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A Study on Health and Safety Practices at Tema Oil Refinery (TOR) in Ghana

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Abstract

This study is built on three main objectives as follows; examined a symbiotic relationship between occupational health hazards and safety culture, to demystify operational risk and improve safety culture and finally, to examine the modelling effect of health hazards on risk management and safety culture at Tema Oil Refinery (TOR) in Ghana. The study employed both descriptive and explanatory research designs. Convenient sampling technique and structured questionnaires were deployed to elicit information from the study participants. The data were analysed using Statistical Package for Social Sciences (SPSS) and Smart Partial Least Square (PLS). The study discovered that the newly proposed model accurately predicted 92% and 77% respectively for health hazards and risk management on safety culture practices in the oil and gas sector in Ghana. From the model the strongest determinant of safety culture in the oil and gas is health hazard ($\beta=0.66$), followed by risk management ($\beta=0.45$). Other significant determinants were identified as follows: biological hazards ($\beta=0.26$), chemical hazards ($\beta=0.22$), mechanical hazards, RM= Risk Management ($\beta=0.27$) and Psychological hazards ($\beta=0.27$). The study also found insignificant effects of psychological hazards on health hazards; also, health hazards had no significant impact on risk management. The study concludes that the newly integrated be adopted to effectively manage safety culture at TOR. The study recommends that integrated model is required to comprehensively explain the safety culture at TOR.

Abstrakt

Tato studie je založena na třech hlavních cílech; zkoumá symbiotický vztah mezi ohrožení zdraví při práci a kulturou bezpečnosti, demystifikuje operační riziko a navrhuje zlepšení kultury bezpečnosti a finálně zkoumá efekt modelování zdravotních rizik na řízení bezpečnosti a kulturu bezpečnosti v rafinerii (TOR) v Ghaně. Studie využívá jak deskriptivní, tak explicitní výzkum. Pro získání informací od účastníků studie byla zavedena praktická metoda odběru vzorků a strukturované dotazníky. Data byla analyzována pomocí Statistického balíčku pro společenské vědy (SPSS) a Smart Partial Least Square (PLS). Studie zjistila, že nově navržený model přesně předpovídal s přesností 92% a 77% zdravotní rizika a řízení rizik v oblasti praktikované kultury bezpečnosti v ropném a plynárenském průmyslu v Ghaně. Nejvýraznějším prvkem v modelu bezpečnostní kultury při zpracovávání ropy a plynu je zdravotní riziko ($\beta = 0,66$), po němž následuje řízení rizik ($\beta = 0,45$). Další významné determinanty byly identifikovány následovně: biologické nebezpečí ($\beta = 0,26$), chemická rizika ($\beta = 0,22$), mechanická rizika, RM = řízení rizik ($\beta = 0,27$) a psychologické nebezpečí ($\beta = 0,27$). Studie také zjistila nevýznamnou provázanost psychologického nebezpečí a zdravotních rizik; zdravotní rizika nevykázala žádný významný dopad na řízení rizik. Závěrem lze doporučit přijmout nově navržený integrovaný systém, s jehož pomocí by bylo dosaženo efektivnější správy kultury bezpečnosti na TOR. Studie doporučuje integrovaný model, aby komplexně vysvětlil kulturu bezpečnosti na TOR.

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1   INTRODUCTION

According to the World Health Organisation (WHO), a substantial part of the general morbidity of the population is related to work. This assertion, though frightening, is not surprising as workers represent half of the global population and contribute greatly to the socio -economic value of contemporary society. Indeed, people spend a significant portion of their lives at work with their jobs often bringing meaning and structure to their lives. Because work is a central part of many people's lives, it generally is recognised that individuals should have a safe and healthy working environment (WHO, 2007; Annan et al., 2015; Asumeng et al., 2015).

According to the WHO Health for all principles and ILO Conventions on Occupational Safety and Health (No. 155) and on Occupational Health Services (No. 161) every worker has the right of access to occupational health and safety services, irrespective of the sector of the economy, size of the company, or type of assignment and occupation. The Rio Declaration on environment and development (1992) also states that, human beings are the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature. Clearly, the ability to enjoy a safe and healthy working environment is an important part of a sustainable future. To date, occupational health has not attained a high profile in the sustainable development agenda particularly in developing countries where most people are engaged in primary industries such as agriculture, logging and mining.

Adei & Kunfaa (2007) assessed the perceived occupational health hazards exposure and the effectiveness of the policies put in place to ensure the health and safety of workers. It was reported that lack of commitment by management to implement OSH policy where it existed, consideration of payment of insurance premium as sufficient protection for their workers, restrictive inspections, education and enforcement by under resourced DFI and Timber and Wood Workers union inability to project OSH agenda have contributed substantially to the neglect of workers health and safety. Adei & Kunfaa (2007) further asserted that there is also need for enforcement of health and safety regulations and policies. One of the most common techniques used to reduce at-risk behaviour within the workplace is to introduce stricter rules, increase supervision of the target behaviour or increase the number of reprimands given out for failure to comply with the companies' policy and procedures.

People worldwide face Occupational Health and Safety (OSH) hazards daily. Over the years, the global occupational hygiene community has worked diligently to develop ways to protect workers in both developed and developing nations, in work places of all types and sizes. Workers face a variety of hazards owing to chemicals, biological agents, physical factors, adverse ergonomic conditions, allergens, a complex network of safety risks, and varied psychosocial factors (Meswani, 2008; Osman and Pala, 2009; Asumeng et al., 2015).

As reported by the international labour office (ILO) (2013) the oil and gas industry are no doubt dominated by hazards, accidents and causes major havoc to human life, property and activities when potential hazards are not adequately controlled. The oil and gas industry is the cash cow for every country that engages in oil exploitation, but the industry is marred with extreme danger and risk of explosions, all forms of pollutions and accidents. With no shred of arguments, the sector posses' immense, economic, environment and health and safety risks to stakeholders in the industry (the government, private investors and financiers, insurance companies, top management and technicians, employees etc.). The occurrence of fire outbreaks and other accidents leads to massive environmental problems, economic losses and subsequently affects the health of humans.

According to Shrivastava (1995) production is intricately linked with risk. However, risks are not only associated with technical issues but also societal and environmental profile. The works of Shrivastava illuminated how managements have relegated the issues of health and safety and ecological concerns to the background.

Markussen (2003) acknowledges the health and safety implications that the oil and gas industry have on employees and stated that it exposes employees to both physical and chemical risk factors through the drilling of mud, treatment of chemicals, petroleum products and radioactive sources. There is therefore the need to apply quality control systems to manage industrial resources and waste. A study conducted by Verma, Johnson and Maclean (2000) on exposure to benzene and hydrogen in the oil and gas industry and recommended that strict health and safety policies should be adopted by oil exploiting companies to minimize exposure to health and safety risks. The study took 1,547 air samples from the Canadian oil and gas industry in different departments and evaluated it. It was concluded that the limits of all required occupational exposures were exceeded.

The study unearthed certain risks that created awareness for the oil and gas to take precautions against glycol dehydrators and exposure of employees to risks. Also, monitoring should be done to maintain standards. As oil supply is finite so are other natural and environmental resources. This means that at the peak of oil production, the subsequent stages in oil production is the decline in the quantity produced. Currently, it is estimated that, there is about 1.3 trillion barrels of oil left. The problem associated with this is that, the world's oil consumption is increasing hence the 1.3 trillion remaining will fall short of the world's demand. At the global stage, the oil and gas industry have been clustered with much politics and inconsistent information coupled with economic depressions so much that valid information on peak seasons in the oil and gas industry comes with a bit of doubts (Hamid, 2008; ILO, 2013; OSHA, 2015).

The reason for these falsified information regarding oil products is the global power associated with oil. On the global markets, oil prices dictate global economic and financial paradigms. Analysts' belief that, the peak seasons as predicted is imminent although there are variations in the peak season from 2010 to 2050 and beyond. Due to emerging technologies, the demand for oil products is decreasing with analysts contemplating whether the demand for oil influences the global prices. In Ghana, Achaw and Boateng (2012) assessed safety practices in the oil and gas and its adjoining industry using both interview and questionnaires. The study found that there are regulations that are geared towards ensuring occupational health and safety. However, there are no national policy on occupational health and safety sole for the oil and gas. This means that companies that operate in this sector must develop their own safety regulations to guide their operations. Because the quest to operate in a safe is dependent on the company, flaws were found in their operations particularly, health and safety practices. In the light of the above this study was aimed to demystify operational risk and improve safety culture at Tema Oil Refinery (TOR) in Ghana.

