

Health and Safety Performance in the Construction Industry in Rwanda

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Abstract: *The construction industry is an important part of the economy in many countries, and an important driver of economic growth especially in developing countries. Despite its importance, construction works are considered risky with frequent incidents of accidents and ill-health problems to workers, practitioners and end users. Health and safety issues have always been a major problem and concern in the construction industry. Workers are exposed to hazards of occupational diseases, injuries and adverse effects of excessively long working hours. This article is informed by Rwanda's Profile on OSH study conducted by the Ministry of Public Service and Labour in 2012, which revealed numerical increase of occupational injuries over the years: 35 (2007), 82 (2008), 93 (2009), 112 (2010), 118 (2011) and 138 (2012). The paper sought to investigate the phenomena of health and safety performance in the construction industry in Rwanda. It reflects particularly to the knowledge level among construction workers on health and safety practices and skills on construction projects in Rwanda; the sources and types of hazards and accidents encountered on construction projects in Rwanda; the level of implementation of health and safety management systems on construction projects in Rwanda; and the factors necessary to improve health and safety on construction projects in Rwanda. To achieve this, an overview of published materials was undertaken. Questionnaires were distributed to construction workers, Observations on safety practices were noted and interviews were conducted with officials at Ministry of Public Service and Labour. Out of a sample of 264, 186 were returned constituting a response rate of 70.45%.*

Key words: *Health, Safety, Occupational ill-health, Risk and hazards, Risk management, Accidents.*

I. INTRODUCTION

The construction industry contributes to 11% of gross domestic products (GDP) in most developing countries, [1]. Despite its importance, however, construction industry is considered as being risky with frequent and high accidents rate and ill-health problems to workers, practitioners and end user, [2]. Globally, poor performance in the industry accounts for more than 100,000 fatalities annually, equating to approximately 30-40% of the world's work related fatal injuries, [3]. Most construction activities involve inherently health and safety risks such as working at height, working underground, working in confined spaces and close proximity to falling materials, handling load manually, handling hazardous substances, noises, dusts, using plant and equipment, fire, exposure to live cables, poor housekeeping and ergonomics, [4].

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The industry alone produces 30 % of all fatal industrial accidents across the European Union (EU), yet it employs only 10 % of the working population; in the United States (US) it accounts for 20 % of all fatal accidents and only 5 % of the employed. In Japan, construction accidents account for 30 % to 40 % of the overall total of industrial accidents, with the totals being 50 % in Ireland and 25 % in the United Kingdom, [5]. The numbers of fatalities within the industry are only the tip of the iceberg, with thousands of major injuries, and even more minor ones, resulting in lost time. Advancement in social sciences has been identified as having promoted a greater awareness of the sanctity of life and the unacceptability of premature death due to work-related accidents, [6]. The injury data discussed above highlights that the high number of construction site accidents is a universal problem of much concern, [6]. The construction industry has therefore earned the reputation of being a dangerous or highly hazardous industry because of the disproportionately high incidence of accidents and fatalities that occur on construction sites around the world, [7]. Quality and safety are key issues in the present construction industry. Besides, a safe work environment is very necessary to erase the high risk image that is closely associated with the construction industry, [8]. Often projects are becoming more complex, and safety has become the main focus in ensuring the safety of the construction personnel and properties. Developed countries such as the UK and Australia have enforced safety rules in contractors' works on site, [8].

II. BACKGROUND

Internationally, construction workers are two to three times more likely to die on the job than workers in other industries while the risk of serious injury is almost three times higher, [2]. The construction sectors of developing countries are typically dominated by contractors who can be classified as small and medium sized enterprises (SMEs) which operate mainly within domestic markets. These contractors give little attention to H&S issues, which results in a significant number of accidents and health problems, [3]. In Rwanda, the Country Profile on OSH conducted by the Ministry of Public Service and Labour in 2012 revealed that the number of occupational injuries increased numerically in six years as follows: 35 (2007), 82 (2008), 93 (2009), 112 (2010), 118 (2011) and 138 (2012) (Labour, 2012). The number of occupational fatalities also kept on increasing: 41 (2007), 84 (2008), 114 (2009), 194 (2010), 264 (2011) and 263 (2012). OSH Country Profile also revealed that the amount of money (Rwf) spent on Occupational Hazards in last seven years was 175,581,001 (2003), 182,985,999 (2004), 182,932,862 (2005), 162,567,520 (2006), 215,999,138 (2007), 232,185,746 (2008) and 247,938,542 (2009-2010), [9].



