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Assessment of Safe Systems of Work Implementation for Lifting Operations across Selected Companies in Onne, Free Zone

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***Abstract*— The study was conducted to ascertain a safe system of work for lifting operations across selected companies in Onne, Rivers State, Nigeria. In the course of the work, there was a review of the concept of safety, occupational safety, and safe systems of work for lifting operations. A descriptive research method was adopted for this work. The number of inhabitants in the review was the functional staff of almost all the companies operating at Onne, including the clearing and forwarding companies. A random sampling method was applied in choosing the samples used in the study. The primary wellsprings of information were gathered with the utilization of poll. The wellsprings of optional information were the records gotten from distributed reputable journals and textbooks. The results obtained indicated a high level of hazards and risk associated with lifting operations in the workplace. It also showed employees and employers consistent exposure to lifting operations risks. The effect of such exposure without proper risk prevention and management often results into high profile incidents. Both temporary and permanent disability of workers may occur which impact on their primary assignments resulting to financial loss and reputation damage. Also, the study showed that awareness level of staff towards inherent hazards and risks was relatively high. Activity risk assessment for lifting operations showed 93.83%.The significance of the study is that, there is high level of compliance to statutory requirements in lifting operations is needed. It is also highly recommended that organizations should constantly train workers on preventive safety measures in lifting operations, and ensure the implementation of international safety best practices.**

***Index Terms*— Safe System of Work, Hazard, Risk, Activity Risk Assessment, Analysis, Statutory Requirement.**

I. INTRODUCTION

The dynamic and complex nature of the construction activities with high rate of accidents could be associated with the improper use of crane-machine. The crane-machine forms central components of construction operations and lifting and rigging activities is inevitable. The expenses of mishaps and weaknesses connected with lifting activities are monstrous. Outer muscle issues or muscular skeleton disorders (MSDs) and agony are serious issues universally, causing human languishing over the individual and financial weight for organizations and social orders. As indicated by Statistics (March et al., 2014), among outer muscle issues, low back pains (LBP) and neck torment account worldwide for around 70% of inability yearly (Hoy et al., 2012).There have been remarkable failures, mistakes, slips, and lapses on the part of the lifting crew with any one of the six types of Occupational Health and Safety Administration (OSHA) violations sighted by EHS insight Resources dated 19th April 2020, leading to high-profile accidents.Lack ofcompliance with Lifting operations, and lifting regulations (LOLER 1998),Provision and Use of Work Equipment Regulations (PUWER 1998),the effect of the Provision and utilization of work hardware framework on lift execution regulation 1998(PUWER), operating standards and guidelines of Nigeria Factory Act 2004, etc as applicable to lifting operations, preventable incident continue to occur.

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II. IDENTIFICATION OF PROBLEMS AND DEVIATIONS.

2.1. Risk evaluation

Operations were broken down into relevant sub-activities and tasks. Potential hazards associated with lifting and rigging operations/activities were identified and appropriate control was provided. Systemic evaluation of risks related to established potential hazards comprising risk evaluation and assessment was conducted.

A team of multidisciplinary professionals conducted a detailed evaluation for a safe system of work across selected organizations for the following areas:

Lifting and rigging operations, personnel competency, reliability of varieties of lifting and rigging devices (cranes and rigging equipment), Physical,Chemical, Biological,Ergonomical,Psychological, psychosocial hazards,tandem lifting, types of machinery/equipment storage and maintenance, compliance with applicable statutory requirements (LOLER, PUWER, OSHA,ISO 45001:2018, Factory Act etc). Permit to work, Job safety analysis, Risk assessment, statutory requirements, Examination, Inspection, Maintenance, lifting plan, lifting method statement, and lifting and rigging risk assessment checklist, were used as required.

2.2. Hazard and Risk assessment.

Hazard: Anything with the potential for harm. Hazard +No exposure =No risk.

Hazard +Exposure=Risk. (Center for Research, Environment Education and Development-EMT-CREED(2021)

Risk.The likelihood that a hazard will cause harm, damage, or loss.Risk is the combination of the likelihood and severity

of a specified hazardous event occurring.

Hazard... Severity x probability=Risk.

The risk could be summarized to be =Probability x Exposure x Consequence

Risk assessment is the conscious and systematic process for hazard identification and control of established activities, and the subsequent evaluation of the risk inherent in the identified hazards.

2.3 Safe system of work.

A safe system of work could be bestdescribed as a systematic methodology of sequences of carrying out an activity or work, taking into consideration, the applicable statutory requirements, andthe inherent hazards and risks of the activity with clearly defined standard control measures applicable to the job activity.

