

Impact of Job Hazard Analysis on Organisational Performance in Shell Bonny Terminal Integrated Project

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Abstract

The paper focuses on the impact of job hazard analysis (JHA) on organizational performance (improved management/employees safety practices, enhanced productivity, increased profitability and reduced accident/incident rate) in shell bonny terminal integrated project. It defines job hazard analysis as a process of identifying potential hazards in construction activities and assessing its potential effects on people, assets and the environment while executing construction jobs. It is based on the theory that performance of job hazard analysis at the task level in construction companies has an influence on employees' safety performance as well as on company performance: enhancement of productivity, profitability and loss control through reduction of accident/incident rate. The paper posits that: if construction companies in Shell Bonny terminal integrated project (BTIP) incorporate job hazard analysis into their investment in machines and technology (socio-technical investments) through better identification, assessment and control of job related hazards, there will be an improvement in management/employees' obedience to safety rules and regulations since the awareness will be created through training and management commitment.. The better safety performance of employees will lead to few accidents, damages, liabilities, legal costs, medical costs etc. through reduction of safety risks and creation of better opportunities for rehabilitation of employees after injury. The better safety performance of the company will bring about better productivity, profitability, efficiency, quality, good corporate image and innovative capacity due to the improvement of employees skills via training, motivation and ergonomics, hence there will be less disruption of work processes and less liabilities. It therefore concludes that incorporation of job hazard analysis at the task level in construction activities will improve management/employees safety practices at work thus enhancing productivity, profitability and loss control. The paper advocates for visible top management/employees commitment to job hazard analysis, competitive intelligence sharing on job hazard analysis at the industry level, high-level knowledge flow management on job hazard analysis at the company level and co-operative resourcing on job hazard analysis for construction companies executing different arms of the same project as a means of improving and sustaining industrial best practices in construction projects in the same location.

Keywords: job hazard analysis, safety performance, construction project, task-level, safety risks.

INTRODUCTION

The need to modernize and automate the existing facilities at the Shell Petroleum Development Company (SPDC) Bonny oil and gas terminal necessitated the award and execution of the bonny terminal integrated project (BTIP). The project consists of the rehabilitation of existing crude oil storage tanks and construction of new ones, construction of new residential and office buildings, construction and installation of new gas turbines, booster pumps, emulsion treatment plant and an automated central control system. It also includes the laying of two new 48inches crude export pipelines to the offshore crude loading platform (CLP).

The BTIP contract with an estimated value of US\$2.2 billion is being executed by three major construction companies namely Hyundai Heavy Industries Nigeria Ltd (HHI), Dec oil and Gas Company Nigeria Ltd and Zakhem oil services Nigeria Ltd. The civil and the mechanical aspects of the BTIP is being

executed by HHI, the Tank rehabilitation aspect is undertaken by Zakhem oil services while the construction of new tanks is being executed by Dec oil and gas Ltd.

Though a health, safety and Environment management system (HSE-MS) was incorporated into the project design and construction contract document as specified in Nigeria's Mineral Oils (Safety) regulations 1997, but the increasing rate of construction Accidents / incidents within the last six months of 2006 in the BTIP, raised several thought provoking questions as to the relationship between construction activities and job hazard analysis, which is usually carried out before the commencement of construction work. It is the influence of Job Hazard Analysis on organizational performance that forms the subject of this research.

According to NISP (2004), a job hazard analysis is a structured review instrument used in identifying, the

hazards and effects of jobs and determining the level of risks and controls required. A job hazard analysis is simply a documentary analysis of the various task steps, associated hazards, typical threats; risk assessment, control and recovery measures associated with different construction activities. It is the bedrock of the Hazards and Effects management process, which is a subsystem of the corporate HSE-MS. The preparation and implementation of a broad based JHA will go a long way in identifying construction hazards, promotion of work planning, safety consciousness, and management of risk and reduction of accidents / incidents.

