SAFETY PRACTICES IN RAILWAY CIVIL ENGINEERING CONSTRUCTION PROJECT

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ABSTRACT

The construction industry is known globally as one of the most dangerous industries due to the unique nature of its products and its array and network of stakeholders. Thus, the purpose of this study is to assess the safety practices,to identify factors influencing safety practices in Lagos/Ibadan railway civil engineering projects. The study made use of a survey research design. Study population comprised the construction professionals and the artisans (non- professionals) on site. The respondents were selected using a convenience sampling technique, due to the inability to access a comprehensive list of all the workers on the project. Two hundred and seventy copies of questionnaires were distributed and two hundred and one retrieved comprising forty-eight construction professionals and one hundred and fifty-three non-professionals,thus giving a response rate of 74%. Statistical Package for Social Scientists (SPSS), version 21 was used to generate results using descriptive statistical tools such as frequency, percentage, and mean. The findings showed that the government's permissive and passive attitude towards employers who ignore health and safety laws, ignorance, long working hours per day/ enormous workload and stress were the factors influencing safety practices. Major safety practices inherent in the railway project were the proper display of safety/caution signs, incident reporting and investigation (near-miss) and engaging resident safety manager. In conclusion, the permissive and passive attitude of the government to employers who ignore safety laws, ignorance, and stress are the major factors that influence safety practices, while the display of signboards/caution signs, incident reporting and investigation, and engaging resident safety managers are identified as major safety practices available on the project. The paper recommends that the federal government of Nigeria should be more active in ensuring that employers (CCECC/CRCC) adhere to health and safety laws. To reduce stress and the effect of long working hours per-day/ enormous workload CCECC can introduce finish-and-go work or adhere strictly to 8hours per day, but disregard overtime and night work.

Keywords: Construction industry, Lagos/Ibadan, Railway civil engineering projects, Safety practices.

1.0 Introduction

Globally, the construction industry is one of the largest employers of labour serving as the backbone for infrastructure development or expansion. Although, in most advanced countries, research efforts are increasingly yielding results such as the development of mechanization and automation options which are landmarks in diversifying sources of labour and increased productivity on the construction process chains. These attainments are also significantly addressing the age long issues such as high death rates resulting from safety mishaps and other occupational health and safety concerns for workers in the industry. Moreover, as far as

mechanization and automation of processes are concerned, the least developed countries of the world have long ways to go, a majority of the construction processes are still reliant on human labour, which is laden with the regular exigencies such as fatalities, fair-employment and compensation considerations (Kamaruddin, Mohammed, Mahhub and Ahmad 2013). As African countries seek to expand infrastructure, railway construction projects are going on simultaneously in many parts of the continent, being an example of large-scale construction projects; both capital and labour intensive, usually dominated by expatriate firms. One of the areas of interest for recent research is in the safety culture/practices on such projects, while recent research has fairly outlined/documented the high rates of hazards in the industry.

Safety practices in the construction industry entail protection from any risk or danger when a project is in progress. Thus, safety management and practices are an important aspect of the project management body of knowledge, to ensure safety during the time of construction especially to the workers. Shibani, Saidani, and Alhajeri(2013) affirm that safety rules usually do not exist if any regulatory authority is usually very weak in implementing such rules effectively. Therefore, the issue of workers' safety is a collective effort, (Kunju 2000) maintained that safety goes beyond accidents, but more towards human behaviours and culture. Langford, Rowlinson and Sawacha (2007) agree that the greater influence will arise from factors that are part of the work practices, individual behaviour of construction workers, beliefs and actions.

Famakin and Fawehinmi (2012) stated that provision of safety plans and policies such as welfare facilities, workers' motivation, enabling working tools and environment, provisions and use of safety wears have positive results on productivity, and increase profit. Unsafe practices common among the workers on construction sites include the failure to adhere to the required safety procedures, and as well take precautions against hazards by wearing personal protective equipment arecommon on project sites (Clark, 2006). Some of the challenges of safety practices are: lack of necessary implementation due to the absence of proper monitoring system, low level of safety awareness and inadequate support from safety managers (Awwad, El Souki and Jabbour 2016). There have been perceived increments in the number of unsafe practices reported on project sites which are unacceptably high considering the numerous regulatory standards and control systems for the safety of workers in the construction industry. Hinze (1997) avows that the construction industry in comparison with other labour-intensive industries, exhibits a disproportionately high rate of disability, injuries, and fatalities.