III. RESEARCH METHODOLOGY

3.1 Research Design:A descriptive method was adopted for this work. Per Kothari (2004); the main aim of the descriptive design approach is the portrayal of the situation as it exists at present. As indicated by Orodho (2003, 2012), the descriptive survey design is powerful, and simple to carry out, and it likewise guarantees ease in getting access to data. The descriptive survey design is helpful in gathering data about individuals' frames of mind, conclusions, propensities, or discernments about issues under scrutiny (Orodho and Kombo, 2002). The source of data collection in this study was primary. A detailed and comprehensive research questionnaire was designed or constructed for participants or respondents was completed and returned to the researcher. The questionnaire consists of arranged, clear and direct questions structured on the present study.

3.2 Study area

The study area was Onne situated at Eleme LGA and Ogu/Bolo LGA in Rivers State; measuring 19km from Port Harcourt City L.G.A. Onne Port comprises three Local Government Areas of Rivers State, namely: Eleme LGA, Ogu-Bolo LGA and Bonny LGA. The area has been designated as an Oil and Gas Free Zone by the government of Nigeria; with over 100 companies licensed to work therein. The Onne seaport operates a Public Private Partnership (PPP), with a multi-purpose and a one 'stop-shop' that relates various port activities that serves the West Africa and the central Africa sub region. Onne port is a Hub and Logistics Centre for oil & gas sector; Centre for onshore and offshore activities with a total land area 2,538.175 hectares. Onne port operates at security level one with two operational areas called Federal Lighter Terminal (FLT) with 4 berths, 2,022 meters quay length, 7.5-meter draft; Federal Ocean Terminal (FOT), operating with 11 berths 2,890 meters quay length and 11.5meters draft.

3.3 Population of the Study

The population of the study is the operational staff of all the companies operating at Onne, including the clearing and forwarding companies operating at Onne. The target population is 308.

3.4 Sample and Sampling Technique

A random sampling method was applied in choosing the samples in the examination. Creswell (2005) characterized random sampling as a subset of people that are arbitrarily chosen from a population. The random sample size for the present study was derived utilizing Yamane Taro's statistical technique. This technique for sample size population was defined by statistician Taro Yamane in 1967 to ascertain the sample size from a given population utilizing a certainty level of 95% and 5% margin error.With a population of 308, the sample size is determined using Taro Yamane (1967) formula as below:

$$n = \frac{N}{1 + N(e)^2}$$

where;

n = sample size

N = population size

e = marginal error (0.05) (assuming a confidence level of 95%). Using this formula and substituting n = 174; thus, 174 copies of the questionnaire were distributed randomly among workers of three (3) clearing and forwarding companies. One hundred and sixty-two responded.

3.5 Validity/Reliability of Research Instrument

Content validity and expert judgment were applied. The rate at which the research instrument measures repeatedly the same thing, in the same way, any time it is used, at the same condition and subject is reliability (Chismall, 1981). Reliability is the level of consistency that the instrument or system shows (Best and Kahn 2006). Dependability of an instrument likewise concerns how much a specific estimating method gives comparative outcomes over various repeated tests (Orodho, 2012).

3.6 Sources of Data

The source of data collection in this study was primary, using the established questionnaire.

174 copies of the questionnaire were distributed randomly among workers of three (3) clearing and forwarding companies. One hundred and sixty-two responded.

3.7 Method of Data Analysis

The study employed the use of both descriptive and quantitative analysis to treat the data collected from the questionnaires distributed. With respect to the quantitative analyses, data were analyzed using SPSS. Descriptive statistics include the use of frequency tables, graphs, and chart.

3.8 Ethical Consideration

To ensure anonymity, the participants were required not to write their names on the questionnaires.

IV. RESULTS AND DISCUSSION

The purpose of the study was to assess the safe systems of work implementation for lifting operations across selected companies in onne, free zone, Rivers State Nigeria**.**

4.1 Results

[1] Response rate	[2] Frequency	[3] Percentage (%)
[4] Responded	[5] 162	[6] 93.10
[7] Not responded	[8] 12	[9] 6.90
[10] Total	[11] 174	[12] 100

Table 4.1: Distributed and Retrieved Questionnaire

4.1.1 Background characteristics and Demography variables Analysis

[13]	[14] Frequency	[15] Percentage	[16] Valid percent	[17] Cumulative percent
[18] Male	[19] 131	[20] 80.9	[21] 80.9	[22] 80.9
[23] Valid Female	[24] 31	[25] 19.1	[26] 19.1	[27] 100.0
[28] Total	[29] 162	[30] 100.0	[31] 100.0	[32] 100.0

