The Islamic University–Gaza
Research and Postgraduate Affairs
Faculty of Engineering Civil
Civil Engineering Department
Engineering Projects Management

الجامعـــــــة الإســـلاميـة – غـزة
شئون البحث العلمي والدراسات العليا
كـليـــــــــــــــــة الهـــندسة
قســـــــم الهنـــــدسة المـــــدنية
إدارة المشـــــروعات الهنـــــدسية

Fall Accident Causes and Prevention in the Construction Industry

حوادث السقوط في المشاريع الانشائية المسببات والوقاية

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A thesis is submitted in partial fulfilment of the requirement for degree of Master in civil engineering – construction management

The Islamic University of Gaza

January/2018

إقـــــــــــــــــــــــــرار

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Fall Accident Causes and Prevention in the Construction Industry
حوادث السقوط في المشاريع الانشائية المسببات والوقاية

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حوادث السقوط في المشاريع الإنشائية المسببات والوقاية

Fall Accident Causes and Prevention in the Construction Industry

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أ. د. مازن إسماعيل هنية

الرقم العام للنسخة	310660	اللغة	ع

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والله ولي التوفيق،

إدارة المكتبة المركزية

توقيع الطالب

محمود رمضان صليحة

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Abstract

Accidents in the construction industry tend to be costly in both human and financial terms. Among all accident causes, fall is the most dangerous. Health and safety is the most challenging issue in Gaza Strip construction industry. Palestinian construction industry suffers recently from poor safety and health conditions as safety rules do not exists and work hazards in the workplace are not perceived.

This research aimed at improving the level of safety at the work areas in Gaza Strip, especially at the high workplaces to prevent the fall accidents. To achieve this aim, the following objectives were set out; (1) determine the factors of causes and prevention for fall accidents in the construction industry, (2) rank the most common causes and prevention for fall accidents in the construction industry, (3) to test the relationship between the causes and prevention of fall accidents, (4) to introduce a quantified model to test the effect of fall causes on the prevention, (5) to suggest a recommendations to minimize the causes of fall and enhance the prevention.

The research used a quantitative method to analysis the collected data. The methodology adopted is based on questionnaire targeting the construction engineers and workers. Questionnaire of engineers includes four sections: personal information, factors affecting the causes of fall accidents, factors affecting the prevention of fall accidents, and diagnosing the fall accidents causes and prevention. Besides, the questionnaire of workers includes three sections: personal information, factors affecting the causes of fall accidents, factors affecting the prevention of fall accidents. A total number of 110 and 300 questionnaires were distributed to engineers and workers respectively who have been working in the contracting companies that are classified under first, second, and third class and competent in the field of buildings. While 100 and 290 questionnaires on engineers and 300 were completed by construction engineers and workers respectively and then reviewed and analysed using Statistical Package for Social Science (SPSS) IBM version 22.

The results of the research showed that the most common causes of fall accidents from the engineers and workers points of view were working on heights without fencing, choosing unskilled workers to work on heights and execute the works without fall prevention safety equipment. Otherwise, the engineers and workers agreed that the most factor of prevention is fencing the work area especially the heights. The research concluded that there is a significant relationship between the causes of fall accidents and the prevention in the construction industry from the engineers and workers point of view. The research also showed that the social and the working environment groups had a significant effect on the prevention from the engineer's point of view. In addition, the occupational safety and health, the working environment, and the economic groups had a significant effect on the prevention from the workers point of view.

In light of this research, the recommendations to minimize the causes of fall accidents and to ensure prevention are: fencing the working area specially heights, providing the safety equipment in the work site including safety built and net, and recruit the suitable workers to work on heights with age, weight, health and psychological status, and education and training qualities.

الملخص

تعتبر الحوادث في المشاريع الإنشائية مكلفة ليس في الجانب البشري فقط، وإنما في الجانب المادي أيضا، وعلى الرغم من كثرة المسببات لهذه الحوادث، تعتبر حوادث السقوط هي الأشد خطورة. السلامة والصحة المهنية هي القضية الأكثر تحدياً في المشاريع الإنشائية ، وتعاني صناعة الانشاءات في قطاع غزة من سوء ظروف السلامة والصحة المهنية حيث لا توجد قوانين خاصة بالسلامة، ولا يتم النظر إلى مخاطر العمل على أنها جانب مهم في مواقع العمل.

تهدف هذه الدراسة إلى تحسين مستوى السلامة في مناطق العمل في قطاع غزة، وخاصة في أماكن العمل المرتفعة لمنع حوادث السقوط. وقد حُددت الأهداف التالية للدارسة وهي: (1) تحديد عوامل الأسباب وعوامل الوقاية من حوادث السقوط في صناعة الانشائات، (2) تقييم الأسباب الأكثر شيوعا لحوادث السقوط وأفضل طرق الوقاية منها ، (3) اختبار العلاقة بين الأسباب والوقاية، (4) إدخال نموذج كمي لاختبار تأثير أسباب السقوط على الوقاية، (5) اقتراح توصيات لتقليل أسباب السقوط وتعزيز الوقاية.

استخدم البحث الطريقة الكمية لتحليل البيانات التي تم جمعها ،و ذلك من خلال استبيان يستهدف المهندسين والعمال في شركات المقاولات،ويحتوي استبيان المهندسين أربعة أقسام وهي: المعلومات الشخصية، والعوامل التي تؤثر على أسباب حوادث السقوط، والعوامل التي تؤثر على الوقاية من حوادث السقوط، وتشخيص حوادث السقوط، إلى جانب ذلك يتضمن استبيان العمال ثلاثة أقسام وهي: المعلومات الشخصية، والعوامل التي تؤثر على أسباب حوادث السقوط، والعوامل التي تؤثر على الوقاية من حوادث السقوط. تم أُخذت العينة من شركات المقاولات المصنفة تحت الدرجة الأولى والثانية والثالثة والمختصة في مجال المباني، والبالغ عددها 186 شركة وقد تمَّ استخدام طريقة العينة العشوائية لجمع البيانات، حيث بلغ عدد الاستبيانات الموزعة 110 استبانة على المهندسين، و300 استبيان على العمال (المهندسين الى العمال بنسبة 1: 3)، وتم استرجاع 100 استمارة من المهندسين، و290 من العمال. تم تحليل البيانات بالمنهج الوصفي التحليلي واستخدام برنامج SPSS لتحليل هذه الاستبيانات.

خلصت هذه الدراسة الى أن الأسباب الأكثر شيوعا لحوادث السقوط من وجهة نظر المهندسين والعمال وهي: العمل في المرتفعات بدون وجود سياج حماية من السقوط، واختيار عمال غير المهرة للعمل في المرتفعات وأيضاً استئناف الأعمال في حالة عدم وجود وسائل الوقاية من حوادث السقوط، بالإضافة الى تسيج مناطق العمل وخاصة المرتفعات هي أهم طرق الوقاية. توصلت هذه الدراسة الى وجود علاقة ذات دلالة إحصائية بين مجموعات العوامل الخاصة بمسببات حوادث السقوط والوقاية في المشاريع الانشائية من وجهة نظر المهندسين والعمال. وأظهرت أيضا أن مجموعاتا العوامل الخاصة بالمناخ الاجتماعي ومناخ العمل لها تأثير كبير على الوقاية من وجهة نظر المهندسين، ومن ناحية أخرى فإن مجموعات العوامل الخاصة بالسلامة والصحة المهنية، ومناخ العمل والاقتصادية لها آثار كبيرة في تجنب حوادث السقوط من وجهة نظر العمال.

وفي ضوء هذه الدراسة فإن التوصيات للتقليل من أسباب حوادث السقوط وتحسين طرق الحماية منها تركزت في: أهمية وجود سايج حماية من السقوط للأعمال في المرتفاعات، وأهمية توافر معدات السلامة في مواقع العمل ويتضمن حزام الوقاية وشبكة الحماية من السقوط و أخيراً طريقة اختيار العمال المناسبين للعمل في المرتفعات مع الأخذ بيعين الاعتبار السنّ ،والوزن، والحالة الصحية والنفسية، والمستوى التعليمي ومدى التدريب.

قُلْ إِنَّ صَلَاتِي وَنُسُكِي وَمَحْيَايَ وَمَمَاتِي
لِلَّهِ رَبِّ الْعَالَمِينَ ﴿١٦٢﴾

الأنعام'162'

Dedication

Firstly, this research is dedicated to my Father Dr. Rafiq Maliha and my beloved Mother who has been my constant source of inspiration. They have given me the guide and discipline to tackle any difficulty in this life with enthusiasm and determination. Without their prayers, love, encouragement, and support. This work has not been possible. Also, I dedicate this effort to the most beautiful gifts from Allah, my wife, and my kids .

And without any doubt, I dedicate this thesis to my beloved brothers, sisters, best real friends, as well as the entire special people who have supported me throughout the process of carrying out this work. Their love and encouragement have had a great impact on me giving me the energy to complete this work .

Mahmoud R. Maliha

Acknowledgment

First and foremost, I would like to thanks Allah for what I have, also from my deep of my heart I would like to Thank my supervisor Dr. Khalid Al Hallaq for his unlimited support and my friends for continuous encouragement me.

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List of Abbreviations

AFR	Accident Frequency Rate
AR	Accident Rate
BLS	Bureau of Labor Statistics
CFOI	Center of Fatal Occupational Injuries
CPS	Current Population Survey
CII	Construction Industry Institute
EASHW	European Agency for Safety & Health at Work
EMR	Experience Modification Rating
EU	European Union
FFH	Falls from height
GNP	Gross National Product
HIOSH	Hawaii Occupational Safety and Health Division
ILO	International Labor Organization
MoL	Ministry of Labor
NEBOSH	National Examination Board in Occupational Safety and Health
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
OSHAct	Occupational Safety and Health Act
OSHBLD	Occupational Safety and Health Branch of the Labor Department
OSHATrain	Occupational Safety and Health Training
PCU	Palestinian Contractor Union
STF	Slips, trips, and falls
SPSS	Statistical Package for Social Sciences
SPL	Safety Performance Level
USA	United State of American
DOSH	Department of Safety and Health
PPE	Personal Protective Equipment

Chapter 1
Introduction

Chapter 1
Introduction

This chapter introducing general information about safety in construction project. and will give a background, and a brief description of the thesis. giving the objectives of the thesis, research (hypothesis, scope and limitation, methodology and structure).

1.1 Background

The Construction Industry contributes persistently to high accident rates: especially fatalities (Belel and Mahmud, 2012). This industry has been plagued by a high number of fatality rates on construction sites. Construction sites itself is commonly known as the most hazardous workplace (Lee and Jaafar, 2012). Current investigation from Department of Safety and Health (DOSH) has shown that construction sites have the highest death toll among all the industries (DOSH, 2012). Safety in the construction industry has been considered an important issue, with construction being one of the most dangerous industries (Mohamed and Tam, 2008).

A large proportion of injuries in the construction industry is due to falls from height. In the UK, it is estimated that falls from height accounted for between 44% and 60% of all fatal accidents in the construction industry across the years 1996 to 2001. It is perhaps not surprising, given the ubiquity of scaffold structures in the construction industry, that falls from scaffolds represent a large proportion of all work-related falls. Clearly, the large loss of life and the financial costs of these accidents to the construction sector justify research into safety aspects of working on and around scaffolds. (Whitaker et al., 2003)

1.2 Statement of the problem

Accidents in the construction industry tend to be costly in both human and financial terms. Among all accident causes, fall is the most dangerous. Health and safety is the most challenging issue in Gaza Strip construction industry. Palestinian construction industry suffers recently from poor safety and health conditions as safety rules do not exists and work hazards in the workplace are not perceived. This situation resulted in the increased number of accidents (Enshassi and Aqad, 2011). The most commonly types of accident in construction site are; falling (22.2%), Stepping on the object (18.2%) and Stroked by falling object (17.1%). This finding coincides with latest accident data obtained from (DOSH, 2011).

Accidents in the construction industry tend to be costly in both human and financial terms, and due to the high rates of injuries and fatalities in the construction industry among all other industries. The most dangers accident is fall, it is essential to conduct a research fall accident causes to reduce rates of accidents and control or eliminate hazards at the work site by Prevention awareness and exert pressure on companies for safety in their construction site.

1.3 Research Aim and Objectives

This research aims to improving the level of safety at the work areas in Gaza strip, especially at the high workplaces to prevent the fall accidents. Throwing study fall accident causes and prevention in the construction industry in Gaza strip. The aim of this research divided into the following objectives:

1. To determine the factors of causes and prevention for fall accidents in construction industry.
2. Rank of the most common causes and prevention for fall accidents in the construction industry regarding the nature of respondent involved.
3. To test the relationship between the groups of causes and the prevention in the construction industry.
4. To introduce a quantified model to test the effect of causes on the prevention for fall accidents.
5. To suggest recommendations to minimize the causes and enhance the prevention for fall accidents.

1.4 Research Hypothesis

The research hypothesis are:

First hypothesis: There is a significant difference among respondents (workers/ engineers) regard the fall accident causes and prevention in the construction industry due to personal information (position, years of experience, qualification, the number of projects in the last five years and age).

Second hypothesis: there is a significant relationship between groups of fall accidents causes and prevention in the construction industry.

Sub hypothesis:

H1: There is a significant relationship between the occupational safety & health and the prevention of fall accidents in the construction industry.

H2: There is a significant relationship between the economic factors and the prevention of fall accidents in the construction industry.

H3: There is a significant relationship between the social factors and the prevention of fall accidents in the construction industry.

H4: There is a significant relationship between the working environment factors and the prevention of fall accidents in the construction industry.

Third hypothesis: There is a significant positive effect of the groups of fall accident causes (independent variables) on the prevention (dependent variable) in the construction industry, engineering and worker point of view.

1.5 Research Scope and Limitations

The scope and limitations of the study as follows:

- The research was conducted only on a population who is living in Gaza strip in Palestine. Because of the geographical limit, it was hard to think about a sample from the same population in West Bank.
- The research survey was limited to Gaza strip contracting companies that are classified under a first, second and third class which have a valid registration in Palestinian Contractor Union (PCU) and competent in the field of buildings.

1.6 Research Methodology

The research methodology will include steps, which can be summarized in the following points:

1- **Problem identification:** It includes defining the problem, demonstrates the aim and objectives, research hypotheses. In addition, promote a research approach and a suitable technique.

2- **Literature Review:** Perform a review of literatures relating to the topic of this research. The objective of the review is to identify the causes of fall accident and the prevention in the construction projects to put the draft questionnaire.

3- **Questionnaire Design:** Modification the questionnaire throwing the pilot study to prove that the questions are clear to by answer.

4- **Data Collection:** Data collect using the questionnaire survey through distributing to the construction company.

5- **Data Analyses:** Perform analysis of data using appropriate statistical techniques which is the SPSS package, do the reliability and validity test and comparing result with previous study.

6- **Conclusion and Recommendations:** Result summary with related objective, proposing applicable solution and recommendations.

7- **Documentation:** Included formatting, editing the final text, and spelling and grammatical review.

1.7 Research structure

The thesis consists of five chapters as follows:

- **Chapter 1: Introduction**

  This chapter has a general introduction to the subject of the thesis. It describes the rational of the research, research objectives, and the outline of the research methodology. The research scope and the outline contents are also stated in chapter1.

- **Chapter 2: literature review**

  Reviews the literature in the area of construction safety, fall accident, prevention and its factors

- **Chapter 3: Methodology**

  This chapter defines the process of the methodology that will be applied through the research.

- **Chapter 4: Results and Discussion**

  This chapter presents the results of the research and discusses them in details.

- **Chapter 5: Conclusions and Recommendations**

  This chapter states the conclusions and recommendations for the research.

- **References.**

- **Appendices.**

Chapter 2
Literature Review

Chapter 2
Literature Review

This chapter present the literature review about the construction safety, previous studies that focuses on accident in the industry of construction, construction safety in Gaza strip, fall accident causes and cost, accident prevention and factors affecting of fall accident.

2.1 Introduction

The Industry of construction generally have many injuries and risks, which make the research process challenging and unique. This makes the construction so risky due to the outdoor operations (Hsiao & Simeonov, 2001; Imriyas et al., 2007), The common cause of workplace fatalities is considered as Falls from height (FFH), this among domestic construction workers, about 64% still the popular fatalities in residential construction. Almost 100% of the fatalities among framing contractors in 2010 (Bureau of Labor Statistics (BLS), 2011). Working at heights (Lipscomb et al., 2006), and often working in dynamic and complex environments (i.e., diverse construction methods (Hsiao & Simeonov, 2001), working conditions and materials (Chi et al., 2004; Imriyas et al., 2007)). Equipment operation coupled with workers 'attitudes, behaviors, and physical characteristics relevant to safety also contribute to the relatively higher risk context in this industry (Hsiao & Simeonov, 2001; Sa et al., 2009) as cited in (Dumrak et al., 2013).

Another reason could contribute to higher risk in the industry is equipment operation coupled with workers 'attitudes, behaviors, physical characteristics and attitudes. (Hsiao & Simeonov, 2001; Sa et al., 2009).

Workplace safety considers as one of the major elements that had been considered by all organizations types. In addition, it is critical with the purpose of protecting and optimizing the function of human resources. Construction also is considered exclusive as it offers great chances for workers to be involved in several projects with various types of construction. Construction project requires varies knowledge and skills hence needs additional people in order to guarantee the successful completion of a project (Sulong, 2009).

Theoretically, prevented or controlled are the two types for the most construction injuries. Unfortunately, this goal practically is very slow to be achieved (Gambatese, 2008). One main global challenge and persistent is the control and prevention in

construction. Having with construction within varied economic sectors what is considered from safety point of view as one of the worst records, this include risky industries, for example electrical, chemical, transportation, and mining (Lehtola et al., 2008; Sa et al., 2009; Hallowell & Gambatese, 2008).