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Yet, it is crucial that such information is availed, as accident statistics, albeit bluntly, are the best method of communicating the importance of H&S. Accident statistics will allow for informed H&S management practices to be developed, preventing accident frequencies from escalating as the country makes significant advancements towards industrialization, [10]. Construction sites in Rwanda have been ranked as the second most dangerous place in which to work after mines and quarries, [9]. The OSH profile conducted in 2012 revealed workers' exposure to Occupational Hazards by economic sectors as follows: Mining and Quarrying with 34%; Construction with 18%; Agriculture, Hunting, fishing with 13.8% and Transport, Warehousing and Communication with 13%. Moreover, deaths, permanent disabilities and several injuries have been on the increase for building workers through major accidents and poor working conditions, [9]. The existing regulatory and compliance mechanism are not so stringent. This is because there is no specific authority to disseminate OHS information to the construction industry, address the OHS requirements specific to the industry and as such, there are no penalties for non-compliance. The OHS regulations in the construction industry are not evolved, not detailed out and not complied with through monitoring systems and audits. As such, companies tend to take advantage of this and compromise on the Health and Safety performance during the execution of their operations. Local governments responsible for the site inspection have also been negligent in supervising the many mushrooming projects in their areas of operation, leading to the defects in construction which could have been avoided and these defects lead to deaths of workers. The department of Occupational Safety and Health under Ministry of Labour and Public Service which is responsible for the well-being of employees at workplaces is unable to inspect every building/road under construction in the country. This is owed to lack of enough labour inspectors to cover every project, and as such, employers tend to compromise on the safety and health standards on most construction projects. Most construction companies also do not recognize Health and Safety as a strategic enabler of sustained economic growth and hence performance is not measured with respect to Occupational Health and Safety. As a result, there is no incentive for stakeholders to improve on OHS performance since they view investing in OHS as a luxury, coming at a cost and one of the things only required for compliance. The end result is not providing adequate education and trainings to their employees as far as their health and safety are concerned during the operations' execution. Several companies have a huge working population with low literacy rates and an abysmal awareness of occupational health hazards in the industry. Workers are not assigned duties in relation to their physical, mental health and skills and this renders them prone to accidents. Such uneducated and untrained employees are not committed to the idea of safety and fail to cooperate with safety initiatives, hence making safety measures become ineffective. To compound this problem is an attitude of acceptance of injuries and accidents as a part of life. Lack of provision of Personal Protective Equipment (PPE) is evident on several construction sites. Employee sensitization to the importance of PPE as a means of first line of defense is still a big challenge. Employees have different needs, and it is imperative that the equipment properly fits to adequately protect employees. Finding

quality protective equipment at affordable price presents a challenge for safety departments in most construction firms. It is important to know what safety equipment is required, for what task, be able to provide and enforce the use of it, and know the inspection, maintenance and history of the equipment. This article focuses on identifying several risks, hazards and accidents being encountered on construction sites; and the health and safety management practices in place to curb these risks. It also assisted in identifying the challenges and constraints limiting the capacity of some construction companies in Rwanda to manage their operations in a safe and healthy manner thereby producing a best practice guide for health and safety within the construction industry in Rwanda.

III. ACCIDENTS IN CONSTRUCTION INDUSTRY

There are at least 60,000 fatal accidents on construction sites annually around the world, the fatal injury rate for the construction industry is higher than national average among industries worldwide, [11]. There is a demonstrated substantial lack of awareness or importance for safety at all levels of the construction industry. In addition, various safety measures have been assessed. Accidents prevention has become increasingly important aspect which could be a major cause of concern in the construction industry. Therefore any effort to identify and explore possible ways of preventing and controlling accidents should be sought after, [11]. The multiple accidents causation theory postulates that there are many contributory causes leading to an accident. The causes are categorized into behavioral and environmental factors, [12]. Various researchers have divided health and safety hazards into two categories, namely the physical injury hazards and the ill-health hazards. Hazard of physical injury include death consequences. Hazard of ill-health can only be notified after a long period and shall cause sickness or death after a certain period of time, [12]. The common hazards on construction sites irrespective of the physical injury or ill-health problems include Manual Handling; Noise; Electricity; Equipment, Machinery, Tools and Transport; Height; Slips and Trips; Chemicals Substances; Dust, Human Error; and Aggression, Violence and Bullying