2   SAFETY PRACTICES IN THE OIL AND GAS INDUSTRY

The oil and gas industry are no doubt dominated by hazards, accidents and causes major havoc to human life, property and activities when potential hazards are not adequately controlled. In Ghana, Achaw and Boateng (2012) assessed safety practices in the oil and gas and its adjoining industry using both interview and questionnaires. The study found that there are regulations that are geared towards ensuring occupational health and safety. However,

there are no national policy on occupational health and safety sole for the oil and gas. This means that companies that operate in this sector must develop their own safety regulations to guide their operations. Because the quest to operate in a safe is dependent on the company, flaws were found in their operations particularly, health and safety practices. In addition to this, the Factories Inspectorate Department that oversees monitoring whether companies are practicing the right health and safety initiatives, but they are also under resourced to carry out their inspection activities. The oil and gas industry are underperforming with regards to health and safety practice which put employees, investments and properties at risk which is very eminent. The thermal power company has full safety measures hence it's observed that until the FID of Ghana is resourced, the FID's mandate to monitor and enforce health and safety in the oil and gas industry will remain dormant and inactive.

In Nigeria, Nnasi et al. (n.d) examined the recurring accidents that relate to pipelines in Nigeria by comparing the safety management practices of Nigeria against the world's standards. The image of the Nigerian oil industry has been marred over the years due to recurring pipeline explosions that has led to loss of human lives as well as valuable properties. The repetitive occurrence of the pipe explosions in Nigeria shows that industry players like government and the oil and gas companies have failed to learn from their mistakes. In other words, there is lack of operational safety management practices within the oil and gas industry. There are internal health and safety standards like API that are used by oil and gas industries around the world to comply with to protect their employees, investment and properties.

The adoption of sustainable supply chain model in the utilization of resources, maximize profit and to ensure continuity is imperative in the oil and gas industry. Research has found that one factor that promotes sustainability is the desire to conserve energy, the quest to be competitive and increase its market shares. Legal and regulatory policies are mostly inactive in terms of sustainability. Factors that militate against sustainability include; infrastructural facilities, limited information on sustainability, lack of environmental awareness among employees and higher take-up costs. There are varied approaches adopted to enrol sustainability into the oil and gas industry. Adopting these sustainability approaches into the supply chain system of the oil and gas leads to improved performance both economic wise and environmental wise which impacts on the organization positively (Abubakar, 2014). Similarly, Asikhia and Emenike (2013) examined occupational health and safety in the oil and gas industry in Nigeria and from their study, employees are exposed to immense health and safety issues at the oil and gas industry in Nigeria. In that direction, Asikhia and Emenike (2013) proposed that, there should be the provision of appropriate health facilities, the supply of fire extinguishers, and free medical check-ups for their employees, enforcing existing legislation and policies that are meant to check and mitigate hazards.

Risk management is important to understand how risks impede the performance of a company and how dealing with them increases the value of the company and improves their financial status. In the study of Osabutey et al. (2013), they discovered the most pressing risk that refineries are exposed to is the foreign exchange which leaves them in huge debts. The Tema Oil Refinery (TOR) in Ghana has instituted risk management practices into its operations by delivering risk management trainings to their employees and control measures to guide their activities. One challenge that TOR is facing is the lack of corporation from employees in implementing the risk management strategies adopted by management. The risks confronting the TOR are in two folds; external and internal risks where the external risks are those controlled by the government but direct influence on the activities of TOR in

reducing risks. In the midst of all these challenges, employees have expressed satisfaction with how management handles and control the risk factors in their working environment. In terms of risks associated with finance, it was proposed that the TOR can result to derivatives like future, forward, options and swaps to mitigate financial risks (Osabutey et al., 2013).

These methods have been duplicated in places like United States and other places to reduce risks. Swapping of currency can be used to withstand undue and unexpected fluctuations in exchange rate which may have serious repercussions on the funding of the company. In addition, currency risks compel suppliers of credit of crude oil to supply more based on their ability to avert all financial risk problems. As the financial management strategies of the oil company becomes solid, so does their transaction position increases. For instance, adopting proper risk management practices may extend credit days from 90 to 120 days when receiving from Nigeria. Both casual and permanent employees should be taken through serious risk management practices to reduce risks at the workplace. Many companies in the refinery industry record most of their accidents from the carelessness of their casual workers which means they need more risk management training to ensure quality health and safety practices at the TOR. This involves intensifying educational programmes to create awareness and emphasize how risks have been causing the company and also risk management policies should be enforced by management and together, the bad attitude of employees towards risk management will be reduced (Osabutey et al., 2013).

The contribution of the oil and gas industry to the world's economy cannot be overlooked but the sector has negatively affected the environment more than any other sector hence sustainable management operations are needed to protect the environment in which they operate. Schneider et al. (2013) evaluated the oil and gas industry towards the maturity of the environment, health and safety (EHS) towards the sustainability of the natural ecosystem. The study analysed ten oil and gas companies around the world and the results showed that these companies have made progress in environment, health and safety. Policies of oil and gas companies have captured laws to mitigating environmental and health and safety issues but there are still rooms for more improvement. The policies on EHS targeted areas of emission, protection of the environment, sustainability, safety measures and ensuring employees' welfare. There are some oil and gas companies that violate some of the EHS laws which are eminent among oil and gas companies in the US and other countries. The violations were related to process safety management and the clean air act. To fulfil the EHS regulations, companies have tried to implement control measures in different ways by substituting, administrative, eliminating, employee protection and engineering works.

In Ghana, Abdulai (2013) examined ways by which Ghana can achieve sustainable development in its oil and gas industry. It was proposed that oil and gas is exhaustible hence the need for the industry to focus on the development of infrastructures such as quality education, healthcare and create jobs for the unemployed. The oil and gas industry benefits should be well integrated to ensure that the future generations also have access to the same benefit. In a study by Hoiyik et al. (2009), 31 employees were interviewed including leaders in a Norwegian petroleum company and the study found that the concept of health, safety and environment are known to be new concepts hence the study wants to know how employees conceptualize the HSE culture and the difference among the variables. The HSE concept means different thing to individuals, companies, communities and nations. The health, safety and the environment are a concept that looks at mediating and averting all negative occurrences that occurs on and off shore. Because of the diversified meanings attached to the

HSE concept, a unilateral pattern to have a single approach towards HSE is lacking and makes setting standards difficult to measure.

Wang et al. (2012) stated that, through the upheavals of societies, global agents who focus on protection of the environment and others have led to major transformations in oil and gas companies implementing safety and hazard measures to protect their employees and the environment. At the site of oil and gas refinery, improvements have been seen in ways to eliminate practices and devices that leads to accidents. These are made possible through the supervision of effective management practices. There are also routine inspections to ensure that machines and other equipment are in order and are operating as expected.

Similarly, Khadair et al. (2011) discussed two main factors that have impacted on safety performance in the oil and gas industry. Organizational factors have effect on safety performance at the oil and gas workplace. Managerial practices have a stake towards fighting the workplace injuries and these include rewards, trainings and commitment are the ways through which accidents can be averted. Also, leadership style is another influence management has on the workplace environment which influences safety performance. Effective feedback system is created when the leadership style welcomes suggestions and opinions, which help to transform delivery. The two most important factors that promote safety performance are management practices and human factors. The adequate integration of the two basic management concepts in the organization improves safety performance in the organization.

Occupational fatalities and injuries are intricately part of the oil and gas industry causing various degrees of fatal injuries to the worse scenario, which is death. As the oil and gas industry increases, so are its accompanying fatalities and accidents. This calls for a collaborative effort between the government and industry players to work collectively to achieve adequate health and safety practices (Witter et al., 2014). In Ghana, Amorin and Broni-Bediako (2013) identified the challenges confronting the oil and gas industry in the country. The complete avoidance of the impact of oil and gas operations cannot be achieved but the country should not overlook the negatives at the expense of the revenues accrued from the sector. As the mistakes are being identified, proper measures should be used to address the challenges as they unfold. The government of Ghana has accepted the Petroleum Management Framework Bill which is due to be passed and its main objective is to manage the oil and gas sector and to ensure that the sector is transparent and accountable to Ghanaians. Institutions such as the EPA, GNPC and GMA have been empowered to monitor the affairs of the oil and gas sector.

Kashwani and Nielsen (2017) explored risk assessment in relation to protecting the four cardinal elements in the oil and gas industry which are People, Environment, Assets and Reputation (PEAR). There is a vast gab between management and end users in the oil and gas industry. These gabs are made profound in the context of behavioural safety which is vital because alienating behavioural safety and analysing the challenges faced in the industry is a waste of time and resource. Hence, it is imperative to analyse the human factors at every stage of risks. Risk assessments have focused on safety engineering systems, procedures, technical variations, behavioural features, risk assessment tools and others. Ideally, these assessments should be done with the human factor being at the centre whether the assessment is in processes, technical or behaviour. Culture also plays a key role in dealing with risks and in an environment where employees are involved in decision making leads to compliance and the opposite leads to non-compliance.