Table 4.2: Gender

TABLE 4.3 Position in the Company

[33]	[34] Frequency	[35] Percent	[36] Valid percent	[37] Cumulative Percent
[38] Manager	[39] 17	[40] 10.5	[41] 10.5	[42] 10.5
[43] Engineer	[44] 36	[45] 22.2	[46] 22.2	[47] 32.7
[48] Supervisor	[49] 20	[50] 12.3	[51] 12.3	[52] 45.1
[53] Foreman	[54] 35	[55] 21.6	[56] 21.6	[57] 66.7
[58] General worker	[59] 42	[60] 25.9	[61] 25.9	[62] 92.6
[63] Operator	[64] 12	[65] 7.4	[66] 7.4	[67] 100.0
[68] Total	[69] 162	[70] 100.0	[71] 100.0	[72]

Table 4.4 Academic Qualifications

[73]	[74] Frequency	[75] Percent	[76] Valid percent	[77] Cumulative percent
[78] Degree	[79] 80	[80] 49.4	[81] 49.4	[82] 49.4
[83] Diploma	[84] 36	[85] 22.2	[86] 22.2	[87] 71.6
[88] Secondary level	[89] 25	[90] 15.4	[91] 15.4	[92] 87.0
[93] Primary Level	[94] 21	[95] 13.0	[96] 13.0	[97] 100.0
[98] Total	[99] 162	[100] 100.0	[101] 100.0	[102]

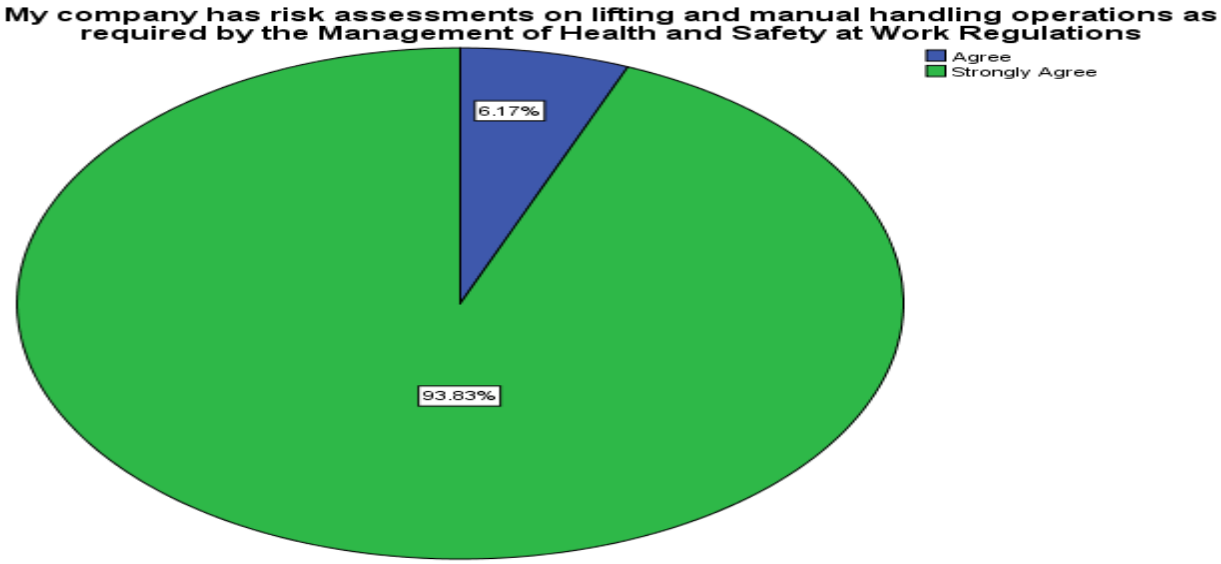
Table 4.5 Experience in Lifting Operations

[103]	[104] Frequency	[105] Percent	[106] Valid percent	[107] Cumulative Percent
[108] 1-5 years	[109] 37	[110] 22.8	[111] 22.8	[112] 22.8
[113] 6-10years	[114] 43	[115] 26.5	[116] 26.5	[117] 49.4
[118] 11-15years	[119] 28	[120] 17.3	[121] 17.3	[122] 66.7

[123] 16-20years	[124] 21	[125] 13.0	[126] 13.0	[127] 79.6
[128] 21+years	[129] 33	[130] 20.4	[131] 20.4	[132] 100.0
[133] Total	[134] 162	[135] 100.0	[136] 100.0	[137] 100.0