IV. OCCUPATIONAL SAFETY AND HEALTH IN RWANDA

Despite various efforts of the Government of Rwanda of assuring safe workplaces for workers through laws and different programs, the phenomenon of OSH persists and has been increasing considerably. Occupational accidents and diseases impose an enormous cost to Rwanda and are among hindrances of development with this regard, Rwanda has taken different measures to attacking these challenges, [9]. Rwanda last conducted a survey on OSH National Profile in 2012 to come up with an image of OSH in the Country. ILO C187 - Promotional Framework for Occupational Safety and Health Convention, 2006 (No. 187) highlights the key elements that should constitute a National Occupational Safety and Health System.



For Occupational hazards, OSH Country Profile revealed that ergonomic lighting, ergonomic ventilation, physical thermal and chemical petrochemicals were very low and ergonomic length of work hours was moderate in the Organizations, [9]. OSH Country Profile also revealed that the highest level of awareness on OSH was in Government Institutions with 18.9% and the lowest level was in Transport sector with 0%; the highest level of existence of fire extinguishers was in Government Institutions with 18.9% and the lowest level was in Mining and Quarrying sector with 0%; the highest level of training on fire was in Manufacturing sector with 9.77% and the lowest level was in Mining, Construction and Transport, [9]. Therefore, to address these challenges, the Government has committed to continuing put in place Policy mechanisms with strategies aiming at promotion of OSH at workplace. Though OSH is still new in the Country and still facing the increment of Occupational hazards and injuries, there have been significant achievements by the Government of Rwanda in this regard, [9]. Different Legislations such as Ministerial Order No. 01 of 17/05/2012 determining the modalities of establishing and functioning of Occupational Safety and Health committees and Ministerial Order No. 02 of 17/05/2012 determining conditions for Occupational Safety and Health have been put in place. Rwanda has also developed OSH Country Profile in 2012 to come up with the general picture of OSH in the Country, [9]. In order to provide a solution to OSH related problems, the Government is committed to have a tripartite National Policy on OSH which will be implemented by the following strategies: To strengthen the coordination and synergy among stakeholders; harmonize laws and regulations, standards & guidelines on OSH; improve OSH inspection; introduce Preventive Workplace Culture; maintain and enhance OSH competence; and establish and implement the integrated OSH information system, [9].

V. RESEARCH METHODOLOGY

A cross sectional research design was used to gather data from a cross section of the respondents in order to answer the research questions, [13]. The study was descriptive since it was undertaken in order to ascertain and be able to describe the characteristics of the variables, [14]. A systematic description that is as factual and accurate as possible was ensured, [13]. The design enabled the researcher to meet the purpose, objectives, and also answered questions of the study. The study targeted government authority in charge of health and safety and employees on construction projects at Horizon Construction Limited. Created in 2007, Horizon Construction Ltd is the first local construction company to build asphalt roads in Rwanda.

Table 1: Sample size Determination:

Category of respondents	Population	Sample size	Percentage of total sample taken	Sampling Technique
Project Managers	22	7	2.65%	Purposive
Supervisors	132	41	15.53%	Purposive
Frontline staff	696	216	81.82%	Simple Random
Total	850	264	100%	

Source: Field Survey 2019

Face-to-face interviews were conducted with Occupation Health and Safety Authority (OSHA) in a bid to generate detailed in depth information. Interviews sought to establish how health and safety standards are facilitated and enforced at construction sites. Data was systematically organized in a manner that facilitates analysis. Data collected through questionnaires (quantitative) was coded with each code representing a response category for each item in the questionnaire. The analysis of descriptive statistics was presented in form of frequencies, percentages and mean. Inferential statistics were determined using Spearman rank order correlation and coefficient of determination. The correlation coefficient (r) was used to determine the strength and direction of the relationship between variables (Amin, 2005).

VI. RESEARCH RESULTS AND FINDINGS

Out of the 264 questionnaires distributed, 186 were returned constituting a response rate of 70.45%. The study variables were measured using a 5-point likert scale where 5 = Strongly agree, 4= Agree, 3= Undecided, 2= Disagree, 1= Strongly disagree.

