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Re-Engineering Technical Vocational Education And Training (TVET) Towards Safety Practice Skill Needs Of Sawmill Workers Against Workplace Hazards In Nigeria.

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Abstract
The study was carried out to identify safety practice skill needs of sawmill workers against workplace hazards in Nigeria. Survey research design was used for study. Three research questions and three null hypotheses guided the study. A structured questionnaire was used for data collection. The population of 96 comprised 54 sawmill workers and 42 woodwork teachers. The instrument was face validated by three experts in University of Nigeria, Nsukka. Cronbach Alpha was used to establish the reliability which yielded a reliability coefficient of 0.88. The data collected were analyzed using mean to answer the research questions and t-test to test the null hypotheses at 0.05 level of significance. It was found that all the safety practice skills identified are needed by the sawmill workers for effective and functional operations against workplace hazards. It was recommended that the safety practice skills identified be put to use by sawmill workers through enforcement by Forestry Services Department in Nigeria. The safety practice skills should be integrated into the curriculum of woodwork in Technical Colleges.
KEYWORDS: Safety, Skill, Sawmill, Workplace Hazards, Technical Vocational Education and Training (TVET), Re-engineering.

Introduction

Safety practice is a fundamental requirement of any job. Safety practices will make one live to work another day. Hence, safety is considered as a key factor to sawmill workers which when properly carried out would reduce incessant workplace accidents to the workers, prolong the service lives of machines, tools and equipment and drastically reduce wastages.

Safety

Safety according Ezeji and Onoh (2008) could be defined as planned measures or precautions that should be taken to control situations and acts in an endeavour to prevent injuries to the persons concerned, injuries to others who may be around the working place and damage to workshop equipment and materials. Oranu, Nwoke and Ogwo (2002) viewed safety as ability to perform every task involved in a job without causing injury to oneself, tools, equipment or materials used in performing the task. A task undertaken without necessary safety practice might result in an accident from which one never recovers, consequently safety which is freedom from danger is a prerequisite in sawmills.

Skill

Skill, according to Osuala (2006) is the ability to perform expertly, facilitate performance during employment. It is also the ability to do something well. Skill is observable competence to perform a learned behaviour regarding the relationship between mental activity and body movements (Miller and Rosenbaum, 2007). This implies that to possess a skill is to demonstrate that habit of acting, thinking and behaving in a specific activity in such a way that the process becomes natural to the individual through repetition or practice.

Safety practice skill as obtained in sawmill is a regular practice of safety skills in sawmill. According Hornby (2010), practice is referred to as doing an activity or training regularly so that one can improve one's skills. A skilled person in a job is an individual who has undergone some extensive training in such job and has thus mastered the activities that lead to successful performance in the job. Okorie (2001) stated that skill is manual

dexterity through repetitive performance of an operation. Skill can be acquired through experience and training. Safety practice skills are required by sawmill workers to perform well.

Sawmill

Sawmill is a place or building in which logs are sawed into planks, boards by machinery for shipping and eventual sale. Aina (2006) defined sawmilling as the process of converting log from the forests into lumber by using a variety of machines. Some of the machines include band saws capable of breaking down logs into desired specifications and re-sawing machines for processing the cants and flitches into specified and marketable dimensions.

Sawmill workers perform practical tasks of processing a log into timber in sawmill or timber yard. Prominent among these tasks are preparing log for processing like rolling log to sawmill deck, set up, operate and maintain various types of milling machines like band saw and circular saw. A sawmill worker can only perform effectively if safety practice skills against workplace hazards are exhibited.

Workplace Hazards

A workplace is any premises or place where an employee, contractor or self employed person works (Tasmanian, 2011). Hazard means anything that has the potential to harm the health or safety of a person or plant. A workplace hazard is anything that has the potential to cause harm to a person if left uncontrolled, which can result in an injury, illness or death. The common workplace hazards in sawmill are log handling hazards, machine related hazards, wood dust hazards, chemical hazards, electrical hazards, fire and explosion.

Log handling embraces the unloading of logs from vehicles coming from outside the plant, the stacking in a specific area of the yard set aside for the storage of timber and the subsequent rolling of logs to log deck or production unit. There are several hazards associated with log handling which include, logs stored in an unsafe manner could move or fall and crush workers among others. (US Occupational Safety and Health Administration [OSHA], 2013).