4.1.2 Company Has Risk Assessment On Lifting And Manual Handling As Required By Law

Figure 4.1



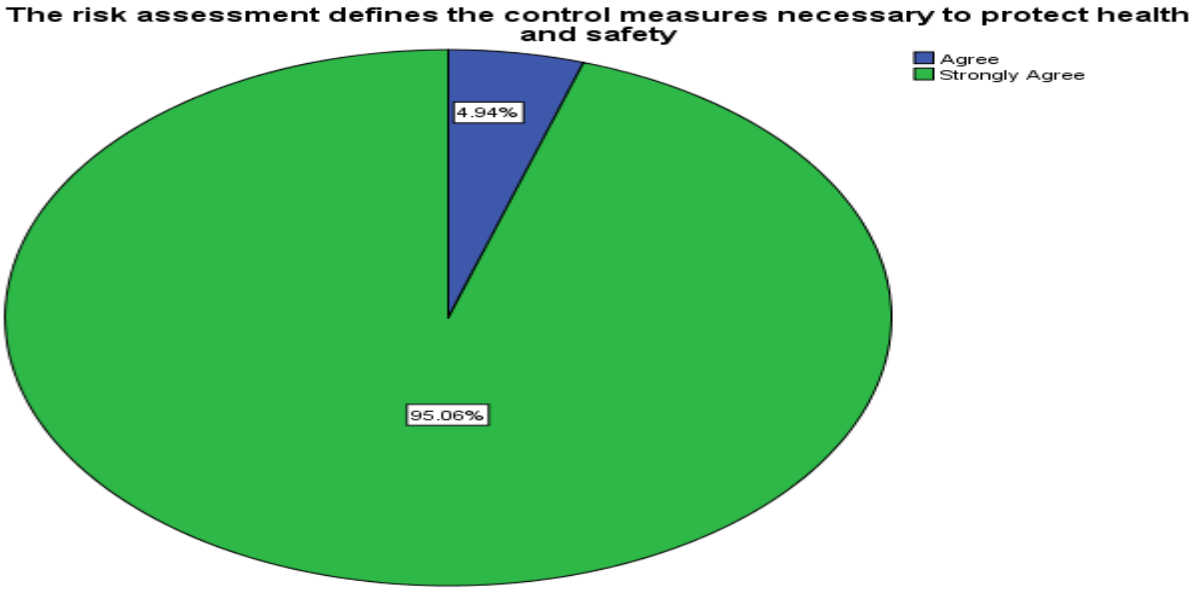


Figure 4.2