According to Carter and Smith (2005), association of hazards with tasks is important to both managing construction of safety and communicating safety and hazard awareness down to the people who are actually exposed to the hazards. This is because hazard identification is fundamental to construction safety from statistical, legislative and risk management perspectives. Since construction project are always faced with time, cost and manpower constraints, tasks need to be prioritized in term of risks so that limited site resources will be focused on those tasks that expose operatives to the greatest danger. The UK CDM (1994) regulations made allowance for this phenomenon and stated that workers health and safety must be protected so far as is reasonably practicable. This term is interpreted as the “degree of risk in a particular activity or environment balance against time, trouble, cost and physical difficulty of taking measures to avoid the risk” (Horner 1998). This explains why the preparation of communication of Job Hazard Analysis is mandatory in all SPDC construction projects.

The influence of job hazard analysis on organizational productivity and loss control in the Nigerian construction industry cannot be over emphasized, especially in the areas of setting minimum health/safety management standards, safe work procedures and environmental management standards. It is assumed that job hazard analysis have a direct relationship with employees’ productivity in view of the fact that assigned tasks can only be safe accomplished when workers are in a good state of health and the work environment is safe and conducive for the execution of the assigned duties, be it construction, manufacturing or servicing, thus, any phenomenon that affects human production capacity will invariably affect organizational productivity hence improving workers wellbeing offers a company the opportunity of enhancing its performance (Galliker, 2000). The consequences of construction incidents (accidents, ill-health and environmental pollution) on workers’ productivity are so grave that construction companies should be legally, morally and socially compelled to incorporate job hazard

analysis as one of their production inputs in taming the tide of this ugly incidents. Construction incidents especially those involving lost time injuries (LTI) and lost workdays (LWD) usually lead to shop closure for incident investigation and reporting. This situation results in loss of man-hours, output, reputation and low workers morale. Andrew Smith (2002), the U.K. secretary of state for workers and pensions in stressing the importance of job hazard analysis as a HSE best practice in the construction industry states thus

“Preventing people from being harmed by construction work and enabling people to continue in work after illness or injury is a vital task whose importance cannot be overstated”.

Apart from the need to reduce or eliminate accidents/incidents, construction companies should incorporate job hazard analysis in their operation in order to satisfy legal, social, moral and cultural obligations of the host country/community. Dorman (2000) argues that for companies to provide effective improvement of health, safety and environment conditions, the costs of ill-health/accidents must be economic, internal, variable and visible.

The extent to which job hazard analysis is viewed as a core management responsibility in construction companies depends on the answers to the questions below:

- Is job hazard analysis perceived to be a critical commercial success factor?
- Are the costs of ill-health, injury and pollution perceived to be significant?
- Do customers or regulatory bodies exert pressure or make demands on the company to achieve certain minimum job hazard analysis at the task level?

If the answer to one or more of these questions is affirmative, it is probable that the practice of job hazard analysis will be seen as an important commercial consideration and treated as a core management responsibility. In the case of construction companies in the BTIP, productivity/loss control has been enhanced to the extent that job hazard analysis is included and regarded as a major production input like enterprise skills in the execution of their operations. Court (2003), in his contribution to corporate job hazard analysis as a safety best practice, argues that creating better work environment and preventing harm from work are the key means of improving productivity.

STATEMENT OF THE PROBLEM

Between March and June 2006, the BTIP recorded two fatalities the first fatality occurred on 4th March 2006, in which a Zakhem worker was drowned, while carrying out marine activities, while the second

fatality occurred on 12th June, 2006, in which a HHI TCN staff died as a result of injuries sustained during a winch cable puling operating. The learning points from the reports of both incident suggested that the JHAs were either inadequate or poorly communicated to the workers.

OBJECTIVES OF THE STUDY

The role of a well-articulated and properly communicated job hazard analysis in the execution of construction activities cannot over emphasized especially in accident prevention. Since 88% of all construction accident can be traced to the unsafe acts of people (Heinrich, 1941). People in most cases exhibit unsafe acts when they are not properly informed about the hazard associated with the jobs they are expected to execute. Thus the objectives of this study are: to ascertain the extent to which BTIP construction companies incorporate job hazard analysis in their activities and the extent of its influence at the organizational level (improved management/employees safety practices, enhanced productivity, increased profitability and reduced accident/ incident rate), since there is support in the literature for the argument that incorporation of job hazard analysis at the organizational level results in better organizational safety performance (Mossink and De Greef, 2002).

