Research Article

Investigating Workplace Safety Programs in a Chemical Industry in Africa

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Abstract
Safety is a critical component in any organisation. The purpose of this study was to investigate the safety culture of a chemical industry in Africa. This was a cross-sectional study conducted among 124 employees from South Africa, Ghana, Nigeria, Kenya and Zimbabwe. Data were collected using self-administered questionnaire via online programme (QuestionPro). The majority of the respondents were satisfied with the overall organisational culture, workplace condition and the support provided by management to ensure employee safety within the organisation. The respondents attested to a positive safety climate, although some felt that it would be of benefit to recognise and reward safety performance. Employee awareness of ImproChem's safety standards and the level of compliance were also satisfactory. More focus can be directed to increasing individual hazard recognition and elimination to ensure "No harm to anyone ever".

Keywords: Compliance, Organisational Culture, Reward, Safety Culture, Workplace Condition

Introduction

Risk tolerance and the ability to identify risks affect the reoccurrence of incidents and injuries [1]. Researchers reported that a better understanding of why and how the injuries occur could assist in identifying corrective action [2]. A South African study revealed that safety performance is also affected by job insecurity, satisfaction and work stress [3]. Another study recommended that safety culture should focus on learning and reporting rather than assigning blame [4].

There are many recognised indicators that contribute to the re-occurrence of accidents. Safety culture and safety climate have been regarded as leading safety indicators, while accidents themselves have been regarded as lagging indicators, as they offer insight into the state of safety with no need to further review negative safety outcomes [5]. A study revealed five major indicators related to potential causes of safety accidents as being environmental, physical, agronomic, psychological and stress [6].

Organisational culture refers to the shared perceptions regarding organisational norms, values, beliefs, procedures and practices [7]. Organisational culture has appeared to be the most significant antecedent of performance in the workplace, as employees' perception of the organisational structure and state of affairs affect their perception of work behaviour and safety. It has been confirmed that a relationship between safety culture, organisational culture and safety perception does exist. This concept was investigated and concluded that safety culture is shaped by organisational culture which in turn influences safety performance [8].

Corporate culture sets restrictions for acceptable human behaviour by establishing behavioural limits and norms. Corporate culture serves as a foundation for employee and managerial decision-making and a blueprint of how things are doing within the organisation [9]. Safety culture is therefore a bi-product of corporate culture. Employee corporate attitudes influence employees' collective approach towards safety [10].

Safety culture is an important aspect as related to safe operation, which requires urgent attention from organisations [11]. The UK Health and Safety Commission defines safety culture as the product of individual and group perceptions, values, competences, attitudes and patterns of actions that determine the level of commitment to, and the proficiency and style of, an organisation's safety and health management [12].

It was reported that two to nineteen safety culture measurements, ranging from management to risk awareness and perceptions and attitudes of safety climate [5]. The most often cited measures of

safety culture are risk awareness and risk taking, leadership style and communication, management and workforce commitment, individual responsibility and management responsibility. Research has shown that individual human behaviours (safe/unsafe) are shaped by personal attitudes, values and beliefs; therefore, workplace safety is founded upon individual and organisational shared beliefs regarding the importance of safety [13].

Compliance with safety regulations is a basic requirement to ensure safety; however, compliance on its own is not enough. Employees who simply comply with the minimum safety requirements are not likely to be able to identify potential hazards before they result in accidents. To be able to promote safe operations, employees themselves ought to have a positive attitude towards safety [14].

ImproChem forms part of 14 business units under the African Explosives and Chemical Industries (AECI) specialty chemical cluster. AECI, being the owner of ImproChem, is a specialty chemicals and explosives group originating in South Africa. ImproChem is committed to seek continuous improvement as far as health, safety, environmental and quality (SHEQ) standards are concerned. ImproChem is also willing to work together with the neighbouring communities and customers to ensure safer and healthier products and operational procedures. ImproChem's leadership team is committed to promote safety at all levels by providing appropriate safety training to all ImproChem employees and subcontractors. ImproChem's goal is "No harm to anyone ever" to ensure alignment with the AECI goal.