More than 19% of all occupational fatalities, The U.S. construction industry is accountable for it, in spite of a gradual decline, this stay the highest source for the occupational accidents (Bureau of Labor Statistics, 2010).

On the other hand, the construction fatalness rate in the United Kingdom raised recently for more than 21.5% of total fatalities (Health and Safety Execute, 2010). Not only this, but also non-fatal injuries averaged 16 per 1000 workers between 2004 and 2009, meaningfully higher than the average of 10 per 1000 workers overall (Labor Force Survey, 2009).

Over one third of all industrial incidents during the last 10 years in China is caused by Construction incidents (Chau et al., 2004; Li and Wang, 2004; Tam et al., 2006; Liao & Perng, 2008).

More than to lose your life and reduction in the life quality of construction workers, project delays will be resulted based on construction incidents (Meerding et al., 2006; Gavious et al., 2009), the higher cost of project (Lipscomb et al., 2003; Horwitz & McCall, 2004), burden of medicine (Lipscomb et al., 2003), and many further damaging consequences. The straight consequence could reach billions of dollars annually or more (Hallowell & Gambatese, 2009); while indirect incidents costs are about six times over the direct costs (Gavious et al., 2009).

E.g., the predictable costs related to injuries of disability in the construction industry of America were predicted about $15.6 billion (The Construction Chart Book, 2008).

2.2 The Construction Industry's Safety History

According to literature, safety issues were not paramount until the workers compensation laws appeared in the US Supreme Court in the early 1900s. Petersen (1971) as cited by Alaqqad (2009) explains that it was in the 1900s when management found to pay for injuries on the job as provided by legislation, which was when they (management) decided to stop injuries. This decision taken by the industry around the world gave birth to the industrial safety organized unions. In December 1970 the William – Steiger Occupational Safety and Health Act (OSHAct), signed by Congress

enacted and President Richard Nixon of the US, which became effective on April 28, 1971.

Lately, both the national and international organizations starting to publish safety regulations and standard which was recognized by the industry of construction, the Occupational Safety and Health Administration (OSHA) standards for the construction industry is one example for this. US Army Corps of Engineers Safety National Institute for Occupational Health and Safety which was established in 1990, and the United States US Department of Energy safety regulations (Kartam et al., 2000).

It is undeniably that one of the international reason for concern is the accident rates in construction which justified because of the he highest casualty rates in several countries caused by construction (Camino et al., 2008).

In several countries, the important issue to handle is the Accidents in construction projects. The phenomena make the construction industry having big appearance as a risky place of accidents (Sawacha et al., 1999; Shi, 2009).

Because of the open space, uniqueness, involving many unskilled Labors, exposure to weather, workers turn over, working at height, confined space, tight schedule of short project duration and physically and psychologically vulnerably working environment which express the nature of construction project, the construction project has more possible hazards of accidents (Chi et al., 2004; Lipscomb et al., 2006; Imriyas et al., 2007).

2.3 Construction Safety in Gaza strip

On the local level in Palestine, the construction industry considered as one of the key economic dynamic sectors, which support strongly the Palestinian economy on the national level. 26% of the Palestinian GDP is a contribution from it. This is a quite high quantity the sector covered it in compare to what is stated by Chitkara in that construction industry accounts 6-9 % of GDP in several countries. Nevertheless, various construction projects on the local level reported poor presentation (Enshassi et al., 2009).

Specifics about reasons and construction injuries due to physical conditions have been inadequate or almost non-existent in the local level in Palestine, particularly, and in the Middle East generally. The existing information and data on this focus is too common and does not deliver sufficient direction so that more effective accident

prevention programs can be established. A humble safety record considered as one of the toughest challenges to face the construction industry in Gaza Strip recently (Alnunu & Maliha, 2015).

The level of injuries and fatalities in the construction is high comparative to other industries in the same community. Based to the Ministry of Labor report, 31% of workers who died were construction workers in the Gaza Strip. Moreover, 19.5% of reported injured workers are construction workers in the Gaza Strip (Enshassi et al., 2007).

The report concludes that consultants, owner's management, and contractors are all aware of how much safety in construction is important. Nevertheless, they do not actively follow the effective behaviors to reach the safety objectives and research suggested to trigger the roles of government, designer, insurance, owner, consultant, and contractor (Alnunu & Maliha, 2015).

Construction safety regulations should be obliged and developed by the government. It should also arrange site visits of construction to insure the safety measures application in the sites with cooperation with insurance. The validity and the sufficiency of the safety supplies in the contracts should be participated by the consultants. In addition, detailed safety work plan should be carried out by contractors ،which gives an opportunity to achieve each task safely (Hassona, 2005; Alnunu & Maliha, 2015).

2.4 The Nature of Accidents

As a definition of the term “accident”, it can be considered as something uncontrolled, unplanned and somehow undesirables; it interrupts the official persons functions and causes injury or near miss. Throughout an accident, a person’s body meets or is exposed to some body. Other person, which is injurious; or the movement of a person reasons injury or produces the chance of injury (Anton, 1989).

Accident can be generally categorized in construction that result in physical injuries and fatalities into the following eight basic collections (Hinze et al., 2005; Haslam et al., 2005) cited by Kamardeen, (2009).

They are:

(i) Falling from height building,

(ii) Fire/ explosion,

(iii) Excavation related accidents,

(iv) Operations of machinery/ tools related accidents,

(v) Strict by falling object/ moving vehicles,

(vi) Electrocutions,

(vii) Failure of temporary structure, and others.

Because of the absence of knowledge or training accidents at work could occur, an absence of supervision or an absence of resources to carry out the task in safe mode, or because of an error of carelessness and judgment. Moreover, to this, the short term and transitory nature of the industry of construction is considered too, less control for the complexity, the working environment, and diversity of the size of construction organizations. All this cause effects on the safety of construction projects. Insecure behavior is considered to be important aspect in the cause of location accidents and consequently delivers evidence of a poor safety culture (Enshassi, 2003).

Moreover, Abdelhamid and Everett (2000) provide four factors of accident causation in construction: they are listed below:

(i) Failure of management,

(ii) Conditions of work,

(iii) Unsafe acts of workers and

(iv) Non-human-related actions.

Suraji et al. (2001) provided introduction about proximal and distal aspects causing to construction accident action. Based to those factors and more, the operative actions for example incorrect personal protective equipment, disappointment to track compliance and instructions with standards of work and careless as well as more confident which cause more than 29.8 % which directly lead to accidents.

Bentley et al. (2006) indicates that causes of trip, slip, and fall accidents are latent extrinsic or failure active failures or aspects and intrinsic aspects. Organizational aspects, design aspects, and environmental aspects are the main components of Latent failures. Design aspects including environmental design, activity/ task and clothing/ footwear, equipment and plant while production pressure being involved in the organizational aspects, equipment decision usage, operational decisions, shifting the schedule, safety of the culture, risk and safe management. Perceptual skills, active

failures cover age, vision /fairness / heath/, use of equipment and footwear, and risk-taking tendency.

2.5 Factors Affecting of Construction Accidents

Accidents of factors are too complex to be structured since their interdepended to cause accident causation (Hu et al., 2009). Several researches expressed that contributory factors could rise the risks caused by accident causation during construction process and that's because of the socio-technical and environmental conditions, for example: human behavior, wind, psychology of workers at work, temperature, education background and organizational issues and this includes law enforcement, commitment, and stakeholder's willingness to mitigate any potential events may lead to accidents (Hinze, 1997; Suraji et al., 2001).

With the purpose of uncover factors linked to construction accidents, researchers used databases for accidents. many studies attempted to consider personal characteristics and work characteristics such as ethnicity, age, gender, work experience to accidents, and occupation.

The previous factors may show a relationship between human physical conditions, accidents, and occupational qualities. In addition, it helps to identify groups of construction workers who are greatly prone to accidents. Moreover, it allows mitigation strategies to be targeted via preliminary factors which known as workers' characteristics.

The previous characteristics alleged to be influential in behaviors of workers inside the construction site, and this may be unsafe in certain circumstances. Hinze et al. (2005) implied that human faults are mostly responsible for construction accidents. Many factors were uncovered by Choudhry and Fang (2008) relating to human mistake. Site conditions or environments of works play key role in construction accidents (Chi et al., 2013).

Dangerous, unsafe, or hazardous places, the construction sites could be labelled with (Sherratt et al., 2013). It is true that the activities of construction varied with changing teams of project and difficult-to-handle equipment and materials, this may lead to human uncontrollable mistakes (Al-Humaidi & Tan, 2010). Furthermore, construction sites which could be temporary and transitory are claimed to pay accidents (Hallowell & Gambatese, 2009).

typical characteristics for a construction site could be listed to include environmental factors such as temperature, climate, and geographical conditions (Liao & Perng, 2008), organizational factors could include some characteristics that refer to construction organizations and works project-based procurement (Rozenfeld et al., 2010). The size of construction organization was analyzed by Lingard and Holmes (2001).

The significance of small businesses was acceptable as majority in Australia and on average employ less than 20 workers. Considered as small businesses makes the characteristics often associated with poorer management skills and insufficient implementation of measures of safety. Environmental and organizational factors where are focusing on it by Ling et al. (2009) who highlighted factors relating to month, time, location, type of construction, and size of organization.

López et al. (2008) indicated that time of day and day of the week both are related with severity of accident. Their research shows that a further investigation for other factors associated with the environment for example: geographic and behavioural factors climatic factors and their impact on accident severities.

Based to Safe Work Australia (2013), the accident mechanism describes the action exposure or event which directly causing injury. This mechanism may lead to an additional explanation on the severity according to a suggestion by Arquillos et al. (2012). The work of Gangolells et al. (2010) indicates that safety in construction can be improved by more understanding to the associations between mechanism of injury (or the safety risks) and types of construction work.

Work and personal characteristics with the environment of work are believed to affect the creation of a dangerous environment that could be caused by different mechanisms which cause an accident (Cheng et al., 2012; Chi et al., 2013).

The model which developed by Chi et al. (2013) places unsafe working conditions, unsafe acts, and accident types at the core to explain three different severity levels. Moreover, an accident which affect the part(s) of the body may determine the severity. The worth of researching of these two main factors in a synchronized manner is evident in Pinto et al. (2012), where the injury mechanism (so-called accident modes) and segments of injured body used in the developing a work accidents severity model process.

Based to a research by Jeong (1998), the analysis of mechanisms and bodily locations of injuries were used to explain the reasons for non-fatalities and fatalities in South Korea. The research shows that about some of mechanisms of accident characteristics were connected with the injured body locations.

In depth investigations by Gibb et al. (2005) confirmed the injury mechanism with injured body locations and they may provide a big number of clues linked to the selection, occupational safety and tools design, materials and equipment.

2.6 The Nature of Fall Accidents

A fall is well-defined as an event where a person coming to rest accidentally on the ground or other lower level, not by the result of a major inherent event such as (stroke) or devastating danger (Tinetti et al., 1988; Ware, 2009).

Generally, falls from height (FFH) are considerable public health danger and are among the important leading causes of serious and deadly injuries for workers in the construction field. A complete understanding for the causal factors in FFH incidents is directly required. (Nadhim et al., 2016).

Accidents caused by fall are major risk of public health and a main cause of nonfatal and fatal injuries globally in the construction workers. An entire of causal reasons leading to incidents because of fall that is needed to prevent falls in the industry of construction (Hu et al., 2009).

Figure (2.1). Hierarchy of Fall Protection. (Source: Roco Rescue Inc. - Roco Safety Posters, 2017)

Locations and others will increase nation of the nature of accidents caused by fallen including preventive actions which developed for reducing, avoiding, and eliminating possible risks to fall accidents (Hu et al., 2009).

Regarding to the workplace environment survey conducting by Barlas and Izci (2018), (Table 2-1), all the respondents agree that they all use personal protective equipment (PPE), and the use of PPE checked regularly. The authors know that safety helmet is the mother of PPE in Turkey. Other personal protective equipment such as mask, gloves, eye protection, safety footwear, safety harness, etc. come after safety helmet. 98.5% of the respondents agree that they have taken suitable courses and training about occupational safety; courses and training is a must before working in a shipyard, and it is against the law if not so. Ninety-three percentage (93%) of the respondents think the training they received was beneficial. Thirty-eight percentage of the respondents believe that the working area is unsafe, in addition thirty percentage (30) agree that the precautions taken were insufficient in the workplace against parts falling from a height.

Table (2.1): Workplace environment questions replies of the respondents by Barlas and Izci (2018).

Question	Yes %	No %
Are the precautions taken sufficient in the workplace against parts falling from a height?	69.7	30.3
Do you use personal protective equipment (PPE) (helmet, mask, etc.)?	100.0	0.0
Are precautions taken to prevent falling from a height enough for you?	67.5	32.5
Is the use of PPE checked regularly at work?	98.5	1.5
Have you taken any courses and training in occupational safety?	98.5	1.5
Do you think the training you received is beneficial?	93.0	7.0
Do you believe you have adequate training about the equipment you use?	81.2	18.8
Do you believe that your working area is safe?	62.0	38.0
Do you get your equipment checked on a regular basis?	65.3	34.7
Are you afraid that you will be exposed to an accident by falling at heights?	63.1	36.9
Are precautions taken to prevent falling from a height enough for	67.5	32.5
Does safety harness complicate your job while working at heights?	60.8	39.2
Do you use safety harness while working at heights?	90.8	9.2

From 1992 to 2006, in United States of America, accidents because of fallen reached about 32% of fatality (Dong et al., 2009) and over 37% of death cases in the industry of construction (Kaskutas et al., 2009). In New Zealand, fall from diverse height is mostly contributory accident (Bentley et al., 2006). but in China, the rate of accident

because of fallen accounts is 51% of injuries in the industry of construction (Yung, 2009).

Chi and Wu (1997) mentioned that 30% of fatal rate in Taiwan are due to fall accidents. The findings of research were conducted in Hong Kong indicated that fall accidents are more than 47% of total fatal in 2004 (Chan et al., 2008). Finally, fall is the most hazardous accident in various countries as concluded in many studies (Lipscomb et al., 2003; Horwitz & McCall, 2004; Gavious et al., 2009).

Research under title "risk factors for falls from height between commercial and residential roofers" was conducted by Sa et al. (2009) where applied survey of 301 roofers in the Midwest. Residential roofers were created to be involved in a bigger number of accidents because of fall. Besides, it has been indicated that smaller businesses have a bad record from safety point of view as compared to the big businesses. It was concluded that implementation of safety work practices and usage of fall protection lowers the fall accidents chances.

Dong et al. (2009) studied "fatal work-related falls among Hispanic construction workforce" by examining data from Center of Fatal Occupational Injuries (CFOI) and Current Population Survey (CPS). Data from 2003-2006 which used in this research, it was found that there is a lack of safety in the small construction companies in the U.S. construction industry. Lack of manpower and resources, and usually non-qualified in the Small companies, which ultimately leads to accidents.

"Project level analysis of specialty trade contractors' fatal accidents" conducted by Hatipkarasulu (2010) that occurred in the year of 2003. 350 fatal accidents were examined from OSHA's investigation documents. The main cause of deaths in residential and commercial building projects found falls. The key cause of fatalities was the falls from the roofs.

Several places may cause a fall accident like the high-level project buildings. It generally occurs on scaffoldings area, working structure and ladders. Which indicates that workers working on environment reinforced by scaffolding, not only this but through use of ladders in addition to top of structure within construction, for example: plate, floor, and column that cause risk of fall accidents (Latief et al., 2011).

Figure (2.2): Occupational Safety and Health Training Fall PPE, (Source: oshatrain.org, 2017)

Olbina, et al. (2011) checked the safe practices of Florida contractors of roofing that recruit Hispanic workers through conducting a survey that was assisted by Florida roofing, air conditioning, and sheet metal contractors. The findings of present research were: Big companies have safety practices compared to small companies and Hispanic workers tend to perform better in safety when received training in their native language.

The tendency of fall protection systems usage, attitudes and behaviors of workers in the industry of residential roofing of Hawaii conducted by Johnson et al. (1998). A research sponsored by Hawaii Occupational Safety and Health Division (HIOSH). Researching when HIOSH provided the case histories along with the job site inspections, and interviews was conducted by researchers of research. It was indicated that the compliance state to standards was extremely poor, creating residential roofing industry of Hawaii more exposed to accidents due to falls as compared to other trades. Absence of fall protection was defined to be the main falls causes.

The training that needed for the contractors of residential roofing were studied by Hung et al. (2012) through conducting interviews for selected roofing companies

which work in the sector of residential roofing. It mainly indicates that the "risk of falls is manageable and controllable" and "falls won't happen to me" approaches may have contributed to poor expression of safety among the participants. It also identified the shortcomings of safety training programs in addition to recognized a gap between actual work practices and in-class training.

Hinze and Gambatese (2003) expressed the sides that influence the safe performance of contractors of specialty trade through conducting structured surveys. while the research relied on surveys from different professional contractors, any relationship of accidents and injuries with respect to the company size was not established, as in one state the injuries were reduced with the increase of company size but for the others it was vice versa. This research shows increased injuries also accidents among specialty trade contractors with a high turnover rate.

Hu et al. (2011) published a review paper in which they discoursed about the factors that influence the risk due to falls in the industry of construction. as the researcher's enrolled 536 papers and selected 121 for the research. About half of the papers were relies on the data collected from the United. States. Construction industry.

So, the results achieved can be considered as a good characteristic set for the trend of falls in the United. States. construction industry. Factors influencing the falls risk containing "workers' safety behavior and attitudes,", "working surfaces and platforms", and "construction of structure and facilities".

Beavers et al. (2009) used OSHA's Integrated Management Information System (IMIS) database to explore the reasons of work related fatalities which considered as a reason for steel erection works. 166 cases (2000-2005) were selected for the analysis. Falls were found to be the primary reason of fatalities for the steel erection trade Labor force.