Machine-related hazards occur in the process of operating machine and equipment. This is as a result of faulty equipment and/or poor safety practices. This hazard could affect the operator, persons around and cause damage to machine and equipment (Giraud, 2009). These hazards include trapping within the carriage drive, contact with rotating cutter block, being drawn into and crushed at feed roller. The severity of the harm varies from injuries like scrape, bruise to serious injuries like severed limbs/fingers, amputation and in the worst cases unexpected death. (UK Health and Safety Executive [HSE], 2012).

Wood dust is described as any wood particle arising from the processing or handling of wood, such as cutting, sanding, or milling. Exposure to wood dust may cause health problems. Health effects associated with wood dust exposure include dermatitis and/or allergic respiratory problem, eye irritation, asthma, nasal dryness/obstruction and frequent headaches.(Thomas and Timothy, 2006 and International Labor Organization [ILO], 2011). Wood dust is also responsible for fire and explosions that occur in sawmills. Most workplaces are susceptible to the risk of fire which can be started by three elements - fuel (combustible dust), an ignition source (heat or a spark) and oxygen - a dust explosion can occur when confinement and dispersion are added to the three elements above. The event may be caused by accidental sparks of general electrical systems of the machine, cigarette butts still lit, non-observance of safety distances between storage areas and plants or presence of inflammable products such as preservatives, primers, paints and solvents or arson. A dust explosion can be catastrophic and cause employee deaths, injuries could be serious or very serious (burns), and destruction of entire workplace (building). (National Fire Protection Association [NFPA] 2006).

Other common workplace hazards in sawmill include electrical hazards since electricity is used to power most of the machines and equipment, workers may sustain injuries from shock burns, electrocution, fires, and explosions. (UK Health and Safety Executive [HSE], 2013). Chemical preservatives used to protect wood from insect and decay are toxic in order to be effective. Exposure to wood preservatives can occur in a variety of ways: during handling and mixing, the chemical effect vary from coughing, sore throat, dizziness, skin rashes, nose-bleeding, skin and eye burns, respiratory irritation to central nervous system disorder, and damage to the lungs, liver, and kidneys (Thomas and Timothy, (2006), All these among others make working in sawmill one of the most dangerous occupations. According to International Labour Organization (2011) sawmills and other lumber mills are extremely hazardous work environments due to the nature of the processes, which involve the movement and cutting of large and very heavy log of wood at relatively high speed. These call for re-engineering of Technical Vocational Education and Training towards safety skill needs of sawmill workers to prevent these avoidable hazards.

Technical Vocational Education and Training (TVET)

Technical Vocational Education and Training is the provision of skills, knowledge, attitude and values needed for a specific occupation. Technical Vocational Education and Training is meant to prepare

learners for careers based on manual and practical activities, understanding of laws of science and technology as applied to modern design and production (Osuala, 2006)

Re-engineering

Re-engineering is the application of technology and management sciences to the modification of the existing system, organization, processes and products in order to make them more effective, efficient and responsive (Ezeji and Onoh, 2008). There is the need for re-engineering technical vocational education and training (TVET) towards safety practice.

Problem

Safety practice skill needs of sawmill workers against workplace hazards cannot be overemphasized. A workplace is supposed to be safe for workers and people around, this is not the situation in South-west sawmills where safety practices are at lowest ebb. On approaching any sawmill in the zone, it is quite noticeable that the air around the mill is polluted with flying wood chips, dusty and dirty environment coupled with noisy machines. Sawmill workers neither put on personal protective devices nor engineering control using machine guards. There are incessant cases of report of accident, injuries of various degrees and in extreme cases untimely death. This has lead to dearth of sawmill workers in South-west zone.

Moreover, there are no laws in place to make the sawmill workers observe safety practices as practiced in the developed nations of the world nor enforcement of safety practices by the Forestry Department of the Ministry of Agriculture that oversees the operation of this sector. The problem therefore is to determine the safety practice skill needs of sawmill workers against workplace hazards in South-west Nigeria which will have a trickling down effect on other wood processing industries, including Technical Colleges that offer woodwork programmes.

Research Questions

The following research questions are formulated to guide the study

1. What are the safety practice skill needs in log handling?
2. What are the safety practice skill needs in machine-related hazards?
3. What are the safety practice skill needs in wood dust hazards?

Hypotheses

H_O1: There is no significant difference in the mean responses of sawmill workers and woodwork teachers on the safety practice skill needs in handling log.

H_O2: There is no significant difference in the mean responses of sawmill workers and woodwork teachers on the safety practice skill needs in machine related hazards.

