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IMPLEMENTATION OF SAFETY REQUIREMENTS BY THE CONTRACTORS IN THE CONSTRUCTION INDUSTRY IN LIBYA: CASE STUDIES

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ABSTRACT
This paper was carried out to study the implementation of safety and health requirements by contractors in the construction industry in Libya. The objective of this study is to identify the factors that contribute to the low implementation of safety and health requirements in Libya and to identify the dimensions that contribute to the satisfaction level of the workers towards the implementation of these requirements by their companies. The purpose of this study is to analyze the various factors that contribute towards these low implementation of the safety and health requirements in Libya. Among the factors identified are budget, awareness and understanding, inadequate training, equipment and facilities and lastly workers' attitude. It was also aimed to observe the level of commitments from the management of these companies to its implementation and also to examine their awareness and understanding. It was found that lack of awareness; training and the worker's attitude itself contribute to the low implementation of these safety and health requirements in Libya.
Keywords:
Implementation, Construction Industry, Safety Requirements, Contractors, Libya

1. INTRODUCTION

All construction workers must deal with some of the most dangerous working conditions faced by employees in any industry. As a result, serious work-related injuries at construction sites occur with unfortunate frequencies. Regulations, specifications, inspection requirements, and job safety programs all seek to prevent construction site accidents and promote safety awareness on the part of all parties involved in the construction sites (Hammer & Price, 2001). Despite all these, it was found that safety and health requirement implementation in construction companies in Libya is still low. This study is on factors that contribute to the low implementation of safety and health requirements in Libya. The most dangerous land based work sector in the world is construction. The fatal accident rate in the European Union is nearly 13 workers per 100, 000 as against 5 per 100, 000 for all the sector average. This is not caused by unknown hazards and risks but it is found to be difficult to control in a constantly changing environment. Occupational Safety and Health (OSH) is a cross disciplinary area concerned with protecting safety, health and welfare of people engaged in work employment. As a secondary effect, OSH also protect co workers, family members, employees, customers, suppliers, nearby communities and other members of the public who are found to affected by the work environment (Glendon and Stanton, 2000). The record of safety and health requirement implementation in workforce in Libya is still far behind in comparison with countries such as Japan, America, Germany as well as Malaysia. In Malaysia, there are statutes that are relevant to the safety, health and welfare of the employees as whole. Developments in the occupational safety and health have been shaped by legislation, notably the Occupational Safety and Health Act 1994 (OSHA). The United States Occupational Safety and Health Administration (OSHA) is an agency of the United States Department of Labor. It was created by Congress under the Occupational Safety and Health Act, signed by President Richard M. Nixon, on December 29, 1970. Its

mission is to prevent work – related injuries, illness, and deaths by issuing and enforcing rules (called standards) for workplace safety and health (Cooper, 2000). Libya extends over 1,759,540 square kilometers (679, 182sq.mi), making it the 17th largest nation in the world by its size. However, Libya is smaller than Indonesia, and roughly the size of the US state of Alaska. The climate is mostly dry and desert like in nature. However, the northern regions enjoy a milder Mediterranean climate. A lot of constructions are taking place in Libya due to its spacious land in the country. However, it was found that focus on the safety and health requirements are at the least importance of these companies (MHLG, 2006). One of the major problem faced by these companies are the cost budgeted for their employees safety are comparatively low. This leads to high expenditure on hiring new worker and trainings given to them. Due to this, construction companies are now implementing new strategies and plans to overcome these issues. There are mandatory requirements implemented for certain industries to set up safety and health committees, audits and also management (Toole, 2002).

Awareness campaigns and safety and health requirements are being reinforced to reach the status of advanced countries. Although the industrial accident rate in Libya has leveled due to a combination of stricter enforcement and higher level of awareness, implementations of these requirements are still setbacks for the country (MHLG, 2006). Many construction companies have prioritized safety and health requirements as such to ensure that their employees are all well protected (Fernandez, 2007). These implementations are still found lacking in Libya. Lawrence (2007) said that there is a great demand for the safety measures as it will help the companies to grow. Construction industry associations should develop information and criteria for engineers and designers that will allow them to learn from the experiences in construction projects that have had their new projects or their lives extended or occupancy changed. Construction site needs to provide adequate resources and facilities for the safety, health and welfare of the employees regardless of the project value and duration. Construction safety includes the safety of the facility to be constructed as well as safety in the process of constructing the facility. Safety of the structure is usually dealt with during the planning and design stage of the facility and mainly the responsibility of the contractors. Thus, this is focused on the factors that contribute to the avoidance of the safety and health requirements implementations by these construction companies. This study is also focused on the importance given by these companies towards these implementations.