2.7 Fall Accidents Causes

One of the key causes of construction injuries is falls. Despite modest overall reduction, in the United States., from 1992 to 2006, falls responsible for 32% of fatal occupational injuries generally (Dong et al., 2009) and about 50% of fatalities in construction (Bureau of Labor Statistics, 2010).

After reviewing the literature, it was clear that finding the reasons and factors that affect construction accidents because of falls was the passion of several researchers.

Previous ones analyzed the injuries and the causes of fatalities that were because of the construction site fall from five key views. Those perspectives are unsafe actions, unsafe conditions, human-related factors, management inactions, and equipment (Huang & Hinze, 2003).

Worldwide, in New Zealand, falls from heights are the primary cause of occupational injuries (Department of Labor, New Zealand, 2010). Falls responsible for around 51% of injuries in China‘s industry of construction (Yung, 2009). In Hong Kong, falling from heights signified over 47% of the total fatal incidents (Chan et al., 2008). Consequently, falls are the most expensive occupational danger in many countries (Gavious et al., 2009).

Through safety intervention efforts, construction safety experts are in need to those overviews (Arboleda et al., 2004). This knowledge able to support policy makers in evaluating policy and designing, owners of the construction and contractors in investing in safety interventions, in addition to workers during implementing their day-to-day activities. Nevertheless, many various factors are relevant to understanding the reasons of work-related falls in the industry of construction.

Figure (2.3): Fall protection plan booklet cover page (Source: Capital Safety, 2017)

In the United States, the yearly costs of fall-related injuries were about six billion dollars in 2000 (Courtney et al., 2001). The whole compensation for those injuries caused by falls from heights levels reached the peak of HK $39,643,353 in 2008 in Hong Kong (Li et al., 2009).

Different studies types containing interviews, surveys, questionnaires, case studies, observations, accident or incident records, and organized laboratory experiments in various disciplines have conducted to elaborate those factors. Given the collection of involved factors, the diverse methods and the volume of studies in the research used,

building a general understanding, which benefits different stakeholders, is challenging. narrower questions were being focused in previous review articles to highlight on for example factors influencing balance (Hsiao and Simeonov, 2001) or interventions of fall prevention (Thompson et al., 2000).

A revision for this literature which captures the variety of studies, assists with in-depth scholarly investigations, not only this, but also delivers an aggregate overview of the domain of knowledge for practitioners can fill practice gap and an important research.

Causes such as time, quality, and cost are continually the main factors considered ahead of safety. Safety issues are always considered secondary (Mbuya & Lema, 2002).

According the research who Sophie and Atkinson (2003) undertook, it stated that attitude of employers towards safety is a problem in decreasing the number of construction fall accidents. The Deputy Minister of Human Resources, Datuk Maznah Mazlan has displayed concern on this situation. She said that the problem still occurred because of several workers did not emphasize on construction workers' safety (Harian Metro, 2010).

In addition, the increase of number of accident due to construction fall in Malaysia is because of the lack of safety awareness among workers that are involved in the industry of construction. (Abdul Hamid, 2003). The attitude of workers is unwilling to track the rules and regulations in construction is also the reason for influencing accidents due to falls to occur (Donald, 1995).

The failure of a responsible person to categorize the risk danger in working at height level and to deliver appropriate training for the employees has also become a problem in mitigating this problem (AbdelHamid & Everett, 2000).

To decrease the number of deaths and injuries related to fall accidents inside construction sites, preventive action needs to be considered. based to the Occupational Safety and Health Act (OSHA) (1994), there are two types of systems to protect and prevent employees from falls and this is considered as active also passive system. Passive system can protect employees from falling threat such as parapet walls and guardrails also from falling by placing a physical barrier.

The active systems might protect employees who have already fallen through limiting the fall to a specified distance not only this, but also limiting the power where the

worker is subjected to such as personal fall arrest systems (Abdelhamid & Everett, 2000).

2.7.1 Fall accidents with respect to fall type/ cause

Many studies investigating in diverse dimensions expressed about fall accidents in the United States industry of construction. It can be diverse physical causal factors which may cause fall accidents. Table 2-1 indicates numerous physical causal factors which cause the fall accidents, as noted by Huang and Hinze (2003). It founded that roof operations, ladders, structures, and scaffolds make up the common of fall dangers. Falls from the roofs was found to be the primary cause of fall accidents.

Table (2.2): Causes of fall accidents by Huang and Hinze (2003), as cited by Siddiqui S. (2014)

Major Causes of Falls	Huang and Hinze (2003)
Roof falls	28.36%
Ladder falls	11.33%
Scaffold staging falls	13.03%
Structure falls	19.34%
Opening falls	7.67%
Bucket (aerial lift/ basket) falls	3.15%
Platform catwalk falls	2.39%
Vehicle (vehicle/ construction equipment) falls	2.30%

The greatest recurring and frequent incident between all types of falls in the United States construction industry is identifies as roofs falls (Huang & Hinze, 2003; Sa et al., 2009). The roofing works mainly include installation of siding, roofing, and sheet metal work on commercial and residential projects. So, because of the nature of work performed by the roofers, roofing is measured to be one of the most hazardous professions of the construction industry.

The chance of roofers sustaining injury which because of fall is over other workers', as the National Institute for Occupational Safety and Health (NIOSH) (2004) reported that the incidence level of non-fatal occupational injuries for roofing workers were 1.1 – 1.8 times higher than others of construction workers in general between 1992 - 2001.

Based to U.S. Bureau of Labor Statistics BLS (2010), the roofing workers are three times more likely to have fatal injuries, than others in the construction industry and the key reason of the accident is fall.

The prevention of heights falls also "struck by" accidents can be maximized through the proper equipment usage and in more or less situations the falling prevention of materials should be a concern (Ertaş & Erdoğan, 2017).

The residential roofing and commercial roofing works are the two major sectors of the roofing industry. Residential roofers are the ones who are more showing to the fall dangers and are exposed to larger accidents and injuries, as compared to the commercial roofers, generally due to lack of training, education, and awareness about the safety practices in construction (Sa et al., 2009).

Generally, falling considered as the first of the ranking results of accidents in construction, for example, building collapse is the first in demolition work. It is identified that heights fall and objects falls come next as the most public accident types based to the research of the 653 accident reports of dangers causing injury, death or any kind of health problems (Ertaş & Erdoğan, 2017).

2.8 Accidents Cost

Accidents cost lives, it also causes a great deal of pain on personal level, financial problems and suffering for individuals also their families (Simpson, 2014). There are costs to the employer and a cost to the nation.

Literature has shown that the benefit of good safety practices includes healthy highly motivated staff, less sick leave, lower staff turnover, and increased performance and profitability and orderly working procedures and environment.

The increasing cost of medical treatment also the possible for lawsuits may lead to higher insurance payments, where it in turn tend to have a negative influence on the profit of the company and safety in construction sites is a main concern in Egypt, and few researches has been conducted on the topic. (Abdul-Rashid et al., 2007)

According to Simpson (2014), the cost of poor safety habits leads to increased sick leave, high staff turnover, high EMR, legal costs, accidents, ill health and death. Thus, to ensure safety at work requires the commitment to follow correct safety procedures, be trained, be authorized to do a job and also be skilled in using equipment.

Due to, employers believe about creating a safety system will always cost more, safety is from time to time identified to be the first item to face cost cutting according to research conducted by (Lin and Mills, 2001). It is also clear that management always concentrate on cutting cost during construction at the detriment of safety.

The industry suffers from the cost of the fall accident, while annually cost of fall accidents in UA approximately USD 6 billion in 2000 (Courtney et al., 2001). Medical cost that necessary to handle accidents in Holland is more than11 Billion in 2004 and the cost incurred for financing accidents due to falls is reached 44% (Meerding et al., 2006).

Total Medical costs in the Netherlands due to work-related injuries were Euro 1.15 billion in 2004, while 44% of them injuries resulted from falls (Meerding et al, 2006). In general, alike statistics, several different countries express that work-related falls represent an exceptional global financial burden. So, it's so important to prevent fall accidents in the industry of construction (Chi et al., 2004; Winn et al., 2004; Bentley et al., 2006; Lehtola et al., 2008).

The understanding of factors would benefit to reduce fall accidents in the construction industry for a policy maker, owners, contractors, workers, engineers, and researchers as key construction stakeholders.

As a result, preventing accidents due to falls considered as priority in the industry of construction development (Gauchard et al., 2001; Kemmlert & Lundholm, 2001; Kines, 2002; Ergör et al., 2003; Chi et al., 2004; Winn et al., 2004; Bentley et al., 2006; Lehtola et al., 2008; Latief, et al., 2011).

Wisam Al Bawab, head of the injuries department at the Ministry of Labor (MoL) in Gaza saed that “no accurate work-related injuries statistics on the industrial and construction sectors in Gaza Strip.” (arij.net, 2014).

According to MoL statistics, 95 injuries must receive compensation from the almost 3.5 million Shekels ($1 million) reserve in the budget, but Medical Commission and the courts review their requests.

Bawab indicated that only a small number of these employees have received reduced quantities of compensation after signing agreements with their employers. (arij.ne, 2014).

2.9 Accident Prevention

Unsafe acts also conditions are often mentioned to as instant or main causes of falls due to they are the most obvious causes and because they are part of the falls accidents either involvement or presence at the of moment accident.

Secondary causes are the failures the management system anticipates and include lack of training, maintenance, lack of job planning and instructions and without safe systems of work in working environment (Holt, 2006).

Unsafe activities and conditions will cause accidents. A research conducted by Gatti (2012) explained that Tarrant (1965) defined an accident as: An unplanned event which interrupted the completion of an activity and is usually preceded by unsafe activities and conditions. Recognition of the safety risks of work is the prerequisite for effective prevention (EASHW, 2004).

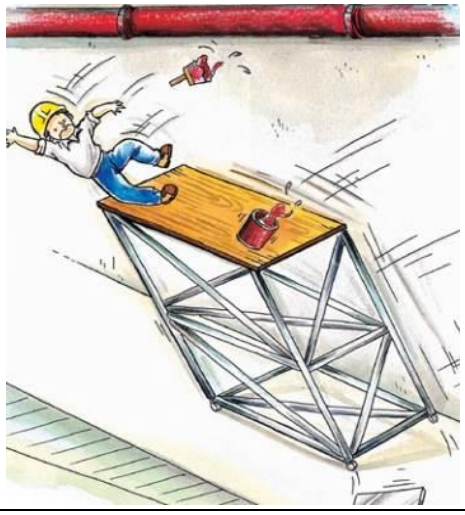
According to Holt (2006), the techniques involved in accident prevention include:

1. Avoid risk by reduce dangers.
2. Solve and handle the risks from the roots.
3. Adapting work based on individual during methods of work.
4. Using new technology to improve area of work.
5. Focus on whole workplace rather than individuals.
6. Ensuring all staff have enough information about why we do to be safe at work
7. Safety management should be accepted by everyone and that it applies to all the activities of the company.

From Occupational Safety and Health Branch of the Labor Department (OSHBLD), Brief Analysis of Site Accident Cases booklet, published on February 2013, illustrated the cause of accident and the illustration of safe practice.

Table (2.3): Causes of fall accidents and Illustration of Safe Practice, (OSHBLD, 2013)

Cause of Accident	Illustration of Safe Practice
Case (1) Falling from Scaffold	
	

Cause of Accident	Illustration of Safe Practice
♠ A safe system of work for scaffold dismantling was not provided ♠ The worker did not attach his safety harness to the independent lifeline	♠ Use a safety harness and attach it to the independent lifeline
Case (2) Falling from mobile tubular scaffold	
	
♠ The tubular scaffold was not horizontally and securely erected on the inclined floor ♠ The worker overstretched his body from the working platform resulting in the imbalance of the tubular scaffold ♠ The steel plate underneath the tubular scaffold failed to balance and secure the scaffold	♠ When erecting a mobile tubular scaffold on an inclined floor, suitable mats should be used to keep the scaffold in a level position
Case (3) Falling from temporary ladder	
	
♠ There was no suitable working platform ♠ Safe dismantling procedures were not provided	♠ use a suitable platform for work at height ♠ report to the foreman on the lack of safety measures and give suggestions

Cause of Accident	Illustration of Safe Practice
Case (4) Falling with boatswain's chair	
	
♠ The overall structure of the boatswain's chair was unsafe ♠ The whole structure was not inspected by a competent examiner before use ♠ The fall arrestor and independent lifeline were not properly installed, thus failing to prevent the worker from falling	♠ Use a suspended working platform instead of a boatswain's chair ♠ Inspect, examine and test the suspended working platform before use ♠ Use the safety harness and independent lifeline properly

2.10 Group Factors Affecting Fall Accidents

2.10.1 Occupational Safety and Health

safety may be considered a key function that used against unnecessary loss of injury, property or death but is not a luxury. Preventing occupational illness and injuries must be a key concern for all workers. Particularly in the developing countries, it has an effort to increase the awareness level between both workers and employers of the importance of safety and health of work sites (Koehn et al., 1995).

Lately, Regulations and safety standards are published by national and international organizations and construction industry accepted it. within these are the Occupational Safety and Health Administration (OSHA) standards for the industry of construction, the United States Department of Energy safety regulations, and US Army Corps of Engineers safety and health requirement manual, (Kartam et al., 2000).

2.10.2 Economic

The leading worry of a contractor is how to increase money and reduce costs. Safety is usually considered as less priority in the company's plans. Safety is considered an

unimportant and wasted money by many contractors while they could be unaware of the effectiveness of safety prevention programs in decreasing costs and growing productivity (Kartam et al., 2000).

The cost of establishing and administering a construction health and safety program is rather less tangible but may be expected with reasonable accuracy. collected Data from a specific contractors' sample of working at various construction sites in 1980 express that the administering a construction safety and health program cost usually account to around 2.5% of direct costs of labor. (Alaqqad, 2009)

2.10.3 Social and Worker

The behavior of human is very significant and difficult to control. Different solutions of engineering, in which numbers are plugged into several formulae to solve particular problems, control people requires situational leadership. Dangers cannot be solved and eliminated by engineering control only. also, it need to be recognized by employees who will reduce their effects. Nevertheless, human behavior cannot be programmed like a machine, (Jannadi, 1995).

Koehn et al. (1995) concluded in their research that in developing countries, workers are generally semiskilled or inexpert, temporarily employed, poorly paid, low rates of productivity, and migrate in a group between places in search of work.

Under the workers' compensation laws, the employers assumed responsibilities for their health and safety in the workplaces. They were required to provide and pay for medical care and lost wages which caused by on-the-job incidents. (Alaqqad, 2009)

2.10.4 Work Environment and Performed

The objective in tide site planning and designing is to produce high efficiency and maximum safety working environment. Material, access and traffic routes, and handling of storage, in addition to amenities and site offices, the construction plant, fabrication workshops, services and facilities, these are the aspects of tide site that need to be addressed. Tidy and well-planned sites are to deliver a high level of safety performance according to previous research.

Workplace dangers may be defined as physical factors that could be considered as pose dangers for likely injuries or ailments. According to this definition, dangers do not at all times result in accidents, but they lurk in environments of work, waiting for the right combination of circumstances to come together (Mohamed, 2002).

The contractors should establish a system of signalling for all operations in which signal are required to prevent danger, as far as practicable a uniform signalling system must be adapted for all constructions. The code of signals should be posted up at suitable places and also made available in the form of a handbook. In order to avoid danger, the contractor should take adequate steps to ensure that workers are familiar with all signals that they should know (Tam et al., 2003).

2.11 Fall Accidents in Gaza Strip

Falling accidents are a serious problem in the construction industry in Gaza Strip, as well as all over the world.

In Gaza Strip, in the last decade, the accident rate is fluctuated from year to year.

Safety considered as one of the most challenging issues facing the construction industry in the Gaza Strip. The accident rate in construction is the highest if we compared it with other industries (Moheeb et al., 2014). The Palestinian Ministry of Labor stated that work-injuries since 2006 to 2011 approximately 611 injuries, which resulted in 11 deaths, 37% of the total number of these incidents were in the construction industry. The most important reasons for increasing number of injuries is the lack of employer's cooperation to find workers safety tools and the lack of commitment by workers to use these tools if it is available, the construction work is not well organized and the marked increase in the reconstruction in Gaza strip (Moheeb et al., 2014; Ministry of Labor (MoL), 2012).

Deputy general director for inspection and Labor protection in MoL in the Gaza Strip Eng. Shadi Hillis says: "In the year 2015 we recorded 131 injuries and four deaths due to work-related injuries, and more than 50% of these results is in the construction sector," (MoL reports 2016)

On the other hand, the reasons for the occurrence of work injuries, the Ministry of Labor in the Gaza Strip (Ministry of Labor, 2012) reported that:

- The main problem lies in the failure to follow occupational health and safety procedures relating to working conditions in many of the economic establishments.
- Lack of professional awareness in safety procedures in a lot of workers.
- Lack of work-cooperation in providing Personal Protective Equipment (PPE) for workers.

- Lack of commitment by workers in using (PPE) tools even if it is become available.
- Lack of organization of work in the construction sector.
- The remarkable rise witnessed in the Gaza Strip in the reconstruction movement with the beginning of 2011.
- Palaces of media in promoting the concept of occupational safety and health in the Palestinian society.
- Lack of cooperation between the relevant institutions in the promotion of occupational safety and health procedures.

2.12 Summary of Factors Affecting fall accidents

From the literature review, a total of seven groups and sixty-eight factors were identified in this research as the major factors affecting the reasons of fall accidents and the prevention in the industry of construction. Table 2-3 shows the groups and factors that affect the causes of fall accidents and the prevention in the construction industry. The main literatures that suggested a list of this research factors are shown as columns. These literatures are: Ansah (2014); Saeed et al. (2014); Ismail et al. (2012); Aksorn & Hadikusumo (2008); Hassan et al. (2007); Fung et al. (2005); Fang et al. (2004); Jannadi and Bu-Khamsin (2001).

