

Construction Safety in Kingdom of Saudi Arabia

Ashraf Jihad Awad

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Approval of the Institute of Graduate Studies and Research

Prof. Dr. Elvan Yılmaz

Director

I certify that this thesis satisfies the requirements as a thesis for the degree of Master of Science in Civil Engineering.

Prof. Dr. Özgür Eren

Chair, Department of Civil Engineering

We certify that we have read this thesis and that in our opinion it is fully adequate in scope and quality as a thesis for the degree of Master of Science in Civil Engineering.

Asst. Prof. Dr. Alireza Rezaei

Supervisor

Examining Committee

1. Assoc. Prof. Dr. Zalihe Sezai

2. Asst. Prof. Dr. Alireza Rezaei

3. Asst. Prof. Dr. Giray Özay

ABSTRACT

The health and safety aspect of workers during construction is an important factor as it influences the project directly since the injuries and accidents costs will be high to the project.

For this reason, it is important to improve the health and safety conditions in the construction process to avoid the fatal accidents and injuries and to decrease the cost to the project. This study examined the factors which influence the health and safety during construction in Kingdom of Saudi Arabia (KSA) and how to improve its level. A questionnaire survey was administered which consisted of many items related to the main factors in order to evaluate the safety level.

The research examined three factors, and evaluated the safety level depending on these three factors which include: management, safety office and the workers. In addition, the research studied the relationship between the size and age of the construction company and the safety level. Hence, it found that the safety in KSA needs improvement in general and there is a relationship between the size and age of the construction company and the safety level, as the level of safety of the old and large companies is higher than the small and new ones.

Keywords: Construction, KSA, Occupational Health and Safety, Safety and Health.

ÖZ

İnşaat işleri sırasında sağlık ve işçi can güvenliği çok önemli bir faktördür. Bu faktör projenin seyrini etkiler, çünkü kazalar projenin maliyetini arttırır.

Bu nedenle, bu ölümcül hataları önlemek ve proje maliyetini azaltmak için projenin gerçekleştirilmesi esnasında can güvenliği ve sağlık seviyesine dikkat edilmelidir. Bunu sağlamak için projeye başlamadan önce can güvenliği ve sağlık seviyesi üzerinde bir çalışma yapılması gerekir. Bu çalışma SUUDİ ARABİSTAN' daki bir projenin üzerinde yapıldı. Bu O projedeki can güvenliği ve emniyetin genel seviyesini değerlendirerek onu etkileyen faktörleri inceledi.

Bu faktörlerin bazıları proje yönetimi, işçiler ve güvenlik ofisidir. Bunlara göre projedeki güvenlik düzeyini değerlendirildi. Ayrıca o çalışmada projeyi yapan (yüklenici) şirketin hacmi ve ömrü ile o şirketteki güvenliğe ilgi düzeyi arasındaki ilişki incelendi. Büyük şirketlerdeki güvenliğe ilgi düzeyi küçük olanlardan daha büyük bulundu.

Anahtar Kelimeler: Emniyet, Güvenlik ve Sağlık, İnşaat, İş sağlığı ve güvenliği.

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LIST OF ACRONYMS/ABBREVIATIONS

KSA: Kingdom of Saudi Arabia

OSH: Occupational Safety and Health

HSE: The Health and Safety Executive

CFOI: Census of Fatal Occupational Injuries

GCC: Gulf Cooperation Council

HR: Human Resources

Chapter 1

INTRODUCTION

1.1 Introduction

The health and safety of workers during construction is an important factor, thus it influences the project directly since the injuries and accidents costs to the project can be very high. According to Diane et al. (1999), the ratios of death, serious injuries and ill health around the world in the construction industry remain too high compared to other sectors. It is necessary to understand the construction health and safety problems in order to determine the factors which influence it and the methods to improve the health and safety of workers.

According to the Census of Fatal Occupational Injuries (2003), an average of 1,115 workers were killed each year on construction sites between the period of 1995 and 2000, which accounted for 20 percent of all industrial fatalities in the USA. This number is a disproportionate distribution of construction worker fatalities since construction workers account for only 7 percent of the industrial workforce. While many methods have been applied to reduce the incidence of injuries, there is still considerable room for improvement. Hence, the industry is trying to find new ways to improve the aspect of safety performance.

To indicate the importance of Occupational Health and Safety (OHS), according to Rowlinson (1997) and Wilson and Koehn (2000), countries such as the United

Kingdom (UK), Singapore, and Hong Kong (HK) have adopted a self-regulatory approach to safety, where the owners and contractors are required to develop, implement, and maintain safety management systems.

Many researchers such as Yusmin (2012), Huang and Hinze (2006) and Zeng (2002) discussed the factors which influence the safety in construction and tried to make a clear relationship between the different factors, and they attempted to prioritize these factors and rank them from the most important to the least important ones. However, the factors which influence the safety and health during construction are different from country to country depending on the culture, the attitudes, and perceptions of the community toward the safety importance. It is also related to the civil community organizations which are interested in the occupational health and safety and the international standards for the health and safety, especially in the construction industry.

1.2 Research Question

This research is conducted to answer the questions “what is the safety level of workers in the construction industry in Kingdom of Saudi Arabia (KSA)?” , “how to improve the health and safety of workers during construction?” and also “is there a relationship between the size and experience of the company and the safety level?” The aim of this research is to answer these questions in order to improve the health and safety of workers during construction in KSA.

1.3 Objectives of Study

In this research, health and safety in construction industry of KSA was surveyed to determine the factors that influence them. By this research, the safety in this region was evaluated according to the international standards for health and safety, and

after determining the factors which affect the safety, the research proposed recommendations in order to solve and improve this aspect. These factors were examined through a questionnaire survey conducted in Al-Qassim city in KSA.

Hence, the objectives of this study are:

1. To determine the main factors which influence the safety of workers during construction in KSA,
2. To examine the factors that influence the health and safety of workers during construction in KSA,
3. To evaluate the safety level of the construction industry in KSA, and
4. To understand the relationship between the size and the experience of the construction companies and their safety level.

1.4 Works Done

In order to perform the study and achieve the proposed objectives, the following works were undertaken:

1. A questionnaire was prepared and distributed to a number of construction companies; the survey questionnaire measured the factors which influence the safety level in a construction project.
2. The answers of the questions in the survey were categorised into different groups according to the common feature of each group.
3. Each common feature was given a specific value which is represented in an own percentage of the general level of safety in the company.
4. A study was conducted to find a relationship between the safety level and the age and the size of the company, this comparison had been done within different companies that had received this questionnaire survey.

1.5 Achievements

1. The analysis of the survey results showed that the health and safety in the construction process are related to three overlapping factors. The first factor is the HR (human resources) office and the OSH (occupational safety and health) office. The second factor is the personal attitudes of the workers about the health and safety, and how they deal with the risks and the dangers during the work. Finally, the third factor is related to the administration of the construction company as if it has a role to the aspect of safety and health in the general plans or not.
2. After the evaluation of each factor the research found the general safety level for each company depending on these factors with specific percentage for each factor.
3. The research found that there is a relationship between the safety level and the age and the size of the company. Thus, the large and old companies have a high level of safety and on the other hand, the new and small companies have a low level of safety.

1.6 Thesis Outline

Chapter one briefly introduces the whole work done and achievements in this study. Chapter two focuses on many research studies discussing these factors and tries to make a clear relationship between the factors by prioritizing the factors and ranking them from the most important to the least important.

Chapter three describes the survey method and shows in details that the questionnaire survey was developed for construction workers who had been selected from different construction companies.

Chapter four discusses on the results of the questionnaire survey.

Chapter five includes the analysis of the questionnaire and the discussion of the survey results with concentration on the relationship between the three factors and the safety of workers during the construction process. It further tries to find the relationship between the size of the company and the safety of its workers.

Chapter six consists the conclusion and some recommendations for future and further studies.

Chapter 2

LITERATURE REVIEW

2.1 Introduction

This research tries to study the safety level of workers in the construction industry in KSA. There are factors that influence the level of safety in the construction industry. Past researches and empirical work show that construction industry has more risk than any other industry or activity because it depends on many factors.

This chapter is aimed to review the previous studies that are related to the aspects of health and safety of workers in construction industry in order to find out the determinants related to the level of safety.

The objective of this study is to specify the research gap in the field of health and safety of workers in construction industry; hence this field requires more development through further research. Past researches will be taken into consideration and they will stand as a reference point for current study.

2.2 Occupational Safety and Health

Occupational safety and health (OSH) is generally defined as the science of the anticipation, recognition, evaluation and control of hazards arising in or from the workplace that could impair the health and well-being of workers, taking into account the possible impact on the surrounding communities and the general environment. This domain is quite vast, encompassing a large number of disciplines

and numerous workplace with environmental hazards. A wide range of structures, skills, knowledge and analytical capacities are needed to coordinate and implement all of the “building blocks” that make up national OSH systems so that protection is extended to both workers and the environment.

The scope of occupational safety and health has evolved gradually and continuously in response to social, political, technological and economic changes. In recent years, globalization of the world’s economy and its repercussions have been perceived as the greatest force for change in the world of work, and consequently in the scope of occupational safety and health, in both positive and negative ways. Liberalization of world trade, rapid technological progress, significant developments in transport and communication, shifting patterns of employment, changes in work organization practices, the different employment patterns of men and women, and the size, structure and life cycles of enterprises and of new technologies can all generate new types and patterns of hazards, exposures and risks. Demographic changes and population movements, and the consequent pressures on the global environment, can also affect safety and health in the world of work.

2.3 The Relationship between Project Size and the Safety of Workers

Hassan et al. (2007) discussed the relationship between the size of the project and the safety of the workers in the construction site. They designed a questionnaire for construction workers who were chosen randomly from 5 construction sites in Kuala Lumpur. The questionnaire was used for checking the safety standards at the site and comparing the results of the small and large projects. The result of this study proved that there is a relation between the size of the project and the safety performance, and that the large projects have higher level of safety than the small projects, and the

range of safety between the large projects is so little, but the range of the safety between the small projects is so wide.

