodation for 200 personnel. Piper was linked by pipelines to 3 other platforms (HSE, 2008).

The disaster occurred on the early morning of 6th July 1988. Singh et al (2009) reckoned that a certain back up or redundant propane condensate pump in the processing area of the platform needed to have the pressure safety valve changed. The operation to change the valve could not be completed by 18:00GMT and the workers received a permission to continue the next day.

Later in the evening, the next shift took over and the primary condensate pump failed and the back up or the redundant pump was started. None of the worker in the evening shift was aware of the operations in the morning and the gas leaked out at high pressure, ignited and exploded consuming the firewalls. The fire then spread to other area of the platform destroying some oil lines and the large quantity of oil stored for export started burning out of control. The deluge system which was to be activated automatically to spray water also failed.

About twenty minutes after the first explosion, the fire had spread and become hot enough to weaken the risers and then burst the gas riser from other platforms (Offshore Installations Regulations, 2005). The condition became so bad that the generation and utilities module which included the fireproofed accommodation unit slipped into the sea. The whole disaster occurred within 22 minutes.

The cause of the accident was attributed to poor communicate among shift of the platform operator. This resulted in safety concerns with the condensate pump, from which the safety valve was removed. The escaping gas from the safety valve ignited and started a series of explosion which further resulted in an extensive damage to the platform and it workforce (Visser, 2011). This accident received worldwide attention, which prompted regulatory authorities in the UK to institute an investigation into it and possibly prevent future occurrence of this magnitude of offshore accident.
2.4 The Lord Cullen Report

The Piper Alpha platform had 226 men on board the platform, 61 men survived out of which 39 were on night duty and 165 men died with 142 off duty (Taylor, 1993; Singh et al., 2009; HSE, 2008). The interesting revelation is that none of the survivors escaped via a life boat. According to the Lord Cullen report the main issues of the Piper Alpha was that;

- There was no formal assessment of major hazards and also limited guidance on fire and explosion.
- Emergency evacuation was poor, life boat failed.
- The then safety regulations were limited and impose solution which was out of date.

The Lord Cullen commission of inquiry came up with 106 recommendations and the principal regulation among the 106 recommendations to the UK government was the safety regulation. The commission recommended that the safety regulation should in a form of goal setting based on the safety case regime as compared to the prescriptive nature of the old regulation (Ledsome, 1994; Taylor, 1993).

The Lord Cullen report has benefited the industry in that operators now demonstrates that adequate level of safety has been achieved and a safety case is submitted to the regulatory authorities as compared to old regime where the operator fit safety equipment in house by their own discretion. Taylor (1993) suggested that, the safety case regime proposed by Lord Cullen report if followed thoroughly will demonstrate that;

- The safety management system of companies is adequate.
- The potential of major hazards and risk to personnel have been identified and necessary control measures put in place.
- The temporary safe refuge is adequate.
- The escape, evacuation and rescue measures are adequate.

The implementation of the lord Cullen report’s recommendations has reduced the number of reported incident that impact on safety in the UK sector of the North Sea by 75% and this can be attributed largely to the use QRA’s as well as better safety regulation (Singh et al 2009; HSE, 2008).

3.0 Methodology

The methodology was to use risk assessment to achieve higher levels of safety and also ensure that the regulations are complied with. The methodology seeks to demonstrate the effectiveness of QRAs and how they can be used to achieve the safety case regulation as recommended by Lord Cullen. Application of QRAs will involve the use of probabilistic approach to ensure that risk exposures to offshore oil and gas facilities are ranked in a structured and practicable manner. The use of Lord Cullen recommendations will enable operators of the facility to prioritise risk and prepare a safety case for the Nigeria authorities, since Nigeria do not have a comprehensive legislation covering risk assessment for offshore facilities. The Escravo gas plant facility was used for this purpose.
3.1 Description of Escravo Gas Facility

The risk assessment implementation was carried out by the Chevron Nigeria Limited on their Escravos gas plant facility. This was the first major project to use Nigeria’s offshore gas both for local industries and export. It was supposed to compress the gas from OKan and Mefa production field which was then piped onshore to a liquid extraction plant which removes liquefied petroleum Gas and condensate and later exported through pipelines to offshore floating storage and off-loading vessel and the remaining dry gas sold to Nigeria Gas Company (Kunu, 1998). A secondary risk assessment was conducted by this paper to demonstrate the effectiveness of QRA for risk assessment and how it could be utilised to achieve the safety case regulation.