A. Knowledge levels among construction workers on health and safety practices and skills on construction projects in Rwanda.

The knowledge levels among construction workers on the health and safety practices and skills on the construction projects was found to be good at 86.50%. The assessment was done on the common health and safety issues on the construction sites. The mean score (3.92) indicted that there was a moderate level of health and safety knowledge amongst the construction.

Table 2: Knowledge levels about health and safety

	Much	Nothing	Little	Mean	Std. Deviation
Knowledge levels about health and safety	161 (86.50%)	4 (2.45%)	21 (11.04%)	3.92	0.95

Source: Field Survey 2019

It was instructive to note that majority of the respondents 151(62.9%) got information about Occupational Health and Safety from personal experience. 106 (49.2%) were informed through short training courses; 101 (33.8%) from the organization through handbook/manual and health workers;83 (30.0%) from co-workers; and 73 (25.1%) from Supervisors.

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Table 3: Source of information about health and safety

Source of Information	Frequency n = 186 (%)
Organization	101 (33.8)
Short Training	106 (49.2)
Co- Workers	83 (30.0)
My Supervisor	73 (25.1)
Personal Experience	151 (62.9)

Source: Field Survey 2019

The correlation between knowledge levels amongst construction workers and health and safety performance in the construction industry was ascertained. The strength and direction of the assumed relationship between knowledge levels and health and safety performance in the construction industry in Rwanda was also determined.

Table 4: Relationship between Knowledge Levels and Health and Safety Performance

	Knowledge Levels	Health and Safety Performance
Knowledge Levels	Pearson Correlation	.648
	Sig. (2-tailed)	.005
	N	186
Health and Safety Performance	Pearson Correlation	.648
	Sig. (2-tailed)	.005
	N	186

Correlation is significant at the 0.01 level (2-tailed)

Source: Field Survey, 2019

A positive relationship between knowledge levels and health and safety performance ($r = .648$) was recorded. This relationship is statistically significant ($\text{Sig.} = 0.005$) at 0.01 level of significance. The results show how the knowledge about health and safety is important in improving the health and safety performance in the construction industry in Rwanda.

B. Sources and types of hazards and accidents encountered on construction projects

Table 5: Type of accidents encountered

Type of accident	Always	Sometimes	Never	Mean	Std. Deviation
Slip and fall injuries	181(97.56)	2(0.81)	3(1.63)	4.64	0.58
Chemical, Fire, heat or electrical burns	175(94.31)	2(1.22)	8(4.07)	4.44	0.74
Scaffold or ladder failures	176(94.72)	4(2.03)	6(3.25)	4.17	0.75
Crushing or amputation injuries	175(94.31)	6(3.25)	5(2.44)	4.44	0.74
Nail injuries	181(97.56)	3(1.63)	2(0.81)	4.64	0.58
Trench cave ins or excavation accidents	177(95.12)	2(0.81)	8(4.07)	3.88	0.99
Crane accidents	176(94.72)	4(2.03)	6(3.25)	4.17	0.75
Eye injuries	178(95.93)	4(2.03)	4(2.03)	2.87	1.19
Electrocution	171(91.87)	6(3.25)	9(4.88)	4.32	0.9
Poisoning due to toxic inhalation	169(90.65)	4(2.03)	14(7.32)	4.17	0.87
Falling debris	180(96.75)	2(1.22)	4(2.03)	4.15	0.89
Anchor bold failures	172(92.68)	5(2.85)	8(4.47)	3.59	0.8
Ceiling, wall or roof failures	174(93.50)	3(1.63)	9(4.88)	4.04	0.85

Source: Field Survey 2019

Results indicate that slips and fall injuries, nail injuries, eye injuries, failing debris and crushing or amputation injuries are the most common types of injuries associated with construction projects in Rwanda.

C. Causes of accidents at the construction sites.

All the factors having a mean rating above 2.5 are considered to be significant. The most significant factors that cause accidents on the construction projects are long hours of work, sophisticated machines and plant, adherence to traditional methods of working, unregulated practices on construction sites, practices of competitive tendering, weak regulatory body, working at heights, confined spaces and underground, handling loads manually, extreme weather conditions, lack of safety gear, low literacy levels and corruption.