Lack of skilled human resources, inadequate government support for regulatory institutions and inefficiency in institutional frameworks responsible for health and safety standards had been identified as the main problems of safety on construction sites (Kheni, 2008). Umoh (2013) Safety practice comprises workers' behaviour regarding safety provisions, conducts that guide workers' attitude in carrying out their tasks at work to reduce or even eliminate accidental losses and injuries. All personnel who are employed to carry out construction work on-site must be trained, competent and fit to do the job safely without putting their own or others' health and safety at risk. Workers must be properly supervised and given clear instructions, have access to washing and toilet facilities, have the right tools, equipment, plant, and protective clothing, and educated about health and safety issues.

Idoro (2008) affirms that contractors' efforts on health and safety are concentrated most in the provision of personal protective equipment (PPE). These efforts by their nature are only directed at preventing or reducing injuries arising from unhealthy and unsafe events such as accidents and perhaps complying with mandatory regulations. Makinde (2014) maintained that despite the effort made by employers in providing protective equipment for workers, the workers are not educated on the importance attached to its usage.

Previous studies on highway safety practices (Zhang andGambatese, 2017), construction projects (Fellows, Duff and Well, 2004; Saeed, 2017) and on relating health and safety (H/S) with performance (Marosszeky, Karim, Davis, and Naik, 2004; Idoro, 2008). However, there is no significant study on safety practices on railway civil engineering construction projects in Nigeria. Thus, this study intends to assess Lagos/Ibadan railway civil engineering construction project's safety practices, with a view to identifying factors influencing safety practices through literature review, research methods, data analysis, conclusion and recommendation to the federal government of Nigeria, CCECC/CRCC and workers.

2.0 Literature Review

2.1 Railway Corporation in Nigeria

The history of railway infrastructure in Nigeria dates back to the twentieth century during the colonial era when the colonial administration sought to expand transportation infrastructure at that time, which was mainly by road and sea, for trade and administration among others.
There was the Lagos government railway as well as the Baro-Kano rail networks which were in 1912 merged to what has remained the Nigerian Railway Corporation to date. This merger further enhanced the prospects of merging the Northern and Southern protectorates.

The railway line ran on two principal North and South trunks: one from Lagos to Nguru and Port Harcourt to Maiduguri, both tracks having branch extensions.

The increase in population and development of the economy necessitated the construction of modern standard-gauge rail, which was wider and more stable than the narrow-gauge, allowing for higher speeds and greater load-bearing capacity to ensure the transportation of goods and services and to ease road traffic. Nigeria, as the giant of Africa and most populous African country, has been in dire need of modern rail transport infrastructure to serve the transportation needs of her growing population and expanding economy across the regions (West, East, South, and North). LequteMan. (2017) affirmed that due to lack of sufficient fund to undergo such project, the China Exim Bank approved the Federal Government's request for a loan of $1.231 billion from its China Africa Fund to construct the Lagos-Ibadan standard-gauge railway, being undertaken by the Federal Government in collaboration with the Chinese government, under a public-private partnership (PPP) arrangement. The Ministry of Finance had in January 2017 set aside the Government's counterpart funding for the project, and the acting President Yemi Osinbajo flagged off construction in March. The Lagos-Ibadan Line, known as Segment Two, of the standard-gauge line that will connect Lagos and Kano, comprises a 160km Line which will run from Iddo in Lagos to Ibadan in Oyo State, passing through Abeokuta in Ogun State. It will also have an extension to the Apapa Ports Complex. It will run at speeds of up to 150km per hour. Railway construction involves a lot of plants, equipment, and manpower. Thus, adequate safety practices must be in place to ensure the efficient performance of the project.

The project, whose estimated completion date was December 2018 is being handled by the Chinese Civil Engineering Construction Company/ China Railway Construction Corporation (CCECC/CRCC) which is a recognized multinational company expected to regard safety with higher priority than indigenous civil engineering construction companies and the recommendations on this study will help to set the standard for subsequent railway construction projects in Nigeria.