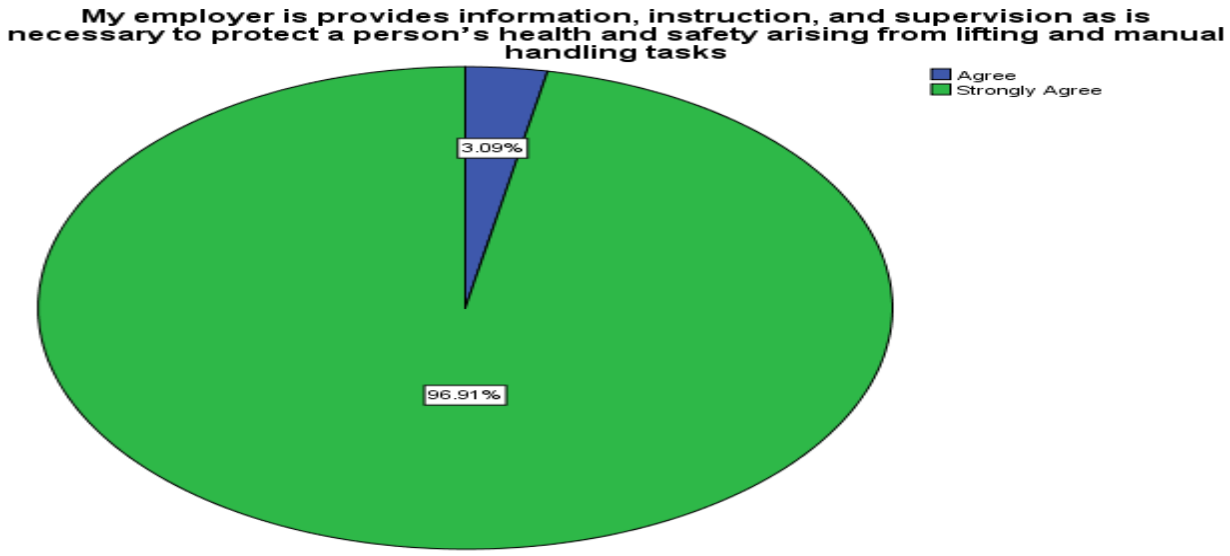


Figure 4.3

4.1.3 The Effects of Injuries From Lifting Operations On The Productivity And Performance Of Workers

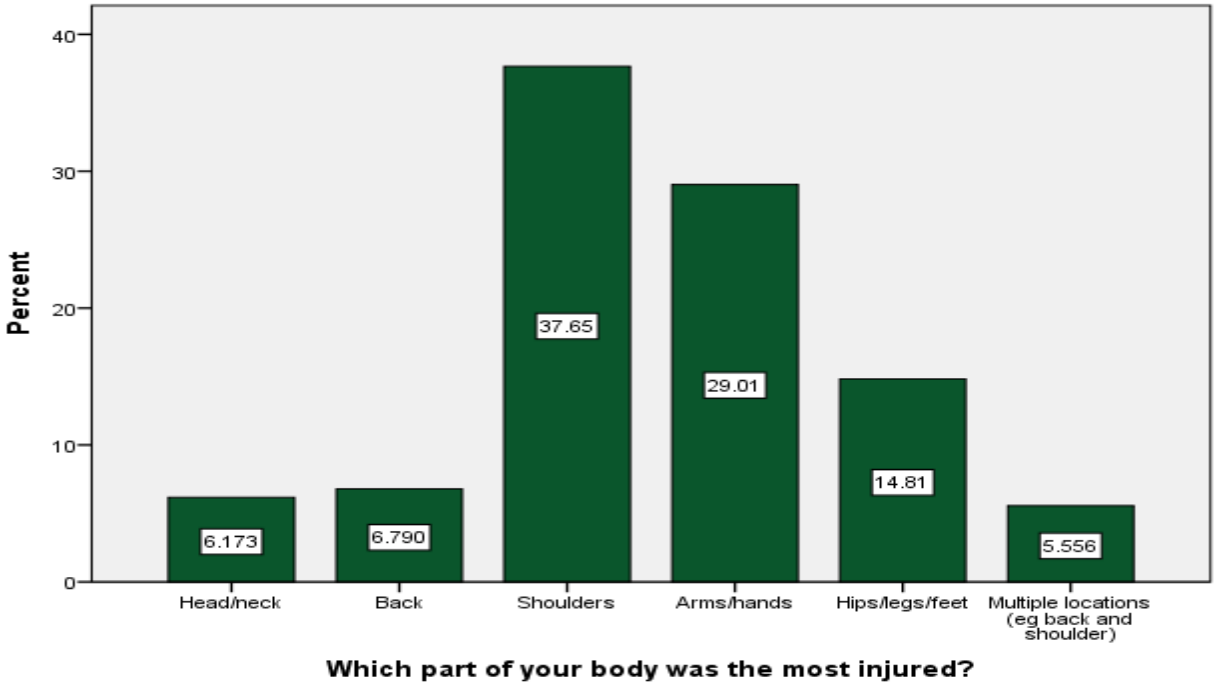