RESEARCH HYPOTHESIS

In view of the above research objectives, the following null hypothesis was formulated:
Better organizational performance (improved management/employees safety practices, enhanced productivity, increased profitability and reduced accident/ incident rate) is not dependent on the incorporation job hazard analysis in construction activities in the BTIP.

CONCEPTUAL FRAMEWORK

Job hazard analysis is a process of identifying potential hazards in construction activities and assessing its potential effects on people, assets and the environment while executing construction jobs. For a job hazard analysis to be suitable and sufficient for a specific construction hazard, it must be proactive, cover all reasonably foreseeable industrial risks and be reasonably practicable in its hazard management approach. A JHA is proactive when it involves routine inspections and checks to make sure standards and policies are being implemented and that controls are working (Hughes and Ferrett, 2007). For these inspections and checks to be effective and efficient, they must address the 'four Ps' of industrial activities: **premises** (access/egress, housekeeping, services like gas and electricity, working environment and fire precautions/emergency procedures), **plant/substances** (machinery guarding, tools and equipment, local exhaust ventilation and use/storage/separation of materials/chemicals),

procedures (safe systems of work, permits to work, use of personal protective equipment and procedures followed) and **people** (health surveillance, people's behavior, training and supervision by appropriate competent person).

According to Hughes and Ferrett, (2007), inspection checklist/form should facilitate:

- ❖ The planning and initiation of remedial action, requiring those doing inspection to rank deficiencies in order of priority
- ❖ Identify those responsible for taking remedial actions, with sensible time scales to track progress on implementation
- ❖ Periodic monitoring to identify common themes which might reveal underlying problems in the system
- ❖ Management information on the frequency or nature of the monitoring arrangements.

For inspections and checks to be successful, HSE auditors should: be selective, know what to look for, practice, keep an open mind, guard against habit/familiarity, not be satisfied with general impressions and record observations systematically. In addition to being a good observer, the HSE auditor must:

- stop for 10 to 30 seconds before entering a new area to audit where employees are working
- be alert for unsafe practices (evaporative unsafe practices) that are corrected as soon as he enters an area
- observe activity – he should not avoid the action
- remember ABBBI - look Above, Below, Behind and Inside
- develop a questioning attitude to determine what injuries might occur if the unexpected happens and how the job might be accomplished more safely. Ask 'why?' and 'what could happen if ...?'
- use all senses: sight, hearing, smell, touch
- maintain a balanced approach, observe all phases of the job
- be inquisitive
- observe for ideas – not just to determine problems
- recognize good performance.

A suitable and sufficient JHA must cover all reasonable and foreseeable risks associated with industrial activities which implies that employers of labour are expected to:

- foresee risks in their activities that are common knowledge
- foresee risks that are known to people in the same industry
- foresee risks that are known to people possessing the required industrial expert knowledge.

A suitable and sufficient JHA must use reasonably practicable risk control measures in managing workplace hazards. This means that the cost of risk

control in terms of time, effort, money or inconvenience must not outweigh the benefits of the risk control measure.

According to Goetzel (1999), improving employees HSE practice at work, is directly related to their productivity and profitability of organizations. Further, he identified some interesting common success factors that are peculiar to JHA incorporation in industrial organizations and these include:

- ❖ JHA compliant companies focus on safety/productivity management, not because it is a human resource activity, because of its alignment with the business purpose of the organization.
- ❖ JHA compliant organizations consider many factors that may impact on workers productivity in addition to those associated with specific HSE conditions e.g. corporate culture and employees' attitude.
- ❖ HSE professionals are the primary drivers and champions of JHA compliance in industrial activities.
- ❖ JHA compliant organizations emphasize HSE/productivity management not just because it is cost-effective, because it means an improvement of the quality of industrial life.
- ❖ HSE data measurement and evaluation are vital for JHA compliant organizations.
- ❖ JHA compliant organizations act on their beliefs that internal benchmarking is as important as external benchmarking.
- ❖ To support investments over time, JHA organizations should be able to demonstrate return on investments for specific programmes related to HSE management, both prospectively and retrospectively.