2.2 Safety Practices on Railway Civil Engineering Projects

Construction workers' safety is a collective co-operation of all stakeholders involved in the construction industry ranging from government, employers, contractors, operatives, supervisors and even the general public.While Dodo (2014) affirmed that health and safety is an unavoidable part of the construction process with the contributions of different tradesmen and professionals at each production stage. Gallagher (1997) suggested that safety practices of construction companies must cover the following aspect of construction processes which include: the commitment of construction managers, making safety expectations known, engaging resident safety manager, engaging safety committee, planned hazard identification, risk assessment and hazard elimination control, and far-reaching inspections measures. Hinze (2005) furthers identified safety practices as jobsite characteristics, owner involvement in project safety, safety staffing, safety planning, training, and education. Other practices include safety meetings, incentives, safety audits, drug testing, subcontract management, accident investigations, insurance company involvement in the safety process and the inclusion of OSHA in the safety process. Okeola (2009) stated that in Canada, projects that involve the appointment of a resident safety manager had better safety performance records than others without safety managers because they ensure that both human and materials resources are managed effectively on site.

Educating and training of the stakeholders is important as it provides information on the following: workplace hazards control, so that they can work more safely and be more productive, provides employers, managers, supervisors, and workers with knowledge and skills needed to do their work safely and avoid creating hazards that could place themselves or others at risk. Also included is the need for specialized training, when their work involves unique hazards. Additional training may be needed depending on the roles assigned in the programme. For example, employers, managers, and supervisors may need specific training to ensure that they can fulfil their roles in providing leadership, direction, and resources for the safety and health programme. Workers assigned specific roles in health and safety (e.g., incident investigation team members) may need the training to ensure their full participation in those functions.

Effective training and education can be provided outside a formal classroom setting. Peer-to-peer training, on-the-job training, and worksite demonstrations can be effective in conveying safety concepts, ensuring the comprehension of hazards and their controls, and promoting good work practices**.** Samuel (2014) identified three key elements which are: safety orientation for new/transferred workers, pre-project safety training received andsafety training received. Mba and Hilda (2014) maintained that regular staff training on safe work procedures will sharpen and improve their hazard identification skills and reduce unsafe acts/conditions in the workplace. They also expressed concerns that staff training involves the expenditure of money,

and expenditures associated with fatalities were greater comparatively. Management may resist regular staff training based on costs, while greater awareness will bring about a change in attitude over some time. In consonance with the above submissions, Shamsuddin et al (2015) agreed that workers' knowledge and understanding of safety practices at work is vital in promoting safety on construction sites.

Agwu and Olele (2014) established that the inclusion ofpositive safety culture by investing in machines and technology (socio-technical investments) in the Nigerian construction industry, would resort tothe better safety performance of employees thereby resulting in reduced rates of unsafe acts and fatalities. In line with this, Samuel (2014) established that it is when you think about safety that you can more probably 'act safely' so that you and everyone connected to your job, directly or indirectly, would be safe.

3.0 Research Method

Survey research design, to reach a large number of respondents, was used; and the population comprises construction professionals (safety managers/personnel, engineers, quantity surveyors, builders, architects), and non-professional (carpenters, bricklayers, iron benders, tillers, unskilled).Non-probabilistic sampling technique in the form of convenience sampling method was used to select the respondents due to inaccessibility to sample frame that can enable samples to be drawn for equal representation of all members of the population (construction professionals and non-professionals on the railway construction project), therefore copies of questionnaires were self-administered based on respondents' availability. A total of two hundred and seventy copies of questionnaires were distributed and two hundred and one were returned and used for the analyses. The respondents compriseforty-eight construction professionals and one hundred and fifty-three non-professionals. This gives a response rate of 74%. Statistical Package for Social Scientist (SPSS) version 21 was used to generate the result using: frequency, percentage, and mean. Respondent's profession/trade and years of experience wereanalysed with frequency and percentages, while objectives analysed using the mean score.