Other literatures might have mentioned a factor or more and are stated in the "Others column" in relation to the corresponding factor they are: Teo et al. (2005); Tam et al. (2003); Siu et al. (2003); Kartam et al. (2000); Sawacha et al. (1999); Jannadi (1995); Koehn et al. (1995); Hinze and Raboud (1988).

Table (2.4): Groups and Factors Affecting the fall accidence in Construction Projects

Group Factor	Factor	Barlas & Izci (2018)	Ertaş & Erdoğan (2017)	Saeed et al. Ansah, N. (2014)	Ismail et al. (2012)	Aksorn & Hadikusumo (2008)	Hassan et al. (2007)	Fung, et al. (2005)	Fang, et al. (2004)	Jannadi & Bu-Khamsin (2001)	Other(s)
Part II Factors: Questions related to factors affecting the causes of fall accidents in the construction industry.											
Occupational Safety and Health	Working without Occupational Safety and Health Plan.						*			*	
	No Clear legislation and laws regard for occupational safety and health in the construction site.			*							*Kartam, et al. (2000)*
	Irregular meetings for occupational safety and health.	*						*	*		
	Lack of safety climate and occupational safety and health.	*									
	Absence the training program for workers on the occupational safety and health.		*	*				*	*		*Kartam, et al. (2000)*
	Lack of Safety culture.			*							*Teo, et al. (2005)*
	Documentary/records system for fall accidents in construction projects is unavailable.		*	*						*	
	Absence of contingency arrangements when it occurs.						*				*Teo, et al. (2005)*
	Creation of a specialized occupational safety and health, such as OSHA.			*							

Group Factor	Factor	Barlas & Izci (2018)	Ertaş & Erdoğan (2017)	Saeed et al. Ansah, N. (2014)	Ismail et al. (2012)	Aksorn & Hadikusumo (2008)	Hassan et al. (2007)	Fung, et al. (2005)	Fang, et al. (2004)	Jannadi & Bu-Khamsin (2001)	Other(s)
Part II Factors: Questions related to factors affecting the causes of fall accidents in the construction industry.											
	Work in hazardous areas on site.	*	*								*Author*
Economic	Absence encouragement system for application of safety.			*							
	Weak using modern equipment in construction projects.		*								
	No budget for implementing the safety plans and their requirements.								*		*Sawacha, et al. (1999)*
	Non-compliance with the working hours specified by law.								*		
	Irregular break hour for workers, which increase pressure on them and reduces the safety.								*		
	lowest prices are the only standard for bidding award.										*Author*
	Execute the works without fall prevention safety	*									
	Unclear safety requirements items included through contracting.			*						*	
Social	The spirit of cooperation and familiarity between employees not exist.										*Author*

Group Factor	Factor	Barlas & Izci (2018)	Ertaş & Erdoğan (2017)	Saeed et al. Ansah, N. (2014)	Ismail et al. (2012)	Aksorn & Hadikusumo (2008)	Hassan et al. (2007)	Fung, et al. (2005)	Fang, et al. (2004)	Jannadi & Bu-Khamsin (2001)	Other(s)
Part II Factors: Questions related to factors affecting the causes of fall accidents in the construction industry.											
	Non-holding special training for workers on falls prevention.	*	*			*	*		*	*	*Sawacha, et al. (1999)*
	lack of coordination between the operators of the project (contractor, owner, donor, etc...) and the relevant government agencies (Ministry of Labor, civil defense, police, etc. ...).										*Hinze & Raboud. (1988)*
	The absence of visits or social trips for employees.										*Author*
	Choosing unskilled workers to work on heights .	*	*						*		*Siu et al, (2003)*
	Not to carry on strict measures (Alert, Warning, penalties, fines, etc. ...) towards violators of the rules and conditions of the safety.									*	
Working Environment.	Contractors neglect implementing the safety standards.			*							
	No existence supervisor/engineer specialist in safety.		*						*		*Jannadi (1995)*

Group Factor	Factor	Barlas & Izci (2018)	Ertaş & Erdoğan (2017)	Saeed et al. Ansah, N. (2014)	Ismail et al. (2012)	Aksorn & Hadikusumo (2008)	Hassan et al. (2007)	Fung, et al. (2005)	Fang, et al. (2004)	Jannadi & Bu-Khamsin (2001)	Other(s)
Part II Factors: Questions related to factors affecting the causes of fall accidents in the construction industry.											
	Weak of Supervision and periodic inspection of the relevant government agencies.								*		
	The absence of indicative and warning signals of safety.									*	
	Do not consider the company record regarding incidents in bidding awarding.			*							
	Weather and climate through working.										*Kartam, et al. (2000)*
	First aid kit is unavailable.									*	*Sawacha, et al. (1999)*
	No existence of safety and health Forman in the crew.			*							
	Unorganized or unarranged of the works on the site.	*						*		*	*Sawacha, et al. (1999)*
	Non-Suitable equipment for the work nature.	*	*								
	Working on heights without fencing.			*							
	Exclusion of the participation of workers in the selection of special methods of protection and safety.										*Author*

Group Factor	Factor	Ertaş & Erdoğan (2017)	Ansah (2014)	Saeed et al. Ansah, N. (2014)	Ismail et al. (2012)	Aksorn & Hadikusumo (2008)	Hassan et al. (2007)	Fung, et al. (2005)	Fang, et al. (2004)	Jannadi & Bu-Khamsin (2001)	Other(s)
Part III Factors: Questions related to factors affecting the prevention of fall accidents in the construction industry.											
Top Management	Commit the managers of the project on safety.			*				*			*Tam, et al. (2004)* *Teo, et al. (2005)*
	Implementing the safety legislation by the government.			*					*		*Koehn, et al. (1995)*
	Providing Safety supervisor or engineer.			*					*		*Jannadi (1995)*
	Size of the company/contractor and record of the safety implementation in the projects.								*	*	*Koehn, et al. (1995)*
	Decreasing the pressure on the worker.										*Author*
	Commit the project time schedule.					*					
	Provide the safety climate in the work environment.		*	*							
work performed	Works carried out must be not complex and tangled.							*		*	
	Providing of Personal Protective Equipment (PPE).		*	*							
	Work area mobilization and protective equipment (safe entrances and exits, etc.).		*							*	
	Providing safety signs and guidance.			*							

Group Factor	Factor	Ertaş & Erdoğan (2017)	Ansah (2014)	Saeed et al. Ansah, N. (2014)	Ismail et al. (2012)	Aksorn & Hadikusumo (2008)	Hassan et al. (2007)	Fung, et al. (2005)	Fang, et al. (2004)	Jannadi & Bu-Khamsin (2001)	Other(s)
Part III Factors: Questions related to factors affecting the prevention of fall accidents in the construction industry.											
	Stop work in bad weather condition.			*							
	Working at night with adequate lighting.									*	
	Fencing the work area and especially the heights.	*		*							
	Periodic maintenance of tools and equipment.										*Author*
Economic	Paying the medical expenses of injured workers.			*							
	Provide insurance/compensation for workers.			*							
	Apply a financial motivation award for the safety commitment.			*							
	Allocate a specific budget for safety requirements.			*							
Factors of Workers	Safety training for the worker.		*			*		*	*		*Teo, et al. (2005)*
	Recruitment educated workers.								*		*Tam, et al. (2004)*
	Recruitment Skilled workers.	*								*	
	Determine specific age for workers.								*		*Siu et al, (2003)*
	Check up the mental state of the worker.								*	*	

Group Factor	Factor	Ertaş & Erdoğan (2017)	Ansah (2014)	Saeed et al. Ansah, N. (2014)	Ismail et al. (2012)	Aksorn & Hadikusumo (2008)	Hassan et al. (2007)	Fung, et al. (2005)	Fang, et al. (2004)	Jannadi & Bu-Khamsin (2001)	Other(s)
Part III Factors: Questions related to factors affecting the prevention of fall accidents in the construction industry.											
	Test the physical condition of the worker.								*		*Author*
	Determine if the worker qualified for work at heights.					*			*		*Tam, et al. (2004) Teo, et al. (2005)*
	Locate the safety culture of the Workers.			*				*			*Teo, et al. (2005)*
	Follow up if the worker Takes the necessary measures for prevention and safety.			*						*	*Kartam, et al. (2000)*

2.13 SUMMERY

The construction industry is one of the most dangerous industries and the most visible of the incidents.

The subject of occupational safety and health is critical, due to its association to workers lives and safety.

As Ministry of Labor in the Gaza Strip cited that no accurate statistics on the industrial and construction sectors injures.

The main problem lies in the failure to follow occupational health and safety procedures relating to working conditions in many of the economic / construction establishments.

The main problem in the emergence of work-related injuries is not to follow the occupational safety and health procedures in many construction sites.

Chapter 3
Methodology

Chapter 3
Methodology

This chapter discusses the methodology that is used in this research. The adopted methodology to accomplish this research uses the following techniques: the information about the research strategy and design, research population and sample, questionnaire design, the process of data collection, statistical data analysis, content validity and pilot research are also summarized.

3.1 Framework of the research methodology:

The research was designed by seven main steps as described below and shown in Figure (3.1).

- **The first one** is to define the problems in order to establish objectives.
- **The second phase** of the research includes a literature review of fall accident causes and prevention in the construction industry.
- **The third phase** of the research focused on the modification of the questionnaire design, through distributing the questionnaire to the pilot research. The purpose of the pilot research was to prove that the questionnaire questions are clear to be answered in a way that help to achieve the objectives of the research. The questionnaire was modified based on the results of the pilot research.
- **The fourth phase** of the research was questionnaire distribution. The questionnaire was used to collect the required data in order to achieve the research objective.
- **The fifth phase** of the research focused on data analysis and discussion. The Statistical Package for the Social Sciences (SPSS 22) was used to perform the required analysis.
- **The sixth phase** of the research included the conclusions and recommendations.
- **The final phase** of the research included formatting, editing the final text, and spelling and grammatical review.

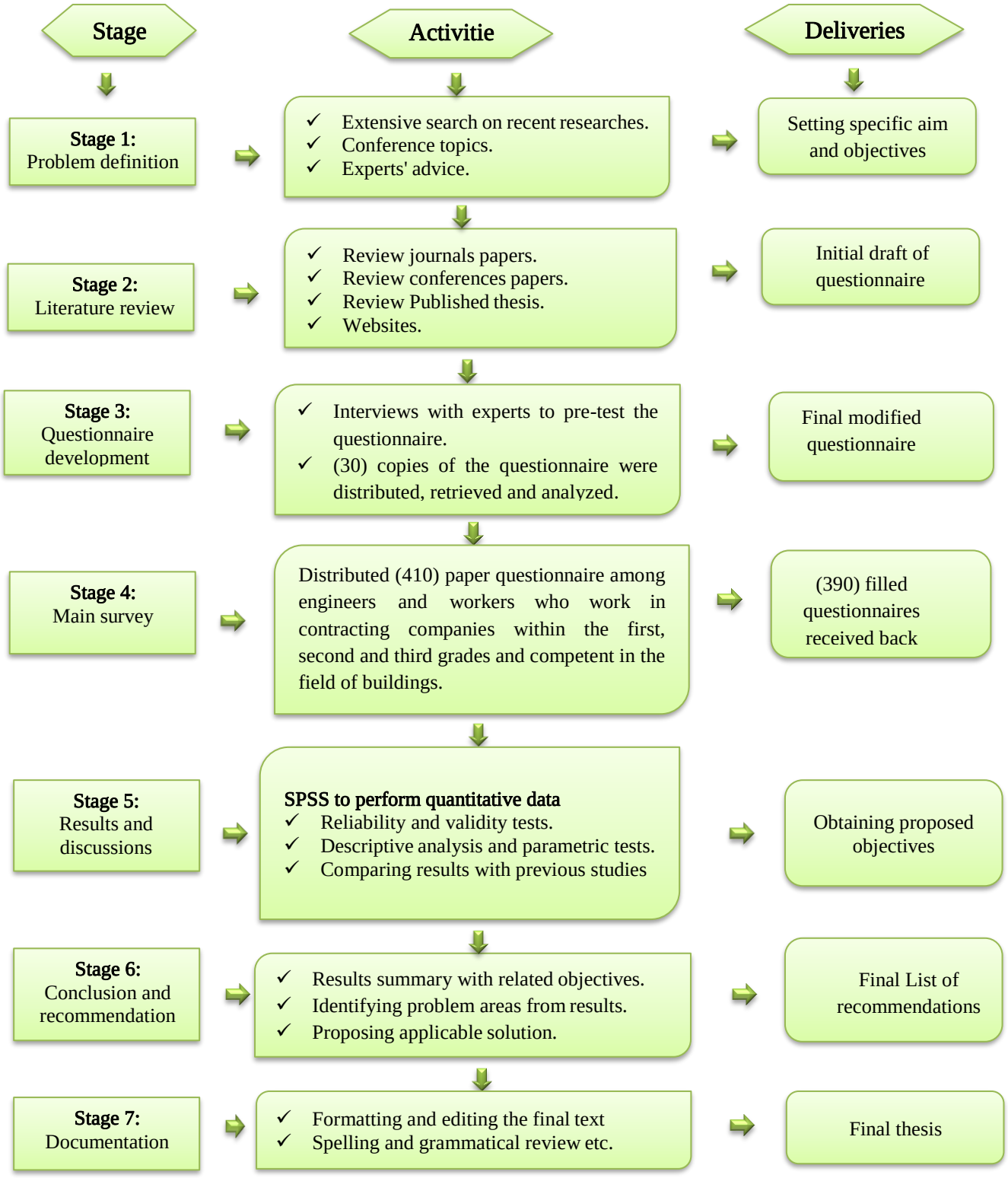


Figure (3.1): Framework of the research methodology

3.2 Research period

The research started on Jun 2016 when the initial proposal was approved. The literature review was completed at the end of Oct 2016. The validity testing, piloting and questionnaire distribution and collection took two months and completed on the beginning of Jul.2017. The analysis, discussion, conclusion and recommendation were completed at the end of Jan 2018.

3.3 Research location

The research was carried out Contracting companies within the first, second and third class and competent in the field of buildings.

3.4 Data Collection

The questionnaire was chosen to be the method of collecting data in this research, since the questionnaire is probably the most widely used data collection technique for conducting surveys.

Questionnaires have been widely used for descriptive and analytical surveys in order to find out the facts, opinions and views (Naoum, 2007). It enhances confidentiality, supports internal and external validity, facilitates analysis, and saves resources. Data are collected in a standardized form from samples of the population. The standardized form allows the researcher to carry out statistical inferences on the data, often with the help of computers. The used questionnaire has some limitations such as: it must contain simple questions, no control over respondents and respondents may answer generally (Naoum 2007).

3.5 Research Population

The population for this research is

Contracting companies within the first, second and third class and competent in the field of buildings ،which number 186 companies.

3.6 Population and sample size:

The following statistical equation was used to determine the sample size

$X = Z^2 P (1 - P)$ ..... equation (1)

$$n = \frac{NX}{((N-1)E^2 + X)}$$ ..... equation (2)

Where:

Z: Z value (e.g 1.96 for 95% confidence interval)

P: percentage picking a choice, expressed as decimal, (0.50 used for sample size needed)

n: Sample size

N: Population size =186

E: Maximum Error of estimation (0.07)

Based on the equation shows that the required sample size equal 96 engineers. We distributed randomly 110 questionnaires on engineers and 300 questionnaires on workers (engineer to workers as 1:3), and received 100 with (90.90%) for engineer, and received 290 with (96.67%) for workers.

$$X = 1.96^2 * 0.95 * (1-0.5) = 1.83$$ ..... equation (1)

$$X = 1.96^2 * 0.5 * (1-0.5) = 0.9604$$

$$n = \frac{186 * X}{((186-1)0.7^2 + X)}$$ ..... equation (2)

$$n = \frac{186 * 0.9604}{((186-1)0.07^2 + 0.9604)} = 95.68 \approx 96$$

3.7 Pilot Research

A pilot research for the questionnaire was conducted before collecting the results of the sample. It provides a trial run for the questionnaire, which involves testing the wordings of question, identifying ambiguous questions, testing the techniques that used to collect data, and measuring the effectiveness of standard invitation to respondents (Naoum, 1998).

The piloting process conducted by interviewing four experts. The four experts represented the two types of populations. Three engineers and one expert in the field of statistic were invited to participate in the piloting process and were asked to review the questionnaire and give their advice. In general, they agreed that the questionnaire

is suitable to achieve the goals of the research. Important comments and some modifications have done. The main comments could be summarized as follow:

- We need to separate the questionnaire into two parts one of them related to engineers and others to workers.
- The workers questionnaire should have simple language to suitable their qualification, and short as soon as possible.

3.8 Questionnaire Design

The questionnaire was provided with a covering letter explaining the purpose of the research, the way of responding, the aim of the research and the security of the information in order to encourage a high response. The questionnaire included multiple-choice question: which used widely in the questionnaire, the variety in these questions aims first to meet the research objectives, and to collect all the necessary data that can support the discussion, results and recommendations in the research.

The sections in the questionnaire will verify the objectives in this research is to develop a clear understanding about Fall accident causes and prevention in the construction industry in Gaza Strip as the following:

3.8.1 The first questionnaire related to engineers:

Divided into four sections:

Section #1: Personal information for respondents consist from four items.

Section #2: Questions related to factors affecting the causes of fall accidents in the construction industry consist of thirty-five items distributed through four fields:

1. Factors related to the Occupational Safety and Health contains 9 items.
2. Factors related to the Economic contains 8 items.
3. Factors related to the Social contains 6 items.
4. Factors related to the Working Environment contains 12 items.

Section #3: Questions related to factors affecting the prevention of fall accidents in the construction industry consist of nineteen items distributed through three fields:

1. Factors related to the Top Management contains 7 items.

2. Factors related to the work performed contains 8 items.
3. Factors related to the Economic contains 4 items.

Section #4: General Questions (diagnosing the fall accidents causes and prevention) consist from five items.