THEORETICAL FRAMEWORK

This paper is based on Mossink and De Greef (2002), theory of economic effects of job hazard analysis compliance at the company level: that JHA compliance of industrial organizations have influence on safety performance as well as on corporate performance/productivity, JHA compliance has positive effects on corporate performance and adds to the initial effects of the safety measures. This theory is illustrated diagrammatically in figure 1 below:

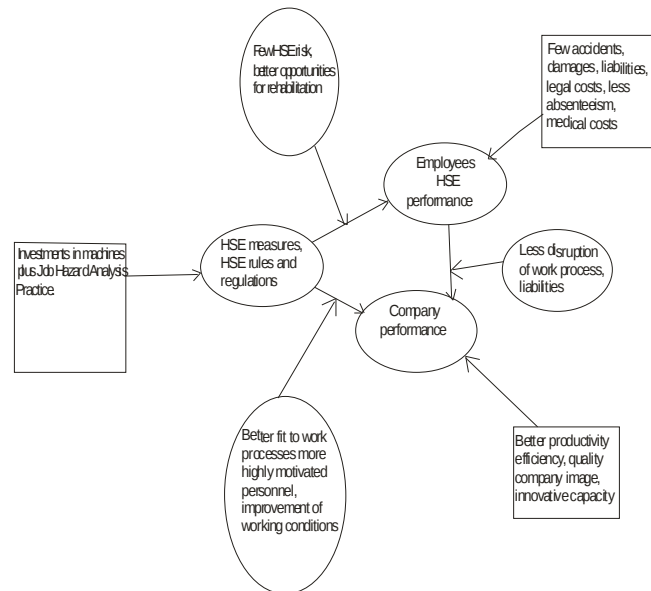


Figure1: Economic Effects of JHA compliance at company level.

Source: Adapted with modification from Mossink, J & De Greef, M (2002) Inventory of social economic cost of work accidents, European Agency for Safety and Health at Work.

Figure 1 is explained thus: If a company incorporates JHA into its investment in machines and technology (socio-technical investments) through better man/machine design (ergonomics), safety training and management commitment, this situation will lead to employees' obedience to safety rules and regulations since the awareness has been created through training and management commitment. The employees and management obedience to safety rules and regulations will make for better safety measures; this will result to better safety performance for employees, the management and the company as a whole. The better performance of employees will lead to fewer accidents, damages, liabilities, legal costs, medical costs etc, through reduction of safety risks and creation of better opportunities and rehabilitation for employees after injury. The better safety performance of the company will bring about better productivity, efficiency, quality, corporate image and innovative capacity due to improved employees skills via training, motivation and ergonomics hence there will be less disruption of work process and less liabilities.

Further, Mossink et al (2002) stated that the economic effects of JHA compliance at company level are necessitated by the need to:

- ❖ Take a balanced decision with regards to the allocation of company resources.
- ❖ Bridge the gap between safety needs and management requirements and desires.
- ❖ Encompass the limited effectiveness of legislation.

However, other JHA scholars criticized the economic approach to JHA compliance on the bases that JHA compliance is part of the social and ethical role of a company and as such should not only be based on economic parameters since it is difficult to evaluate qualitative costs such as suffering, reduction of quality of life, family problems, decrease in lifespan etc, in monetary terms.