Figure 4.4

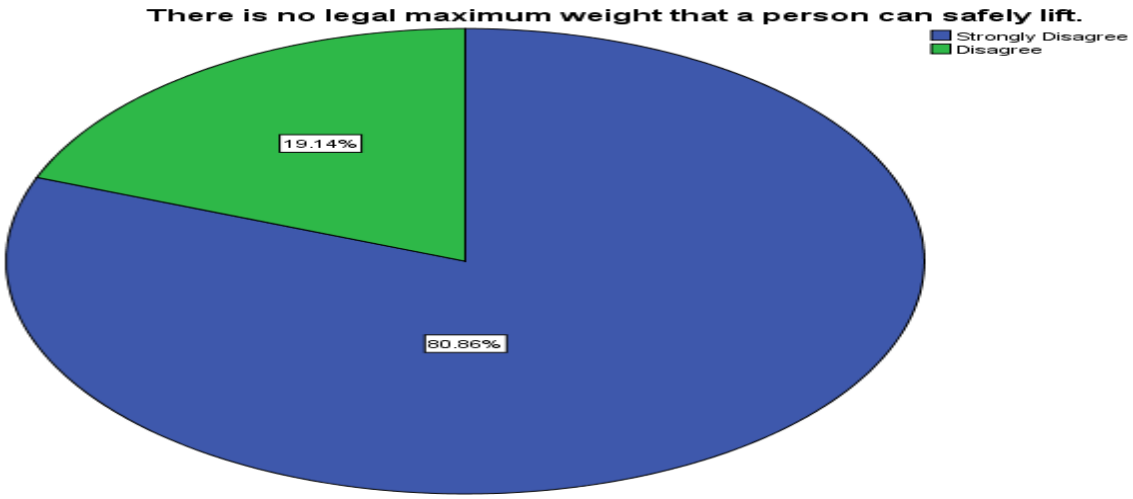


Figure 4.5

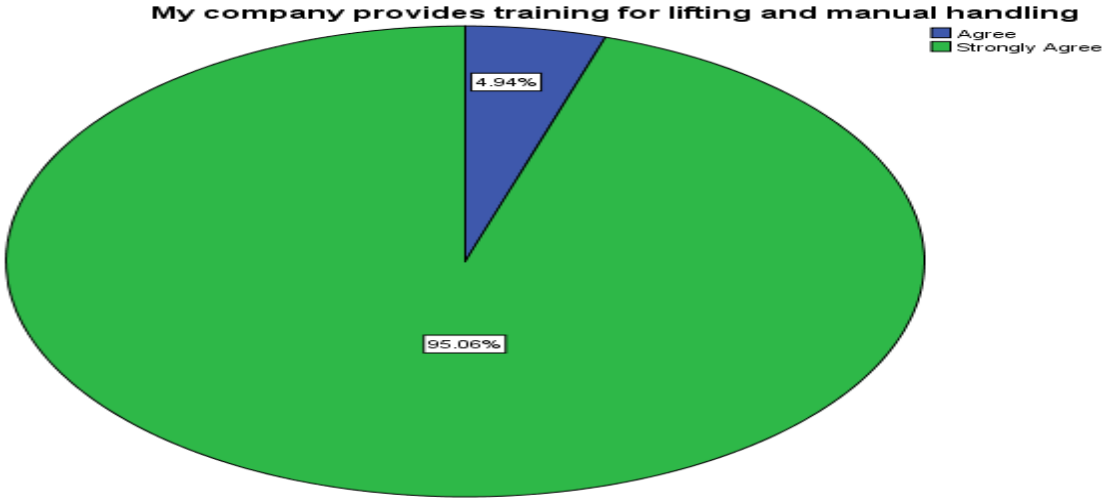
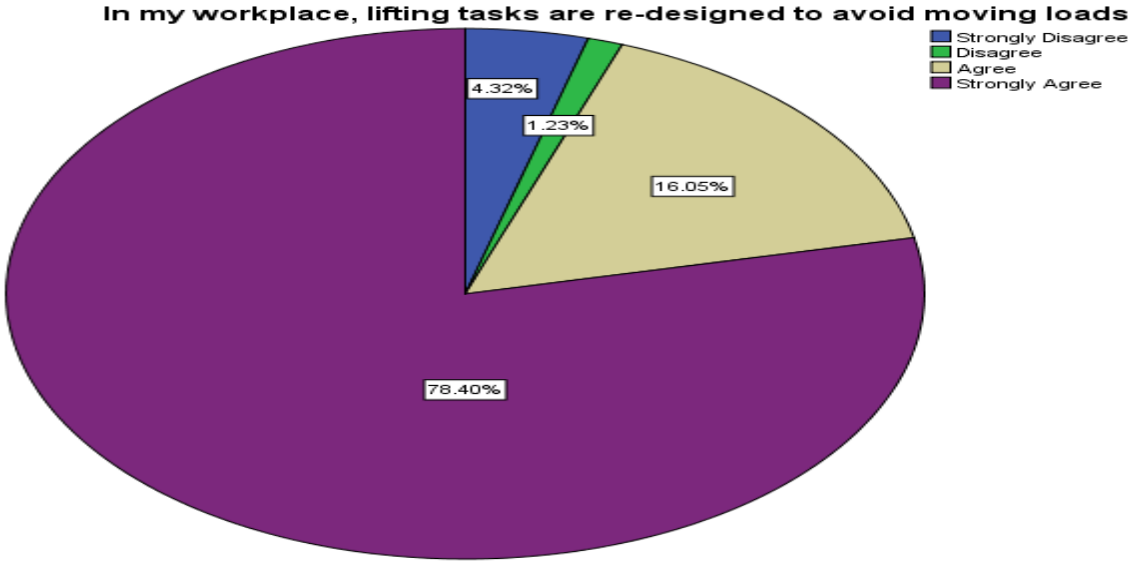