2.4 The Influence of Cultural Dimensions on Workers Safety

Mohamed et al. (2009) discussed the influence of cultural dimensions on workers in Pakistan. The research discussed the effect of the personal attitudes and perceptions of the workers on their safety during construction and found that the most important factor that affects the workers attitudes and perceptions is the practices of the managers. It also found that the higher uncertainty avoidance attitude of workers, make their safety attitudes and perceptions stronger. The relation between workers' behavior and the culture proves that the workers who work in an uncertainty avoidance environment practice safer behavior.

Various studies have denoted personnel factors as any related issues concerning human aspects in workplace.

Teo et al. (2005) suggested that personnel factors consist of both management attitude towards safety, and supervisors and workers attitude towards safety, where both significantly shape the organization on sites.

Direct support and involvement in safety by head quarter's management is a sign of management positive attitude towards safety (Ng et al., 2005). Similarly, a high safety attitude among supervisors will yield a positive safety culture on site. However, this can only be done with continuous safety competence training and seminars (Tam et al., 2004). Nevertheless, constant monitoring of human errors on construction sites can be a proactive way in improving personnel safety performance. Human errors on sites are commonly a result of faulty judgment and

failure to follow safety rules and regulations (Hetherington et al., 2006). By taking this human touch into consideration, personnel errors can be assessed and modeled, preventing any future possibilities that will trigger accidents on site (Sorenson et al., 2002).

2.5 The Influence of Safety Management Activities on Workers Safety

Fang et al. (2004) suggested 5 valid elements of safety in management activities, such as safety inspection, safety meeting, safety regulation enforcement, safety education and safety communication. Safety on sites can be improved effectively, provided that safety inspection can function as a continuous improvement tool to benchmark safety at workplace (Fang et al., 2004; Mearns et al., 2008; Ng et al., 2005). Coupled with regular safety meeting on sites, safety issues can be properly reconciled (Ng et al., 2005; Aksorn and Hadikusumo, 2008; Saurin et al., 2008). Nevertheless, effective governance of safety on sites highly demands strict regulation enforcement. Workers will utterly comply with safety regulations if the management insists on issuing warnings and fines for safety non compliance. Failure of doing so will result in high accident rates as a result of non compliance of safety procedures on sites (Probst and Estrada, 2010).

To ensure that all personnel are aware of the safety matters and acquainted with the nature of working environment on sites, management should emphasize on giving adequate training and education that will equip them with appropriate safety knowledge to mitigate future accidents (Tam et al., 2004; Chan et al., 2010).

Propagation of safety information requires management commitment in providing a robust channel of communication between workers to participate in joint problem

solving processes that would enhance safety performance on sites (Michael et al., 2006; Kim et al., 2008; Kines et al., 2010).

2.6 The Influence of the Technical Factors on the Health and Safety of Workers in Construction

Technical aspects comprises the layout of work, equipment, degree of automation, design of work environment, maintenance and also safety related systems such as risk control systems, personal protective equipment and emergency control system (Sgourou et al., 2010). Effective and organized techniques which should be employed on the site in order to ease the complexity of construction works to avoid any unsafe conditions and unsafe behaviors. To cope with hazards, risk effective, risk response and risk management systems are vital to manage, eliminate and enhance safety.

When hazards cannot be completely eliminated, priorities must be given towards the effort of encouraging technical competence and hazards awareness through appropriate prevention methods such as the use of personal protective equipment (Olson et al., 2009). Adequate technicalities will gradually improve safety performance on site.

2.7 The Factors Influencing Health and Safety of Workers in Construction

Many researchers have studied the main factors that affect the safety of workers in construction projects. For example, Lee and Yusmin (2012) discussed the factors influencing safety from main contractors' perspectives. The goal of the study was to determine and decide the degree for each factor which affects the safety of workers in the construction process. A questionnaire was administered to 110 construction companies in Malaysia. The first part of their survey had focused on the

demography of the companies, and the second part on determining the importance of each factor which affect the safety during construction. The result was that the factors which affect the safety ranked as management, personnel, process, policy, technical, and incentives; while the top three most important factor elements were safety inspection, on site and HQ (Headquarters) management attitude towards safety, and safety regulation enforcement.

Ng et al. (2005) examined the importance of SPE (Safety Performance Evaluation) factors through a questionnaire survey conducted in Hong Kong. A questionnaire survey was conducted among clients, contractors and consultants in HK in order to establish the importance of the factors.

The results indicated that the most important factors are the management and administrative commitment, followed by the health and safety training, codes and standards, selection and the control of subcontractors, safety review and finally the accidents record.

Huang and Hinze (2006) discussed the role of the owner in the safety during the construction process. In their study, the owner's responsibility in safety of the construction was examined. The relationship between the safety of the construction and the owner's effect was discussed, with particular focus on the project context, choosing the safe contractors, safety equipments needed, and the owner's contributing and control of the management of safety.

The results proved that the owner can affect the safety management in the project by the selection of the contractors and subcontractors. Owners should evaluate the

ability of safety management when selecting contractors and contributing to the safety programs and follow it. The results showed that the percentage of the owners who contribute to manage the safety is 20-30 percent.

Zeng et al. (2002) discussed the construction site safety in China. They examined the effect of three factors including orders of production and operations, reputation of firms and psychology of labors on the safety during construction. According to Zeng's study the construction in China is classified as unsafe industry. All the construction firms have records of site accidents, which subsequently affects the reputation of firms. The obvious accidents are falling from the high rise buildings during construction. Although there are factors related to the accidents in construction sites, the main factors include 'lack of attention from leaders', 'reckless action', 'poor safety decisions of managers', 'non-certified skilled labor' and 'lack of emergency measure'.

Hassanein and Hanna (2008) studied the safety performance in the Egyptian construction industry. This research used a questionnaire survey that was distributed to large contractors in Egypt, and made a comparison of the safety between the contractors in United States and Egypt. The results showed that the programs of safety offered by the contractor companies in USA are more effective and formal than the programs of safety for the contractors in Egypt. A few companies in Egypt had records for accidents in the projects and provided good safety training programs. The research recommended that the social insurance for the workers would encourage the contractors to provide them enough attention for safety to avoid the costs after any safety accident for the worker. The research concluded that the programs of safety which the contractors provided in Egypt must be better and more

formal; recommending countries like Egypt, where accident insurance costs are fixed, contractors will try to improve their programs of safety to avoid the high costs of the insurance.

Choi et al. (2006) discussed about the roles and costs of injuries in the roofing contracting industry. The goals of this research were to identify the role of the programs of safety and the attitudes of the management in the roofing companies, and to record the accidents and classify them by the type of injury. Results of this research stated that the roofing in the large companies have a safety environment better than the smaller companies. Most of the large companies have a fulltime safety director but the smaller companies usually attempt to rely on the foreman to achieve the minimum required safety program. With the effective programs of safety, the safety will be better, and the company's profits will increase by decreasing their social insurance and worksite accidents.

It is noticed in literature review that most of the factors which influence the health and safety of the workers during construction are related to three major factors which are:

- 1) The role of HR (human resources) office and the OSH (occupational safety and health) office in the construction company.
- 2) The personal attitudes of the workers about their health and safety.
- 3) The role of the administration of the construction company.

Since the most important factors influencing health and safety of construction projects were summarized to be the role of HR (human resources) office and the OSH (occupational safety and health) office in the construction company, the

personal attitudes of the workers about their health and safety and the role of the administration of the construction company and also since the literature was lacking a proper study on safety and health issues in KSA, this research aims to bridge this gap by investigating the health and safety factors in construction industry of KSA.

Chapter 3

METHODOLOGY

3.1 Introduction

The Kingdom of Saudi Arabia is one of the fastest growing, emerging markets of the Middle East, bolstered and shielded by its strong oil reserves and determined government plans for economic development through diversification and investment programs, which include the development of the renowned six economic cities across the Kingdom. The country is rapidly growing and fast urbanizing, young population constantly fuel demand across the real estate, infrastructure and utilities segments of the market. The country also attracts large tourism revenues further fuelling demand in the tourism and leisure segments.

According to Ventures Middle East (2013), the construction industry of KSA witnessed construction contract awards to the tune of US\$76,574 million in 2012. The KSA Construction Industry Overview (May 2013) is a study based on its vast experience of the GCC construction market and its extensive projects database across the countries of the Middle East and North Africa (MENA) region. It provides a strategic insight into the various political, economic, social, technical, legislative and environmental factors impacting this dynamic market that promises long- run potential. Besides an analysis into the market drivers and restraints culminating in a probability impact matrix of the occurrence of these drivers and restraints on the construction market, the study also provides key statistics of the construction contract

awards across the various sectors of the KSA construction market namely, buildings, oil and gas, power and water, industrial and infrastructure.

The current study was conducted through a questionnaire survey. The survey population was selected randomly in six projects in Al-Qassim city in KSA, which is one of the 13 main cities of Saudi Arabia, placed at the middle of the country, with a population of 106,756 and an area around 65,000 km² (Figure 3.1).



Figure 3.1: Saudi Arabia cities

It is famous as the "alimental basket" of the country, for its agricultural properties. The city is away from the center of Saudi Arabia around four hundred kilometers northwest. It is edged by Ar Riyadh city to the south and east, by Ha'il city to the north, and by Al Madinah city to the west.

The region is connected to each part of Saudi Arabia by a complex network of highways, supported by the fact that there are many large projects under construction process at the time of the survey.

The survey included three large and old construction companies and another three small and new construction companies. The large construction companies included many offices and industrial buildings whereas the small construction companies consisted mainly of residential buildings and housings.

The questionnaire was distributed within an area which lies at the middle of KSA, hence this place have witnessed different construction projects. Most of the workers of these projects are not inhabitants of this area; therefore, the number of population in this area did not influence the results of the survey. Furthermore, the safety procedures followed in these projects are the same with the ones practiced in other places for the same company. Thus, these construction companies do not specify certain places for their projects in the whole KSA.

3.2 Survey Method

Survey questionnaires are typically used for feedback research to evaluate a case, or to estimate the distribution of characteristics in a population. Writing a survey questionnaire is one of the most critical stages in the survey development process. Much of survey questionnaire construction is common sense, but there are characteristics which survey maker should be familiar with.