3.8.2 The second questionnaire related to workers:

Divided into three sections:

Section #1: Personal information for respondents consist from five items.

Section #2: Questions related to factors affecting the causes of fall accidents in the construction industry consist of twenty-five items distributed through four fields:

1. Factors related to the Occupational Safety and Health contains 5 items.
2. Factors related to the Economic contains 5 items.
3. Factors related to the Social contains 5 items.
4. Factors related to the Working Environment contains 10 items.

Section #3: Questions related to factors affecting the prevention of fall accidents in the construction industry consist of eighteen items distributed through two fields:

1. Factors related to the workers contains 9 items.
2. Factors related to the work performed contains 9 items.

3.9 Data analysis method

To enhance the external validity, perceived reliability, and optimize a balance between the depth and breadth of the research, a quantitative method, was adopted in the current research (Muskat et al., 2012; Fellows & Liu, 2008). In fact, quantitative research method was the major type of data collection and analysis methods adopted in behaviour and management research studies. Quantitative methods attempt precise measurement of variables, which was suitable for questionnaire survey data analysis.

3.10 Quantitative data analysis using SPSS

SPSS 22 (Statistical Package for the Social Sciences) for Windows contains a broad range of capabilities for the entire analytical process. The decision-making information can quickly be generated by using powerful statistics, to understand and present the

results with tabular and graphical output, and share the results using a variety of reporting methods. By using this software, seven kinds of data analysis techniques were adopted in this research:

1. Frequency and Percent
2. The relative importance index (RII).
3. One sample t test.
4. Independent sample t test.
5. One-way ANOVA test.
6. Cronbach's alpha for reliability statistics.
7. Spearman correlation coefficient.

3.11 Data measurement

In order to be able to select the appropriate method of analysis, the level of measurement must be understood. For each type of measurement, there was/were an appropriate method/s that can be applied and not others. In this research, ordinal scales were used. Ordinal scale is a ranking or a rating data that normally uses integers in ascending or descending order.

The numbers assigned to the important (1, 2, 3, 4, 5) do not indicate that the interval between scales are equal, nor do they indicate absolute quantities. They are merely numerical labels (Naoum, 2007). Likert scales (originally devised by R. Likert in 1932) which were used in this questionnaire, are devices to discover strength of feeling or attitude towards a given statement or series of statements and the implication here is that the higher the category chosen, the greater the strength of agreement, but care has to be taken not to read too much in these ranked scales. They are usually a three, five or seven-point range and ask respondents to indicate rank order of agreement or disagreement by circling the appropriate number (Bell, 2005). For this research, the five-point scale was chosen as the following:

Table: (3.1): Likert Scale

Item	Very low	Low	Middle	High	Very high
Scale	(1)	(2)	(3)	(4)	(5)

3.11.1 Relative importance Index (RII).

Descriptive statistics namely relative importance index method (RII) was used to determine the ranks of all performance factors and to highlight the relative importance of attributes as perceived by the respondents (Assaf et al., 1995; Faridi &El-Sayegh, 2006). The relative importance index was computed as (Sambasivan & Soon, 2007):

$$RII = \frac{\sum W}{A \times N} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{5N} \quad \text{..... equation (3)}$$

Where:

W = the weighting given to each factor by the respondents (ranging from 1 to 5)

A = the highest weight (i.e. 5 in this case)

N = the total number of respondents

The RII value had a range from 0 to 1 (0 not inclusive), the higher the value of RII, the more impact of the attribute. However, RII does not reflect the relationship between the various attributes.

3.12 One sample t test

Test used to determine if the mean of a paragraph was significantly different from a hypothesized value 3 (Middle value of Likert scale). If the P-value (Sig.) is smaller than or equal to the level of significance $\alpha = 0.05$ then the mean of a paragraph was significantly different from a hypothesized value 3. The sign of the Test value indicates whether the mean is significantly greater or smaller than hypothesized value 3. On the other hand, if the P-value (Sig.) is greater than the level of significance, $\alpha=0.05$, then the mean a paragraph is insignificantly different from a hypothesized value 3.

3.13 Independent sample t test

Test used to examine if there was a statistical significant difference between two means among the respondents toward fall accident causes and prevention in the construction industry due to general information.

3.13.1 One-way ANOVA test

Test was used to examine if there was a statistical significant difference between several means among the respondents toward fall accident causes and prevention in the construction industry due to general information.

3.14 Validity of the Questionnaire

Statistical Validity of the Questionnaire refers to the degree to which an instrument measures what it is supposed to be measuring (Poilt and Hungler, 1985). Validity has a number of different aspects and assessment approaches.

To insure the validity of the questionnaire, two statistical tests should be applied. The first test is Criterion-related validity test (Spearman test) which measure the correlation coefficient between each item in the field and the whole field. The second test is structure validity test (Spearmen test) that used to test the validity of the questionnaire structure by testing the validity of each field and the validity of the whole questionnaire. It measures the correlation coefficient between one filed and all the fields of the questionnaire that have the same level of similar scale.

Content validity test was conducted. The amended questionnaire was sent to a statistical expert to evaluate the procedure of questions and the method of analysing the results. The expert did agree that the questionnaire was valid and suitable enough to measure fall accidents and prevention in the construction industry.

3.15 Criterion Related Validity

3.15.1 Internal consistency

Internal consistency of the questionnaire is measured by pilot research, which consisted of thirty questionnaires, through measuring the spearman correlation coefficients between each paragraph in one field and the whole filed. Tables No.'s from (3.2) to (3.9) clarifies the correlation coefficient and p-value for each field items. As show in the table the P-values are less than 0.05, so the correlation coefficients of this field are significant at $\alpha = 0.05$, so it can be said that the paragraphs of this field are consistent and valid to be measure what it was set for.

Table (3.2): Spearman correlation coefficient of factors related to the Occupational Safety and Health

Engineers			Workers		
Item	Spearman Correlation Coefficient	p-value (Sig.)	Item	Spearman Correlation Coefficient	p-value (Sig.)
Working without Occupational Safety and Health Plan	0.781	0.000*	Irregular meetings for occupational	0.889	0.000*
No Clear legislation and laws regard for occupational safety and health in the construction site	0.768	0.000*	Absence the training program for workers on the occupational safety and health.	0.827	0.000*
Irregular meetings for occupational safety and health	0.833	0.000*	Lack of Safety culture.	0.868	0.000*
Lack of safety climate and occupational safety and health	0.573	0.000*	Work in hazardous areas on site	0.869	0.000*
Absence the training program for workers on the occupational safety and health	0.762	0.000*	Absence of contingency arrangements when it occurs.	0.877	0.000*
Lack of Safety culture	0.675	0.000*			
Documentary/records system for fall accidents in construction projects is unavailable	0.679	0.000*			
Absence of contingency arrangements when it occurs	0.766	0.000*			
There is no specialized organization for safety and health, such as OSHA	0.699	0.000*			

*Correlation is significant at the 0.05 level

Table (3.3): Spearman correlation coefficient of factors related to the Economic

Engineers			Workers		
Item	Spearman Correlation Coefficient	p-value (Sig.)	Item	Spearman Correlation Coefficient	p-value (Sig.)
Absence encouragement system for application of safety.	0.808	0.000*	Absence encouragement system for application of safety.	0.843	0.000*
Weak using modern equipment in construction projects	0.782	0.000*	Weak using modern equipment in construction projects.	0.737	0.000*
No budget for implementing the safety plans and their requirements	0.796	0.000*	Non-compliance with the working hours specified by law.	0.863	0.000*
Non-compliance with the working hours specified by law	0.633	0.000*	Irregular break hour for workers, which increase pressure on them and reduces the safety.	0.794	0.000*
Irregular break hour for workers, which increase pressure on them and reduces the safety	0.657	0.000*	Execute the works without fall prevention safety equipment.	0.868	0.000*
Lowest prices are the only standard for bidding award	0.591	0.000*			
Execute the works without fall prevention safety equipment	0.667	0.000*			
Unclear safety requirements items included through contracting	0.721	0.000*			

*Correlation is significant at the 0.05 level

Table (3.4): Spearman correlation coefficient of factors related to the Social

Engineers			Workers		
Item	Spearman Correlation Coefficient	p-value (Sig.)	Item	Spearman Correlation Coefficient	p-value (Sig.)
The spirit of cooperation and familiarity between employees not exist.	0.719	0.000*	The spirit of cooperation and familiarity between employees not exist.	0.794	0.000*
Non-holding special training for workers on falls prevention.	0.722	0.000*	Non-holding special training for workers on falls prevention.	0.826	0.000*
Lack of coordination between the operators of the project (contractor, owner, donor, etc...) and the relevant government agencies (Ministry of Labor, civil defense, police, etc. ...).	0.777	0.000*	The absence of visits or social trips for employees.	0.815	0.000*
The absence of visits or social trips for employees.	0.576	0.000*	Choosing unskilled workers to work on heights.	0.737	0.000*
Choosing unskilled workers to work on heights.	0.687	0.000*	Not to carry on strict measures (Alert, Warning, penalties, fines, etc. ...) towards violators of the rules and conditions of the safety.	0.745	0.000*
Not to carry on strict measures (Alert, Warning, penalties, fines, etc. ...) towards violators of the rules and conditions of the safety.	0.759	0.000*			

*Correlation is significant at the 0.05 level

Table (3.5): Spearman correlation coefficient of factors related to the Working Environment

Engineers			Workers		
Item	Spearman Correlation Coefficient	p-value (Sig.)	Item	Spearman Correlation Coefficient	p-value (Sig.)
Contractors neglect implementing the safety standards.	0.670	0.000*	No existence supervisor/engineer specialist in safety.	0.647	0.000*
No existence supervisor/engineer specialist in safety.	0.763	0.000*	Weak of Supervision and periodic inspection of the relevant government agencies.	0.635	0.000*
Weak of Supervision and periodic inspection of the relevant government agencies.	0.767	0.000*	The absence of indicative and warning signals of safety.	0.762	0.000*
The absence of indicative and warning signals of safety.	0.800	0.000*	Weather and climate through working.	0.786	0.000*
Do not consider the company record regarding incidents in bidding awarding.	0.572	0.000*	First aid kit is unavailable.	0.658	0.000*
Weather and climate through working.	0.696	0.000*	No existence of safety and health Forman in the crew.	0.701	0.000*
First aid kit is unavailable.	0.584	0.000*	Unorganized or unarranged of the works on the site.	0.722	0.000*
No existence of safety and health Forman in the crew.	0.765	0.000*	Non-Suitable equipment for the work nature.	0.658	0.000*
Unorganized or unarranged of the works on the site.	0.738	0.000*	Working on heights without fencing.	0.640	0.000*
Non-Suitable equipment for the work nature.	0.536	0.000*	Exclusion of the participation of workers in the selection of special methods of protection and safety.	0.783	0.000*
Working on heights without fencing.	0.731	0.000*			
Exclusion of the participation of workers in the selection of special methods of protection and safety.	0.531	0.000*			

*Correlation is significant at the 0.05 level

Table (3.6): Spearman correlation coefficient of factors related to the work performed

Engineers			Workers		
Item	Spearman Correlation Coefficient	p-value (Sig.)	Item	Spearman Correlation Coefficient	p-value (Sig.)
Works carried out must be not complex and tangled.	0.827	0.000*	Works carried out must be not complex and tangled.	0.723	0.000*
Providing of Personal Protective Equipment (PPE).	0.798	0.000*	Respondance of the company to the workers view on protection requirements required in work.	0.792	0.000*
Work area mobilization and protective equipment (safe entrances and exits, etc.).	0.734	0.000*	Providing of Personal Protective Equipment (PPE).	0.825	0.000*
Providing safety signs and guidance.	0.653	0.000*	Work area mobilization and protective equipment (safe entrances and exits, etc.).	0.768	0.000*
Stop work in bad weather condition.	0.584	0.000*	Providing safety signs and guidance.	0.798	0.000*
Working at night with adequate lighting.	0.755	0.000*	Stop work in bad weather condition.	0.707	0.000*
Fencing the work area and especially the heights.	0.742	0.000*	Working at night with adequate lighting.	0.762	0.000*
Periodic maintenance of tools and equipment.	0.637	0.000*	Fencing the work area and especially the heights.	0.810	0.000*
			Periodic maintenance of tools and equipment.	0.783	0.000*

*Correlation is significant at the 0.05 level

Table (3.7): Spearman correlation coefficient of factors related to the Top Management

No.	Statements	Spearman Correlation Coefficient	p-value (Sig.)
1.	Commit the managers of the project on safety.	0.743	0.000*
2.	Implementing the safety legislation by the government.	0.805	0.000*
3.	Providing Safety supervisor or engineer.	0.593	0.000*
4.	Size of the company/contractor and record of the safety implementation in the projects.	0.754	0.000*
5.	Decreasing the pressure on the worker.	0.625	0.000*
6.	Commit the project time schedule.	0.519	0.000*
7.	Provide the safety climate in the work environment.	0.753	0.000*

*Correlation is significant at the 0.05 level

Table (3.8): Spearman correlation coefficient of factors related to the workers

No.	Statements	Spearman Correlation Coefficient	p-value (Sig.)
1.	Safety training for the worker↘	0.646	0.000*
2.	Recruitment educated workers.	0.516	0.000*
3.	Recruitment Skilled workers.	0.721	0.000*
4.	Determine specific age for workers.	0.550	0.000*
5.	Check up the mental state of the worker.	0.656	0.000*
6.	Test the physical condition of the worker.	0.629	0.000*
7.	Determine if the worker qualified for work at heights.	0.743	0.000*
8.	Locate the safety culture of the Workers.	0.739	0.000*
9.	Follow up if the worker Takes the necessary measures for prevention and safety.	0.718	0.000*

*Correlation is significant at the 0.05 level

Table (3.9): Spearman correlation coefficient of factors related to the Economic as factors of prevention

No.	Statements	Spearman Correlation Coefficient	p-value (Sig.)
1.	Paying the medical expenses of injured workers.	0.728	0.000*
2.	Provide insurance/compensation for workers.	0.710	0.000*
3.	Apply a financial motivation award for the safety commitment.	0.702	0.000*
4.	Allocate a specific budget for safety requirements.	0.808	0.000*

*Correlation is significant at the 0.05 level

3.15.2 Structure Validity of the Questionnaire

Structure validity is the second statistical test that used to test the validity of the questionnaire structure by testing the validity of each field and the validity of the whole questionnaire. It measures the correlation coefficient between one filed and all the fields of the questionnaire that have the same level of liker scale. Table No. (3.10) Clarifies the correlation coefficient for each filed and the whole questionnaire. The p-values (Sig.) were less than 0.05, so the correlation coefficients of all the fields were significant at $\alpha = 0.05$, so it can be said that the fields were valid to measure what it was set for to achieve the main aim of the research.

Table (3.10): Spearman correlation coefficient of each field and the whole of questionnaire

No.	Engineers			Workers		
	Field	Spearman Correlation Coefficient	p-value (Sig.)	Field	Spearman Correlation Coefficient	p-value (Sig.)
1.	Factors related to the Occupational Safety and Health	0.788	0.000*	Factors related to the Occupational Safety and Health	0.897	0.000*
2.	Factors related to the Economic	0.834	0.000*	Factors related to the Economic	0.890	0.000*
3.	Factors related to the Social	0.891	0.000*	Factors related to the Social	0.819	0.000*
4.	Factors related to the Working Environment	0.924	0.000*	Factors related to the Working Environment	0.911	0.000*
5.	Factors related to the Top Management	0.876	0.000*	Factors related to the workers	0.763	0.000*
6.	Factors related to the work performed	0.838	0.000*	Factors related to the work performed	0.914	0.000*
7.	Factors related to the Economic	0.776	0.000*			

*Correlation is significant at the 0.05 level

3.16 Reliability of the Research

Reliability of an instrument is the degree of consistency with which it measures the attribute it is supposed to be measuring. The test is repeated to the same sample of people on two occasions and then compares the scores obtained by computing a reliability coefficient. For the most purposes reliability coefficient above 0.6 are considered satisfactory. Period of two weeks to a month is recommended between two tests Due to complicated conditions that the contractors is facing at the time being, it was too difficult to ask them to responds to our questionnaire twice within short period. The statistician's explained that, overcoming the distribution of the questionnaire twice to measure the reliability can be achieved by using Cronbach's Alpha coefficient through the SPSS software.

3.17 Cronbach's Coefficient Alpha

This method is used to measure the reliability of the questionnaire between each field and the mean of the whole fields of the questionnaire. The normal range of Cronbach's coefficient alpha value between 0.0 and + 1.0, and the higher values reflects a higher degree of internal consistency.

Table (3.11) shows the values of Cronbach's alpha for each field of the questionnaire and the entire questionnaire. The results were in the range from 0.755 and 0.929, and the general reliability for all items equal 0.976 (questionnaire of engineers), and 0.968 ((questionnaire of workers). This range is considered high; the result ensures the reliability of the questionnaire.

Table (3.11): Cronbach's Alpha for each field of the questionnaire

Engineers		Workers	
Field	**Cronbach's Alpha**	**Field**	**Cronbach's Alpha**
Factors related to the Occupational Safety and Health	0.908	Factors related to the Occupational Safety and Health	0.916
Factors related to the Economic	0.886	Factors related to the Economic	0.891
Factors related to the Social	0.877	Factors related to the Social	0.839
Factors related to the Working Environment	0.929	Factors related to the Working Environment	0.890
Factors related to the Top Management	0.859	Factors related to the workers	0.843
Factors related to the work performed	0.888	Factors related to the work performed	0.911
Factors related to the Economic	0.755	**All fields**	0.968
All fields	0.976		

Chapter 4
Results and Discussion

Chapter 4
Results and Discussion

Chapter 4 make known to the outcomes and the discussion of the results. This chapter separated into two sections. The first related to Engineers, and other to Workers, each section presents (personal information, factors affecting the causes of fall accident, factors affecting the prevention of fall accident, test of hypotheses).