H_O3: There is no significant difference in the mean responses of sawmill workers and woodwork teachers on the safety practice skill needs in wood dust hazard.

Methodology

Survey research design was adopted for the study. The design was considered adequate since the study will obtain data from sawmill workers and woodwork teachers of technical colleges in South-west Nigeria. this study was carried out in South-west Nigeria. This study was carried out in South-west zone of Nigeria, because of the high volume of sawmill operations that take place in the zone. South-west zone comprises Ogun, Ekiti, Lagos, Ondo, Osun and Oyo States. The population was 96. This comprised 54 sawmill workers and 42 woodwork teachers in technical colleges in the zone.

A structured questionnaire made up of 40 items was developed for collecting data in accordance with the research questions and hypotheses. The instrument is in the three sections A – C Section A was used for data on safety practice skill needs of sawmill workers in handling logs; B was for collecting data on safety practice skill needs of sawmill workers in using machines, and C on safety practice skill needs of sawmill workers against sawdust hazards. The response options for the questionnaire are Highly Needed (HN), Needed (N), slightly Needed (SN) and Not Needed (NN) with numerical values of 4,3,2, and 1 respectively.

The instrument was face validated by three experts from Department of Vocational Teacher Education, University of Nigeria, Nsukka. The questionnaire was tried out on 12 sawmill workers and 12 woodwork teachers in Edo State. The reliability of the instrument was established using Crombach Alpha. It yielded a coefficient value of 0.88. The data was collected by administering the questionnaire directly on the respondents by the researchers and six research assistants.

Method of Data Analysis

The data collected from the study were analyzed using mean for answering the research questions and t-test for testing the hypotheses at probability level of 0.05 and 94 degree of freedom (df). Any item with a mean value of 2.50 and above was regarded as needed while any item with mean value below 2.50 was regarded as not

needed. For the hypotheses, if the calculated value of t is less than table-t value, for an item, accept, otherwise reject, but if the calculated value of t is more than the table – t value, reject.

Results

Table 1: Mean and t-test Analysis of the Responses of Sawmill Workers and Woodwork Teachers on Safety Practice Skill Needs of Sawmill Workers in Log Handling

N1 = Sawmill workers 54
N2 = woodwork 42

S/N	Item Statements			Sawmill Worker		Woodwork Teachers			
		$\overline{X}_G$	Decision	$\overline{X}_1$	SD_1	$\overline{X}_2$	SD_2	t-cal	H_o
1.	Adequate safety practice skills training before embarking on any operation in sawmill.	3.59	HN	3.64	0.23	3.54	0.48	0.84	NS
2.	Access infeed and outfeed deck safely	3.58	HN	3.59	0.24	3.57	0.32	0.18	NS
3.	Minimal stack height of log.	3.29	N	3.19	0.74	3.38	0.79	-1.11	NS
4.	Assess employee's physical capacity before being assigned is job.	3.44	N	3.45	0.55	3.43	0.18	0.16	NS
5.	Work not alone in pond unless within constant visual or audible contact	3.57	HN	3.64	0.23	3.50	0.56	1.11	NS
6.	Adequate level of lighting to prevent workplace hazards.	3.65	HN	3.57	0.25	3.72	0.20	-1.52	NS
7.	Use personal protective equipment like steel capped boots and high visibility jackets.	3.38	N	3.38	0.67	3.37	0.50	0.01	NS
8.	Maintain a clean and tidy work area.	3.52	HN	3.50	0.26	3.54	0.25	-0.38	NS
9.	Place signage like 'log yard is restricted to authorized personnel'.	3.57	HN	3.59	0.24	3.54	0.41	0.43	NS
10.	Demarcate transport routes and control vehicles in log yard.	3.60	HN	3.52	0.26	3.69	0.24	-0.68	NS

T-table = 1.98: NS - Not significant

Note: $\overline{X}_G$ = Grand mean; $\overline{X}_1$ = Mean 1; $\overline{X}_2$ = Mean 2; SD_1 = Standard deviation1; SD_2 = Standard Deviation 2; HN = Highly Needed; N = Needed; t-cal = t calculated **H_o =** Null Hypothesis

Data presented in Table 1 show that the 10 safety practice skills with grand mean values from 3.29 - 3.60 are needed by sawmill workers in log handling. This reveals that all the 10 safety practice skills items are required by sawmill workers for log handling. Table 1 also shows that all the 10 safety practice skills items had their t-cal values less than that of the t-table of 1.98. This indicated there was no significant difference between the mean responses of the two groups of respondents. With this result, the null hypothesis H_o of no significant difference is upheld.