Identifying the audience you aim to survey which is the construction's workers in this study will affect the scope of the research. It will also affect how the questionnaire will be composed. To be sure that it is appropriate for the audience, it is important to

“field test” the survey questionnaire with people similar to the respondents before administering the final version. It is possible to measure the right audience by starting the survey questionnaire with appropriate qualifying questions that filter out respondents who are not a part of the target audience.

Sometimes survey questionnaires fail to achieve their objectives due to presence of errors. Random error is the most common cause for decreasing the survey questionnaire reliability, and occurs when questions are poorly phrased, or presented leading to inaccurate answers.

3.3 Questionnaire Structure

The questionnaire structure is shown in Appendix A. It contains two parts; the first part consists of general information about the workers and the company, including name of company, duties, experience, number of the annual construction projects, and the type of projects. This general information is important because it will determine how much the information will be reliable and accurate. The survey questionnaire consists of 33 questions.

The first eleven questions try to cover the general information about the company and the workers, company size and experience, and general information about the safety level in the company. The second twelve questions try to cover the detailed information about the safety material, equipments, procedures and the perceptions of the workers about the safety.

The first part of the eleven questions in the questionnaire requires yes or no answer, while the second part of the twelve questions in the questionnaire requires answer by

Likert scale of 1-5, this scale was named after Rensis Likert, the person who first published a report describing its use (Likert, 1932).

The primary half consisted of eleven factors evaluated by “yes” or “no”, the second half consisted of ten questions evaluated by percentages from 0 to 100 percent as five selections. Each “yes” was given a score of one hundred and every “no” was given a score of zero.

The score of the first part questions was calculated mathematically by using equation 3.1:

$$\sum [\text{no of “Yes”} \times 100 + \text{no of “No”} \times 0] / \text{number of respondents} \quad \text{Equation 3.1}$$

Items not applicable for selected projects were ignored and not used in the calculation. Each project was scored by getting the typical of the applicable division scores inside that project. The answers of the second part of the questionnaire were divided as these categories: 0-20% as strongly disagree, 20-40% as disagree, 40-60% as uncertain, 60-80% as agree, and 80-100% as strongly agree.

Some of the questions in the survey are related to three major factors, (1) the influence of the management on the safety during construction process, (2) the personal ideas of the workers about health and safety and (3) the role of human resources office in the company in improving health and safety issues.

These items were related to these three factors and each factor has a weight in measuring the safety in each construction company. The research tried to clarify the relation between these three factors together, and the relation between the items which

are related with the three factors. The first three companies were small and new, established from 0-5 years with the number of annual projects less than five projects and the annual turnover of around (\$100,000-\$500,000).

The second three companies were large and old, established more than 20 years ago and the number of annual projects of more than five projects and the annual turnover of more than \$5,000,000. The results of the findings in the survey will be presented in the next chapter.

For the further researches it is strongly recommended for the researchers in the field of the health and safety in construction to visit the construction sites and evaluate the safety case through observations in addition to the survey completed by the workers in the site. It is also important to clarify the safety concepts and phrases as much as possible to the workers in the survey questions because some of the workers understand some questions in a wrong way. Finally, the questionnaires should be completed by the workers in a public region outside the site, because some of the workers are afraid that their answers will affect their job if the manager or the supervisor see their answers.

Chapter 4

RESULTS, DATA ANALYSIS AND DISCUSSION

4.1 Introduction

This part of the study shows the results of the survey. Thus, it is divided into two parts for each company from the six targeted ones. These results are shown in some tables and the answers are listed in percentages for each question.

The results of this survey was collected in three months. Hence, these results were compatible with the general impression toward the levels of safety and security in the construction industry. This compatibility was also noticed by the ones who helped the researcher in distributing this survey.

The health and the safety of workers in the construction process depends mainly on three factors. The first factor is the HR (human resources) office and the OSH (occupational safety and health) office, which has to make the training programs to the workers in order to improve their skills in how to deal and use the equipments safely, how to deal with the risks and the dangers and how to follow the emergency procedures if there is a need. Also to provide the company with the safest equipments. This office is responsible to hold regular meetings to discuss safety during work, to record the accidents, and suggest ways on how to solve it as a team.

The office is also responsible to check that the workers use the safety equipments such as eye protection, rubber boots, helmets and safety belts. They have to give a special attention to the new workers by training them and providing them with the essential information about safety and health.

The second factor is the personal attitudes of the workers about their health and safety, how they deal with the risks and the dangers during the work, and that these attitudes depend basically on the environment and the culture of the community which the worker is from, the personal culture of the worker and his psychological situation. For example, some workers prefer and feel excited to work in unsafe environment, other workers may see it necessary to take risks in order to achieve the work rapidly.

The third factor is the administration of the construction company as it pays attention to the safety and health within the general plans of the company and its central decisions.

The discussion of the survey results will concentrate on the relationship between these three factors and the safety during the construction processes, and it will try to find a relationship and the effect of the size of the company on the safety of its workers.

4.2 Results Analysis

Each of the three major factors was measured through some direct and indirect questions.

The first major factor which is the role of HR office and the OSH office evaluated by three sub-factors, health and safety meetings, training programs and supervision on the workers.

In order to evaluate the health and safety meetings, the respondents were asked about the availability of the health and safety meetings, and its effectiveness.

The training programs level was evaluated by asking about the attendance and regularity of the emergency procedures training, using of fire protection equipments training and safety trainings for the new workers.

In order to evaluate the level of the supervision on the workers in the construction sites, the respondents were asked about the availability and usage of the first aiders, safety belts, safety hat, eye protection and safety rubber boots.

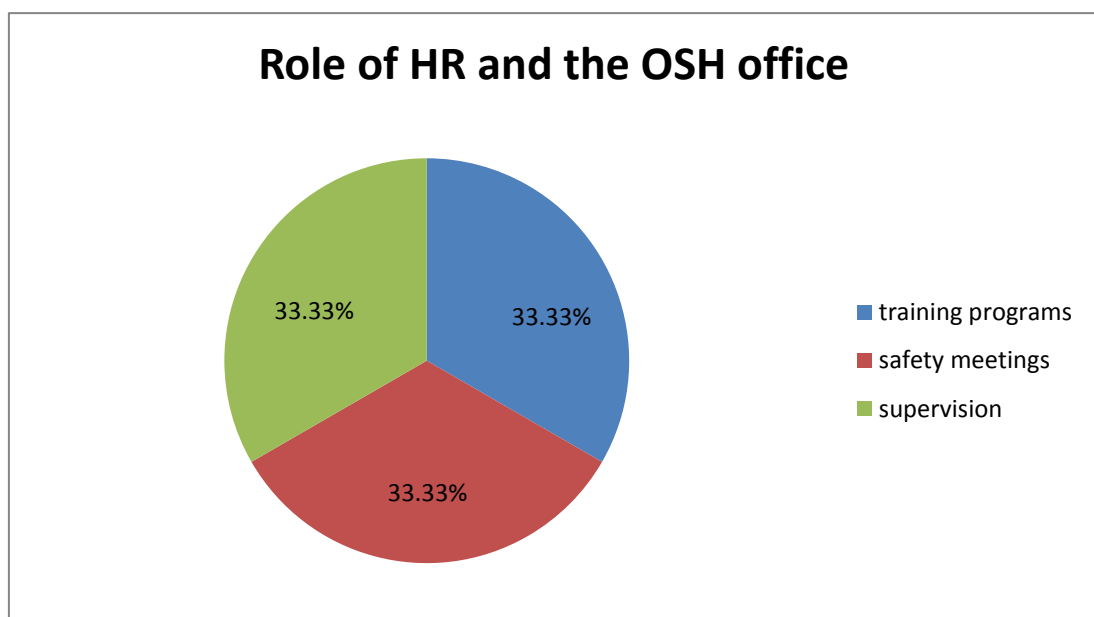


Figure 4.1: The criteria of Factor 1 (the role of HR and the OSH office)

Each sub-factor will measure 33.33% of the total percentage of the major factor which is the positive effect of OSH and HR office on the safety as shown in Figure 4.1.

The second major factor which is the personal attitudes and habits of the workers was measured through some direct questions and other indirect questions.

In order to evaluate the personal attitudes and perceptions of the workers about safety, the respondents were asked about their opinion about working in unsafe environment, the need to do risky procedures and their intention to read more about safety in order to measure how much the workers are interested in improving their information about safety equipments.

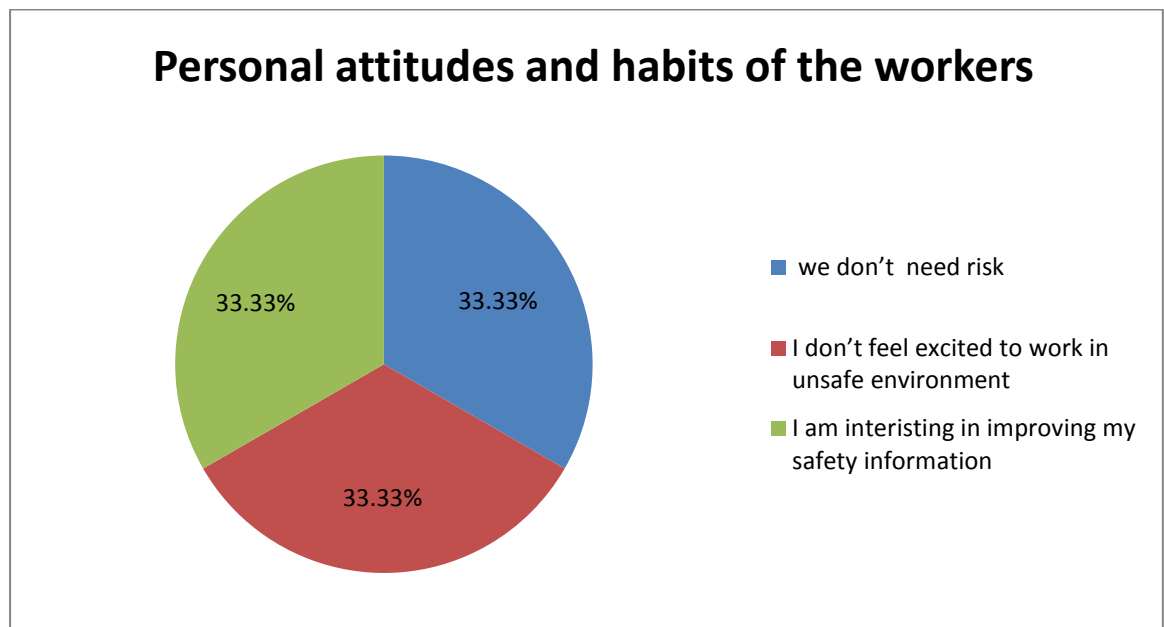


Figure 4.2: The criteria of Factor 2 (personal attitudes and habits of the workers)

Each sub-factor will measure 33.33% of the total percentage of the second major factor which has positive effect on the personal attitudes and habits of the workers on the safety as shown in Figure 4.2.