Fatalities in the oil and gas can be reduced through collective training aimed at protecting workers from hazards. Training of employees is very vital to exposing employees to understand ways to prevent harm from happening at the workplace. Information is also important in this stance and this should be in relation to the tools being used, PPEs and other protective devices and the dangers of being exposed to chemicals. Increasingly, workers are being employed into the oil and gas industry hence the need to educate new employees on the usage of the equipment used in the oil and gas sector. Regular training should also be offered for old employees to ensure they don't become complacent. Employing highly qualified employees and training them to handle equipment with care at the worksite create a more conducive and safe working environment (Stromme, 2013).

Sustainable operations and safety management practices has been researched in relation to offshore oil and gas exploitation. Several models have been designed to address the problem of health and safety in the oil and gas industry and one of such models is the four (4) blocks that have been proposed by the CCPS Management System which include; commitment to process safety, evaluation of risks and understanding hazards, managing risks and learning from experience. Apportioning greater emphasis to the four blocks commitment to process safety, evaluation of risks and understanding hazards, managing risks and learning from experience helps to predict what may occur in the future and address them immediately (Gimenes et al., 2015). The risk management puts safeguard into perspective by using preventive measures. Developing a safe working environment has no control over petrobras' HSE management patterns because it's an operational process that covers the permit of work processes which are obligatory to every task that involves risk (Gimenes et al., 2015).

The International Labour Organization Act 174 contains no traces of managing changes and safety work practices. Also, the International Labour Organization Act 174 does not include anything in relation to Seveso III or API RP 750. However, Seveso III have incorporated training and performance assurances in their write-ups where operational readiness is not found in any part unless in the CCPS proposal. Reliability is always binding with safety systems within the operations environment. Policies of oil and gas companies have captured laws to mitigating environmental, health and safety issues but there are still rooms for more improvement. There are some oil and gas companies that violate some of the EHS laws which are eminent among oil and gas companies in the US and other countries. The violations were related to process safety management and the clean air act. In order to fulfil the EHS regulations, companies have tried to implement control measures in different ways by substituting, administrative, eliminating, employee protection and engineering works (Gimenes et al., 2015).

3 RESEARCH METHODOLOGY

3.1 Research Design

Generally, research design is a plan or a framework for guiding a study. Research purposes are fall under three main categories. These are; the exploratory, descriptive and explanatory (Creswell, 2009). The research designs used are both explanatory and descriptive. The descriptive design focus on what exist. It describes the characteristics of the variables in general. The explanatory design was used to explain the relationships between the variables. These relationships were between the independent variables and the dependent variable. Neuman (2000) also indicates that survey is a process of asking many people the same questions and examining their answers. The positivist's assumption was adopted for the

study. This means a quantitative design was used specifically; a descriptive design was adopted for the study. The study utilized positivism assumption (quantitative design) by empirically observing facts. Descriptive design was the main research design adopted in this study.

3.2   Population

A population refers to a group of people or objects which form the subject of study. In simple terms it consists of all elements or individuals, items or objects whose characteristics are being studied Saunders et al (2007). Population is the entire number of people or element available for a study. Responses were gathered from the perspective of management and employees of TOR on safety culture. Respondents that constituted the study population included fulltime workers, contract workers and casual workers.

3.3   Sampling and Sample Size

According to Strydom (2005) sampling means taking any portion of a population or universe as representative of that population. If the population itself is relatively small, the sample should comprise a reasonably larger percentage of the population. Large samples enable researchers to draw more representativeness and accurate conclusions and to make more accurate predictions than in smaller samples. Neuman and Neuman (2003) argued that 30% of a given population is adequate sample size for any meaningful study. An estimated 350 sample size was envisaged for the study employing Cooper and Schindler (2006) statistical formulae at 95% confidence interval. However, 186 useable questionnaires were returned recording 53.1% response rate. The study drew responses from the perspectives of employees and management of TOR with regards to safety culture. Target population consisted of fulltime, contracts and casual staff of the company.

3.4   Data Collection Instrument

Both primary and secondary sources of data were used. With the help of structured questionnaires, convenient sampling approach was employed to elicit for data from 186 respondents. The instruments used for the study were adopted and modified from Osabutey (2013). In all, there were 23 questions on operational risks, safety policy and safety procedures for employees and management of TOR. The instruments were measured using 5-point Likert Scale (where 5=critical and 1=very low). Secondary data was deduced from scientific database like Impact factor, Ulrich, Cite Seerx, BASE and Index Copernicus and among others.

3.5   Data Analysis:

The data was validated to ensure there were no wrong entries, omissions, non-response, double entry and among other to enhance the reliability, the completeness, validity and consistency of the data. Because of the objectives, both descriptive and inferential statistics were deployed. Specifically, Paired T-test, Means, Standard Deviations and percentages were the main analyses conducted in this study. Statistical Package for Social Sciences (SPSS) Version 23 was used to analyse the data gathered from the field.

3.6   Ethical Consideration:

Data analysis is concerned with examining, categorizing, and tabulating sources of evidence to address the initial proposition of the study. Analysing data is an essential component of case

study research, but it is often difficult because the strategies and techniques for coding and testing this evidence are the least defined. Before analysing the data, the data were cleaned up to remove possible errors to ensure accuracy and consistency. Since the study would take place in corporate context the researchers adhered to pertinent corporate ethics such as informed consent, respect for human right, protection from harm and professional integrity. In view of this the consent letter was sent to TOR authority for review and approval before conducting the survey. Subsequently, data was collected from both employees and management.

4 RESULTS AND DISCUSSION
4.1 Socio-Demographic Characteristics

The table 1 presents result on demographic information about the respondent. From the survey, 29% of the respondents were between the ages of 32-40 years, 24.2% were 41-50 years and 46.8% were above 50 years. This implies that majority of the respondents are fully matured. Furthermore, the survey revealed that, 76.3% of the respondents were males and 23.7% were females. This implies that the number of male respondent is dominant over the female. Moving on, the study showed that, 14% of the respondents belonged to Islamic religion, 76.3% belonged to Christianity religion and 9.7% belonged to other religions. From the survey it's a fair judgment that about 80% of the respondents are Christians. Moreover, the research revealed that, 9.1% of the respondent had their educational level to be primary, 14.5% had a degree, 47.8% had their masters, and 28.5% had other forms of educational background. This result is an indication that majority (47%) of the respondent have acquired a higher level of education and are highly intellectuals. Again, the study revealed that slightly below 82% were married and 9.1% were divorced. Lastly, 9.1% of the respondents were widows. This implies that, a reasonable number of the respondents are couples. Furtherance, the research showed that, 9% of the respondents had 5-9 years working experience, 19.4% had 10-114 years working experience and 71% had 15> working experience. This result is an indication that, 71% of the respondents have the most intensive knowledge of the work.

Table 1: Socio-Demographic Characteristics of Respondents (n=186)

Demographics	F	%
Age		
31-40	54	29.0
41-50	45	24.2
>50	87	46.8
Sex		
Male	142	76.3
Female	44	23.7
Religion		
Islam	26	14.0
Christianity	142	76.3
Others	18	9.7
Educational level		
Primary	17	9.1
Degree	27	14.5
Masters	89	47.8
Others	53	28.5

Marital status		
Married	152	81.7
Divorce	17	9.1
Widow/er	17	9.1
Years of working in TOR		
5-9	18	9.7
10-14	36	19.4
15>	132	71.0
Nature of employment		
Backup	18	9.7
Full Time	125	67.2
Contractor	17	9.1
Casual	26	14.0
Running of shift		
Yes	160	86.0
No	26	14.0

Source: Field Survey, 2016

In addition, the survey revealed that, 9.7% had a backup nature of employment, 67.2% had full time nature of employment, 9.1% had contractor nature of employment and 14% had casual nature of employment. This implies that most of the respondents have a full-time profession. Also, the study revealed that, 86% of the respondents run shifts and 14% do no run shifts. The results point out that majority (86%) of the respondents move from one place to another and therefore are dominant over the 14% who do not run shifts.

4.2 Descriptive Statistics on Physical Health Hazards

Table 2 on the next page presented the results of physical health hazards at the work environment. The study revealed that a greater number of employees (M=3.47 & SD=0.79) agreed that noise is relatively high at their workplace, a larger proportion (M=3.61 & SD=0.47) agreed that they could lose their hearing due to the exposure to loud noise at the workplace, majority (M=1.33 & SD=0.47) disagreed that their job function deals with handling of tools, objects, equipment, machines, chemicals etc. that have high temperatures.