2. CONCEPTUAL FRAMEWORK

The conceptual framework of this paper is illustrated in the Figure (1) below. The purpose of the research is to discover the various factors and its consequences towards numerous hazards that have been caused at the sites.

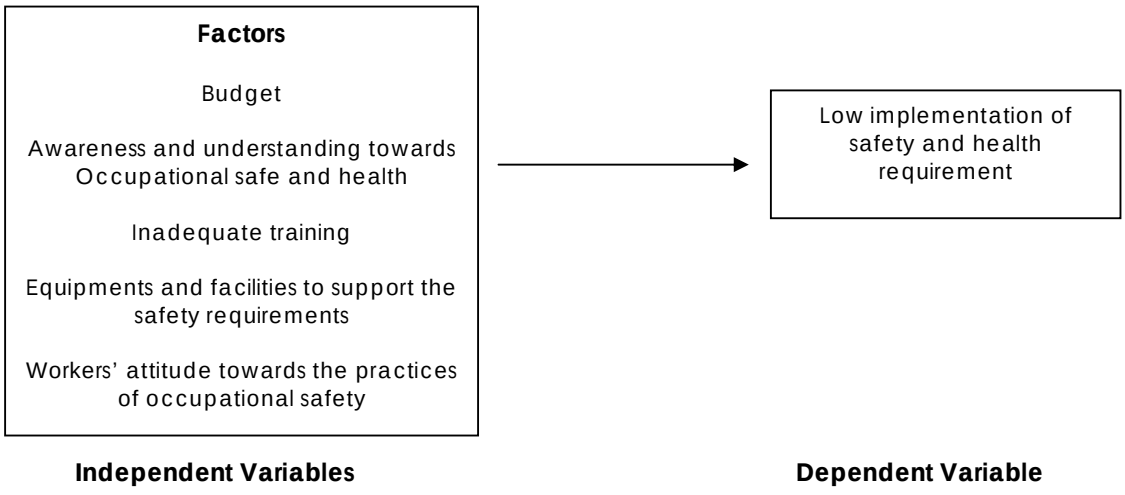

Figure 1. Frameworks of Independent and Dependent Variables

3. RESEARCH METHODOLOGY

Population refers to the entire group of people, events or things of interest that the researcher wishes to investigate (Sekaran, 1992). The target population for this study comprised of those belongs to the construction companies. In addition, this population will constitute people who are working at these chosen 6 construction companies and are considered a potential respondent for this study. It has been conducted under normal conditions and it was based on a field survey in Libya. More importantly, it focused on people who are relevant in construction and their relationship with the construction work place and what are the ways they are aware of problem and how they are improving the safety measure further on. A sample is a subset of the population selected for participation in the study (Abdelnaser *et al.*, 2008). The convenient sampling method was selected and used. Convenient sampling is one of the non – probability sampling technique in which the sampled members are chosen because they are more easily accessible. After taking into consideration the given time frames (1 month time, from February 2007 to March 2007, excluding the pilot study) to completing this study, sample size of 100 respondents was chosen. This group of sample is those found to be the staffs or workers of the chosen construction companies. The data was collected from those Labour on site construction companies in Libya and these people were our target population. These respondents are from Libyan private or government construction industry and which represented different level of knowledge and working experiences in the private schools and collages industry. Questionnaire is a formalized set of questions for obtaining information from respondent. The questionnaire was divided into 3 parts. The first selection of the questionnaire consists of demographic characteristics and the background information of the respondents. This section covered gender, age, and marital status, level of education, occupation and income level. The second section focused on the independent variables to test the importance each of the factors that contributes to low implementation of safety and health requirements. In the third section, the questions were designed to explore the respondent's implementation of these requirements at their sites. This measurement of each dimensions as stated below:

In statistical term, a hypothesis is a statement or assumption about the parameter values of a population. The philosophy of significant testing maintains that the researcher first formulates the hypothesis, which a researcher believes to be true and is ready to accept it until evidence to the contrary becomes statistically overwhelming. The Statistical Package for Social Science (SPSS) was used to analyze the data collection in this study. Multiple regression analysis was employed to determine the relationship between the dependent variable and independent variables. Besides, the ANOVA test was adopted to test the significant differences in the consumer buying behavior towards purchases pure essential oils. The test includes Reliability Analysis, Regression Analysis, *t*–Test and One–way ANOVA. Before any other tests are done, The Reliability Analysis was done to every question to obtain Cronbach's alpha value to ensure reliability and internal consistency in this study. Regression analysis is based on the assumptions that the relations between the dependent variables and the independent variables are linear. Therefore, there is a need to verify these assumptions to ensure that the linear equation above is valid. This can be done by examining the partial regression plot between dependent variable and each independent variable. The plots should demonstrate a good linearity. After the regression analysis, multiple regression procedures were used to identify significant association between the demographic, situational factors and customer buying behavior that are metric in nature. Analysis of variance is a dependence technique that measures the differences for one or more metric dependent variables based on a set of categorical (non metric) variables acting as independent variables. This analysis is implemented to test if different groups have significant differences in each of dimensions of situation resulting from factor analysis. A summary of the questionnaires distributed and collected for computing analysis is as shown in (Table 1). A total of 100 sets of questionnaire were distributed and 82 sets were successfully collected. The response rate was 82%.