The third major factor which is the administration of the company was measured by a direct question to the workers. In order to evaluate the role of the administration of

the company in the safety, the respondents were asked about their opinion on the attention of administration of the company give to the general plan and central decisions of the company. So this question was designed to measure the workers opinion toward the company's administration attention on the aspects of the safety and health. Actually, it would have been very easy to ask this question to the administration itself, but it was preferred to ask this question to the workers themselves as the aim was to understand how they feel about attention in their practical work and the effect of this feeling on safety.

For company number 1:

The results for the company number 1 are included in Tables 4.1 and 4.2.

Table 4.1 Results of part 1 in the questionnaire in company 1

Question Number		Yes	NO
Q1.	Did you face a fatal accident?	30%	70%
Q2.	Do you have first aiders near you?	40%	60%
Q3.	Do you have regular meetings for safety?	30%	70%
Q4.	Do you have regular training programs for safety?	40%	60%
Q5.	Do you wear the safety belts during your work?	60%	40%
Q6.	Did you read information about how to use equipment safely?	50%	50%
Q7.	Does your company have a record for accidents?	60%	40%
Q8.	If you have training programs for safety , Have you been trained how to use the emergency procedures?	60%	40%
Q9.	Have you been trained how to use the personal protective equipment?	50%	50%
Q10.	Have you been trained how to use the fire protection equipment?	60%	40%
Q11.	Does your company have a training program for the new workers?	30%	70%

Table 4.2 Results of part 2 in the questionnaire in company 1

Number of question	Questions	The answer as Percentage
Q1.	You feel your work is dangerous.	66%
Q2.	You feel it is excited to work in unsafe environment.	28%
T Q3.	Sometimes it is necessary to do risk procedures to get the job done, what is your opinion?	24%
h Q4.	You are able to get the equipment needed to work on health and safety procedures.	20%
e Q5.	The safety and health meetings are effective.	30%
A Q6.	You always use the safety hat during the work.	40%
n Q7.	You always use the eye protection during the work.	32%
a Q8.	The age of the worker has an effect on his safety during working.	28%
I Q9.	The age of the long working hours for the worker has an effect on his safety during working.	40%
y Q10.	There is enough control on using safety equipment and rules by your managers.	35%
s Q11.	You always use the safety rubber boots during the work.	29%
i Q12.	Your company pays enough attention to safety and health.	40%

The first major factor in Table 4.3:

In the evaluation of the safety meetings, Q1 refers to the presence of safety meetings and Q2 refers to the efficiency of these meetings.

In the assessment of the training programs level, Q1 refers to the presence of emergency procedures training, Q2 refers to the availability of personal protective equipments training, Q3 refers to the availability of fire protection equipments training and Q4 refers to the presence of safety trainings for the new workers.

In order to evaluate the level of the supervision on the workers in the construction sites, Q1 refers to the availability and usage of the first aiders, Q2 refers to the usage of safety belts, Q3 refers to the usage of safety hat, Q4 refers to the usage of eye protection and Q5 refers to the usage of safety rubber boots.

Table 4.3 The analysis of Factor 1 for company 1

	Meetings		Training programs				Supervision				
The weight of question	Q1 50%	Q2 50%	Q1 25%	Q2 25%	Q3 25%	Q4 25%	Q1 20%	Q2 20%	Q3 20%	Q4 20%	Q5 20%
%The answer	15	15	15	15	12.5	15	8	12	8	6.4	5.8
Percentage	30%		57.5%				40.2%				

The analysis of the second major factor for company 1:

In the evaluation of the personal attitudes and habits of the workers, Q1 refers to the need for risk according to the worker opinion, Q2 refers to the feeling of excitement in working in unsafe environment and Q3 refers to the measure of how much the worker is interested in improving his information about safety equipments.

Table 4.4 The analysis of Factor 2 for company 1

	Don't need risk	Don't feel excited to work in unsafe environment	improving my safety information
% of each criteria	33.33%	33.33%	33.33%
The answer from % of criteria	25.33	24	16.66
The total percentage of the factor	66%		

The percentage of safety according to the three related factors:

Table 4.5 The Factors analysis for company 1

Factor number	The safety percentage	The total percentage of safety
F1	42.56%	49.52%
F2	66%	
F3	40%	

According to the results shown in Table 4.3 which represent the first major factor, it is clear that there is a weakness in the health and safety meeting, as it has been evaluated 30% according to the regularity and effectiveness of the safety meetings. Table 4.3 also shows that the percentage of holding the health and safety training programs is 57.5% and the supervision on the workers was evaluated 40.2% which mean that the level of safety training programs and the supervision should be improved.

Table 4.4 shows the results of the second major factor which evaluates the attitudes of the workers about the safety, and indicates that the workers' perceptions are positive with 66% of them with the opinion that the working environment is unsafe, there is need for risk to be reduced and there was interests in improving the awareness

on safety equipments. This means that workers need more awareness about the importance of safety.

Table 4.5 shows the evaluation of the health and safety level in the company which depends on the three major factors, that indicates the general safety level which has been evaluated as 49.52%. This shows that it needs improvement.

Table 4.5 is also represented by a bar chart in Figure 4.3 which reveals the safety level of the company according to the three major factors.

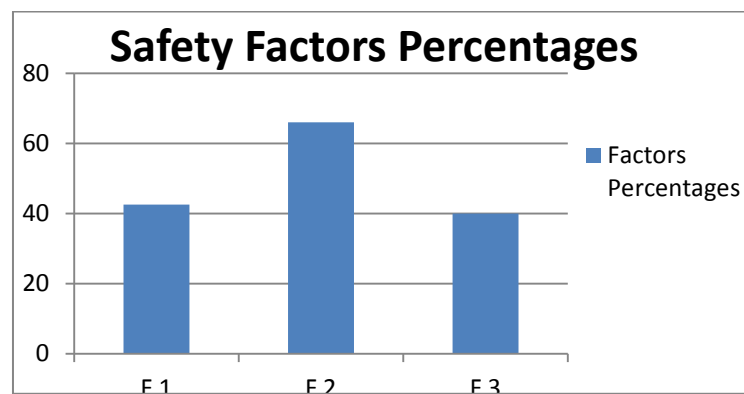


Figure 4.3: The Factors percentages for company 1

For company number 2:

The results of the survey for the company number 2 are included in Tables 4.6 and 4.7

Table 4.6 Results of part 1 in the questionnaire in company 2

Question Number		Yes	NO
Q1.	Did you face a fatal accident?	20%	80%
Q2.	Do you have first aiders near you?	40%	60%
Q3.	Do you have regular meetings for safety?	50%	50%
Q4.	Do you have regular training programs for safety?	50%	50%
Q5.	Do you wear the safety belts during your work?	40%	60%
Q6.	Did you read information about how to use equipment safely?	50%	50%
Q7.	Does your company have a record for accidents?	30%	70%
Q8.	If you have training programs for safety, Have you been trained how to use the emergency procedures?	30%	70%
Q9.	Have you been trained how to use the personal protective equipment?	30%	70%
Q10.	Have you been trained how to use the fire protection equipment?	20%	80%
Q11.	Does your company have a training program for the new workers?	30%	70%

Table 4.7 Results of part 2 in the questionnaire in company 2

Number of question	The question	The answer as Percentage
Q1.	You feel your work is dangerous.	72%
Q2.	You feel it is excited to work in unsafe environment.	25%
Q3.	Sometimes it is necessary to do risk procedures to get the job done, what is your opinion?	26%
Q4.	You are able to get the equipment needed to work on health and safety procedures.	55%
Q5.	The safety and health meetings are effective.	48%
Q6.	You always use the safety hat during the work.	50%
Q7.	You always use the eye protection during the work.	40%
Q8.	The age of the worker has an effect on his safety during working.	57%
Q9.	The age of the long working hours for the worker has an effect on his safety during working.	62%
Q10.	There is enough control on using safety equipment and rules by your managers.	55%
Q11.	You always use the safety rubber boots during the work.	45%
Q12.	Your company pays enough attention to safety and health.	65%

The analysis of the first factor:

Table 4.8 The analysis of Factor 1 for company 2

	Meetings		Training programs				supervision				
The weight of question	Q1 50%	Q2 50%	Q1 25%	Q2 25%	Q3 25%	Q4 25%	Q1 20%	Q2 20%	Q3 20%	Q4 20%	Q5 20%
%The answer	25	24	7.5	7.5	5	7.5	8	12	10	8	9
Percentage	49%		27.5%				47%				
The weight of question	41.16%										

The analysis of the second factor:

Table 4.9 The analysis of Factor 2 for company 2

	Don't need risk	Don't feel excited to work in unsafe environment	I am improving my safety information
% of each criteria	33.33%	33.33%	33.33%
The answer from % of criteria	25	25	16.66
The total percentage of the factor	66.66%		

Table 4.10 The percentage of safety according to the three related factors

Factor number	The safety percentage	The total percentage of safety
F1	41.16%	57.6%
F2	66.66%	
F3	65%	

Table 4.8 represents the first major factor, and shows that the health and safety meetings level is fair as it was evaluated 49% according to the regularity and effectiveness of the safety meetings.