Table 2: Mean and t-test Analysis of the Responses of Sawmill Workers and Woodwork Teachers on Safety Practice Skill Needs of Sawmill Workers Against Machine- Related Hazards

	Item Statements			Sawmill Workers		Woodwork Teachers			
		$\bar{X}_G$	Decision	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	t-cal	H_o
1.	Read manufacturer's manual carefully before operating a machine.	3.55	HN	3.69	0.22	3.41	0.61	1.91	NS
2.	Use protective equipment like shoes, ear muffle, goggles, respirators while operating machines	3.65	HN	3.72	0.21	3.57	0.28	1.45	NS
3.	Always be under the supervision of a competent worker.	3.73	HN	3.74	0.20	3.72	0.20	0.22	NS
4.	Sufficient clearance around machines to allow for safe operations.	3.53	HN	3.57	0.55	3.48	0.25	0.68	NS
5.	Securely anchor machine and equipment to prevent tripping.	3.50	HN	3.52	0.26	3.48	0.62	0.30	NS
6.	Tension band saw blade to prevent vibrations.	3.47	N	3.55	0.44	3.39	0.58	1.10	NS
7.	Work not alone while working with chainsaw and band saw.	3.46	N	3.40	0.59	3.52	0.25	0.88	NS
8	Use sharp tools in machine operations.	3.63	HN	3.52	0.25	3.73	0.20	-2.03	NS
9	Focus on machine as long as machine operation continues.	3.60	HN	3.55	0.25	3.65	0.23	0.98	NS
10	Fix guards in place where available.	3.37	N	3.24	0.92	3.50	0.41	-1.89	NS
11	Feed work carefully within the capacity of machine.	3.44	N	3.33	0.65	3.54	0.29	1.45	NS
12	Operate machine when physically fit and not under the influence of drug.	3.46	N	3.50	0.25	3.41	0.62	0.68	NS
13	Use approved push sticks, push blocks, and other safety devices to hold end of wood when operating machine.	3.56	HN	3.55	0.25	3.54	0.37	0.09	NS
14	Examine saws as they are fitted / removed from machine to detect cracks or any other defects.	3.57	HN	3.50	0.39	3.63	0.24	1.10	NS
15	Turn off the power and make sure the machine stops running before leaving the area.	3.47	N	3.52	0.26	3.41	0.88	0,73	NS
16	Check wood materials for knots, splits, metal objects like nails and other defects before machining.	3.38	N	3.36	0.07	3.39	0.62	0.18	NS
17	Enclose moving gears, chains and rollers.	3.29	N	3.19	0.74	3.39	0.79	-1.11	NS
18	De-energize or lockout machine during maintenance or attempts to remove jams.	3.43	N	3.45	3.41	0.50	0.32	-0.32	NS
19	Do not operate chainsaw above shoulder level	3.38	N	3.36	0.67	3.39	0.62	0.18	NS
20	Use splitter to prevent stocks from binding with blade which can cause kick back.	3.57	N	3.57	0.25	3.56	0.48	0.68	NS

T-table = 1.98: NS - Not significant

Note: $\bar{X}_G$ = Grand mean; $\bar{X}_1$ = Mean 1; $\bar{X}_2$ = Mean 2; SD_1 = Standard Deviation1; SD_2 = Standard Deviation 2; HN = Highly Needed; N = Needed; t-cal = t calculated H_o = Null Hypothesis

Data presented in Table 2 show that the 20 safety practice skill needs with grand mean values from 3.29 - 3.73 are needed by sawmill workers in using sawmilling machines. These revealed that all the 20 safety practice skills are needed by sawmill workers for using sawmilling machines. Table 1 also shows that all the 20 safety practice skills have their t-cal. values less than that of the t-table of 1.98. This indicated there was no significant

difference between the mean responses of the two groups of the respondents. With this result, the null hypothesis H_o of no significant difference is upheld.