According to the Occupational Safe and Healthy Act 1993 (OSH Act), it is the duty of an employer to provide a safe and healthy environment for his or her employees as far as reasonable practicable. The duty of the employees is to look after their own health and safety and the safety of those who may be affected by their actions. Risk tolerance and the ability to identify risks affect the reoccurrence of incidents and injuries [15]. Researchers contend that a better understanding of why and how the injuries occur can assist in identifying corrective action [2]. Many studies have been conducted; however, compliance with safety requirements is still a challenge in South African industries [16]. The total recordable injury rate (TRIR), has not shown any improvement in conjunction with investments ImproChem has made to improve workplace safety. The number of fatalities and injuries keeps on increasing: The February 2015 TRIR showed an increase of 0.79 compare to the February 2014 TRIR, which was 0.59 [17]. Therefore, the purpose of this study was to investigate workplace safety programs at ImproChem in Africa.

Research Methodology
This was a cross-sectional study conducted among all the employees who were working at ImproChem. The study was conducted at ImproChem in South Africa, Ghana, Nigeria, Kenya and Zimbabwe. The research focused on different departments within the organisation such as the energy division, production, marketing, human capital, SHEQ and Imprologistics departments. No sampling was done to select the sample for the study as the population of 395 employees was given an opportunity to participate in the survey. The survey respondents covered almost all the employees in the organisation, from individuals working in less hazardous areas to individuals who are greatly exposed to safety risk when performing their task. The production supervisors were also included, as they have the important task of driving safety culture within the production department, which has high risks exposure. The different job classifications included technicians, supervisors, line managers and directors. Each respondent has a role to play in ensuring a positive safety culture within the organisation.

A self-administered questionnaire was used to collect the data. The questionnaire was pre-tested among 10 employees in the same organisation to test the validity of the questionnaire. The questionnaire consisted of 36 closed-ended questions. The first section of the questionnaire was designed to assess to what extent the working non-human factors (work environment, work design) affect employee participation in ImproChem SHEQ programmes. The second section was designed to test employees' level of understanding of ImproChem's SHEQ requirements and to assess their level of compliance with the SHEQ requirements. To assess employees' level of commitment and attitude towards ImproChem's safety improvements, questions on aspects such as using a questioning attitude when doing day-to-day tasks were asked. Management's level of support was identified as the most important factor to improve safety within any organisation, and therefore questions to understand the level of support offered by management were asked. To gain insights into different ImproChem organisational safety cultures, questions on how the overall organisation feels about hiding safety errors were asked. Regarding the improvement of ImproChem's safety, employees were asked two open-ended questions on what safety-improvement strategies are already in place and which safety-improvement strategies can be employed to improve safety at ImproChem. All the statement were five-points likert type scales where answers ranging from complete disagreement to complete agreement. The questionnaire was sent out on 21 May 2015 and the respondents were given three weeks to respond. A weekly reminder was sent to encourage the respondents to complete the survey.

The data were imported from QuestionPro to the SPSS program to complete the data analysis. Descriptive summary measures such as median was used since the data were not normally distributed. Kruskal Wallis test and Wilcoxon rank-sum W-test (Mann- Whitney U-test) were used to compare the median for three or more groups and between two groups. P-value <0.05 was considered statistically significant.

Results
A total of 395 questionnaires were distributed, but only 124 respondents completed the self-administered questionnaire. The response rate was therefore 31%. The respondents' socio-demographic variables are summarised in Table 1. It was found that about two-thirds (64%) of the respondents were male, more than two-thirds of the respondents (68%) fell within the 25–44year age group, and the Energy division had the most responses (41%), followed by the Marketing/Human Capital/ Finance (MHCF) department (18%) and the Production department (16%).

Table 1: Distribution of socio-demographic information (n=124)

Variables	Frequency	Percent
Gender		
Male	79	64
Female	45	36
Age group		
18-24 years	5	4
25-34 years	45	36
35-44 years	40	32
45-54 years	20	16
55-64 years	14	11
Departments		
Energy	33	41
Marketing/Human/Capital/Finance	15	18
Production	13	16
Other	7	9
SHEQ	5	6
Technical	4	5
Logistic	3	4
Human Capital	1	1

Based on Table 2, it is evident from the medians that in four of the five statements 50% or more of the respondents felt that non-human factors were always on par, and it can be inferred that they feel these had minimal influence on carrying out their jobs safely and contributed minimally towards the number of accidents. Only on the statement "My job often leaves me with little time to think about safety" did 50% or more of the respondents reply that their job never leaves them with little time to think about safety. A more detailed discussion of the statements is given in the following paragraphs.