Table 4.8 shows also that the percentage of holding the health and safety training programs is 27.5% and the supervision on the workers was evaluated at 47% which shows that the level of safety training programs seems to be weak and should be improved, while the supervision evaluation has almost acceptable percentage but still requires more development.

The results of the second major factor in Table 4.9 which shows the evaluation results of the positive attitudes of the workers about the safety, indicates that the workers' perceptions are positive with 66.66% of them with the opinion that the working environment is unsafe, and there is need for risk to be reduced and there was interests in improving their awareness about safety equipments. It means that workers need more awareness about the importance of safety.

Table 4.10 shows the evaluation of the health and safety level in the company which depends on three major factors, and shows the general safety level which has been evaluated as 57.6%. This means the level of the safety can be acceptable but it is preferable to be improved.

Table 4.10 is also represented by a bar chart in Figure 4.4 which reveals the safety level of the company according to the three major factors.

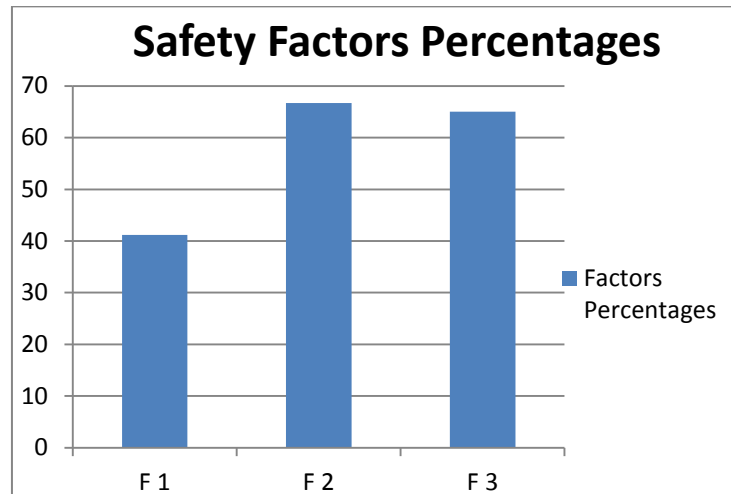


Figure 4.4: The Factors percentages for company 2

For company number 3:

The results for the company number 3 are included in Tables 4.11 and 4.12.

Table 4.11 Results of part 1 in the questionnaire in company 3

Question Number		Yes	NO
Q1.	Did you face a fatal accident?	10%	90%
Q2.	Do you have first aiders near you?	40%	60%
Q3.	Do you have regular meetings for safety?	30%	70%
Q4.	Do you have regular training programs for safety?	30%	70%
Q5.	Do you wear the safety belts during your work?	40%	60%
Q6.	Did you read information about how to use equipment safely?	50%	50%
Q7.	Does your company have a record for accidents?	20%	80%
Q8.	If you have training programs for safety, Have you been trained how to use the emergency procedures?	20%	80%
Q9.	Have you been trained how to use the personal protective equipment?	20%	80%
Q10.	Have you been trained how to use the fire protection equipment?	10%	90%
Q11.	Does your company have a training program for the new workers?	20%	80%

Table 4.12 Results of part 2 in the questionnaire in company 3

Number of question	Questions	The answer as Percentage
Q1.	You feel your work is dangerous.	58%
Q2.	You feel it is excited to work in unsafe environment.	22%
Q3.	Sometimes it is necessary to do risk procedures to get the job done, what is your opinion?	22%
Q4.	You are able to get the equipment needed to work on health and safety procedures.	50%
Q5.	The safety and health meetings are effective.	52%
Q6.	You always use the safety hat during the work.	55%
Q7.	You always use the eye protection during the work.	50%
Q8.	The age of the worker has an effect on his safety during working.	60%
Q9.	The age of the long working hours for the worker has an effect on his safety during working.	60%
Q10.	There is enough control on using safety equipment and rules by your managers.	62%
Q11.	You always use the safety rubber boots during the work.	50%
Q12.	Your company pays enough attention to safety and health.	62%

The analysis of the first factor:

Table 4.13 The analysis of Factor 1 for company 3

	Meetings		Training programs				supervision				
The weight of question	Q1 50%	Q2 50%	Q1 25%	Q2 25%	Q3 25%	Q4 25%	Q1 20%	Q2 20%	Q3 20%	Q4 20%	Q5 20%
%The answer	15	26	7.5	7.5	7.5	5	8	8	11	10	10
Percentage	41%		27.5%				47%				
The weight of question	38.5%										

The analysis of the second factor:

Table 4.14 the analysis of Factor 2 for company 3

	We don't need risk	Don't feel excited to work in unsafe environment	I am improving my safety information
% of each criteria	33.33%	33.33%	33.33%
The answer from % of criteria	26	26	16.66
The total percentage of the factor	68.66%		

The percentage of safety according to the three related factors:

Table 4.15 The Factor analysis for company 3

Factor number	The safety percentage	The total percentage of safety
F1	38.5%	56.3%
F2	68.66%	
F3	62%	

The results of the first major factor which are represented in Table 4.13 show that the health and safety meetings level is evaluated by 49% according to the regularity and

effectiveness of the safety meetings. Table 4.13 shows that the percentage of holding the health and safety training programs is 27.5% and the supervision on the workers is evaluated at 47% which shows that the level of safety training programs is low, therefore it should be improved. In reference to the supervision level on the workers, its percentage looks moderate but it has also to be improved.

In Table 4.14, the results of the second major factor which shows the results of the positive attitudes of the workers about the safety, indicate that the workers' perceptions are positive with 68.66% of them with the opinion that the working environment is unsafe, and there is need for risk to be reduced and their interests in improving their awareness about safety equipments. According to this percentage of workers' perceptions, 68.66% is fairly acceptable but it also clarifies that workers seek for more awareness about the importance of safety.

The evaluation of the health and safety level in Table 4.15 which depends on the three major factors shows that the result of safety level is 57.6%. This percentage can be applicable but could be enhanced by the recommendations which will be provided later in this chapter.

Table 4.15 is also represented by a bar chart in Figure 4.5 which reveals the safety level of the company according to the three major factors.

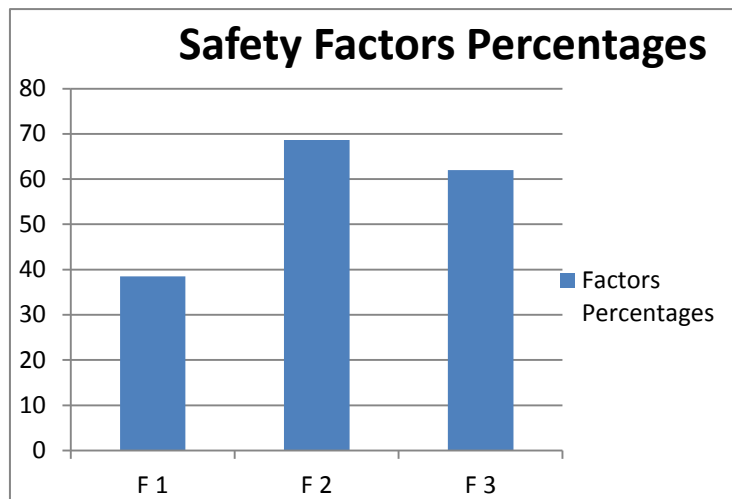


Figure 4.5: The Factors percentages for company 3

For company number 4:

The results for the company number 4 are included in Tables 4.16 and 4.17.

Table 4.16 Results of part 1 in the questionnaire in company 4

Question Number		Yes	NO
Q1.	Did you face a fatal accident?	10%	90%
Q2.	Do you have first aiders near you?	80%	20%
Q3.	Do you have regular meetings for safety?	80%	20%
Q4.	Do you have regular training programs for safety?	90%	10%
Q5.	Do you wear the safety belts during your work?	80%	20%
Q6.	Did you read information about how to use equipment safely?	60%	40%
Q7.	Does your company have a record for accidents?	70%	30%
Q8.	If you have training programs for safety , Have you been trained how to use the emergency procedures?	80%	20%
		90%	10%
Q9.	Have you been trained how to use the personal protective equipment?	70%	30%
Q10.	Have you been trained how to use the fire protection equipment?	80%	20%
Q11.	Does your company have a training program for the new workers?	10%	90%

Table 4.17 Results of part 2 in the questionnaire in company 4

Number of question	Questions	The answer as Percentage
Q1.	You feel your work is dangerous.	42%
Q2.	You feel it is excited to work in unsafe environment.	30%
Q3.	Sometimes it is necessary to do risk procedures to get the job done, what is your opinion?	30%
Q4.	You are able to get the equipment needed to work on health and safety procedures.	67%
Q5.	The safety and health meetings are effective.	75%
Q6.	You always use the safety hat during the work.	85%
Q7.	You always use the eye protection during the work.	82%
Q8.	The age of the worker has an effect on his safety during working.	80%
Q9.	The age of the long working hours for the worker has an effect on his safety during working.	78%
Q10.	There is enough control on using safety equipment and rules by your managers.	76%
Q11.	You always use the safety rubber boots during the work.	78%
Q12.	Your company pays enough attention to safety and health.	81%

The analysis of the first factor:

Table 4.18 The analysis of Factor 1 for company 4

	Meetings		Training programs				Supervision				
The weight of question	Q1 50%	Q2 50%	Q1 25%	Q2 25%	Q3 25%	Q4 25%	Q1 20%	Q2 20%	Q3 20%	Q4 20%	Q5 20%
The answer	40	37.5	20	22.5	17.5	20	16	16	17	16.4	15.6
Percentage	77.5%		80%				81%				

The analysis of the second factor:

Table 4.19 the analysis of Factor 2 for company 4

	We don't need risk	Don't feel excited to work in unsafe environment	I am improving my safety information
% of each criteria	33.33%	33.33%	33.33%
The answer from % of criteria	23.33	23.33	20
The total percentage of the factor	66.66%		

The percentage of safety according to the three related factors:

Table 4.20 The Factor analysis for company 4

Factor number	The safety percentage	The total percentage of safety
F1	79.5%	75.72%
F2	66.66%	
F3	81%	

The first major factor results which are represented in Table 4.18 show that the health and safety meetings level is evaluated by 77.5% according to the regularity and effectiveness of the safety meetings which indicates that the safety meetings are available and effective. Table 4.18 also presents that the percentage of holding the health and safety training programs is at 80% and the supervision on the workers is evaluated by 81% which denotes that the level of safety training programs is high in comparison with the previous companies.