4.1 The questionnaire of Engineers

4.1.1 Data Analyses

In this chapter, the data will be analyzed by SPSS with help of several tests.

4.1.2 Descriptive Statistics

After analyzing the questionnaire 100 were suitable to use for the data analysis. Persons who complete the entire questionnaire were used for the data analysis.

4.1.3 Personal information:

Table No. (4.1) Show that:

- Most of engineers of the sample are from the bachelor and master degree, this means that the selected sample was able to solve / responses the questionnaire.
- 27.0% of the sample their experience between (1 - less than 3) years, and 56.0% between (5 - less than 15) years, which means that selected sample was expert engineers, and will give the questionnaire good and a balance answers.
- Most of engineers of the sample are site engineer, which means that the selected sample have a practical experience, close to the work site.
- Most of the engineers in the sample participated in the implementation of less than 10 projects

Table (4.1): Personal information of engineers

Personal information	Frequency (F)	Percent (%)
Position		
Project manager	20	20.0
Site engineer	56	56.0
Other	24	24.0
Years of experience		
1 - Less than 3	27	27.0
3 - Less than 5	10	10.0

5 - Less than 10	37	37.0
10 - Less than 15	19	19.0
15 - Less than 20	5	5.0
More than 20	2	2.0
Qualification		
PhD	2	2.0
Master	25	25.0
Bachelor	70	70.0
Diploma	3	3.0
Projects executed in the last five years		
Less than 10	63	63.0
11 – 20	22	22.0
21- 30	9	9.0
More than 30	6	6.0

4.1.4 Factors affecting the causes of fall accidents in the construction industry

As categorized in the second part of the questionnaire, there were four groups of the causes of fall accidents in the construction industry (i.e. occupational safety and health, the economic, the social and working environment). Table No. (4.2) shows the relative index and the ranks of each factor affecting the causes of fall accidents in the construction industry.

Table (4.2): RII's and test values for factors affecting the causes of fall accidents in the construction industry - engineering point of view

No.	Item	Mean	SD	RII (%)	Test Value	P-value (Sig.)	Rank
1	Factors related to the Occupational Safety and Health	3.59	0.81	71.80	7.48	0.000*	3
2	Factors related to the Economic	3.60	0.77	72.00	7.78	0.000*	2
3	Factors related to the Social	3.57	0.72	71.33	7.86	0.000*	4
4	Factors related to the Working Environment	3.71	0.73	74.23	9.75	0.000*	1
	All fields	.363	0.67	72.55	9.34	0.000*	

*The mean is significantly different from 3 SD: Std. Deviation RII: Relative importance Index

4.1.4.1 Factors related to the Occupational Safety and Health

A list of 9 attributes related to occupational safety and health was adopted from literature and pilot research. These attributes were subjected to the views of respondents and the outcomes of the analysis was shown in table No. (4.3)

The results indicated that the attribute *"Lack of safety climate and occupational safety and health"* with a mean index of 3.94 and proportional weight 78.80% was ranked the first. The obtained results are agreed with Mohamed (2002). This result illustrates clearly that providing a safety climate (through safety system and Personal Protective Equipment PPE) in the work site is most important factor affecting directly to the accident causes.

This was closely followed by *"Lack of Safety culture"* with a mean index of 3.67, and proportional weight 73.40%. The obtained results are agreed with Ansah (2014); Barlas and Izci (2018). This result illustrates clearly that dominant culture and negligence in safety affected directly to the accident causes.

"Documentary/records system for fall accidents in construction projects is unavailable" have the ninth ranked with a mean index= 3.38, and proportional weight (67.60%). The obtained results are agreed with Ertaş and Erdoğan (2017). This result illustrates that developing statistics reports for fall accidents in construction projects has a little affect to the accident causes.

Results of the entire field *"The Occupational Safety and Health"* show that a mean index=3.59, and proportional weight (71.80%), with the third ranked (Table 4.2). that means the factor related to the occupational safety and health affect in causes of fall accidents.

Table (4.3): RII's and Test values for factors related to the Occupational Safety and Health - engineering point of view

No.	Statement	Mean	SD	RII (%)	Test Value	P-value (Sig.)	Rank
1.	Working without Occupational Safety and Health Plan.	3.65	1.17	73.00	5.57	0.000*	3
2.	No Clear legislation and laws regard for occupational safety and health in the construction site.	3.57	1.17	71.40	4.85	0.000*	5
3.	Irregular meetings for occupational safety and health.	3.63	1.03	72.60	6.11	0.000*	4
4.	Lack of safety climate and occupational safety and health.	3.94	0.91	78.80	10.35	0.000*	1
5.	Absence the training program for workers on the occupational safety and health.	3.47	1.21	69.40	3.89	0.000*	7

No.	Statement	Mean	SD	RII (%)	Test Value	P-value (Sig.)	Rank
6.	Lack of Safety culture.	3.67	0.93	73.40	7.18	0.000*	2
7.	Documentary/records system for fall accidents in construction projects is unavailable.	3.38	1.09	67.60	3.49	0.001*	9
8.	Absence of contingency arrangements when it occurs.	3.51	1.10	70.20	4.65	0.000*	6
9.	There is no specialized organization for safety and health, such as OSHA.	3.40	1.31	68.00	3.05	0.003*	8
	All paragraphs of the field	3.59	0.81	71.80	7.48	0.000*	

***The mean is significantly different from 3 SD: Std. Deviation RII: Relative importance Index**

4.1.4.2 Factors related to the Economic

A list of 8 attributes related to the Economic was adopted from literature and pilot research. These attributes were subjected to the views of respondents and the outcomes of the analysis was shown in table No. (4.4)

"Execute the works without fall prevention safety equipment" factor rank as number one with mean value 3.93, relative important index equals (RII) 78.60%. This result agreed with Kartam, et al., (2000). This output shows that safe workplace more important than an economy.

"Unclear safety requirements items included through contracting" factor rank as the second with mean factor and RII percentage 3.81 and 76.20% respectively, while rising a little bit in term of Test value to be 8.08. P-Test remains the same as rank number one (0.000) that less than ✔●0.05, the mean value is bigger than the hypothesized value 3 wherefore the test is positive. The obtained results are agreed with Ansah (2014) and Jannadi & Bu-Khamsin (2001) which is pointed out that "placement of considerable emphasis on the selection of safe contractors by the owner is necessary for fewer monitoring and control actions". Also, the results illustrate that contacting stage is very important in terms of OSHA.

On the other hand, *"No budget for implementing the safety plans and their requirements"* rank in sixth place with mean value 3.46 and 69.20 percent for RII. Test value shows a high decrease comparing to the first and the second ranks, with value 4.13, while P-Value shows a little increase (0.000) which is less than ✔●0.05. The obtained results are agreed with Aksorn and Hadikusumo (2008) which is pointed out

that “a higher budget allocation is required for installing fall protection such as guardrails, safety nets, etc. This is very important for high-rise building construction". Also, result illustrates that for a high safety level a budget should be allocated for safety purposes.

Results of the entire field *"factor related to the economic"* show that a mean index=3.60, and proportional weight (72.00%), with the second ranked (Table 4.2). that means the factor related to the economic affect in causes of fall accidents.

Table (4.4): RII's and Test values for factors related to the Economic - engineering point of view

No.	Statement	Mean	SD	RII (%)	Test Value	P-value (Sig.)	Rank
1.	Absence encouragement system for application of safety.	3.44	1.11	68.80	3.95	0.000*	7
2.	Weak using modern equipment in construction projects.	3.18	1.07	63.60	1.69	0.095	8
3.	No budget for implementing the safety plans and their requirements.	3.46	1.11	69.20	4.13	0.000*	6
4.	Non-compliance with the working hours specified by law.	3.55	1.03	71.00	5.35	0.000*	5
5.	Irregular break hour for workers, which increase pressure on them and reduces the safety.	3.72	1.03	74.40	7.02	0.000*	3
6.	Lowest prices are the only standard for bidding award.	3.71	0.99	74.20	7.19	0.000*	4
7.	Execute the works without fall prevention safety equipment.	3.93	1.22	78.60	7.59	0.000*	1
8.	Unclear safety requirements items included through contracting.	3.81	1.00	76.20	8.08	0.000*	2
	All paragraphs of the field	3.60	0.77	72.00	7.78	0.000*	

***The mean is significantly different from 3 SD: Std. Deviation RII: Relative importance Index**

4.1.4.3 Factors related to the Social

Table (4.5) represent the difference between six factors according to the Mean value, SD value, the percentage of RII, Test & P-value and the rank, results from the questionnaire answered by Engineers.

Overall, *"Choosing unskilled workers to work on heights "*the factor comes as number one with mean value 3.81, relative important index equals (RII) 76.20%, this results

agreed with Barlas and Izci (2018), which is pointed out that "Classification of fatal occupational accidents revealed five major reasons for the shipyard workers; falling from the higher height to a lower level was the first, based on the category of the worker ", furthermore, the results illustrate that choosing an appropriate worker - based to their specifications - in the heights, reduces falls.

"Non-holding special training for workers on falls prevention" factor rank as the second with the mean factor, RII percentage and Test value slightly less than the first rank (Choosing unskilled workers to work on heights) 3.80, 76.00%, and 7.78 respectively, while. P-Test remains the same (0.000), that less than ✔ ●0.05, the mean value is bigger than the hypothesized value 3 wherefore the test is positive. The obtained results are agreed with Ertaş & Erdoğan, (2017); Ansah, (2014); Aksorn & Hadikusumo; (2008) and Kartam, et al., (2000), which is pointed out that "Wherever possible a safe working platform should be set up by trained personnel" Also result illustrates that the training is a serious issue, which is affected directly by reducing accidences.

On the other hand, *"The absence of visits or social trips for employees"* rank in sixth place with mean value 3.07 and 61.40 percent for RII. Test value shows a sharp decrease comparing to the first and the second ranks, with value 0.62, while P-Value shows a high increase (0.534) more than ✔ ●0.05. This factor came in the penultimate position, which means that is not an important factor.

Results of the entire field *"factor related to the Social"* show that a mean index=3.57, and proportional weight (71.33%), with the fourth ranked (Table 4.2). that means the factor related to the Social affect in causes of fall accidents.

Table (4.5): RII's and Test values for factors related to the Social - engineering point of view

No.	Statement	Mean	SD	RII (%)	Test Value	P-value (Sig.)	Rank
1.	The spirit of cooperation and familiarity between employees not exist.	3.50	0.78	70.00	6.37	0.000*	4
2.	Non-holding special training for workers on falls prevention.	3.80	1.04	76.00	7.78	0.000*	2

No.	Statement	Mean	SD	RII (%)	Test Value	P-value (Sig.)	Rank
3.	Lack of coordination between the operators of the project (contractor, owner, donor, etc...) and the relevant government agencies (Ministry of Labor, civil defense, police, etc. ...).	3.47	1.02	69.40	4.61	0.000*	5
4.	The absence of visits or social trips for employees.	3.07	1.12	61.40	0.62	0.534	6
5.	Choosing unskilled workers to work on heights.	3.81	0.96	76.20	8.43	0.000*	1
6.	Not to carry on strict measures (Alert, Warning, penalties, fines, etc. ...) towards violators of the rules and conditions of the safety.	3.74	1.05	74.80	7.05	0.000*	3
	All paragraphs of the field	3.57	1.11	71.33	3.95	0.000*	

***The mean is significantly different from 3 SD: Std. Deviation RII: Relative importance Index**

4.1.4.4 Factors related to the Working Environment

Table (4.6), it is shown that the results of questionnaires about twelve different factors in terms of mean, SD value, the percentage of RII, Test & P-value and the rank, answered by engineers.

"Contractors neglect implementing the safety standards" came in the first rank with mean value 3.94, relative important index equals (RII) 78.80%, this result agreed with Ansah (2014), which is pointed out from his research that issuance of laws, standards, regulations, and legislation on safety had the highest rank in this group with mean score of 4.25 and a standard deviation of 0.87. Also, result shows that the Contractors must take into consideration – during the construction - the implementing of occupational safety and health standards

While *"Working on heights without fencing"* factor rank as the second with the mean factor, RII percentage and Test value slightly less than the first rank 3.92. 78.40 % and 8.05 respectively, while. P-Test remains the same (0.000), that less than ✔●0.05. This was in sharp contrast to the research conducted by Jannadi and Bu-Khamsin (2001), in his factor "Fence and access gates". On the other hand, the position of this result is very close to the research conducted by Ertaş and Erdoğan (2017), which is referred to "fencing" as a 4, 5, 7 type as common and very important factors. Also, the result shows that fencing plays an important role in reducing accidences.

On the last position, *"Weather and climate through working"* came with mean equal 3.35 and 67.00 percent for RII. Test value shows a sharp fall comparing to the first and the second ranks, with value 3.70, while P-Value remains constant, which less than ✔●0.05. The obtained results are agreed with the research conducted by Kartam, et al (2000) in his factor which came in the 9th level (last factor). Also result show that is not an important factor.

Results of the entire field *"Factor related to the working environment"* show that a mean index=3.71, and proportional weight (74.23%), with the first ranked (Table 4.2). that means the factor related to the working environment affect in causes of fall accidents.

Table (4.6): RII's and Test values for factors related to the Working Environment - engineering point of view

No.	Statement	Mean	SD	RII (%)	Test Value	P-value (Sig.)	Rank
1.	Contractors neglect implementing the safety standards.	3.94	0.97	78.80	9.67	0.000*	1
2.	No existence supervisor/engineer specialist in safety.	3.70	1.12	74.00	6.23	0.000*	7
3.	Weak of Supervision and periodic inspection of the relevant government agencies.	3.75	1.09	75.00	6.91	0.000*	5
4.	The absence of indicative and warning signals of safety.	3.72	1.05	74.40	6.83	0.000*	6
5.	Do not consider the company record regarding incidents in bidding awarding.	3.57	1.13	71.40	5.04	0.000*	11
6.	Weather and climate through working.	3.35	0.95	67.00	3.70	0.000*	12
7.	First aid kit is unavailable.	3.79	1.04	75.80	7.61	0.000*	4
8.	No existence of safety and health Forman in the crew.	3.90	0.98	78.00	9.19	0.000*	3
9.	Unorganized or unarranged of the works on the site.	3.67	0.92	73.40	7.27	0.000*	8
10.	Non-Suitable equipment for the work nature.	3.65	0.89	73.00	7.29	0.000*	9
11.	Working on heights without fencing.	3.92	1.14	78.40	8.05	0.000*	2
12.	Exclusion of the participation of workers in the selection of special methods of protection and safety.	3.58	0.99	71.60	5.88	0.000*	10
	All paragraphs of the field	3.71	0.73	74.23	9.75	0.000*	

***The mean is significantly different from 3 SD: Std. Deviation RII: Relative importance Index**

4.1.5 Factors affecting the prevention of fall accidents in the construction industry

As categorized in the third part of the questionnaire, there were three groups of prevention of fall accidents (i.e. the top management, the work performed, the economic). Table No. (4.7) shows the relative index and the ranks of each factor affecting the prevention of fall accidents.

Table (4.7): RII's and test values for factors affecting the prevention of fall accidents in the construction industry - engineering point of view

No.	Item	Mean	SD	RII (%)	Test Value	P-value (Sig.)	Rank
1	Factors related to the Top Management.	3.66	0.68	73.14	9.62	0.000*	2
2	Factors related to the work performed.	3.87	0.69	77.30	12.54	0.000*	1
3	Factors related to the Economic.	3.57	0.71	71.40	8.08	0.000*	3
	All fields	3.66	0.63	73.24	10.50	0.000*	

***The mean is significantly different from 3 SD: Std. Deviation RII: Relative importance Index**

4.1.5.1 Factors related to the Top Management

Table No. (4.8) gives information about the mean value, SD value, percentage of RII, Test &P value and the Rank for seven different factors. This results from the questionnaire answered by Engineers.

It is clear that *"decreasing the pressure on the worker"* rank as number one with mean value 3.80, relative important index equals (RII) 76.00%, Test-value =10.64, and Sig less than 0.05, and this result agreed with the research conducted by Hinze and Raboud (1988) studied safety on large construction projects; the research discussed the relationships between company size, level safety policy, project level safety policy, project coordination, and economic pressure on worker safety. It was found that higher frequencies of construction accidents occurred on projects that were over budget and those that were competitively bid. Also, result illustrates that the workers' working conditions and pressures of work have a great impact on safety.

"providing safety supervisor or engineer" comes as number two in term of the rank with the mean factor and RII percentage a little less than the first rank 3.79 and 75.80 % respectively, while Test value decreased to 7.46. P-Test remains the same (0.000), that less than ✔ ●0.05. The obtained results are agreed with the research conducted by

Hassan et al. (2007). Hassan finds out that "Workers will work more safely with a supervisor". Also, result illustrates that having a safety supervisor is important to keep your work safe.

In term of Rank, *"Commit the project time schedule"* rank in the last position with mean value 3.41 and 68.20 percent for RII. Test value shows a sharp drop comparing to the first and the second ranks, with value 4.25. P-Value remains the same (0.000), that less than ✔●0.05. The obtained results are agreed with the research conducted by Jannadi and Bu-Khamsin (2001) finds out that " Projects on or ahead of schedule were safer". Also, result illustrates that scheduling project items keeping your work safe.

Concerning the whole fields affecting on prevention of fall accidents in the construction industry form engineers view *"factor of the top management"* have the second ranked with 3.66 for the mean, 73.14% for the relative important index equal ,9.62 for the Test value, and 0.000 for the P-value less than ✔●0.05. The respondent engineers tend to agree that the factors related to the top management affect in the prevention of fall accidents in the construction industry.