Table 6: Type of accidents encountered

Causes of accidents	Agreed	Undecided	Disagree	Mean	Std. Deviation
Long hours of work	162(86.99)	16(8.54)	8(4.47)	4.704	0.465
Sophisticated machines and plant	163(87.40)	4(2.03)	20(10.57)	4.556	0.506
Adherence to traditional methods of working	145(78.05)	20(10.57)	21(11.38)	3.963	0.854
Unregulated practices on construction sites	155(83.33)	16(8.54)	15(8.133)	3.741	0.656
Practices of competitive tendering	141(76.02)	26(13.82)	19(10.16)	3.556	0.506
Weak regulatory body	170(91.46)	5(2.44)	11(6.10)	3.556	0.801
Working at heights, confined spaces and underground	163(87.40)	9(4.88)	14(7.72)	3.444	0.577
Handling loads manually	170(91.46)	7(3.66)	9(4.88)	3.296	0.465
Extreme weather conditions	165(88.62)	8(4.47)	13(6.911)	3.16	0.84
Lack of safety gear	156(83.74)	13(6.91)	17(9.355)	3.01	0.99
Low literacy levels	147(79.27)	16(8.54)	23(12.20)	2.446	0.554
Corruption	129(69.11)	40(21.54)	17(9.355)	2.074	0.675

Source: Field Survey 2019

D. Level of implementation of health and safety management systems on construction projects

The level of implementation of health and safety management systems on construction projects in Rwanda was carried out. All the implementation factors have a mean rating above 2.5 and therefore considered to be significant. The results indicate that the company has a formal health and safety training programme, a written health, safety and environmental policy; and there are site supervision personnel with basic knowledge on occupational safety requirements, often updates its health and safety policy, always keeps records of the accidents to the employees; and employees always receive compensation whenever there are accidents.



Table 7: Implementation of Health and Safety Management Systems

Implementation factors	Agreed	Not Sure	Disagreed	Mean	Std. Deviation
The company has a formal health and safety training programme.	172(92.28)	0(0.00)	4(2.03)	4.19	0.48
The company has a written health and safety policy.	172(92.68)	7(3.66)	6(3.25)	4.77	0.64
The company has a written environmental policy.	172(92.28)	7(3.66)	5(2.85)	4.9	0.65
There are site supervision personnel with basic knowledge on occupational safety requirements.	166(89.02)	10(5.22)	3(1.63)	4.89	0.64
The site has a safety officer or a written safety plan.	173(93.09)	6(3.22)	11(5.69)	3.82	0.89
How often does the company keep records of all the accidents to the employees?	176(94.72)	6(3.22)	5(2.44)	3.56	0.79
How often do you receive compensation when accidents occur?	8(4.07)	5(2.44)	10(5.28)	3.78	0.79

Source: Field Survey, 2019

E. Use of personal protective equipment (PPE)

The mean scores of six out of the thirteen factors are greater than 2.5 for the construction workers. This means that these are the six practices performed by construction workers and which conform to health and safety requirements. Hand gloves, safety nettings, helmets, high-visibility clothing, and safety boots, welding face shield and eye protection glasses and hearing protection are the most used personal protective equipment (PPE). The least used personal protective equipment are respiratory protection, safety belts, dusty surfaces sprinkled with water, overall protection suites, hoarding and overall protection suites.

Table 8: Use of PPE

Safety Gear	Every time	Sometimes	Never use	Mean	Std. Deviation
Helmets	172(92.28)	16(8.54)	30(16.26)	2.825	0.907
Hand gloves	181(97.15)	11(6.10)	17(8.94)	3.778	0.892
Safety Boots	175(93.90)	6(3.25)	20(10.98)	2.704	1.382
Respiratory protection	174(93.50)	9(4.88)	18(9.76)	1.044	0.506
Hearing protection	166(89.43)	14(7.32)	33(17.89)	2.585	0.920
Welding face shield and eye protection glasses	173(93.09)	13(6.91)	26(13.82)	2.651	0.492
Overall protection suites	175(94.31)	11(6.10)	22(11.79)	2.446	0.554
Safety belts	177(95.12)	8(4.07)	17(8.94)	1.423	0.530
Safety Nettings	166(89.02)	12(6.50)	33(17.48)	2.844	0.506
High-visibility clothing	168(90.24)	10(5.28)	28(15.04)	2.711	0.700
Overall protection suites	178(95.53)	8(4.07)	20(10.57)	2.077	0.675
Dusty surfaces sprinkled with water	170(91.46)	15(8.13)	31(16.67)	2.037	0.649
Hoarding	166(89.43)	1(0.41)	19(10.16)	2.148	0.907