Table 2: Physical Health Hazards

Statements	Mean ± SD	Skewness	Kurtosis	Decision
The noise level in my workplace is relatively high	3.47 ± 0.79	-1.63	2.24	Agree
Loss of hearing could result from exposure to loud noise	3.61 ± 0.49	-0.47	-1.80	Agree
My job function has to do with working with object, tools, equipment, machine, chemical etc. that has high temperature	1.33 ± 0.47	0.71	-1.51	Strongly disagree
Extreme heat could cause body cramp	1.63 ± 0.73	0.69	-0.80	Strongly disagree
My workplace shakes as a result of vibration from workplace machines and	2.89 ± 0.87	-0.69	0.03	Disagree

equipment

Statements	Mean ± SD	Skewness	Kurtosis	Decision
Vibration could disorder the spine and causes fatigue	2.34 ± 0.78	-0.69	-1.03	Disagree
My workplace is adequately lighted	2.34 ± 1.29	-0.67	-1.65	Disagree
Inadequate illumination could affect the eyes	2.19 ± 0.79	-0.29	-1.33	Disagree
Radiations like in welding, radioactive substances etc. could be emitted as I perform my job function	1.80 ± 0.85	-0.35	-1.51	Strongly disagree
Radiation could cause cancer and premature skin aging	2.09 ± 0.81	-0.18	-1.47	Disagree

SD=Standard Deviation   ***Source: Field Survey, 2016.***

Again, a greater proportion (M=1.63 & SD=0.69) strongly disagreed that extreme heat could cause body cramps, most of the respondents (M=2.89 & SD=0.87) disagreed that their workplace shakes owing to vibrations from machines and equipment, equally, a reasonable number (M=2.34 & SD=0.78) of workers disagreed that vibrations could cause disorders in their spines and cause fatigue. Similarly, a greater proportion (M=2.34 & SD=1.29) of workers disagreed they have adequate lighting system, however majority (M=2.19 & SD=0.79) disagreed that inadequate illumination could affect their eye sight and a greater portion (M=1.80 & SD=0.85) strongly disagreed that radiations from welding and radioactive substances could be emitted as they perform their job functions. Lastly, majority (M=2.09 and SD=0.81) of the employees disagreed that radiations could cause cancers and premature skin aging.

4.3   Descriptive Statistics on Chemical Health Hazards
The Table 3 on the next page showed the outcome of chemical health hazards. The survey discovered that majority (M=1.87 & SD=0.87) of the employees strongly disagree that they work with chemical substances, another, (M=1.61 & SD=0.72) strongly disagreed that the substance they work with are solvents, mist, fume and gases and majority (M=2.45 & SD=1.14) of the workers disagreed that the substances they use involve dust particles, metals and metalloids.

Table 3: Chemical Health Hazards

Statements	Mean ± SD	Skewness	Kurtosis	Decision
Working with chemical substances is part of my job function	1.87 ± 0.87	0.26	-1.53	Strongly disagree
The substances are solvent, mist, fume and gases	1.61 ± 0.72	0.75	-0.73	Strongly disagree
The substances are dust, particles, metal and metalloid	2.45 ± 1.14	0.26	-1.37	Disagree
The chemical/gases are flammable, poisonous and corrosive	2.98 ± 0.88	-0.72	-0.03	Disagree
The hazardous chemicals are sometimes inhaled, ingested, injected and spill over my skin	3.28 ± 0.77	-1.18	1.56	Agree
Eating where there is chemical is	3.47 ± 0.59	-0.59	-0.58	Agree

highly prohibited

Statements	Mean ± SD	Skewness	Kurtosis	Decision
Chemical substances should be carefully handled and labelled	3.43 ± 0.66	-1.08	1.49	Agree
Chemical hazards are likely to affect one's health when they are exposed to them for a long period of time	3.62 ± 0.49	-0.49	-1.78	Agree
Exposure to chemical hazards could cause reproductive disorder, cardiovascular disease, respiratory diseases, renal diseases etc.	3.76 ± 0.43	-1.22	-0.53	Agree
The health impact of chemical hazards could lead to loss of life	3.53 ± 0.50	-0.11	-2.01	Agree

SD=Standard Deviation   ***Source: Field Survey, 2016.***

In furtherance, a large number (N=2.98, SD=0.88) of employees disagreed that the chemical/gases they use are flammable, poisonous and corrosive but a greater proportion (M=3.28 & SD=0.77) of the workers agreed that the hazardous chemicals are inhaled, injected, injected and sometimes spill over their skin. Similarly, majority (M=3.47 & SD=0.59) of the worker agreed that eating at a chemical contaminated area is highly prohibited with a larger number (M=3.43 & SD=0.66) agreed that chemical substances should be carefully handled and labelled and, a reasonable number (M=3.62 & SD=0.49) agreed that chemical hazards are likely to affect their health when they are exposed for a long period of time. In addition, a greater majority (M=3.76 & SD=0.43) agreed that exposure to chemical hazards could cause reproductive disorders, cardiovascular diseases, respiratory diseases, renal diseases etc. and a greater portion (M=3.53 & SD=0.50) agreed that the health impact of hazards could lead to loss of human life.

4.4 Descriptive Statistics on Mechanical/Ergonomic Health Hazards
The Table 4 on the next page presents descriptive result on ergonomic health hazards. From the study, many workers (M=3.47 & SD=0.74) agreed that they sometimes take awkward postures while working, minority (M=3.04 & SD=0.90) disagreed that they sometimes work in height, another large proportion (M=3.57 & SD= 0.49) of workers agreed that when performing their work functions, they stand for long hours.

Table 4: Mechanical/Ergonomic health hazards

Statements	Mean ± SD	Skewness	Kurtosis	Decision
I sometimes take an awkward posture while working	3.47 ± 0.74	-0.99	-0.46	Agree
I sometimes work in height	3.04 ± 0.90	-0.88	0.18	Agree
When performing my job functions I stand for a long while	3.57 ± 0.49	-0.29	-1.94	Agree
The work material at my duty post is obsolete	1.33 ± 0.47	0.71	-1.51	Strongly disagree
I lift heavy objects manually the chair, desk and other working tools and materials arrangements in my workplace is very comfortable and	2.32 ± 0.84	-0.17	-0.83	Disagree

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convenient with my job functions

Statements	Mean ± SD	Skewness	Kurtosis	Decision
I sit most time when I am on duty	2.72 ± 0.94	-0.11	-0.95	Disagree
My work is repetitive and monotonous	2.42 ± 0.89	-0.18	-0.83	Disagree
Ergonomic hazards could cause deformity of one's body	2.66 ± 1.13	-0.11	-1.40	Disagree
Mechanical/Ergonomic hazards could cause back, neck and body pain	2.24 ± 0.87	-0.03	-0.95	Disagree

SD=Standard Deviation   ***Source: Field Survey, 2016.***

More so, minority (M=1.33 & SD=0.47), strongly agreed that the work materials at their duty post is obsolete, majority (M=2.32 & SD=0.84) disagreed that they lift objects manually. the chair, desk, and other working tools and materials arrangements in their workplace is very comfortable and convenient with my function and minority (M=2.72 & SD=0.94) agreed that they sit most times when they are on duty. Moreover, greater number (M=2.42 & SD=0.89) disagreed that their work is repetitive and monotonous, majority (M=2.66 & SD=1.13) also disagreed that ergonomic hazards could cause deformity of one's body and minority (M=2.24 & SD=0.87) agreed that mechanical/ergonomic hazards could cause back, neck and body pain.

4.5   Descriptive Statistics on Biological Health Hazards
Table 5 presented the results on biological health hazards. The survey unearthed that majority (M=2.62 & SD=1.09) disagreed that microbes could be found in some of the substances they work with. With regards to hazardous waste, many of the employees (M=2.38 & SD=0.91) disagreed that they generate hazardous waste while working and equally high number of employees (M=1.87 & SD=0.84) strongly disagreed that some of the hazardous waste could impact on their health.

Table 5: Biological Health Hazards

Statements	Mean ± SD	Skewness	Kurtosis	Decision
Microbes could be found in some substances I work with in my work station	2.62 ± 1.09	-0.08	-1.31	Disagree
I generate hazardous waste while working	2.38 ± 0.91	-0.02	-0.84	Disagree
Some of this hazardous waste could impact on the health of workers	1.87 ± 0.84	0.26	-1.53	Strongly disagree
Biological hazards could cause Tuberculosis, pneumonitis, pneumoconiosis etc.	1.61 ± 0.72	0.75	-0.73	Strongly disagree
Proper environmental hygiene is lacking in my place of work	2.01 ± 0.76	-0.02	-1.25	Disagree

SD=Standard Deviation   ***Source: Field Survey, 2016.***

Regarding biological hazards, a greater proportion (M=1.61 & SD=0.72) strongly disagreed that biological hazards could cause Tuberculosis, pneumonitis, pneumoconiosis etc. and

lastly, majority (M=2.01 & SD=0.76) of the employees disagreed that proper environmental hygiene is lacking in their workplace.