Table 4.19 represents the results of the second major factor which shows the results of the positive attitudes of the workers about the safety and measures how much the workers' perceptions are positive which show that 66.66% of them are of the opinion that the working environment is unsafe, and there is need for risk to be reduced and their interests in improving their awareness about safety equipments is high. This percentage is endurable and workers can keep seeking for more awareness about the importance of safety.

The evaluation of the health and safety level in Table 4.20 which depends on the three major factors shows that the safety level is 75.72%. This percentage can be applicable and it looks high in comparison with the previous companies.

Table 4.20 is also represented by a bar chart in Figure 4.6 which reveals the safety level of the company according to the three major factors.

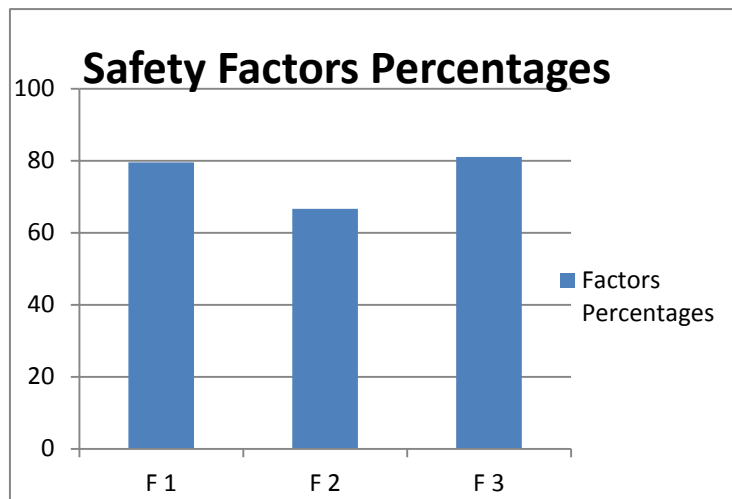


Figure 4.6: The Factors percentages for company 4

For company number 5:

The results for the company number 5 are included in Tables 4.21 and 4.22.

Table 4.21 Results of part 1 in the questionnaire in company 5

Question Number		Yes	NO
Q1.	Did you face a fatal accident?	0%	100%
Q2.	Do you have first aiders near you?	80%	20%
Q3.	Do you have regular meetings for safety?	90%	10%
Q4.	Do you have regular training programs for safety?	70%	30%
Q5.	Do you wear the safety belts during your work?	80%	20%
Q6.	Did you read information about how to use equipment safely?	90%	10%
Q7.	Does your company have a record for accidents?	70%	30%
Q8.	If you have training programs for safety, Have you been trained how to use the emergency procedures?	80%	20%
Q9.	Have you been trained how to use the personal protective equipment?	80%	20%
Q10.	Have you been trained how to use the fire protection equipment?	90%	10%
Q11.	Does your company have a training program for the new workers?	0%	100%

Table 4.22 Results of part 2 in the questionnaire in company 5

Number of question	Questions	The answer as Percentage
Q1.	You feel your work is dangerous.	40%
Q2.	You feel it is excited to work in unsafe environment.	21%
Q3.	Sometimes it is necessary to do risk procedures to get the job done, what is your opinion?	18%
Q4.	You are able to get the equipment needed to work on health and safety procedures.	75%
Q5.	The safety and health meetings are effective.	78%
Q6.	You always use the safety hat during the work.	83%
Q7.	You always use the eye protection during the work.	79%
Q8.	The age of the worker has an effect on his safety during working.	78%
Q9.	The age of the long working hours for the worker has an effect on his safety during working.	76%
Q10.	There is enough control on using safety equipment and rules by your managers.	80%
Q11.	You always use the safety rubber boots during the work.	80%
Q12.	Your company pays enough attention to safety and health.	82%

The analysis of the first factor:

Table 4.23 The analysis of Factor 1 for company 5

	Meetings		Training programs				supervision				
The weight of question	Q1 50%	Q2 50%	Q1 25%	Q2 25%	Q3 25%	Q4 25%	Q1 20%	Q2 20%	Q3 20%	Q4 20%	Q5 20%
%The answer	15	26	7.5	7.5	7.5	5	8	8	11	10	10
Percentage	41%		27.5%				47%				
The weight of question	38.5%										

The analysis of the second factor:

Table 4.24 the analysis of Factor 2 for company 5

	We don't need risk	Don't feel excited to work in unsafe environment	I am improving my safety information
% of each criteria	33.33%	33.33%	33.33%
The answer from % of criteria	27.33	26.33	30
The total percentage of the factor	83.66%		

The percentage of safety according to the three related factors:

Table 4.25 The Factor analysis for company 5

Factor number	The safety percentage	The total percentage of safety
F1	82.3%	82.65%
F2	83.66%	
F3	82%	

The first major factor results which are represented in Table 4.23 show that the health and safety meetings level is evaluated by 84% according to the regularity and effectiveness of the safety meetings which indicates that the safety meetings are available and effective. This percentage is quite high and identifies the professional level of the safety and health meetings. Table 4.23 also presents that the percentage of holding the health and safety training programs is 82.5% and the supervision on the workers is evaluated by 80.4% which denotes that the level of safety training programs is extremely high.

The second major factor which shows the results of the positive workers' attitudes about the safety and measures the perception of workers towards safety show that 83.66% of them are of the opinion that the working environment is unsafe, there is need for risk to be reduced and their interests in improving their awareness about safety equipments was high according to Table 4.24. This percentage is really high comparing to previous companies, so workers can keep their awareness level about the importance of safety.

The evaluation of the health and safety level in Table 4.25 which depends on the three major factors shows that the result of safety level is 82.65%. This percentage is very high and it looks high in comparison with the previous companies.

Table 4.25 is also represented by a bar chart in Figure 4.7 which reveals the safety level of the company according to the three major factors.

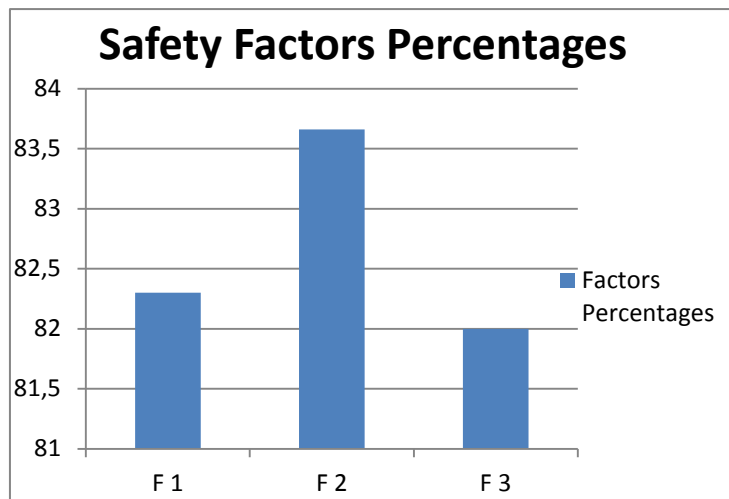


Figure 4.7: The Factors percentages for company 5

For company number 6:

The results for the company number 6 are included in Tables 4.26 and 4.27.

Table 4.26 Results of part 1 in the questionnaire in company 6

Question Number		Yes	NO
Q1.	Did you face a fatal accident?	10%	90%
Q2.	Do you have first aiders near you?	80%	20%
Q3.	Do you have regular meetings for safety?	80%	20%
Q4.	Do you have regular training programs for safety?	90%	10%
Q5.	Do you wear the safety belts during your work?	80%	20%
Q6.	Did you read information about how to use equipment safely?	60%	40%
Q7.	Does your company have a record for accidents?	70%	30%
Q8.	If you have training programs for safety , Have you been trained how to use the emergency procedures?	80%	20%
		90%	10%
Q9.	Have you been trained how to use the personal protective equipment?	70%	30%
Q10.	Have you been trained how to use the fire protection equipment?	80%	20%
Q11.	Does your company have a training program for the new workers?	10%	90%

Table 4.27 Results of part 2 in the questionnaire in company 6

Number of question	Questions	The answer as Percentage
Q1.	You feel your work is dangerous.	38%
Q2.	You feel it is excited to work in unsafe environment.	26%
Q3.	Sometimes it is necessary to do risk procedures to get the job done, what is your opinion?	20%
Q4.	You are able to get the equipment needed to work on health and safety procedures.	78%
Q5.	The safety and health meetings are effective.	76%
Q6.	You always use the safety hat during the work.	78%
Q7.	You always use the eye protection during the work.	83%
Q8.	The age of the worker has an effect on his safety during working.	80%
Q9.	The age of the long working hours for the worker has an effect on his safety during working.	79%
Q10.	There is enough control on using safety equipment and rules by your managers.	82%
Q11.	You always use the safety rubber boots during the work.	79%
Q12.	Your company pays enough attention to safety and health.	38%

The analysis of the first factor:

Table 4.28 the analysis of Factor 1 for company 6

	Meetings		Training programs				supervision				
The weight of question	Q1 50%	Q2 50%	Q1 25%	Q2 25%	Q3 25%	Q4 25%	Q1 20%	Q2 20%	Q3 20%	Q4 20%	Q5 20%
%The answer	40	38	19.5	19.75	20.5	19.75	16	16	15.6	16.6	16.4
Percentage	78%		79.5%				80.6%				
The weight of question	79.36%										

The analysis of the second factor:

Table 4.29 The analysis of Factor 2 for company 6

	We don't need risk	Don't feel excited to work in unsafe environment	I am improving my safety information
% of each criteria	33.33%	33.33%	33.33%
The answer from % of criteria	20	24.66	26.66
The total percentage of the factor	71.32%		

The percentage of safety according to the three related factors:

Table 4.30 The Factor analysis for company 6

Factor number	The safety percentage	The total percentage of safety
F1	79.36%	76.56%
F2	71.32%	
F3	79%	

The first major factor results which are represented in Table 4.28 show that the health and safety meetings level is 78% which shows that the safety meetings are available and effective. Table 4.28 also reveals that the percentage of holding the health and safety training programs is 79.5% and the supervision on the workers is at 80.6% which shows that the level of safety training programs is again high in comparison with previous companies.