RESEARCH METHODOLOGY

The scope of the research is limited to the three construction companies (HHI Nigeria Ltd, Dec oil gas ltd and Zahkem Nigeria Ltd) involved in the SPDC Bonny BTIP. An exploratory, cross-sectional survey was used in generating the primary data required for the study. The population of study consists of 40,568 workers of three categories (3,560 supervisors, 10,028 foremen and 26,980 workmen) drawn from the three BTIP construction companies. A sample of 396 workers (35 supervisors, 98 foremen and 263 workmen) determined at 5% level of significance for sample error, using Taro Yamane's (1964) formula, was selected using stratified random sampling method for the purpose of questionnaire administration. The questionnaire was designed to obtain a fair representation of the opinions of the three categories of construction workers in the three construction companies using a five-point Likert type scale. The questionnaire responses of the sample respondents were presented using tables, analyzed and interpreted using simple percentages. A total of 396 copies of the questionnaire were administered, out of which 2 were cancelled while 4 were not returned and 390 (98%) were used for analysis.

RESULTS AND DISCUSSION

Table1, Response pattern on the extent of incorporation of JHA in the three BTIP construction companies

Category of Respondents/Workers	Responses Provided					Total
	Very large extent	Large extent	Mild extent	Poor extent	Very poor extent	
Supervisors	10	20	2	2	1	35
Foremen	25	65	4	2	2	98
Workmen	60	172	15	6	4	257
Total	95	257	21	10	7	390

Source: Field Survey, 2011.

Table 1, indicates that a total of 257 i.e. 66% of the workers across the three categories are of the opinion that their company to a large extent incorporate JHA in their activities, 95 i.e. 24% of the workers are of the view that their company to a very large extent incorporate JHA in their activities, 21 workers i.e. 5% expressed a mild extent view of their companies incorporation of JHA , 10 workers i.e. 3% expressed a poor extent view of their companies incorporation of JHA in their activities while 7 workers i.e. 2% were of a very poor view of their companies incorporation of JHA in their activities. We therefore

conclude that there is evidence of a large extent incorporation of JHA in the activities of the three BTIP construction companies as buttressed by the 66% large extent response of the sample respondents.

Table 2 Response pattern on the extent JHA incorporation influences better organizational performance (improved management/employees' safety practices, enhanced productivity, increased profitability and reduced accident/ incident rate) in the BTIP construction companies

Category of Respondents/Workers	Responses Provided					Total
	Very large extent	Large extent	Mild extent	Poor extent	Very poor extent	
Supervisors	23	10	1	1	0	35
Foremen	67	25	2	2	2	98
Workmen	175	62	10	6	4	257
Total	265	97	13	9	6	390

Source: Field Survey, 2011.

Table2, indicates that a total of 265 i.e. 68% of the workers across the three categories are of the view that their company's incorporation of JHA in their activities, to a very large extent influences better organizational performance (improved management/employees' safety practices, enhanced productivity, increased profitability and reduced accident/ incident rate),97 i.e. 25% of the workers are of the view that their company's incorporation of JHA in their activities, to a large extent influences better organizational performance, 13 workers i.e. 3% expressed a mild extent view, 9 workers i.e. 2% have a poor extent view while 6 workers i.e. 2% were of a very poor view of their company's incorporation of JHA in influencing better organizational performance. We therefore conclude that there is evidence that incorporation of JHA in the activities of the three BTIP construction companies to a very large extent influences better organizational performance as buttressed by the 68% very large extent response of the sample respondents.

Table 3: Responses on the extent better organizational performance (improved management/employees HSE practices, enhanced productivity, increased profitability and reduced accident/ incident rate) depends on incorporation of JHA in the BTIP construction companies

Category of Respondents/Workers	Responses Provided			Total
	Large extent	Mild extent	Poor extent	
Supervisors	20	10	5	35
Foremen	75	15	8	98
Workmen	230	20	7	257
Total	325	45	20	390

Source: Field Survey, 2011.

Table 3 shows that a total of 325 i.e.83.33 % of the workers across the three categories were of the view that better organizational performance depends to a large extent on their company's incorporation of JHA in their activities, 45 i.e. 11.54% of the workers

expressed a mild extent view while 20 i.e. 5.13% of the workers expressed a poor extent view. We therefore conclude that there is evidence that better organizational performance depends on incorporation of JHA in construction activities as buttressed by the 83.33% large extent response of the sample respondents.