Table 1. The questionnaires sample profile

Number of questionnaires distributed	100
Number of questionnaires collected back	82
Response Rate	82%

4. DATA ANALYSIS AND RESULTS

The first analysis was to obtain the Frequency of each demographic item of the respondents summarized in Table 2.

Table 2. Summary of Demographic Characteristics of Respondents

Demographic Variables	Categories	Frequency	Percentage %
Age	Below 18 years old	-	-
	18 – 29 years old	35	42.7
	30 – 55 years old	36	43.9
	Over 55 years old	11	13.4
Educational Background	Certificate / lower	-	-
	Diploma	-	-
	Bachelor's Degree	31	37.8
	Master's Degree	33	40.2
	Phd	18	22.2
Nature of Job	Production	-	-
	Engineering	18	22.0
	Finance	22	26.8
	Sales and marketing	21	25.6
	Personnel	21	25.6
	Service Line	-	-
	Others	-	-
Job Level	Manager	-	-
	Executive	22	26.8
	Supervisor	18	22
	Clerk	21	25.6
	Others	21	25.6
Length of service	Less than 1 year	-	-
	1-3 years	22	26.8
	4-8 years	39	47.6
	9-15 years	21	25.6
	Over 15 years	-	-
Nature of origin	Libyan	68	82.9
	American	7	8.5
	Japanese	-	-
	Taiwanese	-	-
	German	2	2.4
	Others	5	6.1

As for the demography category of gender, it was found that most of them belong to the age group of 30 – 55 years which is about 43.9%. The second highest group is those belong to 18 - 29 years old, which is 42.7%. This is because the respondents were chosen based on working experiences and also some level of exposure towards the safety and health issues. Most of the respondents chosen for this survey are those masters qualified and also those currently pursuing it. It consumes about 40.2% of the overall respondents. Those who are degree holders consume about 37.8%. It was also found that 26.8% of the respondents are working or has been working in a finance department of organizations. Despite, those belong to the sales and marketing and personnel are about 25.6%. Respondents interviewed also belong to certain group of job level. This information includes those who has worked before and also currently working. Based on the rate, it was found that those belong to the executive level consume about 26.8%. This also followed by those belong to the category of clerks and others which includes various industry. This category shows about 25.6% of response rate. Lastly, those belong to the supervisory rate is about 22% of the

overall respondents. This survey need experience people in the workforce. Due to that, respondents belong to the level of experience between 4 – 8 years shows the highest rate of response which is 47.6 %. This followed by the other category of age group. The focus of the study is those who are working in the construction sites in Libya. Thus, most respondents are from Libya.

5. EVALUATION OF FINDINGS

5.1. Reliability Analysis

A reliability test was used to asses the internal consistency and stability of the gathered data. In addition, reliability analysis can reflect how well the set of items within each variable are positively correlated with one another. The results of the Reliability Analysis are shown in Table 3. The number of the independent variables (i.e. budget, awareness and understanding, inadequate training, equipments and facilities, and worker's attitude), and the dependant variable (low implementation) are tabulated together with their corresponding Cronbach Alpha values.

Table 3. Summary of Results of Reliability Analysis

Variables	Number of items	Cronbach Alpha
Independent Variables		
Budget	5	.5749
Awareness and understanding	5	.6974
Inadequate training	6	.5148
Equipments and facilities	7	.7575
Workers' attitude	5	.6111
Dependent variable		
Low implementation of safety and health requirements	7	.6342

5.2 Regression Analysis

The regression analysis was applied to determine whether the five factors that have any impact on the low implementation of health and safety requirements in the construction companies in Libya. The summary of the results of Regression Analysis shown in Table 4.