Table 4.29 shows the second major factor which explains the results of the positive attitudes of workers on safety meetings and measures the perceptions of workers towards safety as 71.32% meaning that the workers consider their working environment as unsafe, thus there is need for risk to be reduced and their interests in improving their awareness on safety equipments is high. This percentage can be acceptable and workers should keep their awareness about the importance of safety.

The evaluation of the health and safety level in Table 4.30 which depends on the three major factors and reveals that the safety level is 76.56%. This result appears good enough among these companies.

Table 4.30 is also represented by a bar chart in Figure 4.8 which reveals the safety level of the company according to the three major factors.

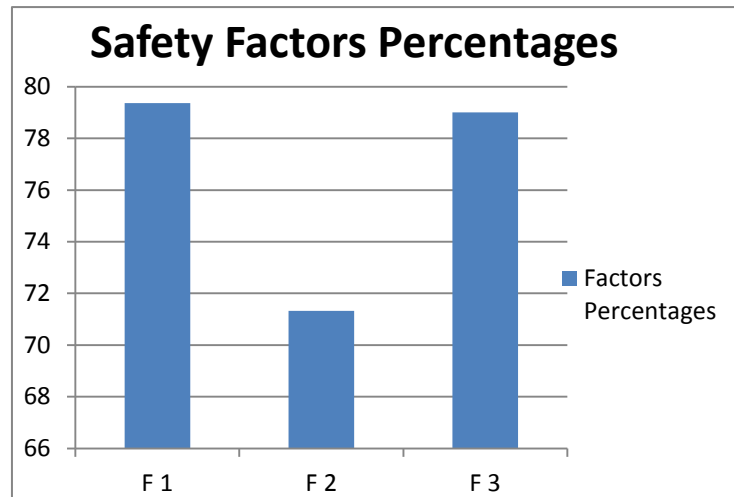


Figure 4.8: The Factors percentages for company 6

4.3 Discussion

The bar chart in Figure 4.9 represents the three factors percentages for each company. The first factor represents the influence of the safety and health office and the human resources office on the safety during construction. The second factor represents the influence of the personal attitudes and habits of the workers on their safety during construction. The third factor represents the effects of the administration of the construction company on the safety during construction.

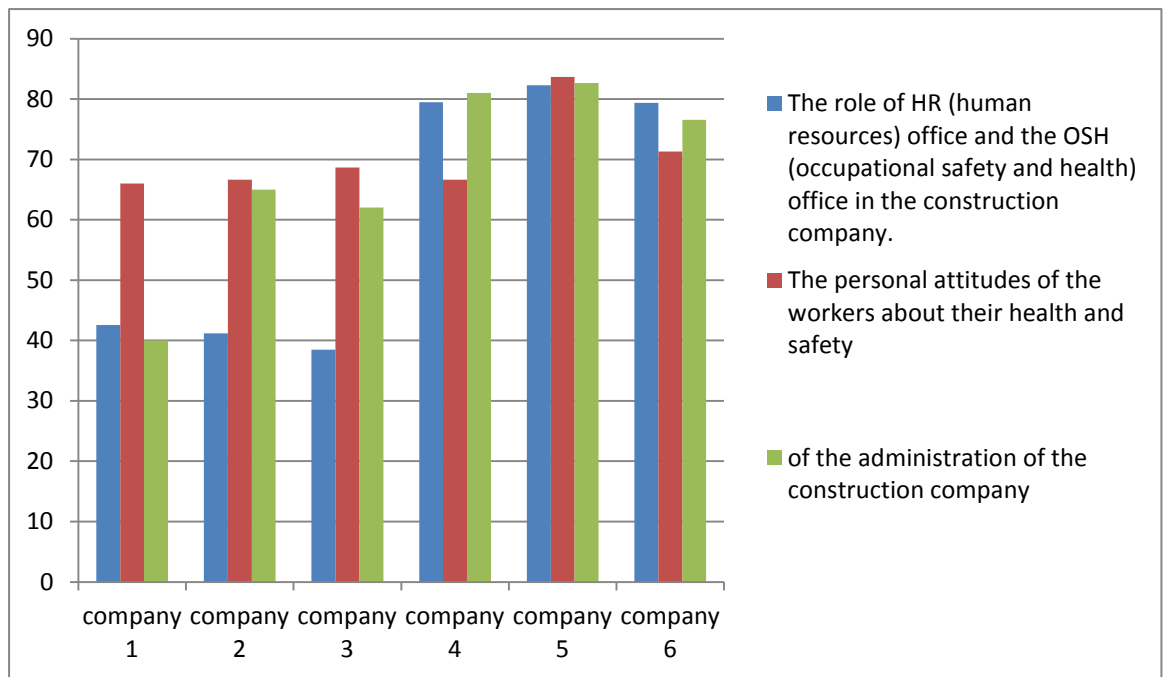


Figure 4.9: The three factors percentages for each company from the six companies

The histogram shows that the percentages of safety for the companies 4, 5 and 6 which are large and old companies are more than the percentages of safety for the companies 1, 2 and 3 which are small and new.

So, it was noticed that the safety has a relationship with the size of the project and company and the experience of the company. This relationship states that when the size and the experience of the company increase, the safety will increase.

The average of the safety for the six companies is 66.39% considering the three factors. It is acceptable for a developing city, but when the reasons of missing some safety requirements were analyzed which are related to the three factors, it was found that many of the companies do not have any relation with the organizations which were interested in the international standards for the occupational health and safety and technical support.

Many of the companies (specially the small ones) do not have an office specialized in the safety and health so they do not give it high importance.

Most of the offices of human resources were interested in the salaries and attendance of the workers more than the safety of them.

The offices of human resources concentrated on the training programs and technical skills and sometimes ignore the safety issues, and the effect on the personal attitudes of the workers. Some of them consider it necessary to take the risks to finish the work quickly, while some felt excited to work in unsafe environment.

Others were not interested in improving their safety skills and did not try to increase their awareness about safety because they did not want to change some of their habits.

Hassanein and Hanna (2008) had investigated the impact of safety training programs on the safety level, and they found that there is a direct proportional relation which means that if the safety training programs in the companies are of high level, the safety level will increase as well.

By comparing the present study with the previous study conducted by Hassanein and Hanna (2008), the study found that the companies which have a high level in training programs had the highest safety level.

It is also clear that the cultural dimension which influences the workers attitudes about safety procedures is an effective factor on the safety level. Many of the attitudes are wrong, some of these attitudes are the wrong understanding of the fate and

religious ideas which must have a positive effects on the behavior of the workers. Many of the workers, when they were asked about the reason which forbid them to follow the safety procedures, answered “the age is in God’s hand”. These ideas are the result of the false understanding of fate, so to solve this problem, the companies have to change the perception of the workers and explain to them the importance of following the safety procedures.

This describes the culture and its influence on the level of safety in the construction industry in KSA. It investigates the safety perceptions, attitudes, and behaviour of the construction workers and management safety practices. It shows the results of a number of questionnaire surveys administed in KSA targeting construction workers, and managers with safety management responsibilities.

Based upon the survey results, this study shows that the majority of KSA construction workers have a good degree of risk awareness and self-rated competence, and a relatively high degree of safety awareness.

Furthermore, it was empirically found that overall workers' intentional behaviour seems to be best explained by workers' attitudes towards their own and management safety responsibilities, and their perception of risk which they are generally exposed to in their workplace.

The reasons of the low percentage of safety meeting according to the workers during the personal interview is attributed to:

- 1) Many workers do not attend the safety meetings.
- 2) The number of workers increases by the day and management finds it difficult to organise them.
- 3) The routine of the safety meetings makes the workers bored and this decreases the effectiveness of these safety meetings.

The results of the study show that the administration of the company has a direct effect on the safety level. Considering the high costs as adding safety offices and employing safety specialists, the high financial costs of the social insurance of the procedures and the costs of the safety articles and tools are the main reasons why company administrations mostly do not prefer to take safety measures.

4.4 Recommendations

It is important for the companies' administrations to specify enough budgets for health and safety costs, and to interact with the international organizations specialized in health and safety as OSHA, and liase with certified consultancy companies which revise the documents and evaluate the safety needed for each stage of construction.

It is preferable for the companies to have independent offices for safety and health which include professional and specialized staff to design the management system to solve the safety problems and decrease the number of accidents, and these offices have the responsibility of holding regular meetings for safety and health, organizing training and technical programs, providing safety and health equipments and recording the accidents in the site.

It is also recommended that the workers in such companies must have social insurance which will make the companies more cautious and install more safety equipments. It is also important for the managers to practice the safety procedures in front of the workers.

Chapter 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

This research has found out that there are different problems related to the aspects of safety and health of workers in the construction industry of KSA that should be improved.

Thus, this research concluded that safety and health in construction in this region is influenced by three significant factors which include the management, the health and safety office or human resources office, and the workers.

Firstly, the administrations of construction companies did not submit persuasive programs in their management and strategic plans and did not allocate enough proportion of the budgets to reach the required levels of safety and health within their companies. Secondly, the role of health and safety offices or human resources offices in these companies was not effective because there was absence for the dynamics of health and safety meeting, training programs for safety and technical, the provision of first aid equipments, personal protective equipments such as safety hat, safety belts, and rubber boots.

Thirdly, there were three determinants affecting the dynamic of workers. The ideas and perceptions of those workers showed that they become more excited when

performing their works without safety equipments. There are also different religious misconceptions related to the belief of fate. Most importantly, the behavior of managers is compatible to a big extent to the safety measures practiced by these workers.