4.0 Data Analysis and Discussion of Findings

4.1 Classification of Respondents

Table 1 shows the distribution of respondents under two major classifications namely professionals and non-professionals. 48% of the professionals were safety personnel while 28% were engineers. Project managers and quantity surveyors accounted for 11% and 7% of the professional cadre respectively. This shows that the clients understood the essence of safety practices by ensuring safety personnel was employed on the site to assist in safety rules implementation.

From the table, it also shows that 30% of the non-professionals were carpenters and masons, 18% were iron benders, 13% unskilled labourer and 8% were foremen. It shows that railway construction projects are labour intensive, thus safety practices are paramount to prevent accidents and injuries which could affect the performance of the project.

Table 1: Profession/Trade of Respondents

Respondents Profession	Frequency	Percentage (%)
Professionals		
Safety personnel	23	48
Engineer	14	28
Project manager	5	11
Quantity Surveyor	3	7
Builder	2	4
Architect	1	2
Total	**47**	**100**
Non-professionals		
Carpenter	46	30
Mason	46	30
Iron bender	28	18
Unskilled labour	20	13
Foreman	12	8
Plumber	2	1
Total	**153**	**100**

4.2 Years of Experience of Respondents

Table 2 shows the years of experience of the respondents.It revealsthat 67% of the professionals have been in the construction industry between 0 – 10years, 20% between 21- 30years and 9% between 11- 20years. It shows that the professionals had adequate knowledge of safety practices and its implication. For non-professionals, 53% have years of experience between 11-30years, while 67% of the non-professionals have 0-10years of experience in railway civil engineering projects. This implies that the non-professionals constituted the proportion of workers with longer years of experience in construction and possibly safety issues.

Table 2: Years of Experience of Respondents

	Non-Professionals		**Professionals**	
Experience (years)	Frequency	Percentage (%)	Frequency	Percentage (%)
0-10years	53	37	30	67
11-20years	19	13	4	9
21-30years	57	40	9	20
31-40years	13	9	2	4
41years and above	1	1	0	0

4.3 Factors Influencing Safety Practices in Lagos/Ibadan Railway Civil Engineering Project

Table 4 below displays the factors influencing safety practices. Respondents maintained that the government's permissive, and passive attitude towards employers who ignored health and safety laws is the major factor influencing safety, as it ranks the highest (3.79).This aligns with Diugwu and Egila (2012). Among the non-professionals, long working hours perday/ enormous workload (mean = 3.57), stress (mean = 3.25), and the poor decision of management are perceived as major factors influencing safety practices. Professionals perceived ignorance, alcohol intake, daily safety briefing hasa serious influence on the project. However, the lack of incentive ranks 8th with both professional and non-professionals. The factors that rank the least with means below 2:00 include no warning system, lack of signboards on-site, and lack of involvement by major stakeholders. These three factors are the least ranked because the

Lagos/Ibadan railway project is not lacking in warning systems, display of safety signboards and caution signs on-site (written in English and further translated to Chinese languages) and major stakeholders are involved in the project.

Table 3: Factors Influencing Safety Practices in Lagos/Ibadan Railway Civil Engineering Project

	Professionals		Non-professionals		Overall	
Factors	**Mean**	**R**	**Mean**	**R**	**Mean**	**R**
Government's permissive, passive attitude towards employers who ignore health and safety laws	4.05	1	3.72	1	3.79	1
Ignorance	3.39	2	3.42	6	3.41	2
Alcohol intake	3.22	3	2.85	13	2.92	13
daily safety briefing	3.22	4	2.92	12	2.98	12
Engaging a safety committee in investigating and auditing the cause of accidents	3.18	5	2.73	14	2.82	14
Review health and safety practices regularly and share with employees	3.02	6	3.19	10	3.15	8
Inadequate information on casualties	2.91	7	1.80	17	2.05	17
Lack of incentives	2.80	8	3.27	8	3.17	7
Lack of involvement by major stakeholders	2.75	9	1.65	18	1.89	18
Not having the right equipment/ dangerous equipment	2.74	10	3.26	9	3.15	8
Unsafe working conditions and practices	2.72	11	2.31	15	2.41	15
Use of safety net where the height of structure exceeds 5m	2.57	12	3.17	11	3.03	11
Poor decisions of management	2.51	13	3.44	4	3.23	5
Attachment of punishment to non-compliance	2.48	14	3.43	5	3.21	6
Long working hours per day/enormous workload	2.45	15	3.57	2	3.31	3
Improper handling of material and equipment	2.44	16	3.32	7	3.12	10
Stress	2.43	17	3.48	3	3.25	4
Lack of supervision/ monitoring	2.29	18	2.08	16	2.12	16
No warning system	2.18	19	1.56	20	1.70	20
lack of safety signboards on site	2.13	20	1.64	19	1.75	19