To test the significance between ImproChem departments, the Kruskal-Walls test was applied. As shown in Table 4.3, the null hypothesis is accepted on all counts, as in each statement the p-value is greater than 0.05 (i.e. significance is when $p < 0.05$). The researcher therefore concluded that the distribution of responses across departments for statements on the extent to which non-human factors contributed to the number of accidents is similar at the 95% confidence level.

Table 2: The extent to which non-human factors influence employee safety performance

Statement	Median	p-value* (Department)	p-value* (Age)	p-value+ (Gender)
1a. My job often leaves me with little time to think about safety	1	0.6324	0.1928	0.2416
1b. I use tools that are in good condition	5	0.0992	0.2372	0.1576
1c. Safe working procedures are readily available for each task and machinery I use	5	0,0738	0.3088	0.3268
1d. I use machinery that is in good condition	5	0.1475	0.1201	0.3617
1e. Emergency procedures are readily available in case job-related conditions change	5	0.3697	0.2497	0.3642

*Kruskal Wallis test; +Mann-Whitney U-test

Table 3 shows the central tendency statistics and significance tests relating to the construct evaluating employees' level of understanding of ImproChem's SHEQ requirements. Based on the median responses to the above statements, it can be said that 50% or more respondents agreed to three of the four statements. On the statement "I know what to do in case of an emergency", 50% or more respondents strongly agreed. The most frequently selected response to the first three statements was "agree", while "strongly agree" was the most frequently selected response to the last statement: "I know what to do in case of an emergency".

Using the Kruskal-Wallis test to detect any significant differences between the distribution of responses between the different departments, it was found that there were no statistically significant differences between departments at the 95% confidence level. Based on Table 4, for all the statements, the median indicates that

Table 3: Employees' level of understanding of ImproChem's SHEQ requirements

Statement	Median	p-value* (Department)	p-value* (Age)	p-value+ (Gender)
2a. I am fully aware of all ImproChem SHEQ programmes	4	0.1049	0.5349	0.9348
2b. I have received adequate ImproChem SHE training	4	0.1984	0.3580	0.4055
2c. I follow safe working procedures when performing my tasks	4	0.8722	0.6616	0.9454
2d. I know what to do in case of an emergency	5	0.7471	0.6870	0.4348

*Kruskal Wallis test; +Mann-Whitney U-test

50% or more respondents selected "always" as a response. No statistically significant differences were detected when comparing the distribution of responses by department for six of the seven statements constituting this construct. Statement 3a (EMPRO's Hazard Assessment Tool booklet) and statement 3e (Site risk assessments) were the only two statements with statistically significant differences across departments at the 5% level of significance. The result showed that the median scores were not similar between male and female for statements 3a, 3c, and 3f. It can therefore be concluded that differences were detected in the distribution of responses in at least one department for this particular statement at the 5% level of significance. As tabulated in Table 5, more than

Table 4: Employee level of compliance with ImproChem SHEQ requirements

Statement	Median	p-value* (Department)	p-value* (Age)	p-value+ (Gender)
3a. Hazard Assessment Tool (HAT) booklet	4	0.0454	0.8156	0.0358
3b. PPE register	4	0.0955	0.9118	0.1014
3c. Safety data sheet letter of acceptance (LOA)	4	0.1029	0.4398	0.0107
3d. EMPRO's documented emergency plan at customer sites	4	0.1667	0.6046	0.0206
3e. Site risk assessments (SRAs)	4	0.0403	0.6400	0.0461
3f. Driver checklist	4	0.0901	0.6533	0.0157
3g. Medical assessments	4	0.3324	0.8823	0.6979

*Kruskal Wallis test; +Mann-Whitney U-test

half of the respondents indicated that they often take ownership of ImproChem's SHEQ improvement plan in three of the eight statements comprising this construct (viz. 4b, 4d and 4e) as per their medians. The median responses also indicate that for five statements (4a, 4c, and 4f–4 h), 50% or more respondents indicated that they always take ownership with respect to these statements. The

most frequently selected response as per the mode for each statement mirrors that of the median responses in all but one statement (4e). According to the mode for statement 4e, the respondents most often indicated that they always discuss safe practices for a job, along with associated hazards, with their team. The result showed that the median scores were not similar between male and female for statements 4d, 4e and 4g.

In the testing for difference in the distribution of responses between the 11 departments, no statistically significant differences were found in seven of the eight statements tabulated above. The only statement that showed significant differences was statement 4g: "I am my brother's keeper". It can therefore be concluded that statically significant differences exist in at least one of the departments in the distribution of responses to the statement "I am my brother's keeper" at the 95% confidence level.