4.6 Descriptive Statistics on Psychosocial Health Hazards

Table 6 presented the results on health hazards. The study found that majority (N=3.24 & SD=0.53) of employees agreed that they have a very challenging workload, a larger portion (M=3.57 & SD=0.59) of the workers agreed that they wants to be transferred to another unit or department, another greater proportion (M=3.61 & SD=0.49) agreed that they work in isolation while majority (M=3.48 & SD=0.50) agreed that they are constantly being talked down by their supervisors and a whopping proportion (M=3.58 & SD=0.49) agreed that they are faced with some form of aggression and harassment at the workplace. Lastly, majority (M=3.62 & SD=0.49) agreed that psychosocial hazards could cause hypertension, anxiety, boredom and etc.

Table 6: Psychosocial Health Hazards

Statements	Mean ± SD	Skewness	Kurtosis	Decision
My workload is very challenging	3.24 ± 0.53	0.17	-0.26	Agree
I would like to be transferred to another unit/department	3.57 ± 0.59	-1.00	0.03	Agree
I work in isolation	3.61 ± 0.49	-0.47	-1.80	Agree
I am constantly talked down by my Superior	3.48 ± 0.50	0.09	-2.01	Agree
I am faced with some kind of aggression and harassment in my place of work	3.58 ± 0.49	-0.31	-1.93	Agree
Psychosocial hazard could cause hypertension, anxiety, boredom etc.	3.62 ± 0.49	-0.49	-1.78	Agree

SD=Standard Deviation   ***Source: Field Survey, 2016.***

4.7 Descriptive Statistics on Precautionary Measure

The Table 7 presented precautionary measures. The study revealed that majority (M=3.44 & SD=0.72) agreed that they have pre-employment training when they were newly employed, majority (M=3.47 & SD=0.91) also agreed that they had pre-employment health examination when they were newly employed while another (M=2.56 & SD=1.09) disagreed that employers periodically calls for a health examination monitoring or surveillance on their on their employees and the greater proportion of employees (M=3.43 & SD=0.73) agreed that personal protective equipment (PPE) provided by management is adequate and appropriate. Nonetheless, majority (M=1.33 & SD=0.47) of the employees strongly disagreed that employers periodically send them for trainings to update and upgrade their efficiency and effectiveness and a larger number (M=2.66 & SD=1.25) disagreed that there are first aid boxes at their workplace. Moreover, majority (M=2.23 & SD=0.69) disagreed there is HSE policy that is duly signed by managing directors at their workstation with a simile portion (M=2.15 & SD=0.71) disagreed that implementation of HSE policy is taken seriously by management.

Table 7: Precautionary Measure

Statements	Mean ± SD	Skewness	Kurtosis	Decision
I had a pre-employment training when newly employed	3.44 ± 0.72	-0.89	-0.55	Agree
I had a pre-employment entrance health examination when newly employed	3.47 ± 0.91	-1.45	0.73	Agree
My employer periodically calls for a health examination monitoring/surveillance on their employees	2.56 ± 1.09	-0.18	-1.26	Disagree
Personal Protective Equipment (PPE) provided by Management is adequate and appropriate	3.43 ± 0.73	-0.87	-0.61	Agree
My employer periodically sends the employees for trainings to update and upgrade their efficiency and effectiveness	1.33 ± 0.47	0.71	-1.52	Strongly disagree
There is a First Aid Box in my workplace	2.66 ± 1.25	-0.23	-1.59	Disagree
There is an HSE Policy that is duly signed by the Managing Director in my workstation	2.23 ± 0.69	-0.33	-0.86	Disagree
Implementation of the HSE Policy is taken seriously by Management	2.15 ± 0.71	-0.22	-0.99	Disagree
Management is completely committed to the health and well-being of their workers	2.42 ± 0.86	-0.94	-0.97	Disagree
There is a very functional and active Occupational Health Safety System in place in my Company	2.52 ± 0.74	-1.16	-0.71	Disagree

SD=Standard Deviation   **Source: Field Survey, 2016.**

More so, majority (M=2.42 & SD=0.86) disagreed that management is completely committed to the health and well-being of their workers and lastly, (M=2.52 & SD=0.74) disagreed that there is a very functional and active occupational health and safety system in place in their company.

4.8 T-Test Results on Operational Risk and Safety Culture at TOR

Table 8 presents T-test results on operational risk and safety culture practices at TOR. There was a significant statistical ($t_{185} = 17.33$, p-value = 0.000 < 0.05) mean differences between expected and actual depreciation of the cedi against major currencies in the company.

Table 8: T-Test Results

Statements	t-value	df	95%CI	p-value	MD
Instability in global oil prices	27.97	185	1.85-2.14	0.000	1.99
Depreciation of the cedi against major currencies	17.34	185	0.65-0.82	0.000	0.74
Health & safety	46.59	185	2.79-3.04	0.000	2.91
Credit safety-default on the part of OMC's	81.02	185	3.12-3.28	0.000	3.19
Theft	76.32	185	3.26-3.44	0.000	3.35
Political interference	75.35	185	3.25-3.44	0.000	3.33
Environmental safety	66.23	185	3.11-3.31	0.000	3.21
Brain Drain	78.44	185	2.91-3.06	0.000	2.99
Shortage of crude oil	77.75	185	3.19-3.36	0.000	3.27
Safety of attack on TOR's facilities	86.07	185	3.06-3.21	0.000	3.13
Operational safety (Fire and breakdown of equipment)	36.05	185	3.03-3.39	0.000	3.21
Huge debt owed Ghana commercial bank	64.73	185	2.64-2.81	0.000	2.73
Reputation: Critique from the general public	9.62	185	0.27-0.40	0.000	0.33

CI = Confidence Interval, MD=Mean Difference   ***Source: Field Survey, 2016***

On average actual depreciation of the cedi against major currencies was 0.74 points higher than expected (95% CI [0.65, 0.82]). The survey further revealed significant statistical (t_{185} = 46.59, p-value = 0.000 < 0.05) mean differences between expected and actual Health & safety policy in the company. On average actual safety policy was 2.9 points lower than expected (95% CI [2.7, 3.04]). These findings affirmed the works many researchers (ILO, 2013; Asumeng *et al.,* 2015; OSHA, 2015) on health and safety particularly in the oil and gas sector. These authors had reported that the problem of policy insufficiency poses numerous risks and safety concerns

More so, the study found significant statistical (t_{185} = 81.02, p-value = 0.000 < 0.05) mean differences between expected and actual credit risk-default on the part of Oil Marketing Companies (OMCs) in the company. On average actual credit risk-default on the part of OMC's was 3.1 points higher than expected (95% CI [3.12, 3.27]). The study found significant statistical (t_{185} = 46.59, p-value = 0.000 < 0.05) mean differences between expected and actual theft in the refinery in the company. On average actual theft in the refinery was 3.34 points higher than the expected (95% CI [3.26, 3.43]). These results lean support to Osabutey *et al.* (2013) that TOR should ensure that their customers that have high risks be given products secured with assets while and others with poor credit repayment should be dealt with on cash transactions.

The study found significant statistical (t_{185} = 66.23, p-value = 0.000 < 0.05) mean differences between expected and actual environmental pollution caused by the company. On average actual environmental pollution was 3.2 points higher than expected (95% CI [3.11, 3.31]). Relating to this finding Schneider *et al.* (2013) reported that the contribution

of the oil and gas industry to the world's economy cannot be overlooked but the sector has negatively affected the environment more than any other sector hence sustainable management operations are needed to protect the environment in which they operate. Schneider *et al.* (2013) evaluated the oil and gas industry towards the maturity of the environment, health and safety (EHS) towards the sustainability of the natural ecosystem. The study analysed ten oil and gas companies around the world and the results showed that these companies have made progress in the area of environment, health and safety.

The study found significant statistical ($t_{185} = 75.35$, *p*-value = 0.000 < 0.05) mean differences between expected and actual political interference in the company. On average actual political interference was 3.33 points higher than the expected (95% CI [3.24, 3.42]). The study found significant statistical ($t_{185} = 77.75$, *p*-value = 0.000 < 0.05) mean differences between expected and actual rates of crude oil shortage in the company. On average actual crude oil shortage was 3.2 points higher than the expected (95% CI [3.19, 3.36]). The survey found significant statistical ($t_{185} = 27.97$, *p*-value = 0.000 < 0.05) mean differences between expected and actual global oil prices safety cultural practices in the company. On average actual risk and safety associated with instability in global oil prices was 1.99 points higher than the expected (95% CI [1.85, 2.14]).