Table (4.8): RII's and Test values for factors related to the Top Management - engineering point of view

No.	Statement	Mean	SD	RII (%)	Test Value	P-value (Sig.)	Rank
1.	Commit the managers of the project on safety.	3.74	0.91	74.80	8.17	0.000*	3
2.	Implementing the safety legislation by the government.	3.67	0.96	73.40	6.95	0.000*	4
3.	Providing Safety supervisor or engineer.	3.79	1.07	75.80	7.46	0.000*	2
4.	Size of the company/contractor and record of the safety implementation in the projects.	3.55	0.95	71.00	5.81	0.000*	6
5.	Decreasing the pressure on the worker.	3.80	0.75	76.00	10.64	0.000*	1
6.	Commit the project time schedule.	3.41	0.96	68.20	4.25	0.000*	7
7.	Provide the safety climate in the work environment.	3.63	1.13	72.60	5.56	0.000*	5
	All paragraphs of the field	3.66	0.68	73.14	9.62	0.000*	

***The mean is significantly different from 3 SD: Std. Deviation RII: Relative importance Index**

4.1.5.2 Factors related to the work performed

Table (4.9) illustrates the questionnaire results for eight different factors in terms of the Mean Factor, SD factor, the percentage of RII, Test & P-value and the rank.

First of all, *"stop work in bad weather condition"* rank as number one with mean value 4.18, relative important index equals (RII) 83.60%, and Sig less than ✔●0.05. This test shows positive results as the mean factor higher than 3, and this result agreed with Kartam, et al. (2000), which is pointed out from his research that many contractors tend to work long hours during good weather to make up for the time lost due to bad weather. Also result show that the bad weather situation must take into consideration during the construction.

"Fencing the work area and especially the heights" rank as the second with mean factor, RII percentage and Test value less than the first rank, 4.03, 80.60%, 9.91 respectively. P-Test shows constant value (0.000) less than ✔●0.05, the mean is higher than 3, wherefore the test is positive. These results show a sharp contrast with the research conducted by Jannadi and Bu-Khamsin (2001), in his factor " Fence and access gates " which take 2.36 Mean Impact. On the other hand, the position of this result is very close to the research conducted by Ertaş and Erdoğan (2017), which is referred to "fencing" as a 4, 5, 7 type as common and very important factors. Also result show that fencing plays an important role in reducing accidences.

The last position in Rank list goes to *"Works carried out must be not complex and tangled"* with mean value 3.46, RII 69.20%. Test value 4.27, while P-Value stay the same (0.000) smaller than ✔●0.05. Therefore, the obtained results are agreed with Ansah (2014). Also result show that the complex and tangled works decreasing the safety.

Regarding the whole fields affecting on prevention of fall accidents in the construction industry form point of view engineers *"factors related to the work performed"* occupied the first position in terms of the rank and mean value 3.87, RII percentage (77.30%), and Sig= 0.000 which is under ✔●0.05. The respondent engineers decide that the factors related to the work performed affect in prevention of fall accidents in the construction industry.

Table (4.9): RII's and Test values for factors related to work performed - engineering point of view

No.	Statement	Mean	SD	RII (%)	Test Value	P-value (Sig.)	Rank
1.	Works carried out must be not complex and tangled.	3.46	1.08	69.20	4.27	0.000*	8
2.	Providing of Personal Protective Equipment (PPE).	3.92	1.01	78.40	9.09	0.000*	4
3.	Work area mobilization and protective equipment (safe entrances and exits, etc.).	3.81	0.81	76.20	9.97	0.000*	6
4.	Providing safety signs and guidance.	3.83	0.95	76.60	8.70	0.000*	5
5.	Stop work in bad weather condition.	4.18	0.81	83.60	14.59	0.000*	1
6.	Working at night with adequate lighting.	3.76	0.93	75.20	8.14	0.000*	7
7.	Fencing the work area and especially the heights.	4.03	1.04	80.60	9.91	0.000*	2
8.	Periodic maintenance of tools and equipment.	3.93	0.79	78.60	11.70	0.000*	3
	All paragraphs of the field	3.87	0.69	77.30	12.54	0.000*	

*The mean is significantly different from 3 SD: Std. Deviation RII: Relative importance Index

4.1.5.3 Factors related to the Economic

Table No. (4.10), shown the results of questionnaires about four different factors related to Economic in terms of mean, SD factor, the percentage of RII, Test & P-value and the rank, answered by engineers.

"Provide insurance/compensation for workers" had the highest value for the Mean (3.64) and ranked as the first. Further relative important index equals (RII) 72.80%, Sig = 0.000 that is less than ✔ ●0.05, and this result agreed with Ansah (2014), which is pointed out from his research that buying workers compensation insurance take 3.9 mean. Also result show that providing insurance workers compensation increasing the safety.

While *"Paying the medical expenses of injured workers"* ranked as the last one with the mean factor, RII percentage and Test value, (3.40). (68.00 %) and (4.63) respectively, while. P-Test remains the same (0.000) less than ✔ ●0.05, wherefore the test is positive. The obtained results are agreed with Ansah (2014), which is pointed out from his research that paying for the medical expenses of injured take 4.3 mean

and the second rank. Also result show that paying for the medical expenses of injured workers increasing the safety.

Concerning the whole fields affecting on prevention of fall accidents in the construction industry form engineers view *"Factor of the economic"* have the third ranked with mean = 3.57, and the relative important index equal (71.40%), and Sig less than 0.05. Respondent Engineers are satisfied with these results for the factors related to the economic affect in the prevention of fall accidents in the construction industry.

Table (4.10): RII's and Test values for factors related to the Economic - engineering point of view

No.	Statement	Mean	SD	RII (%)	Test Value	P-value (Sig.)	Rank
1.	Paying the medical expenses of injured workers.	3.40	0.86	68.00	4.63	0.000*	4
2.	Provide insurance/compensation for workers.	3.64	0.80	72.80	8.02	0.000*	1
3.	Apply a financial motivation award for the safety commitment.	3.60	1.04	72.00	5.75	0.000*	3
4.	Allocate a specific budget for safety requirements.	3.63	0.99	72.60	6.46	0.000*	2
	All paragraphs of the field	3.57	0.71	71.40	8.08	0.000*	

***The mean is significantly different from 3 SD: Std. Deviation RII: Relative importance Index**

4.1.6 Diagnosing the fall accidents causes and prevention

Figure (4.1) shows that:

- In the first paragraph, 46% indicate that the training is sometimes held and this affects negatively and directly on safety performance in the construction projects. An approved training system for construction projects should be implemented to reduce and prevent falls.
- The second paragraph indicates that safety professional supervisors are not available at any time, therefore they must be available.
- The third paragraph confirms the absence of a statistical record of accidents, which affects the accumulation of experience and knowledge to prevent falling accidents.

- The fourth paragraph emphasizes the absence of standards and policies related to accidents, which necessitates working on providing them.

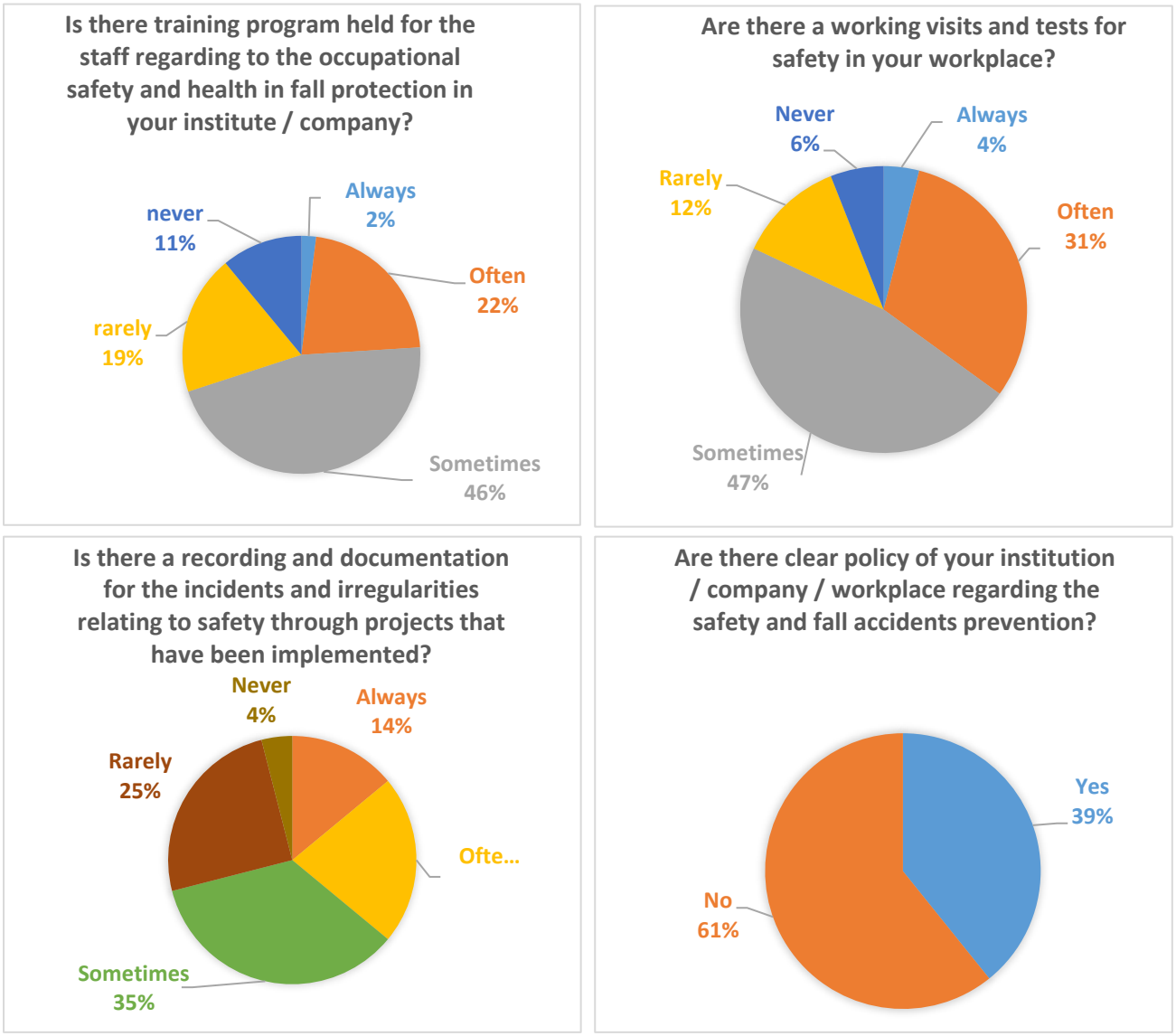


Figure (4.1): Percent of diagnosing the fall accidents causes and prevention

Figure (4.2) shows that 47% of sites have an accident, which is a large percentage.

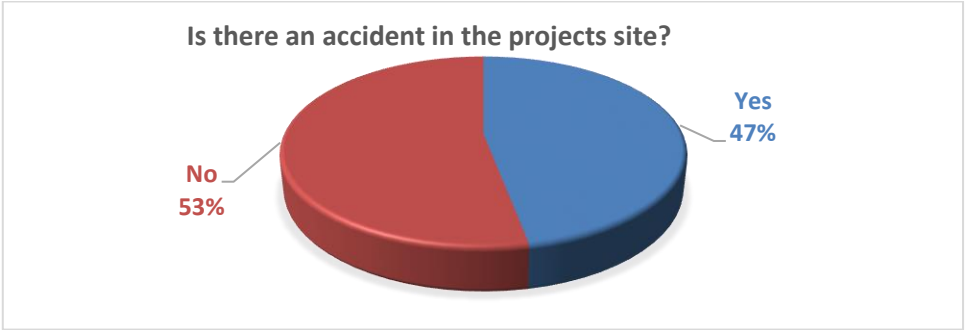


Figure (4.2): Percent of diagnosing the fall accidents causes and prevention

Figure (4.3) shows the percentage (68.1 %) in the previous paragraph indicates that most accidents were fall accidents, and this is an important result and corresponds to many previous international studies in this field and stresses the importance of this research.

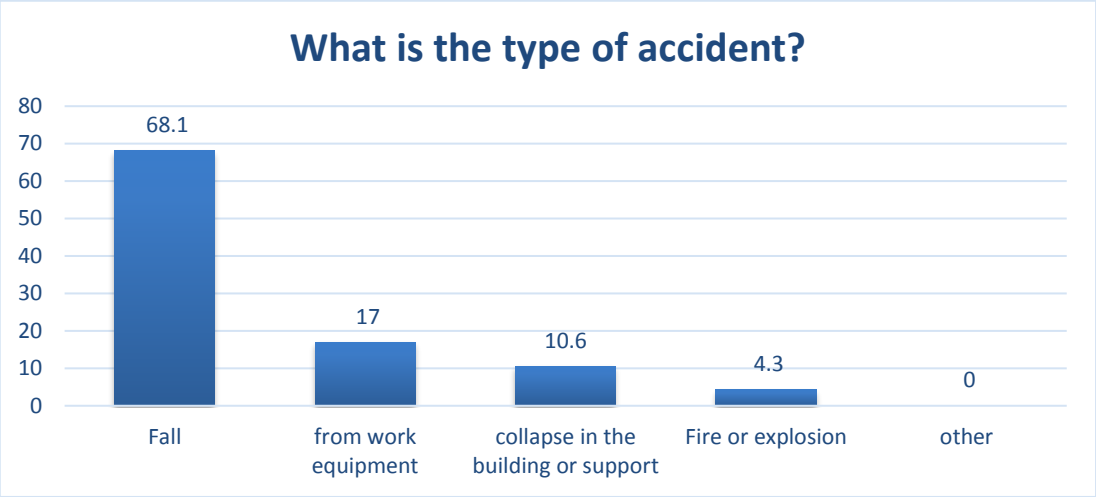


Figure (4.3): If yes, what is the type of accident?

Figure (4.4): shows Roof and scaffolds are the most factor impacting fall accidents.

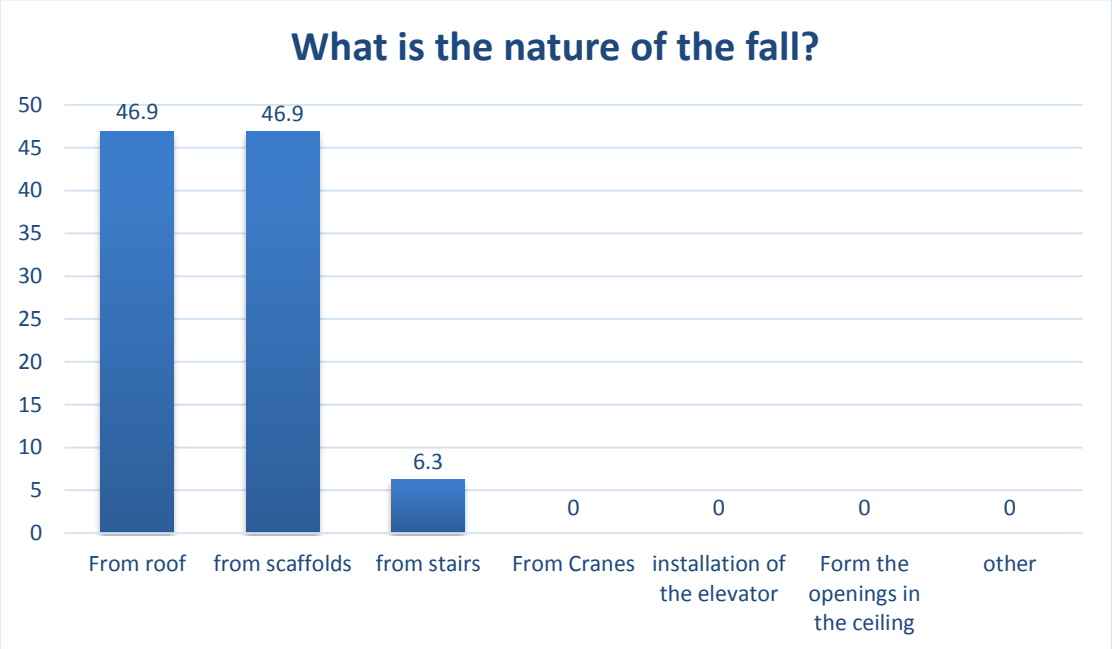


Figure (4.4): If the answer fall, what is the nature of the fall?

Figure (4.5) show the percentage in this section indicates that the high incidence of accidents is from workers, and this is normal because of the nature of their work.

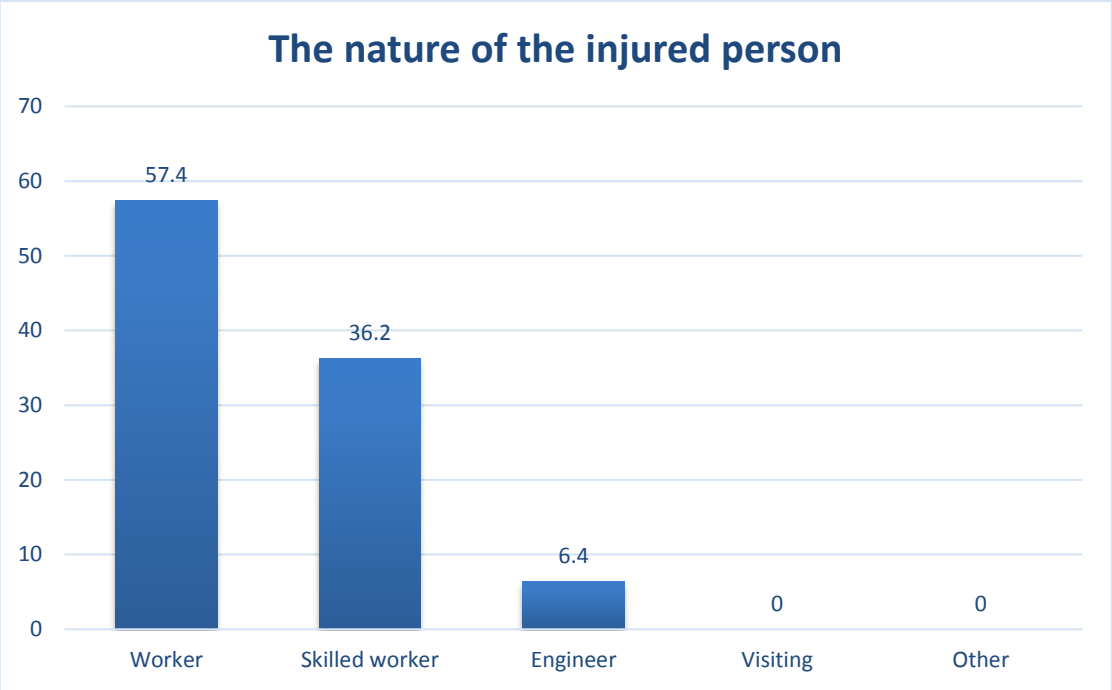


Figure (4.5): The nature of the injured person

Figure (4.6) show the percentage indicates that accidents could have been avoided if safety standards were followed.