Table 5: The extent to which employees take ownership of the ImproChem SHEQ improvement plan

Statement	Median	p-value* (Department)	p-value* (Age)	p-value+ (Gender)
4a. I take immediate corrective action when I observe an unsafe act	5	0.4319	0.4782	0.0541
4b. I routinely review job procedures to make sure they are understood and followed	4	0.0728	0.7070	0.0890
4c. I use judgement and stay alert for underlying causes of unsafe acts and unsafe conditions	5	0.1408	0.7668	0.1926
4d. I use a questioning attitude on the job, asking myself what injuries could occur if the unforeseen happens	4	0.1870	0.8107	0.0269
4e. My team and I discuss safe practices required for the job and the associated hazards	4	0.1954	0.2780	0.0037
4f. I use all my senses (total observation) of the surrounding area when performing my job	5	0.1965	0.6231	0.1975
4g. I am my brother's keeper	5	0.0034	0.5350	0.0220
4h. I reinforce safe work practices	5	0.4162	0.2522	0.1045

Based on Table 6, "always" was the most frequently selected response to all five statements comprising this construct, as per their modes. The medians indicate that 50% or more respondents felt that management always supports initiatives that ensure safe working conditions for four of the five tabulated statements. Statement 5d, "Remove barriers to safe working conditions", was split between 50% or more respondents feeling that management either always or often supports the removal of barriers to safe working conditions. There were also no statistically significant differences observed between the distributions of responses between departments at the 5% level of significance.

Table 6: Management's level of support in ensuring a safe working environment

Statement	Median	p-value* (Department)	p-value* (Age)	p-value+ (Gender)
5a. Value employee safety above all priorities	5	0.8196	0.2461	0.1905
5b. Believe we can achieve AECI goal of "No harm to anyone ever"	5	0.5912	0.0925	0.9759
5c. Respond timely to our safety concerns	5	0.8995	0.3993	0.4737
5d. Remove barriers to safe work environment	4,5	0.9489	0.1475	0.9006
5e. Reward safety performance	3	0.2745	0.1603	0.9958

*Kruskal Wallis test; +Mann-Whitney U-test

Table 7 shows that respondents most often agreed to statements 6a, 6c and 6d. They also most often strongly agreed to statement 6e i.e. that "No job is urgent to the extent of compromising my own safety". However, they strongly disagreed with statement 6b, indicating that they believe that there is no gain at all to be derived from covering up SHE errors. The median scores indicate that 50% or more respondents agreed to statements 6a, 6d and 6e. However, 50% or more disagreed about advantages being derived from covering up SHE errors. At least 50% of the respondents remained neutral to statement 6c, "People are recognised for their safety performance". The result showed that the median scores for statement 6c is significantly different among different departments (p = 0.0056). Statistically significant differences between the distribution of department responses were detected only for statement 6c at the 5% level of significance. This indicates that differences existed in at least one of the departments' responses to the statement "People are recognised for their safety performance". The respondents were asked to indicate which safety mechanisms are

Table 7: Influence of organisational culture on employee participation in ImproChem safety measures

Statement	Median	p-value* (Department)	p-value* (Age)	p-value+ (Gender)
6a. People in the organisation are often afraid of making SHE-related errors	4	0.6613	0.8773	0.3332
6b. There are advantages to covering up SHE errors	2	0.5679	0.2315	0.2487
6c. People are recognised for their safety performance	3	0.0056	0.5380	0.5396
6d. People are encouraged to express their ideas and opinions about safety	4	0.0705	0.1747	0.4886
6e. Our motto is "No job is urgent to the extent of compromising my own personal safety"	4	0.5918	0.6387	0.1660

*Kruskal Wallis test; +Mann-Whitney U-test

in place to improve safety performance. As far as mechanisms that are in place to ensure that safety performance is improved, most often the respondents indicated that shared learning from "accident investigations", "near-miss reporting" and "incident reports" was in place. Their responses are summarised in Table 8.