The offshore facilities of Escravo gas plant are located 12 kilometres offshore in six (6) metres high of water depth. It has eight (8) legs with 7500 tone structure with three (3) levels and eight (8) topside modules of 66 metres high from seabed to crane top. Jacket base area of 650 square metres, three 1400 horse power gas turbine compressors, liquid separation and gas dehydration systems. It has a 20 person accommodation quarters, emergency flare tower which is 50 metres high from seabed to top.

The risk assessment was conducted on three major components of Escravos facility namely; the Offshore facilities, the onshore gas plant and the Floating storage and off-loading vessel.

Potential risk assessment was conducted for gas leakage, oil spill and fire outbreak with probabilistic risk assessment approach. The methodology involved the use of the probabilistic approach to ensure that risk exposure to the facility is ranked as low as reasonably practicable (ALARP).

The hazard identification process also involved the identification of possible hazard that could have been present and its consequences. The hazard that was considered in the review was;

Hazardous Substances
- Toxic Materials
- Flammable materials
- Sources of Ignition.

Mechanical hazards
- Impact hazards
- Cutting hazards
- Falling hazards

3.2 Assessment Procedure

The assessment was conducted by demonstrating that the following steps which are generally used in the offshore industry are followed:
Identification of the risk that could lead to significant loss to personnel, facility and the environment.

- Calculation of Risk.
- Ranking of risk.
- Initiating alternative protection and prevention strategies.
- Estimation of Variation in probability and consequences.

Identification of the risk was achieved by the use of checklist by considering process component, operating standards and environmental impact.

Exposure levels were determined by using three classes of exposure levels shown in the table 1 below.

**Table 1: Classes of risk exposure levels**

<table>
<thead>
<tr>
<th>Exposure level</th>
<th>Classes point</th>
</tr>
</thead>
<tbody>
<tr>
<td>High risk / exposure(HR)</td>
<td>10 to 14 point</td>
</tr>
<tr>
<td>Medium risk / exposure(MR)</td>
<td>5 to 9 point</td>
</tr>
<tr>
<td>Low risk / exposure(LR)</td>
<td>0 to 4 point</td>
</tr>
</tbody>
</table>

**APPLICATION OF PROBABILITY FACTOR (Pf)**

Probability factor used for the three classes of exposure were Pf (HR) = 0.57, Pf (MR) = 0.33 and Pf (LR) = 0.10

These were achieved by calculating the weighting factor of the class point, and then Pf were determined. The table below summarises the weighting factors.

**Table 2: Weighted average of risk exposure**

<table>
<thead>
<tr>
<th>Average weighting value(Wa)</th>
<th>Average weighting in figures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average weighting value of Wa(HR)</td>
<td>10 +14/2 = 12</td>
</tr>
<tr>
<td>Average weighting value of Wa(MR)</td>
<td>5 +9/2 = 7</td>
</tr>
<tr>
<td>Average weighting value Wa(LR)</td>
<td>0 + 4/2 =2</td>
</tr>
<tr>
<td>Total average weighting value(Wt)</td>
<td>12+7+2 = 21</td>
</tr>
</tbody>
</table>

Pf for HR, MR and LR were obtained by Wa/Wt

Pf (HR) = Wa(HR)/Wt = 12/21 = 0.57

Pf (MR) = Wa(MR)/Wt = 7/21 = 0.33
Pf (LR) = Wa(LR)/Wt = 2/21 = 0.10

Now summation of probabilities must be equal to 1, that is Pf (HR) + Pf (MR) + Pf (LR) = 1.

Then final ranking will be denoted by Fr (HR), Fr (MR) and Fr (LR). These are the overall checklist for highest risk, moderate risk and low risk.