Osabutey *et al.* (2013) asserted that TOR should ensure that their customers that have high risks be given products secured with assets while and others with poor credit repayment should be dealt with on cash transactions. Using this strategy will reduce TOR's debts and autonomy should be given to TOR to manage their own finances free from government interferences. The study found significant statistical ($t_{185} = 86.07$, *p*-value = 0.000 < 0.05) mean differences between expected and actual debt owed commercial banks. On average actual debt owed Ghana commercial bank was 2.72 points higher than the expected (95% CI [2.64, 2.81]). The study found significant statistical ($t_{185} = 9.62$, *p*-value = 0.000 < 0.05) mean differences between expected and actual debt owed commercial banks. On average actual debt owed Ghana commercial bank was 0.33 points higher than the expected (95% CI [0.27, 0.40]).

The study found significant statistical ($t_{185} = 78.44$, *p*-value = 0.000 < 0.05) mean differences between expected and actual rates of brain drain in the company. On average actual brain drain was 2.9 points higher than the expected (95% CI [2.91, 3.06]). The study found significant statistical ($t_{185} = 86.07$, *p*-value = 0.000 < 0.05) mean differences between expected and actual rates risk of attack on the company facilities. On average actual attacks was 3.1 points higher than the expected (95% CI [3.06, 3.20]). The study found significant statistical ($t_{185} = 36.05$, *p*-value = 0.000 < 0.05) mean differences between expected and actual rates of fire and breakdown of company equipment. On average actual fire and breakdown of company equipment was 3.2 points higher than the expected (95% CI [3.03, 3.39]).

4.9 Descriptive Statistics Results on Safety Management Procedure

The survey revealed that 66.7% of the respondents have indicated that there are standard guidelines on procedure of managing safety, meanwhile 33.3% refute there are standard guidelines on procedures of managing safety. The survey results imply that there are standard safety guidelines and procedures in managing safety at TOR. Moreover, the survey results indicated that 59.1% of the respondents affirmed that there were control measures in implementing safety management process whereas 40.1% were not aware of control measures in implementing safety management process. This result suggests that majority of

the respondents were aware of the existing control measures in safety implementation. Regarding policy implementation, the study found that below one-third (26.9%) of the employees' contributions were inculcated into the implementation of safety management at TOR, meanwhile, a large majority (73.1%) contributions were not inculcated into the safety management implementation at TOR. This result suggests that employee's needs and aspirations were to a greater extent ignored by management in the preparation and implementation of safety policy.

Table 9: Descriptive Statistics Results on Safety Management Procedure

Statements	Percent (%)	
	Yes	No
Standard guidelines on procedures of managing	66.7%	33.3%
Control measures in implementing safety management process	59.1%	40.9%
Inculcating employees' contribution into the implementation of safety management	26.9%	73.1%

Source: Field Survey, 2016

4.10 Descriptive Statistics on Operational Risk and Safety Culture

The survey results found that slightly above one-third (39.8%) of the respondents showed that instability in global oil prices have high effect on safety culture, 26.9% indicated that instability in global oil prices as having moderate effect on safety culture, 26.3% claimed instability in global oil prices have low effect on safety culture and at least 7% revealed that instability in global oil prices as having very low effect on safety culture. The survey revealed that majority (59.7%) of the respondents rated depreciation of the cedi against major currencies as having low effect on safety culture practice, 33.3% rated depreciation of the cedi against major currencies as having very low effect on safety culture practice, whiles 7% rated depreciation of the cedi against major currencies as having moderate effect on safety culture practice. The survey discovered that majority (67.2%) rated Credit safety-default on the part of OMC's as having high effect on operational risk and safety culture practice at TOR, 26.3% rated Credit risk-default on the part of OMC's as having critical effect on operational risk and safety culture practice at TOR, finally 6.4% rated Credit safety-default on the part of OMC's as having moderate effect on operational risk and safety culture practice at TOR.

The study revealed that 52% of the respondents rated theft as having critical effect on operational risk and safety culture practice at TOR, 41.4% rated theft critical as having critical effect on operational risk and safety culture practice at TOR, also 6.5% rated theft as moderately having critical effect on operational risk and safety culture practice at TOR. The survey found that 52.7% of the respondents indicated that political interference has high effect on operational risk and safety culture practice at TOR, 40.3% indicated that political interference have critical effect on operational risk and safety culture practice at TOR, finally 7% agreed that political interference have moderately effect on operational risk and safety culture practice at TOR. The study found that 52.2% of the respondents have showed that environmental risk has high effect on safety culture practice at TOR, 34.4% regarded this as critical whiles 13.4% viewed this as moderate.

The survey showed that 73.1% of the respondents indicated that brain drain has high effect on operational risk and safety culture practice at TOR, 14% agreed that brain drain

has moderate effect on operational risk and safety culture practice at TOR whiles 12.9% believed that brain drain has critical effect on operational risk and safety culture practice at TOR. The study found that majority (59.7%) of the respondents highly agreed that that shortage of crude oil has high effect on operational risk and safety culture practice at TOR, 33.9% of the respondents considered effect as critical whiles 6.5% described this effect as moderate. The survey found that majority (73.7%) of the respondents agreed that there was high risk of attack on TOR facilities has effects on operational risk and safety culture practice at TOR, 19.9% agreed that there was critical attack on TOR facilities has effects on operational risk and safety culture practice at TOR, finally 6.5% indicated that risk of attack on TOR facilities has moderately effect on operational risk and safety culture practice at TOR.

The survey revealed that majority (60.2%) of the respondents have rated Fire and breakdown of equipment as having critical effect on operational risk and safety culture practice at TOR, 19.9% have rated Fire and breakdown of equipment as having high effect on operational risk and safety culture practice at TOR, 7% have rated Fire and breakdown of equipment as having moderate effect on operational risk and safety culture practice at TOR, 6.5% each respectively have rated Fire and breakdown of equipment as having low and very low effects on operational risk and safety culture practice at TOR.

Table 10: Descriptive Statistics on Operational Risk and Safety Culture

Statements	Critical	High	Moderate	Low	Very low
Instability in global oil prices	-	39.8%	26.9%	26.3%	7.0%
Depreciation of the cedi against major currencies	-	-	7.0%	59.7%	33.3%
Credit risk-default on the part of OMC's	26.3%	67.2%	6.5%	-	-
Theft in the refinery	41.4%	52.2%	6.5%	-	-
Political interference	40.3%	52.7%	7.0%	-	-
Environmental risk	34.4%	52.2%	13.4%	-	-
Brain Drain	12.9%	73.1%	14.0%	-	-
Shortage of crude oil	33.9%	59.7%	6.5%	-	-
Risk of attack on TOR's facilities	19.9%	73.7%	6.5%	-	-
Operational safety (Fire and breakdown of equipment	60.2%	19.9%	7.0%	6.5%	6.5%
Huge debt owed Ghana commercial bank	6.5%	59.7%	33.9%	-	-
Reputation: Critique from the general public	-	-	-	33.3%	66.7%

Source: Field Survey, 2017

The survey found that majority (59.7%) of the respondents have rated huge debt owed Ghana commercial bank as having high effect on operational risk and safety culture practice at TOR, 33.9% have rated huge debt owed Ghana commercial bank as having moderate effect on operational risk and safety culture practice at TOR, finally 6.5% have

rated huge debt owed Ghana commercial bank as having moderate effect on operational risk and safety culture practice at TOR. The study found that majority (66.7%) of the respondents have rated Critique from the general public as having very low effect on operational risk and safety culture practice at TOR, 33.3% rated Critique from the general public as having very low effect on operational risk and safety culture practice at TOR.

4.11 Means and Standard Deviations on Operational Risk and Safety Culture

The survey found that majority (M=3.1, SD=0.97) of the respondents regarded instability in global oil prices as having moderately effect on operational risk and safety of the company. Also, the survey found that majority (M=1.73, SD=0.57) regarded depreciation of the cedi against major currencies as having very low effect on operational risk and safety of the company. Moreover, the survey found that majority (M=4.0, SD=0.85) regarded Health & safety policy as having high effect on operational risk and safety of the company. More so, the survey found that majority (M=4.2, SD=0.53) regarded credit risk-default on the part of OMC's as having high effect on operational risk and safety of the company. The survey revealed that majority (M=4.3, SD=0.59) regarded theft in the refinery as having high effect on operational risk and safety of the company. Also, the survey discovered that majority (M=4.2, SD=0.53) rated political interference as having high effect on operational risk and safety of the company.