4.4 Safety Practices on Lagos/Ibadan Railway Civil Engineering Projects

Table 4 shows the various safety practices and their availability in railway project with proper display of safety/caution signs ranking the highest with a mean score of 3.58, while other practices in hierarchical order of means between 3.29 and 2.49 are: incident reporting and investigation (Near miss), engaging resident safety manager, provision of fire extinguisher, engaging safety committee in investigating and auditing cause of accidents, safety planning, training, and education. Mba and Hilda (2014), making safety expectation known provision, maintenance, replacing, and use of PPE, daily safety briefing, workers' commitment/ involvement in health and safety, risk assessment and hazard elimination, provision and adequacy of first aid box or clinical services or medical personnel on-site, and so on are included in a civil engineering project. However, it is paramount to note that manual lifting (mean=2.67) is inherent in the project coupled with the possibility of low effective response (mean=2.53) in cases of accidents. Safety practices such as recognition and award, insurance company's involvement in the safety process, and drug testing/ substance abuse testing,with mean scores between 2.00 and 2.36are not available on the project.

Table 4: Safety Practices on Lagos/Ibadan Railway Civil Engineering Project.

Safety Practices	Mean	Rank
Proper display of safety/ caution signs	3.58	1
Incident reporting and investigation (Near miss)	3.29	2
engaging resident Safety Manager	3.28	3
Provision of fire extinguisher	3.26	4
Engaging a safety committee in investigating and auditing the cause of accidents	3.21	5
Safety planning, training, and education	3.09	6
making safety expectation known	3.07	7
Provision, maintenance, replacing, and use of PPE	3.02	8
daily safety briefing	2.94	9
Workers' commitment/ involvement in Health and safety	2.92	10
Risk assessment and hazard elimination	2.89	11
Provision and adequacy of first aid box or clinical services or medical personnel on-site	2.80	12
commitment of construction managers	2.71	13
Manual lifting of equipment	2.67	14
Owner's involvement	2.55	15
Effective response	2.53	16
Subcontract management	2.49	17
Recognition and Rewards	2.36	18
Safety audit	2.32	19
insurance company involvement in the safety process	2.28	20
Drug testing/substance abuse testing	2.09	21

5.0 Conclusion and Recommendations

The study concludes that safety practices on railway civil engineering projects include the following:the proper display of safety/caution sign, incident reporting and investigation (near-miss), engaging resident safety manager, provision of fire extinguisher, engaging safety committee in investigating and auditing cause of accidents, safety planning, training, and education, making safety expectation known, and provision, maintenance, replacing, and use of PPE, while recognition and award, insurance company's involvement in the safety process, and drug testing/ substance abuse testing are safety practices not available on the project. Manual lifting of equipment and effective response means are inherent in railway civil engineering projects which may put the lives of workers or accident victims at serious risk.

The major factors influencing safety practices in railway civil engineering projects are: government's permissive, and passive attitude towards employers who ignore health and safety laws, ignorance, long working hours per day/ enormous workload, stress, andthe poor decision of management. The paper recommends that the federal government of Nigeria should be more active in ensuring that employers (CCECC/CRCC) adhere to health and safety laws. To reduce stress and the effect of long working hours per-day/ enormous workload CCECC can introduce finish-and-go work or adhere strictly to 8hours per day, but disregard overtime and night work.

6.0 Limitation of the Study

Despite researchers' effort in getting necessary documents for securing permission to research the Lagos/Ibadan railway project, the researchers could not break the barrier of gatekeepers on the project which made penetration difficult and access to a list of workers (sample frame) impossible.

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