Hence Fr (HR) = Wa(HR) * Pf(HR) = 12 * 0.57 = 6.84
Fr (MR) = Wa(MR)*Pf(MR) = 7*0.33 = 2.31
Fr (LR) = Wa(LR)*Pf(LR) = 2*0.10 = 0.2

These final ranking were used to prioritise the various equipment and it associated hazard as well as the consequences of the risk.

4.0 Discussion

The identification of risk was done by the use of checklist and hazard & operability (HAZOP). The checklist had a YES/NO and by filling the checklist, the equipment or process exposure level was determined and it was achieved by the use of three classes of exposure. The three classes had a certain degree of severity used in the final ranking of the facilities, which was concerned on personnel safety, safe guarding of facilities and the environmental impacts.

After completion of the checklist, HAZOP was conducted to confirm the already identified risk. The HAZOP consisted of the primary elements required for hazard management strategy. These elements considered during the HAZOP process were;

- Identification of hazardous events
- Analyses and assessment of hazardous event
- Reduction of risk from fire, explosion and mechanical handling
- Implementation of protective measures.
- Effective communication of protective measures.

The risk criticality matrix which is largely used by many companies in the offshore oil and gas industry (Tronskar, 2004) was used to rank the level of risk involved in process safety equipment and fire & gas explosion. The risk matrix can be defined as high severity risk, medium severity risk and low severity risk and these rankings were based on the final risk weighted average. The highest probability factor corresponds to colour red and signifies that, the particular equipment of the facility ranked in this section have a high risk probability, followed by the yellow colour and the green colour.
The criticality matrix has frequency against criticality/consequences. Any components that will be rank in the red colour mean such components are of high risk severity. This means that for high risk severity components the frequency of occurrences is high as well as the consequences also being high and action must be taken immediately to reduce both risk and consequences.

Components ranked in the yellow colour will implies that, the risk can be reduced and becomes cost effective than putting in place measures to deal with consequences.

The green colour is acceptable risk, which means that any component ranked there has lower risk and lower consequences which does not pose much danger to life of personnel as well as the facility. Good maintenance practices can effectively deal with the risk in this zone.

After this exercise the list of criticality components were produced to which operators used in planning the kind of maintenance strategy applicable to the facility as well as the spare parts to be present. This helps to ensure that production time is maximized by reducing downtime.

The risk assessment technique used above which involved the use of QRA helped in the decision making process to;

- Identify component that contributes to risk, such as flammable and toxic gas.
- Selection of cost effective solution.
- Setting requirement for optimum protection.
- Quantifying the effectiveness of possible solutions.
- Meeting governmental regulation.

The QRA techniques used provided the opportunity to improve the safety level of the gas facility by coming up with modifications and changes to the facility and also enabled us to evaluate the potential of accident in terms of frequency and consequences.

The use of QRA which is a systematic approach in risk analyses provided the review team a basis for safety decision. This safety decisions is an important component of the Lord Cullen recommendation on
safety management system, which goes a long way to help companies to prepare safety cases for approval by regulatory authorities. The result of the QRA and its recommendations can be reintroduced into the design process.

The risk register which comes under the communication and monitoring section of the risk management process is very important to any project because of its advantage of making management members of companies to know the progress on risk and it related consequences on a project at any point in time.

**Conclusion**

The methods of risk analyses techniques have changed over the decades but it must be emphasised that the technique has proved very effective and has become an important tool in enhancing system and structural safety in the offshore oil and gas industry.

QRA has also become an important tool for risk assessment in the offshore oil and gas industry but it is not the only tool that can use for this purpose. There are equally good tools to be used for risk assessment but QRA is widely used.

The risk present in any facility offshore can be at the lowest level when the right maintenance strategy is implemented coupled with right engineering design. The use of Lord Cullen recommendation for the Escravo gas facility demonstrated enough, how QRA could be used and its associated benefits to the facility. It also aided operators of the facility to understand the risk in offshore operation and identify and prioritised ways to improve upon the identified risk.
References