Figure 4.6



4.1.4 Analysis of Variance Among the Companies

Table 4.1: Test of Variance for Company A (50 Respondents)

HR

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
5.20	12	13.9167	1.34964	.38961	13.0591	14.7742	11.20	15.60
5.60	12	16.2000	6.37704	3.18852	6.0527	26.3473	11.20	25.20
6.20	7	13.8857	2.71258	1.02526	11.3770	16.3944	11.20	18.60
7.20	10	14.9400	2.01119	.63599	13.5013	16.3787	12.20	17.40
8.60	9	14.6000	2.16333	1.24900	9.2260	19.9740	12.20	16.40
Total	50	15.7360	4.78474	.67667	14.3762	17.0958	11.20	33.60

Table 4.2: Test of Homogeneity of Variances

HR

Levene Statistic	df1	df2	Sig.
4.261[a]	7	34	.002

Groups with only one case are ignored in computing the test of homogeneity of variance for HR.

Table 4.3: ANOVA

HR

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	812.446	15	54.163	5.953	.000
Within Groups	309.349	34	9.099		
Total	1121.795	49			

Table 4.4: Test of Variance for Company B (60 Respondents)

HR

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
5.20	10	13.5200	1.35056	.42708	12.5539	14.4861	11.20	15.20
5.60	15	16.2000	6.37704	3.18852	6.0527	26.3473	11.20	25.20
6.20	10	14.3333	2.67333	1.09138	11.5279	17.1388	11.40	18.60
7.20	12	15.1250	1.96523	.69481	13.4820	16.7680	12.20	17.40
8.60	13	15.5000	2.52190	1.26095	11.4871	19.5129	12.20	18.20
Total	60	16.0000	5.23969	.82847	14.3243	17.6757	11.20	33.60

Table 4.5: Test of Homogeneity of Variances

HR

Levene Statistic	df1	df2	Sig.
7.942[a]	7	30	.000

Groups with only one case are ignored in computing the test of homogeneity of variance for HR.

Table 4.11: ANOVA

HR

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	649.056	9	72.117	5.131	.000
Within Groups	421.664	30	14.055		
Total	1070.720	39			

Table 4.7: Test of Variance for Company C (34 Respondents)

HR

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
5.20	8	13.4750	1.30027	.45972	12.3879	14.5621	11.20	15.20
6.20	8	13.2667	2.57164	1.48474	6.8784	19.6550	11.40	16.20
7.20	10	15.1250	1.96523	.69481	13.4820	16.7680	12.20	17.40
8.60	8	15.5000	2.52190	1.26095	11.4871	19.5129	12.20	18.20
Total	34	16.1824	5.60765	.96170	14.2258	18.1390	11.20	33.60

Table 4.8: Test of Homogeneity of Variances

HR

Levene Statistic	df1	df2	Sig.
15.769[a]	7	24	.000

a. Groups with only one case are ignored in computing the test of homogeneity of variance for HR.

Table 4.9: ANOVA

HR

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	643.133	9	71.459	4.346	.002
Within Groups	394.577	24	16.441		
Total	1037.709	33			

Table 4.10: Test of Variance for Company D (26 Respondents)

HR

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
5.20	10	14.2400	.71274	.31875	13.3550	15.1250	13.20	15.20
6.20	10	13.2667	2.57164	1.48474	6.8784	19.6550	11.40	16.20
7.20	6	15.2667	1.67650	.68443	13.5073	17.0261	13.40	17.40
Total	26	16.9385	6.13026	1.20224	14.4624	19.4145	11.20	33.60

Table 4.11: Test of Homogeneity of Variances

HR

Levene Statistic	df1	df2	Sig.
19.441[a]	6	16	.000

Groups with only one case are ignored in computing the test of homogeneity of variance for HR.

Table 4.12: ANOVA

HR

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	586.790	9	65.199	2.958	.028
Within Groups	352.712	16	22.045		
Total	939.502	25			

V. CONCLUSIONS

The study sample size was determined to be one hundred and seventy-four (174) with the aid of Taro Yamane formula to whom questionnaires were delivered manually. Only one hundred and sixty (162) were successfully retrieved and were properly filled and fit for use for further data analysis. The discarded retrieved questionnaire had some not completely filled while others were not filled at all. With one hundred and sixty-two (162) filled questionnaire ensured we had .93.1% retrieval rate.