Table 4. Regression Analysis

Variables	Beta	t	Sig.
Budget	.100	.657	.513
Awareness	.212	3.115	.003
Training	.011	.140	.889
Equipment	.321	2.324	.023
Attitude	.601	8.961	.000

Predictors: Budget, Awareness and understanding towards the requirements, Training provided, equipment and facilities prepared and workers' attitude towards the requirements
R Square (R) = .896
Durbin – Watson = 1.515
F value = 131.526
Sig. F = .000
** $P < 0.05$
* $P < 0.10$

Generally, if Sig. Is less than 0.05, the variables can be accepted. From the Table 4.5, the findings are:

- **Budget** : **Sig. = .513**

According to the regression analysis, the Sig. of tangibles is .513 which is more than 0.05, thus we found that budget has no significant relationship with the low implementation of the safety and health requirement in Libya. Therefore, Hypothesis H1: 'There is a significant relationship between the budget allocated and the low implementation of safety and health requirements' is rejected

- **Awareness and understanding towards Occupational safe and health**: **Sig. = .003**

The regression analysis shows that the significance of reliability is .003 less than 0.05, and the Beta was positive at .212, therefore, it was found that lack of understanding awareness among the workers contributes to the low implementation of safety and health requirements at the most construction sites. Hypothesis H2: 'There is a significant relationship between the level of awareness / understanding of the workers towards the low implementation of safety and health requirements" is accepted.

- **Inadequate training**: **Sig. = .889**

Inadequate training has no significant positive relationship with the low implementation of safety and health requirement in Libya since its significant value level is at .889, more than 0.05. Therefore, Hypothesis H3: 'There is a significant relationship between the inadequate training and the low implementation of safety and health requirements" is rejected.

- **Equipments and facilities to support the safety requirements**: **Sig. = .023**

The significant value for the equipments and facilities is 0.23. The Beta value was positive. It was found that this factor has significant positive relationship with the low implementation of safety and health requirements in Libya. Therefore the Hypothesis H4: 'There is a significant relationship between the equipment and facilities provided towards the implementation of safety and health requirements" is accepted.

- **Workers' attitude towards the practices of occupational safety**: **Sig. = .000**

It is found that the significance of workers' attitude towards the practices of occupational safety was .000, and Beta value was positive which is .601, thus the attitude has significant positive relationship with low implementation safety and health requirement. Therefore, the hypothesis H5: 'There is a significant relationship between the Workers' attitude towards the practices of occupational safety and the low implementation of safety and health requirements is accepted. The R square value of .896 implies that all the five independent variables (budget, awareness, training, equipment and workers' attitude) collectively can explain the dependant variable (low implementation). The acceptable Durbin – Watson range is between 1.5 and 2.5. Therefore the Durbin – Watson value of 1.515, which is between the acceptable ranges, shows that there was no auto correlation problems in the data used in this research. F – Value was valued at 131.526 and was to be found to be significant (i.e. Sig. F = 0.000) which indicates that the regression model was fit for use in this research.

6. DISCUSSION OF FINDINGS

As the paper outcome had shown that not all the five factors have an impact on the low implementation of the safety and health requirements at the Libyan construction companies. The results show that budget and training has no significant relationship with the low implementation. The other variables such as awareness, attitude and equipment have significant relationships with the low implementation of the requirement.

6.1. Budget

Based on this study, it was identified that most construction companies has an amount of budget allocated for this purpose. Despite, most of these construction companies in Libya are found to be meeting the requirement of setting aside the budget for safety issues. Moreover, these companies in Libya are doing well as they gain a lot of profits from the construction projects. There is normally no fix sum allocated by the companies, it depends very much on the project obtained. The actual amount will depend on the client requirements. Thus, based on this research, it was found that budget has no significant relationship with implementation of safety and health requirements in all these construction companies. The construction industry is an important sector as its activities are linked to more than 100 industries. It is considered one of the main contributors to a country's economy. Hence, the industry is an important factor to country's economical growth and there will not be any problems in budget allocation.

6.2. Awareness and understanding towards Occupational safe and health

Lack of management responsibility and commitments are still the major factors contributing to these industrial accidents and deaths. The occupational and safety Health regulations have increased employers' duties to create a safe and healthy workplace. However, continued enforcement and education need to be carried out before any of the rise of problems. According to Hammer & Price (2001), many companies continue to believe that careless workers are really to be blamed for accidents but a 1976 survey of industrial injuries in Pennsylvania concluded that only 26 percent were the results of employees' careless. This study shows that awareness and understanding of the management play a vital role at construction sites. It is the management responsibilities to provide knowledge and understanding to the workers. Management themselves must also be well equipped with the rules and knowledge of these safety requirements. This study shows that safety is not being understood clearly by the site personnel and the worker at the construction site. Based on this study, areas that could be improved are:

- To conduct and implement emergency drills on site
- To make sure that all exits are available and visible
- To maintain, update and post the log of occupational injuries
- To ensure that floor openings have standard railings or floor hole cover
- To employ adequate emergency medical staffs

Thus, it is identified that lack of awareness and understanding contributes to the low implementation of safety and health requirement at the construction sites in Libya. Management need to focus more in providing adequate information about the importance this implementation at their workplace.