Table 4 Observed and Expected Frequencies of table 3

Category of Respondents/Workers	Responses Provided			
	Large extent	Mild extent	Poor extent	Total
Supervisors	20 (29.17)	10 (4.04)	5 (1.79)	35
Foremen	75 (81.67)	15 (11.31)	8 (5.03)	98
Workmen	230 (214.17)	20 (29.65)	7 (13.18)	257
Total	325	45	20	390

Source: Field Survey, 2011.

Test of Hypothesis

(i) H_0 : Better organizational performance (improved management/employees HSE practices, enhanced productivity, increased profitability and reduced accident/ incident rate) is not dependent on the incorporation of JHA in the BTIP construction companies.

H_1 : Better organizational performance (improved management/employees HSE practices, enhanced productivity, increased profitability and reduced accident/ incident rate) is dependent on the incorporation of JHA in the BTIP construction companies.

(ii) $\alpha = 0.05$

(iii) Degree of Freedom (df) = (r - 1)(c-1) = (3-1)(3-1)=4

(iv) Chi- square critical value $\chi^2_{0.05} = 9.49$

(v)) Chi- square computed value from table 4 = $\chi^2_1 = \sum (F_o - F_e)^2 / F_e$

Table 4 Computation of Chi-square Test Statistic from table 3

Fo	Fe	(Fo-Fe)	(Fo-Fe) ²	(Fo-Fe) ² /Fe
20	29.17	9.17	84.0889	2.8827
75	81.67	6.67	44.4889	0.5447
230	214.17	-15.83	250.5889	1.1700
10	4.04	5.96	35.5216	8.7925
15	11.31	3.69	13.6161	1.2039
20	29.65	-9.65	93.1225	3.1407
5	1.79	3.21	10.3041	5.7565
8	5.03	2.97	8.8209	1.7537
7	13.18	-6.18	38.1924	2.8978
				$\chi^2_1 = 28.1425$

(vi) **Decision Rule:**

Reject H_0 : if $\chi^2_1 > \chi^2_0$

Accept H_0 : if $\chi^2_1 < \chi^2_0$

Since $\chi^2_1 > \chi^2_0$ i.e. 28.1425 > 9.49, we reject the null hypothesis and accept the alternative hypothesis that better organizational performance (improved management/employees safety practices, enhanced productivity, increased profitability and reduced accident/ incident rate) is dependent on the incorporation of JHA in the BTIP construction companies.

CONCLUSION

This paper has tried to address the implications of JHA incorporation on corporate performance in the execution of the BTIP, from the economic perspective. Concisely stated, the main thrust of the economic approach to JHA incorporation in construction activities at the company level is based on three principles:

- ❖ Good JHA practice will lead to better performance of employees, management and the company as a whole resulting in less disruption of work process and less liabilities.
- ❖ Better performance will lead to few accidents, damages, liabilities, legal costs, medical costs etc. through reduction of safety risks and creation of better opportunities and rehabilitation for employees after injury.
- ❖ Better company performance will lead to better productivity, profitability, efficiency, quality, corporate image and innovative capacity through improvement of employees' skills via training, motivation and ergonomomy.

RECOMMENDATIONS

Arising from the findings of this paper, it is suggested that the management of the three BTIP construction companies in Shell Bonny terminal should take the following measures:

- ❖ Continuous training of their safety personnel and the entire workforce on the acquisition of modern hazard identification/JHA preparation skills.
- ❖ Continuous improvement on employees' motivation and safe work environment through promotion JHA awareness.
- ❖ Continuous top management/employees commitment to JHA best practices.
- ❖ Continuous implementation of safety regulations and best practice procedures/techniques on JHA.
- ❖ Continuous review of corporate safety policies to accommodate changes in the construction environment and modern developments in hazard management.
- ❖ Continuous use of competitive intelligence, high-level knowledge flow management and co-operative resourcing as a means of obtaining information for improving and sustaining JHA best practices compliance in their operations.

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