Table 11: Means and Standard Deviations on Operational Risk and Safety Assessment

Statements	Mean ± Std. D	Decision
Instability in global oil prices	3.01 ± 0.97	Moderate
Depreciation of the cedi against major currencies	1.74 ± 0.58	Very low
Health & safety	4.02 ± 0.85	High
Credit risk-default on the part of OMC's	4.19 ± 0.54	High
Theft	4.35 ± 0.59	High
Political interference	4.33 ± 0.60	High
Environmental safety	4.21 ± 0.66	High
Brain Drain	4.01 ± 0.52	High
Shortage of crude oil	4.27 ± 0.57	High
Safety of attack on TOR's facilities	4.13 ± 0.49	High
Operational safety (Fire and breakdown of equipment)	4.21 ± 1.21	High
Huge debt owed Ghana commercial bank	3.73 ± 0.57	Moderate
Reputation: Critique from the general public	1.33 ± 0.47	Very low

Source: Field Survey, 2017

The survey discovered that majority (M=4.2, SD=0.66) rated environmental pollution as having high effect on operational risk and safety of the company. Again, the survey uncovered that majority (M=4.0, SD=0.52) rated brain drain as having high effect on operational risk and safety of the company. Furthermore, the survey discovered that majority (M=4.2, SD=0.57) rated shortage of crude oil as having high effect on operational risk and safety of the company. Similarly, the survey discovered that majority (M=4.13, SD=1.23) rated safety of attack on TOR's facilities as having high effect on operational risk and safety of the company. Moving on, the survey discovered that majority (M=4.2, SD=0.49) rated Operational safety (Fire and breakdown of equipment) as having high effect on operational risk and safety of the company. Moreover, the survey found that majority (M=3.72, SD=0.57) rated Huge debt owed Ghana commercial bank as having moderate effect on operational risk and safety of the company. Finally, the survey found that majority (M=1.33, SD=0.47) rated Critique from the public as having very low effect on operational risk and safety of the company.

4.12 SEM Results for Inner Model

The study had measured number of constructs to determine the reliability and validity of the newly proposed model. Construct reliability measures the extent of internal consistency of measures used. In this study cronback alpha was used to determine construct reliability which has 0.7 as the acceptable level of internal reliability among the individual items employed in the study (Hair et al., 2010). From the construct reliability and discriminant validity scores as shown in Table 12 Cronback alpha were above 0.7 suggesting that these multiple measures are reliable for the measurement of each construct which is an indication of acceptable measure of reliability. Construct validity assesses the degree to which the observed measurement items logically connect and represent a construct proposed by fundamental theory (Fornell and Larcker, 1981). It is assessed through convergent validity and discriminant validity (Hair et al., 2010).

Convergent validity is the extent to which the measurement items together explain the construct they represent in the structural model (Hair et al., 2010). The convergent validity was assessed through composite reliability (CR) with acceptable minimum of 0.70 (Fornell and Larcker, 1981; Hair et al., 2010). As shown in Table 12 all the AVEs scores for each construct were above 0.50 indicating that items for each construct collectively explain the constructs they represent, confirming convergent validity of the derived measures. From the inner model the CR scores for all constructs ranged from 0.60 to 0.83 which is acceptable.

Discriminant validity is the extent to which the measurement items explain adequately their respective constructs more than they do explain other constructs in the structural model (Hair et al., 2010). It is achieved when the square root of the AVEs for each construct is greater than their respective inter-construct correlation (Hair et al., 2010; Fornell and Larcker, 1981). From Table 12 the square roots of the AVEs (in the diagonal) are greater than their respective inter-construct correlations. The results of the inner model imply that the proposed model is deemed fit to explain the moderating effect of Health Hazards on safety culture on risk management in the oil and gas sector.

4.13 Results of Structural Model

Table 12: Path Estimates and Hypotheses Testing

Hypothesized relationship	Regression weight	Mean	Standard error	*t*-Statistics	*p*-value	Remarks
BH - > Health Hazards	0.265	0.207	0.151	1.75	0.003	Supported
CH - > Health Hazards	0.227	0.266	0.135	1.67	0.006	Supported
HH - > RM	0.209	0.260	0.176	1.18	0.238	Unsupported
HH - > SC	0.664	0.575	0.280	2.36	0.000	Supported
MH - > Health Hazards	0.271	0.330	0.121	2.23	0.008	Supported
PsyH - > Health Hazards	0.272	0.223	0.123	2.21	0.009	Supported
PH - > Health Hazards	0.228	0.144	0.186	1.22	0.224	Unsupported
RM - > Safety Culture	0.451	0.421	0.233	1.93	0.056	Supported
Health Hazards	0.915					
Risk Management	0.769					

Notes: * Significant at 0.05, ** significant at 0.01, *** significant at 0.00.

NB: BH= Biological hazards, CH= chemical Hazards, HH= Health Hazards, SC= Safety Culture, PsyH= Psychological Hazards, MH= Mechanical Hazards, RM= Risk Management.

The Table 12 presents results on path estimate and hypothesis testing. The new model accurately predicted 92% and 77% respectively for health hazards and risk management. This model is supported by it predictive power to consistently predict safety cultural behaviours in the oil and gas sector in Ghana. From the mode the strongest determinant of safety culture is hazard health (β=0.66), this is also followed by risk management (β=0.45).

Table 13: Construct Reliability and Discriminant Validity

	PHH	CHH	MHH	BHH	PSYH	RM	HH	SC	AVE	CR	Cronbach's Alpha
PHH	**0.75**								0.57	0.60	0.70
CHH	0.05	**0.71**							0.50	0.75	0.81
MHH	0.46	0.38	**0.88**						0.77	0.74	0.67
BHH	0.18	0.33	0.16	**0.74**					0.56	0.79	0.71
PSYH	-0.04	0.48	0.37	-0.16	**0.76**				0.58	0.73	0.070
RM	0.13	-0.01	0.16	-0.01	-0.03	**0.71**			0.51	0.83	0.80
HH	0.61	0.69	0.78	0.55	0.39	0.09	**0.62**		0.38	0.69	0.89
SC	0.67	0.12	0.49	0.20	-0.28	0.25	0.49	**0.45**	0.20	0.62	0.69

Note: The Square root of AVEs are in the diagonal; correlations are underneath the diagonal; AVE-Average Variance Extracted, CR- Composite Reliability. **NB**: BH= Biological hazards, CH= chemical Hazards, HH= Health Hazards, SC= Safety Culture, PsyH= Psychological Hazards, MH= Mechanical Hazards, RM= Risk Management.