Table 8: Mechanisms in place to improve safety performance at ImproChem (Multiple answers)

Mechanism	Frequency	Percentage
7a. Collaborative safety – peer-to-peer interventions	73	59
7b. Compliance with regulatory requirements	101	81
7c. Near-miss reporting and sharing the learning	106	85
7d. Accident investigation and sharing the learning	108	87
7e. Meaningful safety performance recognition	68	55
7f. Incident reports and sharing the learning	106	85

The respondents were asked to recommend ways to improve safety performance. The most prominent suggestions were that "Leadership at all levels should drive the change in safety culture" (72%) and that a "No name, no blame culture" (71%) should be adopted (Table 9).

Table 9: Suggested mechanisms that could be added to improve safety performance

Suggested mechanisms	Frequency	Percentage
Toolbox talks discussion (employees to also conduct some sessions)	66	53
Safety performance reviews	69	56
Enhancing employee involvement and participation in proactive initiatives	78	63
Leadership at all levels driving the change in safety culture (leadership safety)	89	72
Behavioural-based safety – peer to peer (No name, no blame culture)	88	71
Other	12	10

Discussion

The study was intended to evaluate safety performance at ImproChem across different departments and to recommend safety improvements that can be implemented to achieve the AECI goal of "No harm to anyone ever". The present study found that more respondents felt that safe working procedures are often available rather than being always available for the employees to carry out their tasks in a safe manner, and also indicated that there were times where the emergency procedures are not available. The study found that workplace design and lack of procedures contribute to accidents in the workplace [18]. The safe working procedures can be updated at varying frequencies to ensure it is relevant to that particular task. Over and above this requirement, the procedures should be administered in the language the employee can easily understand.

Sufficient training is the main driver to reduce incidents by empowering employees with the necessary art and science of hazard recognition and elimination. It is important to thoroughly train the employees so they can perform their tasks safely and are encouraged to participate in all SHE initiatives. Health and safety legislative organisations emphasise fundamental safety practices, which include safety training. The safety training is aimed at increasing employee knowledge and understanding of ImproChem SHEQ requirements and standards. Among the respondents, very few (3.2%) indicated they were unaware of some of the ImproChem safety improvement programmes, while 7% indicated that they have not received adequate safety training. On-the-job training can assist in increasing the employee safety confidence level in the field. A study concluded that emphasise providing employees with the training specific to the job they do [18]. Another study reported that safety training indicates employee perception with regard to the training programmes developed by their organisation [19]. The quality of training can positively influence employee participation in workplace programmes to improve safety.

One in every seven respondents indicated there are no rewards associated with achieving a good safety record, while other respondents indicated that it is rare for management to reward safety performance. There is no clear individual safety goals linked to performance incentives. Safety recognition can be done in different ways, rather than providing momentary incentives. Researcher points out that safety behaviour promotion reflects employees' perception about the type of rewards gained for safety behaviour and the importance of rules and procedures fulfilment [20]. This indicates that the rewarding of safety performance can improve safety

within the organisation and can motivate employees to improve organisational safety. Providing positive feedback to employees with regard to their safety performance is a powerful tool to improve safety performance. According to the four safety cultures proposed by the competing values framework leadership should motivate employees to achieve safety excellence [21].

The present study found that there are dissimilarities in ImproChem's safety culture among the departments. The nature of the business makes it a challenge for the safety department to clearly communicate and track safety performance throughout all the departments. Researchers found significant differences in safety cultures between different plants of similar organisations [5, 22]. In these studies, the employee levels of satisfaction and autonomy was also found to be different, which were then linked to each department's safety performance. Department structures were also examined, and the findings indicated that some of the departments had centralised decision-making processes and closed communication [22].

Conclusion and Recommendation
It is important to create a culture in which employees take ownership of their own safety and the safety of their fellow employees. This study adds knowledge to the body of literature on employee wellness programmes, and in particular to chemical industry in Africa. There is very limited study done in this area. Therefore, this study adds to the scholarly evidence in this area, particularly in the South African context.

Synergy in safety culture needs to exist, where the SHEQ department can clearly communicate SHE goals and track safety performance. Every employee should have clearly defined safety key performance indicators to which safety performance incentives can be linked. Employees should have influence on the designing of safe work procedures and programmes and safety-management system practices by being actively involved in facilitating safe behaviours and attitudes. Direct involvement in the development of safe working procedures will increase motivation levels and employees can take ownership of safety, adopt safe working practices and encourage other employees as well. ImproChem should implement similar safety-management systems and one culture throughout the organisation. Safety-management systems should be the uniform – a system whereby the SHEQ department is able to communicate the safety goals and track employee performance in line with the goals and objective should be developed.

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