Source: Field Survey, 2019

F. Factors necessary to improve health and safety on construction project

Table 9: Factors necessary to improve Health and Safety

Health and safety Management	Important	Fairly Important	Not Important	Mean	Std. Deviation
Strict regulations	180(96.75)	3(1.63)	3(1.63)	4.209	0.804
Strict inspection mechanisms	181(97.56)	2(0.81)	3(1.63)	4.185	0.736
Heavy Fines	180(96.75)	4(2.03)	2(1.22)	4.296	0.984
Management commitment	180(96.75)	11(5.69)	3(1.63)	4.111	0.7
Use of experienced workers	182(97.97)	2(1.22)	2(0.81)	4.222	0.81
Health and safety trainings to all workers	184(98.78)	1(0.41)	2(0.81)	4.16	0.601
Provision of safety gear	184(98.78)	2(0.81)	1(0.41)	4.148	0.907
Job safety analysis and daily toolbox talks	180(96.75)	0(0.00)	1(0.41)	4.00	0.345
Improved communication	180(96.75)	8(4.47)	2(1.22)	4.407	0.572
Reduced time exposure	180(96.75)	8(4.07)	0(0.00)	3.333	1.445
Improved monitoring and supervision	184(98.78)	2(0.81)	1(0.41)	4.312	0.688

Source: Field Survey, 2019

To improve health and guarantee safety standards, eleven factors necessary to improve health and safety on the various construction sites in Rwanda were evaluated. Table 9 above shows the mean scores, standard deviations and the percentage frequencies of the eleven factors. All the factors have mean ratings above 2.5 and therefore considered to be significant. The most significant factors to improve health and safety on the various construction sites include health and safety trainings to all workers; provision of safety gear; heavy fines; use of experienced workers; strict regulations; strict inspection mechanisms; improved communication; improved monitoring and supervision; management commitment; job safety analysis and daily toolbox talks; and reduced time exposure.

VII. CONCLUSION AND RECOMMENDATIONS

Health and safety performance and management in the construction industry in Rwanda is important on the construction projects to ensure that accidents and risks are minimized. To achieve this, it is recommended that; The most common causes of injuries are slips and tools and equipment’s respectively. Slips were found to occur more likely more than any other accidents. Majority of the accidents at construction sites were minor. Workers need to wear their personal protective equipment properly and as directed by their employer or comply by the person in control of the site. Contractors should make provision for safety and health when preparing bids. The provision for safety and health must be made competitive with the aim to compete with other bidders and to avoid a monetary loss.

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Costs for Personal Protective Equipment's measures should be explored and explicitly be part of tendering and costing for the project implementation.

Contractors should provide appropriate programmes that are consistent with national Laws and Regulations to ensure the health and safety of workers. This includes maintaining a workplace that has minimal risks and accidents that can result in injury or loss of life. They should also ensure that a competent person inspects the construction project site at suitable intervals to ensure safety guidelines are adhered to. Education campaigns need to be launched to arouse awareness among all management and construction workers. The Directorate of Occupational Health and Safety services should incorporate an information and education wing in which a data bank of educative materials on health and safety measures can be kept and practical methods of disseminating them to relevant parties developed. The Directorate of Occupational Health and Safety services must ensure that the construction sites are inspected regularly for health and safety as provided in OSHA. Contractors must make an assessment of the health and safety risks to which construction workers and others are exposed on construction projects. The significant findings must be noted where five or more workers are employed. Since managing health and safety is different from managing any other aspect in construction there need to do a risk assessment to find out about the risks, and to put sensible actions in place to control them, and make sure they stay controlled. Project supervisory staff should be sensitized with Occupational Health and Safety and should share that knowledge with the co-workers. The site supervisors should incorporate safety officers to make regulations, warning signs and other measures governing the construction sites. The regulations should apply to everyone on site and should be in writing and be brought to attention of all those who may be affected.

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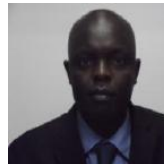
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