Table 3: Mean and t-test Analysis of the Responses of Sawmill Workers and Woodwork Teachers on Safety Practice Skill Needs of Sawmill Workers Against Sawdust Hazards

S/N	Item Statements			Sawmill Worker		Woodwork Teachers			
		$\overline{X}_G$	Decision	$\overline{X}_1$	SD_1	$\overline{X}_2$	SD_2	t-cal	H_o
1.	Train workers on health implications of sawdust on human.	3.50	HN	3.55	0.39	3.44	0.48	0.81	NS
2.	Use personal protective equipment like goggle, face shield, nose mask.	3.50	HN	3.52	0.26	3.48	0.45	0.33	NS
3.	Fit machine with efficient and well maintained local exhaust ventilation system to remove sawdust and chips.	3.11	N	3.24	0.72	2.98	1.56	1.21	NS
4	Train workers on the dust fire and explosion hazards and proper work practices.	3.44	N	3.50	0.25	3.37	0.79	0.95	NS
5	Control of ignition sources to prevent explosions	3.50	HN	3.52	0.26	3.48	0.45	0.33	NS
6	Identify where combustible dust may build up.	3.39	N	3.43	0.39	3.35	0.76	0.52	NS
7	Good house- keeping.	3.54	HN	3.57	0.25	3.51	0.25	0.58	NS
8	Inspect dust residues in open and hidden areas at regular intervals.	3.38	N	3.45	0.25	3.31	0.59	1.08	NS
9	Separate heated surface from dust	3.52	HN	3.45	0.39	3.59	0.48	-1.04	NS
10	Provide adequate fire protection plans.	3.37	N	3.43	0.25	3.31	0.59	0.92	NS

T-table = 1.98: NS - Not significant

Note: $\overline{X}_G$ = Grand mean; $\overline{X}_1$ = Mean 1; $\overline{X}_2$ = Mean 2; SD_1 = Standard Deviation1; SD_2 = Standard Deviation 2; HN = Highly Needed; N = Needed; t-cal = t calculated **H_o =** Null Hypothesis

Data presented in Table 3 show that 10 safety practice skills needs with grand mean values from 3.11-3.54 are needed by sawmill workers against sawdust hazards. This shows that all the 10 safety practice skills are needed by sawmill workers in sawdust hazards. Table 3 also shows that all the 10 safety practice skills have their t-cal values less than that of the t-table of 1.98. This indicates that there is no significant difference between the mean responses of the two groups of respondents. With this result, the null hypothesis H_o of no significant difference is accepted.

Discussion of the results

The findings presented in table 1, show that all the safety practice skills are needed by sawmill workers against workplace hazards in South-west Nigeria. The 10 safety practice skills are needed by sawmill workers in handling logs. This finding is in line with UK Health and Safety Executive (2012) who stated that safe work environment, adequate skills and proper handling of logs are required against workplace hazards. The findings also are in consonance with Swift (1999) that safe working environment and proper log handling will prevent accident in sawmills.

From the study, it was also found that 20 safety practice skills are needed by sawmill workers in machine related hazards. This is in line with US Occupational Safety and Health Administration [OSHA] (1999) that machines used in woodworking are dangerous. Safeguarding woodworking machinery, ensuring employees receive proper training prior to operating equipment and making sure workers wear appropriate personal protective equipment to keep them safe and good housekeeping are necessary safety practice needs. This supports the findings of Business and Legal Resources (BLR) (2013) that adequate level of safety skill must be exhibited in using milling machines against machine hazards.

It was also found from the study that 10 safety practice skills are required by sawmill workers against sawdust hazards. This is in line with International Agency for Research on Cancer that certain types of wood dust, can cause allergic reactions, and saw dust has been determined to be a group A carcinogen among many other diseases that are associated with wood dust. Also the finding is in line with National Fire Protection Association (NEPA) (2006) that finely divided dust presents fire or explosion hazard when dispersed and ignited in air, hence the need for effective safety practice skills to forestall these hazards.

Conclusion

The sawmill workers lack adequate knowledge of health implications of the hazardous nature of the work they do, hence, they handle safety with levity. They also believe that they cannot be involved in accidents. This makes them not to use engineering way of controlling hazards (guard) or personal protective equipment. It is also evident that these workers acquired their skills and expertise on the job. hence, they lack the professional safety approach to do the work.

Recommendations

Based on the findings of this study, the following recommendations are made:

1. Sawmill workers should be educated on the dangers of wood dust.
2. The identified safety practice skill should be packaged as code of practice for sawmill workers in South-west Nigeria and law enforcement agents be set up to ensure their implementation.
3. Employers should develop, implement, and enforce a written safety programme.
4. Safety training, or a lockout program to ensure that machines are lock out when they are being serviced or maintained, so that they cannot accidentally turn on, should also be a routine in any workplace, to prevent injury.
5. Safety practice skills should also be integrated into the curriculum of Woodwork in all wood related programmes.

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