Tables 4.2-4.5 show the frequency distributions of background characteristics and demography variables of respondents. It reveals that 80.9% of the samples studied were males with the female counterparts constituting the other 19.1%. Also, an enquiry into the position held in the company of the study participants reveals that 10.5% are managers, 22.2% are engineers, 12.3% are supervisors, 21.6%, 25.9%

and 7.4% are foreman, general worker and operator respectively, this implies that participations cut across all notable positions in the workplace on the subject hence assuring validity of responses. Furthermore, the academic qualification of the respondents reveals that 49.4% were degree holders, 22.2% respondents were Diploma holders while 15.4% and 13% of the participants were of secondary level and primary level respectively. Table 4.5 shows that 22.8% respondents had 1-5years of experience, 26.8% respondents had 6-10years of experience, 17.3% respondents had 11-15years of experience, while 13.0% respondents and 20.4% respondents had 16-20 years of experience and 21+ years of experience respectively.

Figures 4.1-4.7 above demonstrate the result of the analysis of research question one which is basically on the level of employee's awareness of the hazards associated with lifting operations in their work places within Onne. Based on the data gathered and analyzed displayed on the tables and figures, it would be appropriate to infer that the level of employee's awareness of the hazards associated with lifting operations in their work places within Onne is relatively very high as the employees were exposed to the embedded risk of lifting operations in workplace.

Risks associated with lifting operations in workplaces as noted according to the findings of this study are as follows;

a. Employee's related risk: these are risk that can be related to staff in the work place. This includes body strains and sprains from lifting loads improperly or from carrying loads that are either too large or too heavy. Also, muscle strain or torn ligaments or muscles, dislocation, fracture and internal injury are common hazards associated with manually moving materials. This risk tends to affect productivity and performance of workers.
b. Employer's related risk: These are risk that posed threat to the operations of the work place as such that when employees are injured, the company losses fund to take care of the health of the staff and may result to temporal or permanent loss of A-list workers which makes company operations run effective due injuries sustained as a result of heavy load lifting.

Figures 4.14-4.24 above shows graphical representations of analyzed results of the safe systems needed for lifting operations in selected workplaces in Onne. It would be appropriate to conclude that the movement of heavy loads with hands should be eliminated but should be done via automation, mechanical devices should be used for lifting operations, for example trucks, barrows, rollers, handling aids, forklift trucks, sack trucks; risk of injury from lifting operations would be reduced as reasonably practicable by improvements to the task and load (for example reduce the load size and/or distance travelled; consider a team load), guide to help employees with lifting and manual handling assessments etc. as notable safe systems needed for lifting operations in selected workplaces in Onne, Rivers State.

Tables 4.6-4.17 show if the difference between each *pair* of means is statistically significant. It also includes 95% confidence intervals for these differences. Mean differences that are "significant" at our chosen $\alpha = .05$ are flagged. Note that each mean differs from each other mean, if we take a good look at the exact 2-tailed p-values, it can be seen that they are all < .01. We have 50 respondents from first company, 60 respondents from the second company, 34 respondents from the third company and 26 respondents from the last company that was analyzed.

As a rule of thumb, it can be concluded that if "Sig" or $p < 0.05$, we will reject the hypothesis and accept alternate hypothesis. For the 4 companies, $p > 0.05$. We therefore reject the null hypothesis of equal population variances, so these companies violate the homogeneity of variance assumption needed for an ANOVA. The ANOVA tables (Tables 4.8, 4.11, 4.14 and 4.17) show the output of the ANOVA analyses and whether there are statistically significant differences between the company means. We can see that the significance value is 0.00 (i.e., $p = .00$) (except for the last two companies that has a significant value of 0.02 and 0.28 respectively) which is below 0.05. Therefore, there is no statistically significant difference in the knowledge of the 4 companies' employees about the awareness of lifting operations hazards and risks and awareness of lifting operations safe systems and measures. A general rule of thumb is that we reject the null hypothesis if "Sig." or $p < 0.05$ which is the case here. So, we reject the null hypothesis that all population means are equal, i.e., there is no difference in the knowledge of all those employees about hazards and risk and safety measures. Hence, in conclusion, all employees have the same view on safety and hazard in all the sampled organizations.

Based on the study findings, the following recommendations were made:

i. Companies with lifting operations should train their personnel quarterly on the safety practices in lifting operations.
ii. Periodic Safety management system audits based on International standards should be conducted by independent and competent parties.
iii. Companies should also ensure that there is insurance on both life and property in the workplace.
iv. Constant employee buy-in to international best practices related to lifting and manual operations should be encouraged.
v. I strongly recommend findings be integrated into the general operating system of the clearing and forwarding companies.

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