In addition, this research found out that there is a compatibility between the size and experience of the company in the one hand and the aspect of safety in the other. Hence, it is noticed that well experienced and large companies put more consideration into safety than the newly established ones.

5.2 Further Recommendations

It was so difficult to observe the construction companies budget for the safety, so it is so important in the further researches to concentrate on the budget of the safety in each company and to find the minimum percentage which should be determined for the safety in the general budget of the company. It is so important also in the further studies to concentrate more on the effect of the social insurance and its relationship with the safety.

REFERENCES

- Aksorn, T., & Hadikusumo, B. H. W. (2008). Critical Success Factors Influencing Safety Program Performance in Thai Construction Projects. *Safety Science*, 46(4), 709-727.
- Chan, D. W., Chan, A. P., & Choi, T. N. (2010). An Empirical Survey of the Benefits of Implementing Pay for Safety Scheme (PFSS) in the Hong Kong Construction Industry. *Journal of Safety Research*, 41(5), 433-443.
- Fang, D. P., Huang, X. Y., & Hinze, J. (2004). Benchmarking Studies on Construction Safety Management in China. *Journal of Construction Engineering and Management*, 130(3), 424-432.
- Hassan, C. R. C. H. E., Basha, O. J., & Hanafi, W. H. W. A. N. (2007). Perception of Building Construction Workers Towards Safety, Health and Environment. *Journal of Engineering Science and Technology*, 2(3), 271-279.
- Hassanein, A. A., & Hanna, R. S. (2008). Safety Performance in the Egyptian Construction industry. *Journal of Construction Engineering and Management*, 134(6), 451-455.
- Hetherington, R., Farrimond, B., & Presland, S. (2006). Information Rich Temporal Virtual models using X3D. *Computers & Graphics*, 30(2), 287-298.

Huang, X., & Hinze, J. (2006). Owner's Role in Construction Safety. *Journal of Construction Engineering and Management*, 132(2), 164-173.

Kines, P., Andersen, L. P., Spangenberg, S., Mikkelsen, K. L., Dyreborg, J., & Zohar, D. (2010). Improving Construction Site Safety Through Leader-Based Verbal Safety Communication. *Journal of Safety Research*, 41(5), 399-406.

Kretzschmar, M. (2006). U.S. Patent No. 7,066,778. Washington, DC: U.S. Patent and Trademark Office..

Lee, C. K., & Yusmin, J. (2012). Prioritization of Factors Influencing Safety Performance on Construction Sites: A Study Based on Grade Seven (G7) Main Contractors' Perspectives. In *2012 International Conference on Business, Management and Governance in Hong Kong (ICBMG2012)* (Vol. 57).

Meliá, J. L., Mearns, K., Silva, S. A., & Lima, M. L. (2008). Safety Climate Responses and the Perceived Risk of Accidents in the Construction Industry. *Safety Science*, 46(6), 949-958.

Mohamed, S., Ali, T. H., & Tam, W. Y. V. (2009). National Culture and Safe Work Behaviour of Construction Workers in Pakistan. *Safety Science*, 47(1), 29-35.

Ng, T. S., Pong Cheng, K., & Martin Skitmore, R. (2005). A Framework for Evaluating the Safety Performance of Construction Contractors. *Building and Environment*, 40(10), 1347-1355.

Olson, R., Grosshuesch, A., Schmidt, S., Gray, M., & Wipfli, B. (2009). Observational Learning and Workplace Safety: The Effects of Viewing the Collective Behavior of Multiple Social Models on the Use of Personal Protective Equipment. *Journal of Safety Research*, 40(5), 383-387.

Probst, T. M., & Estrada, A. X. (2010). Accident Under-Reporting Among Employees: Testing the Moderating Influence of Psychological Safety Climate and Supervisor Enforcement of Safety Practices. *Accident Analysis & Prevention*, 42(5), 1438-1444.

Reay, Daine, & Wiliam (1999). I will be a Nothing: Structure, Agency and the Construction of Identity through Assessment. *British Educational Research Journal*, 25(3), 343-354.

Rowlinson, S. M. (1997). *Hong Kong Construction: Site Safety Management*. Hong Kong: Sweet & Maxwell Asia.

Saurin, T. A., Formoso, C. T., & Cambraia, F. B. (2008). An Analysis of Construction Safety Best Practices from A Cognitive Systems Engineering Perspective. *Safety Science*, 46(8), 1169-1183.

Sgourou, E., Katsakiori, P., Goutsos, S., & Manatakis, E. (2010). Assessment of Selected Safety Performance Evaluation Methods in Regards to their Conceptual, Methodological and Practical Characteristics. *Safety Science*, 48(8), 1019-1025.

Tam, C. M., Zeng, S. X., & Deng, Z. M. (2004). Identifying Elements of Poor Construction Safety Management in China. *Safety Science*, 42(7), 569-586.

Teo, E. A. L., Ling, F. Y. Y., & Chong, A. F. W. (2005). Framework for Project Managers to Manage Construction Safety. *International Journal of Project Management*, 23(4), 329-341.

Ventures Middle East, Retrived From L.L.C <http://www.ventures-me.com/contents.php?contents=111>, Accesed in 19 May, 2013

Wilson, J. M., & Koehn, E. E. (2000). Safety Management: Problems Encountered and Recommended Solutions. *Journal of Construction Engineering and Management*, 126(1), 77-79.

APPENDICES

Appendix A: The questionnaire

Safety Questionnaire	
Name of company:	Place:
Name of employee:	
Position in company:	
Please complete the following questionnaire by placing $\checkmark$ in appropriate box:	
I- Working experience :	
☐ 0 – 5 yrs	☐ 5 – 10 yrs
☐ 10 – 20 yrs	☐ More than 20 yrs
II- Number of employee :	
☐ Less than 5	☐ 5 – 1
☐ 10 – 50	☐ More than 50
III-Number of annual projects :	
☐ 1	☐ 1 – 3
☐ 03 – 05	☐ More than 5
IV- Type of projects: ☐ Public projects. ☐ Private projects.	
V- Field of work :	
☐ Buildings constructions	☐ roads construction
☐ Water projects	☐ industrial
☐ Other, please specify	

VI- Annual turnover :

☐ Less than 100,000 \$

☐ 100,000 – 500,000

☐ 500,000 - 5,000,000

☐ More than 5,000,000

NO		YES	NO	NOT Applicable
1-	You face fatal accidents during your work.	☐	☐	☐
2-	You have first aiders and first aid facility on your premises.	☐	☐	☐
3-	Health and safety meetings are held regularly in work place.	☐	☐	☐
4-	Training programs on health & safety issues are held regularly in your company.	☐	☐	☐
5-	You use safety belts and life line during your work.	☐	☐	☐
6-	You read enough information about safety of the equipment which you use.	☐	☐	☐
7-	You have a system in place to report and record incidents and near misses.	☐	☐	☐
8-	You have been trained how to use the emergency procedures.	☐	☐	☐
9-	You have been trained how to use personal protective equipment.	☐	☐	☐
10-	You have been trained how to use the fire protection equipment.	☐	☐	☐
11-	There is an orientation for new workers in your company on how to use the safety equipment and rules.	☐	☐	☐

no		Strongly agree	agree	Uncertain	Disagree	Strongly disagree	Not applicable
12-	Your work in general is dangerous.	☐	☐	☐	☐	☐	☐
13-	You feel excited to work in unsafe environment.	☐	☐	☐	☐	☐	☐
14-	You think that sometimes it is necessary to do risk procedures to get the job done.	☐	☐	☐	☐	☐	☐
15-	You are able to get the equipment needed to work on health and safety procedures / rules.	☐	☐	☐	☐	☐	☐
16-	If regular meetings regarding safety issues are held in your work place, actions are always done regarding matters discussed at the health and safety meeting.	☐	☐	☐	☐	☐	☐
17-	You always use a hard hat during your work.	☐	☐	☐	☐	☐	☐
18-	You always use an eye protection during your work.	☐	☐	☐	☐	☐	☐
19-	You think the age of employee has an effect on how to deal with the risks he may face in your work place.	☐	☐	☐	☐	☐	☐
20-	You think that long working hours has an effect on your concentration and increases your safety risk.	☐	☐	☐	☐	☐	☐
21-	There is enough control on using safety equipment and rules by your managers.	☐	☐	☐	☐	☐	☐
22-	You use safety shoes (rubber boots) during work.	☐	☐	☐	☐	☐	☐
23-	You believe your company pays enough attention to safety & health issues.	☐	☐	☐	☐	☐	☐

Appendix B: Summary of the companies' results

Question Number		Yes	NO
Q1.	Did you face a fatal accident?	13%	86.7%
Q2.	Do you have first aiders near you?	60%	40%
Q3.	Do you have regular meetings for safety?	60%	40%
Q4.	Do you have regular training programs for safety?	62%	38%
Q5.	Do you wear the safety belts during your work?	63%	37%
Q6.	Did you read information about how to use equipment safely?	60%	40%
Q7.	Does your company have a record for accidents?	42%	58%
Q8.	If you have training programs for safety , Have you been trained how to use the emergency procedures?	58%	42%
Q9.	Have you been trained how to use the personal protective equipment?	53%	47%
Q10.	Have you been trained how to use the fire protection equipment?	53%	47%
Q11.	Does your company have a training program for the new workers?	67%	33%

Number of question	Questions	The answer as Percentage
Q1.	You feel your work is dangerous.	53%
Q2.	You feel it is excited to work in unsafe environment.	25%
Q3.	Sometimes it is necessary to do risk procedures to get the job done, what is your opinion?	23%
Q4.	You are able to get the equipment needed to work on health and safety procedures.	57.5%
Q5.	The safety and health meetings are effective.	60%
Q6.	You always use the safety hat during the work.	65%
Q7.	You always use the eye protection during the work.	61%
Q8.	The age of the worker has an effect on his safety during working.	64%
Q9.	The age of the long working hours for the worker has an effect on his safety during working.	66%
Q10.	There is enough control on using safety equipment and rules by your managers.	65%
Q11.	You always use the safety rubber boots during the work.	60%
Q12.	Your company pays enough attention to safety and health.	61%