6.3. Inadequate training

Based on this research it was found that training has no relationship with the safety and health implementation at constructions sites. Although training are important for better understanding but it was identified that there is no time for on the job training for the companies. Thus, it is not an element that contributes to lack of implementation in construction sites. Most companies do not have on – going training on the safety due to cost reason. Normally, it is done one time only during the orientation for few new comers. Training of management and supervisory staffs will ensure that all personnel in particular new workers or transferred personnel to new project sites are given proper training. These staffs should be briefed on the relevant aspects before commencing their work.

6.4. Equipments and facilities to support the safety requirements

Most equipment and tools are not reviewed by the safety personnel; it is often put into operation unless defects are found. That is the reason it is being ignored by most of these construction companies. The findings and performance of the companies could be analyzed by identifying the followings:

- Tools and equipments which are not safe such as electric equipment without ground wire
- Tools of equipment which are not proper
- Bad housekeeping, such as materials poorly piled on height
- Lack of procedures , such as informative posters
- Lack of proper tools or equipment as such small trolley for big items
- Lack of understanding towards the usage of these tools by the workers
- Lack of guard or safety devices such as no guard rail o scaffold, poor traffic control.

Safe working practices in the companies' means well–defined procedures and instructions to carry out work assignments or tasks properly. They are geared towards illustrating the proper way to complete task or work environment. It should include considerations for safety, quality and productivity. These procedures should be documented

as work procedures for regulations requirements. Safe work practices applied at the workplace will eliminate or minimize the risk of injuries to people damage to property and harm to environment.

6.5. Workers' attitude towards the practices of occupational safety

The success implementation of safety and health requirements also lies in the attitude of workers towards these issues. Workers should be more positive and adaptable towards the various strategies used to implement these requirements. A workers' attitude also includes getting information from the company, involving in the training provided, following the safety procedures and policies. Thus, it is all in the attitude of workers towards the practices of safety and health requirements implementation.

7. CONCLUSION

The overall objectives of this research have been met. In conclusion, the safety and health of the employees in the construction industries are important as it is in other industries. The safety and health record in Libya need to be upgraded and monitored so that workers could be prevented from all the hazards. It was found that there is a need to formulate a study at national level. This will examine the overall implementation of safety and health requirement in Libya as a whole. There is also a need to study the involvement of design construction industry. In construction, designers set the scene for the project, defining the work which is to be done. Designers are found to be in unique position to eliminate hazards from the projects and to alter the design so that the risks could be tackled. There is also a need to study and examine the ways of promoting and stimulating safety awareness and contractors' management commitments in the industry.

REFERENCES

[1.] ABDELNASER, O. MAHMOOD, A. AZIZ, H.A. and SHUKRI, A.Y. Attitude of Malaysian on recycling of solid wastes in Malaysia, Case studies in the major towns of the east coast and north Malaysia, PhD Thesis Unpublished, Universiti Sains Malaysia, 2008.

[2.] COOPER M.D. Toward a model of safety culture, Journal of Safety Science, (36), 111–136, 2000.

[3.] COOPER, M. Current issues in Health and Safety Training in the UK, J. European Industrial Training, MCB University Press, (22), 9. 354 – 361, 1998.

[4.] FERNANDEZ, R. Trench Safety: Protect Your Workers Light & Medium Truck. Alexandria; (20), 1, 36, 2007.

[5.] GLENDON, A.I., and STANTON, N.A. Perspectives on safety culture, Journal of Safety Science, (34), 193–214, 2000.

[6.] HAMMER W. and PRICE, D. Occupational Safety Management and Engineering. 5th Ed., New Jersey: Prentice Hall, 2001.

[7.] LAWRENCE G.S. Enhancing long-Term building occupancy and safety buildings. Cedar Rapids, (101), 1, 60-63, 2007.

[8.] Ministry of Housing and Local Government (MHLG) in Libya. Information on implementation of safety and health requirements by contractors in the construction industry in Libya obtained through an interview conducted by Mr. Mousa Muftah with MHLG, (12th November], 2006.

[9.] SEKARAN, U. Research methods for business: a skill building approach, Wiley, New York, 1992.

[10.] TOOLE T. Construction Site Safety Roles, Journal of Construction Engineering and Management, 16, 203-210, 2002.