Other significant determinants were identified as follows: Biological hazards (β=0.26), chemical Hazards (β=0.22), Mechanical Hazards, RM= Risk Management (β=0.27) and Psychological Hazards (β=0.27). The study also found insignificant effects of Psychological Hazards on health hazards; also, health hazards had no significant impact on risk management. The Figure 1 further elaborated on the new model. The research results alows to create a new safety structure model. The graphical interpretation of analysis results uncovers rtelations between individual determinats in safety sector. This model coud be expressed as a bichromatic oriented graph with weighted arcs. Because the condition of alternating vertices cant be met here, this is called as incomplete bichromatic graph. The proposed net consist of 8 circles representing main safety determinants and 71 partial safety areas conected with oriented weighted arcs. Its graphical interpretaion is in the figure 1.
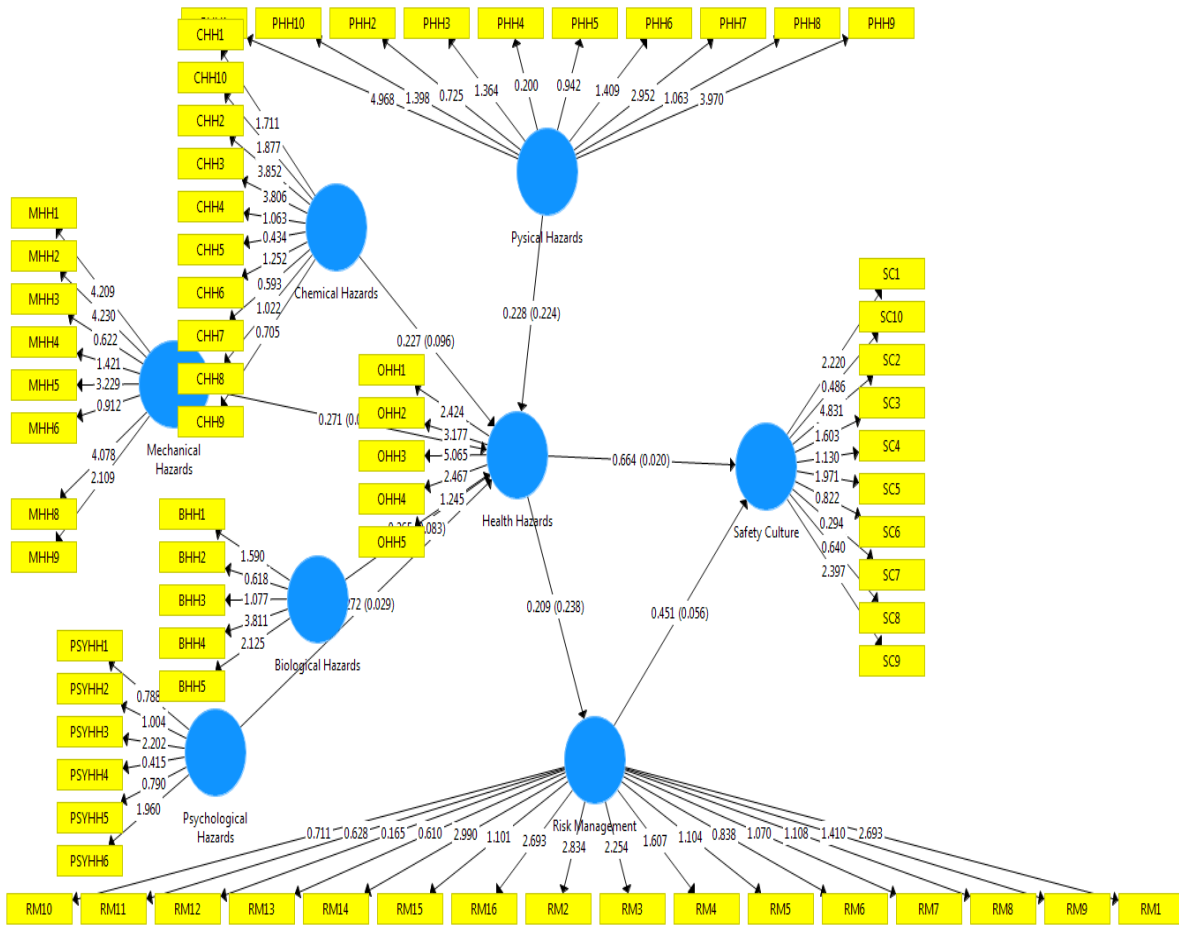
Figure 1: Proposed Safety culture model in the Ghanaian oil and gas sector

In the figure 1 factors in the corporate environment that affect work safety are represented. Distinctive relationships between the found safety determinants are noted. Each of the determinants aggregates partial elements that are represented by yellow frames. The degree of interaction of the individual determinants (represented by blue circles) with each other is represented by the weights of the respective oriented arcs. Similarly, the significance of the individual partial factors is represented by the arcs connecting them with the relevant determinants. In this graphical interpretation are the arcs oriented from determinant to partial factors.

Based on the result thus represented, it is possible to quickly and clearly assess the various factors affecting safety in the workplace. At the same time, it is also clear to what extent each of them participates in the possible risk. Possible conclusions can be found in chapter 5.

5   CONCLUSIONS AND BENEFITS OF THE THESIS

The implications were deduced from the meanings derived from the data analyses and conclusions were duly provided. This study was conducted to examine a symbiotic relationship between Occupational health hazards and safety culture at Tema oil refinery in Ghana. The study employed both exploratory and descriptive research designs. Convenient sampling technique and structured questionnaires were deployed to elicit information from 186 participants.

In line with the first objective which assessed the incidence of occupational health hazards and safety culture at TOR in Ghana, the study found out that the causes of accidents were identified as poor working conditions, human errors and the lack of protective clothing. The study results further suggest that noise is an intricate part of job functions at the work environment. This has the potential to impair the hearing of employees both now and may have lasting effect on their hearing in the future. Moreover, there is poor illumination, which may have immense negative effect on the sight of employees particularly those with generic eye problems. From the chemical hazards perspective, the study implied that employees are perpetually exposed to chemical substances. The incessant exposure to hazardous chemical poses health complications like respiratory diseases, reproductive disorders, cardiovascular diseases, renal diseases and others.

Also, protective wears and equipment are lacking resulting in the inhalation of hazardous chemicals and sometimes spillage over their skin. The study further illustrated that employees take awkward postures while working, they are made to work at heights with less or no protective tools and materials, when performing their work functions, they stand for long hours which has great effect on the joints of employees especially those who are tall in nature. Moreover, the work materials at their duty post is obsolete, they lift objects manually on chairs, desks and other working tools and material arrangements in their workplace and nonetheless, there are employees that sit most times when they are on duty for longer hours putting more pressure on the waist.

Furthermore, their work is repetitive and monotonous, ergonomic hazards could cause deformity of one's body and mechanical or ergonomic hazards could cause back, neck and body pain. More so, there is a clear indication of poor employee welfare hence the Tema Oil Refinery can be described to be product centred other than projecting the interest of employees. In relation to biological health hazards, the study implied that less or no health complications to affect employees at TOR owing to a very minimal or no direct or indirect dealings with biological substances. The survey unearthed that microbes could be found in some of the substances they work with. With regards to hazardous waste, they generate hazardous waste while working and some of the hazardous waste could impact on their health. Regarding biological hazards, the biological hazards could cause Tuberculosis, pneumonitis, pneumoconiosis etc. and the employees disagreed that proper environmental hygiene is lacking in their workplace. The relations between relevant factors and their mutual influences are the main result of this work and are in details represented on the diagram in Figure 1.

From the psychosocial health hazard perspective, the study implied that the job description at TOR is very challenging, tedious and time consuming. This has led to many of the employees requesting for transfer from their current department to another. In addition, the right of employees is violated by management and sometimes they harass employees and intimidate them. Finally, the study suggested that although TOR offers pre-employment training before employees are employed, the company lacks continuous policy on training where employees are periodically trained to equip them on health and safety practices. Surprisingly, TOR is less proactive about the health of employees because they lack policies that ensure occasional check-ups for health issues.

The study recommends that there is the urgent need to integrate policies and models to effectively manage safety culture at TOR. Furthermore, the study recommends that integrated model is required to comprehensively explain the safety culture at TOR since

implementation of occupational health and safety management system (OHS-MS) has been proven inadequate.

This study based on the objective two of the study which was conducted to demystify operational risk and improve safety culture at Tema Oil Refinery (TOR) in Ghana. The study drew responses from the perspectives of employees and management of TOR with regards to safety culture. The study utilized positivism assumption by empirically observing facts. Every oil producing company like the Tema Oil Refinery and country are confronted with limitless challenges emanating from the production of oil. The expanse of this challenge cannot be over emphasized as they cut across every aspect of human endeavour from the psychological level to the physical and environmental levels.

Owing to the mercurial nature of oil producing companies and their hyper-susceptible tendencies to danger and fierce explosions and varying degrees of negative repercussions, the Tema Oil Refinery offers pre-employment training when new people are employed, and they go further to conduct pre-employment health examination and personal protective equipment (PPE) provided by management is adequate and appropriate. On the contrary, periodic medical or health examinations and not conducted and employers do not periodically send them for trainings to update and upgrade their efficiency and effectiveness. The company also lack first aid boxes that help to manage situation when an accident occurs, and this have huge negative impact on employees' health and wellbeing. The study revealed that factors such as fire outbreak, breakdown of equipment, shortage of crude oil, environmental pollution, brain drain, huge debt and public critique have devastating effect on the operations and safety culture of the company. The study further revealed that the inadequacy nature of theoretical and methodological strategies concerning safety culture limit any attempt towards the development of appropriate assessment tools.

Prioritizing safety practices is the best supportive initiative that helps to mitigate risks and accidents. Also, supervising safety, equipment maintenance, management of change and commitment to risks indicators leads to the avoidance of accidents and risks. Safety climates are a president that averts major accidents and risks. The link between safety measures at the workplace and accidents have received little attention in Ghana with regards to the causatives of accidents at our workplaces. Developing adequate safety climate indicators is a valuable contributing factor to reducing accidents and risks.

This implies that there are standard safety guidelines and procedures in managing safety at TOR. It must be noted that different working environments demands different health and safety practices to promote OHS standards at the work premises. Moreover, the survey indicated that there were control measures in implementing safety management process and workers at the TOR were aware of the existing control measures in safety implementation.

The survey further found there were high risk of attack on TOR facilities that has effect on operational risk and safety culture practice at TOR, and the employees rated Fire and breakdown of equipment as having critical effect on operational risk and safety culture practice at TOR.

Regarding policy implementation, the study found that employees contribution was inculcated into the implementation of safety management at TOR, meanwhile, employee's needs and aspirations were ignored by management in the preparation and implementation of safety policy.

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