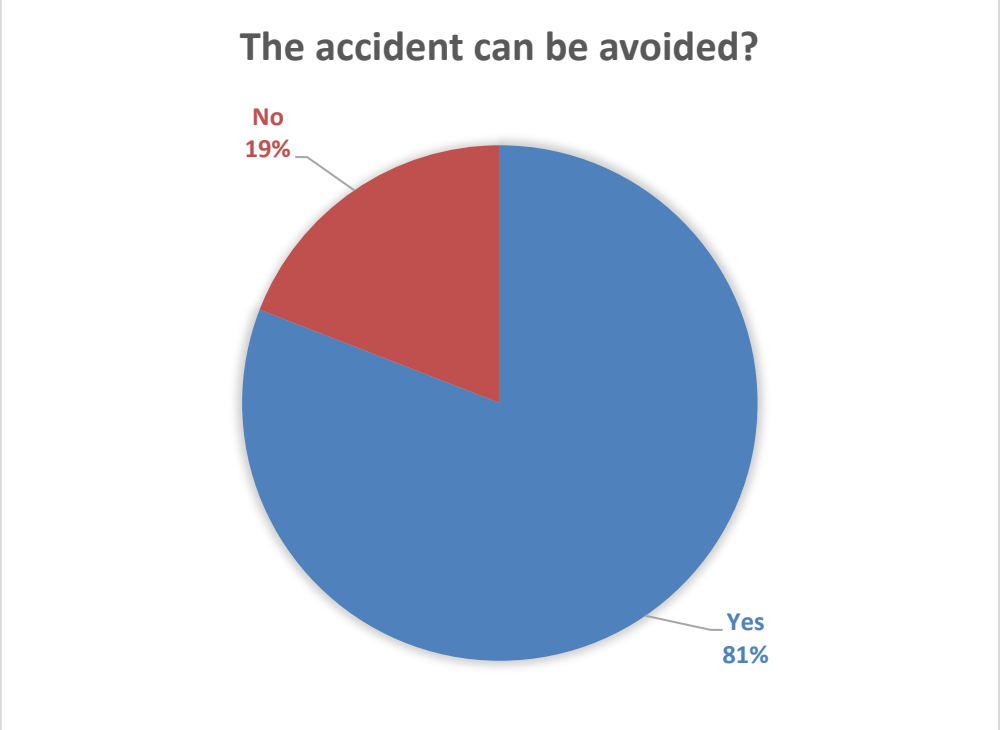


Figure (4.6): The accident can be avoided?

4.1.7 Test of hypothesis - engineering point of view

4.1.7.1 Test of first hypothesis

There is a significant difference among respondents regard the fall accident causes and prevention in the construction industry due to personal information (position, years of experience, qualification, the number of projects in the last five years and age).

This part was to analyze the differences among respondents toward the fall accident causes and prevention in the construction industry due to personal information.

- **The Position.**

There is no significant differences among respondents regard the fall accident causes and prevention in the construction industry due to their position.

Table (4.11) shows that the p-value (Sig.) is greater than the level of significance ✔●0.05 for all the fields, then there is insignificant difference among the respondents toward all these fields due to position. It can be concluded that the personal characteristics' position has no effect on all the fields.

The reason for the difference is that respondents have different experiences, cultures, years of service and the number and type of projects derailed with.

Table (4.11): One-way ANOVA of the fields and their p-value for position of engineers

Section	Field	Test value	P-value (Sig.)	Means		
				Project manager	Site engineer	Other
Factors affecting the causes of fall accidents in the construction industry	Factors related to the Occupational Safety and Health	2.102	0.128	3.71	3.69	3.31
	Factors related to the Economic	1.600	0.207	3.46	3.72	3.43
	Factors related to the Social	1.335	0.268	3.80	3.52	3.49
	Factors related to the Working Environment	1.917	0.153	3.90	3.74	3.49
	All fields	1.688	0.190	3.74	3.68	3.41
Factors affecting the prevention of	Factors related to the Top Management	0.941	0.394	3.54	3.74	3.57

fall accidents in the construction industry	Factors related to the work performed	0.187	0.829	3.95	3.84	3.84
	Factors related to the Economic	0.089	0.915	3.59	3.54	3.61
	All fields	0.059	0.943	3.72	3.74	3.69
All fields		0.926	0.400	3.73	3.70	3.51

❖ **The Experience.**

There is no significant differences among respondents regard the fall accident causes and prevention in the construction industry due to their experience.

Table (4.12) shows that the p-value (Sig.) is smaller than the level of significance ✔●0.05 for each field and all the fields, then there is significant difference among the respondents toward these fields due to experience. It can be concluded that the personal characteristics' experience has an effect on these fields.

The mean for the category "5 - Less than 10" respondents have the highest among the other experience categories, then It can be concluded that the category "5 - Less than 10" respondents is agreed for all the fields much more than the other experience categories. This indicates that the experience "5 - Less than 10" respondents gives a definite view of the factors mentioned.

Table (4.12): One-way ANOVA of the fields and their p-value for experience of engineers

Section	Field	Test value	P-value (Sig.)	Means					
				1 - Less than 3	3- Less than 5	5- Less than 10	10- Less than 15	15- Less than 20	More than 20 years
Factors affecting the causes of fall accidents in the construction industry	Factors related to the Occupational Safety and Health	6.127	0.000*	3.19	3.79	4.02	3.28	3.93	2.63
	Factors related to the Economic	3.524	0.006*	3.30	3.79	3.94	3.46	3.07	3.13
	Factors related to the Social	2.509	0.035*	3.26	3.63	3.82	3.39	3.87	3.67
	Factors related to the Working Environment	4.988	0.000*	3.27	3.80	4.00	3.63	4.30	3.08
	All fields	4.965	0.000*	3.25	3.74	3.96	3.46	3.81	3.14
Factors affecting the prevention of fall accidents in	Factors related to the Top Management	6.301	0.000*	3.24	3.99	3.99	3.53	3.60	2.86

the construction industry	Factors related to the work performed	4.506	0.001*	3.45	4.05	4.10	3.80	4.43	3.38
	Factors related to the Economic	7.566	0.000*	3.00	3.53	3.93	3.72	3.50	3.50
	All fields	6.343	0.000*	3.28	3.92	4.03	3.68	3.93	3.21
All fields		5.894	0.000*	3.26	3.80	3.98	3.54	3.85	3.17

* The mean difference is significant at 0.05 level

❖ **The Qualification.**

There is no significant differences among respondents regard the fall accident causes and prevention in the construction industry due to their Qualification.

Table (4.13) shows that the p-value (Sig.) is greater than the level of significance ✔●0.05 for the fields "the Occupational Safety and Health, the Economic, the Top Management, and the work performed", then there is insignificant difference among the respondents toward these fields due to qualification. It can be concluded that the personal characteristics qualification has no effect on these fields. That indicates the compatibility in this area and factors.

For the other fields, the p-value (Sig.) is smaller than the level of significance ✔●0.05, then there is significant difference among the respondents toward these fields due to qualification. It can be concluded that the personal characteristics' qualification has an effect on the other fields. It shows that the diversity of experiences and qualification affects the judgment of the individual.

The mean for the category "PhD" respondents have the highest among the other qualification categories, then It can be concluded that the category "PhD" respondents is agreed for the other fields much more than the other qualification categories. It indicates that the scientific certificate has an impact on the judgment and decision on the factor.

Table (4.13): One-way ANOVA of the fields and their p-value for Qualification of engineers

Section	Field	Test value	P-value (Sig.)	Means			
				PhD	Master	Bachelors	Diploma
Factors affecting the causes of fall accidents in the construction industry	Factors related to the Occupational Safety and Health	1.514	0.216	3.91	3.80	3.37	3.82
	Factors related to the Economic	0.955	0.417	3.94	3.76	3.47	3.89
	Factors related to the Social	3.326	0.023*	4.40	3.84	3.35	3.30
	Factors related to the Working Environment	4.348	0.006*	4.10	4.08	3.55	3.20
	All fields	2.825	0.043*	4.08	3.89	3.44	3.51
Factors affecting the prevention of fall accidents in the construction industry	Factors related to the Top Management	1.354	0.262	4.00	3.90	3.55	3.75
	Factors related to the work performed	1.759	0.160	4.28	4.15	3.76	3.78
	Factors related to the Economic	5.160	0.002*	4.25	3.92	3.44	2.75
	All fields	3.420	0.027*	4.17	4.01	3.62	3.57
All fields		3.918	0.011*	4.11	3.93	3.50	3.53

* The mean difference is significant at 0.05 level

❖ **The Number of projects in the last 5 years.**

There is no significant differences among respondents regard the fall accident causes and prevention in the construction industry due to their number of projects in the last 5 years.

Table (4.14) shows that the p-value (Sig.) is greater than the level of significance ✔●0.05 for all the fields, then there is insignificant difference among the respondents toward all these fields due to number of projects. It can be concluded that the personal characteristics number of projects has no effect on all the fields. That indicates the compatibility in this area and factors.

Table (4.14): One-way ANOVA of the fields and their p-value for the number of projects in the last 5 years for engineers

Section	Field	Test value	P-value (Sig.)	Means			
				Less than 10	11 – 20	21- 30	More than 30
Factors affecting the causes of fall accidents in the construction industry	Factors related to the Occupational Safety and Health	1.827	0.147	3.54	3.93	3.43	3.29
	Factors related to the Economic	0.585	0.626	3.62	3.66	3.28	3.63
	Factors related to the Social	0.318	0.812	3.56	3.48	3.67	3.78
	Factors related to the Working Environment	1.967	0.124	3.60	3.99	3.92	3.56
	All fields	0.573	0.634	3.58	3.79	3.61	3.59
Factors affecting the prevention of fall accidents in the construction industry	Factors related to the Top Management	0.858	0.466	3.72	3.58	3.63	3.29
	Factors related to the work performed	0.394	0.758	3.84	3.97	3.93	3.67
	Factors related to the Economic	1.345	0.264	3.50	3.77	3.36	3.83
	All fields	0.206	0.892	3.72	3.79	3.70	3.56
All fields		0.398	0.755	3.63	3.79	3.64	3.58

* The mean difference is significant at 0.05 level

4.1.7.2 Test of second hypothesis

There is a significant relationship between groups of fall accidents causes and prevention in the construction industry.

From Table No. (4.15), it is shown that:

- (H1): there is a significant relationship at the level of significance ✔●0.05, between the occupational safety and health regard to causes of fall accidents and prevention in the construction industry.
- (H2): there is a significant relationship at the level of significance ✔●0.05, between the economic regard to causes of fall accidents and prevention in the construction industry.
- (H3): there is a significant relationship at the level of significance ✔●0.05, between the social regard to causes of fall accidents and prevention in the construction industry.

- (H4): there is a significant relationship at the level of significance ✔ ●0.05, between the working environment regard to causes of fall accidents and prevention in the construction industry.

Table (4.15): Correlation coefficient between causes of fall accidents and prevention - engineering point of view

Field	Statistics	prevention
The Occupational Safety and Health regard to causes of fall accidents	Pearson correlation (r)	0.573*
	P-value (Sig.) (2-tailed)	0.000
the Economic regard to causes of fall accidents	Pearson correlation (r)	0.647*
	P-value (Sig.) (2-tailed)	0.000
the Social regard to causes of fall accidents	Pearson correlation (r)	0.840*
	P-value (Sig.) (2-tailed)	0.000
the Working Environment regard to causes of fall accidents	Pearson correlation (r)	0.854*
	P-value (Sig.) (2-tailed)	0.000

**Correlation is significant at the 0.05 level.

4.1.7.3 Test of third hypothesis

There is a significant positive effect of the groups of fall accident causes (independent variables) on the prevention (dependent variable) in the construction industry, engineering point of view.

Table (4.16) shows Stepwise regression is used and the following results were obtained:

- Multiple correlation coefficient R = 0.884 and R-Square= 0.782 this means 78.2% of the variation in the prevention is explained by the groups of "the social and the working environment ".
- Analysis of Variance for the regression model. F=173.946, Sig. = 0.000, so there is a significant relationship between the dependent variable the prevention and the independent groups "the social and the working environment".
- The working environment appears to be the strongest group among others.
- Based on stepwise regression method, the groups "occupational safety and health and the economic" have insignificant effect on the prevention.

The estimated regression equation is:

The prevention = 0.816+ 0.432× (The Working Environment) + 0.366× (The Social)

The estimated regression equation is used to predict the value of the prevention for any give values (responses) to the independent groups "the social and the working environment".

Those results demonstrate the existence of a significant positive effect of the groups of causes (the social and the working environment) on the prevention of fall accidents in the construction industry.

This means and clearly shows that the social and the working environment groups, have the highest direct impact in relation to the prevention of fall accidents in the construction industry, from the engineer' point of view and results are agreed with Ertaş & Erdoğan (2017); Ansah (2014); Aksorn & Hadikusumo (2008) and Kartam et al. (2000).

Table (4.16): Result of Stepwise regression analysis - engineering point of view

Group	β	T	Sig.	R	R-Square	F	Sig.
(Constant)	0.816	5.135	0.000*	0.884	0.782	173.946	0.000**
The Working Environment	0.432	5.819	0.000*				
The Social	0.366	4.872	0.000*				

* The variable is statistically significant at 0.05 level
** The relationship is statistically significant at 0.05 level

4.2 The questionnaire of Workers

4.2.1 Descriptive Statistics

After analyzing the questionnaire 300 were suitable to use for the data analysis. Persons who complete the entire questionnaire were used for the data analysis.

4.2.2 Personal information:

Table No. (4.17) Show that:

- Most of workers of the sample their qualification Secondary School and diploma, about 40 % which is normal in our Gazian / Palestinian community.
- 54.5% of the sample their experience between (5 - less than 15) years which means that the worker has an appropriate experience.

- Most of the workers of the sample their age between (20-40) years, which is a good age for safety.
- 54.5% of workers of the sample work in Less than 10 projects in the last five years, this result due to the sage on the Gaza strip.

Table (4.17): Personal information of workers

Personal information	Frequency (F)	Percentages (%)
Position		
Skilled Labor	105	36.2
Un-Skilled Labor	70	24.1
semi-Skilled Labor	105	36.2
Other	10	3.4
Years of experience		
1 - Less than 3	44	15.2
3 - Less than 5	34	11.7
5 - Less than 10	91	31.4
10 - Less than 15	67	23.1
15 - Less than 20	41	14.1
More than 20	13	4.5
Age		
Less than 20	5	1.7
20 - Less than 30	94	32.4
30 - Less than 40	135	46.6
40 - Less than 50	45	15.5
More than 50	11	3.8
Qualification		
Bachelor	17	5.9
Diploma	89	30.7
Secondary School	114	39.3
Primary School	46	15.9
Non-Educated	24	8.3
Projects work in the last five years		
Less than 10	158	54.5
11 – 20	91	31.4
21- 30	26	9.0
More than 30	15	5.2

4.2.3 Factors affecting the causes of fall accidents in the construction industry

As categorized in the second part of the questionnaire, there were four groups for the causes of fall accidents in the construction industry. The groups are occupational safety and health, the economic, the social and working environment. Table No. (4.18) shows the relative index and the ranks of each factor affecting the causes of fall accidents in the construction industry.

In the workers questionnaire, the term *"Factors related to the working environment"* came in the first class, On the other hand the term *"Factors related to the Working Environment"* in the engineer's questionnaire came in the first class. This result shows a consensus between the views of workers and engineers regarding the Factors related to the working environment. It also indicates the most important issues related to the working environment, Because of their direct importance to the performance of work and avoid exposure to falls accidents.

Table (4.18): RII's and test values for factors affecting the causes of fall accidents in the construction industry - worker point of view

No.	Item	Mean	SD	RII (%)	Test Value	P-value (Sig.)	Rank
1	Factors related to the Occupational Safety and Health	3.58	0.95	71.66	10.46	0.000*	4
2	Factors related to the Economic	3.60	0.94	71.94	10.84	0.000*	2
3	Factors related to the Social	3.59	0.81	71.80	12.62	0.000*	3
4	Factors related to the Working Environment	3.61	0.71	72.23	14.71	0.000*	1
	All fields	3.60	0.74	72.02	13.89	0.000*	

***The mean is significantly different from 3 SD: Std. Deviation RII: Relative importance Index**

4.2.3.1 Factors related to the Occupational Safety and Health

Table (4.19) illustrates the comparison results between five different factors in terms of the Mean value, SD value, the percentage of RII, Test & P-value and the rank. Overall, *"Absence the training program for workers on the occupational safety and health"* factor rank as number one with mean value 3.80, relative important index equals (RII) 75.93%, P-value less than ✔ ●0.05, and this result agreed with Ismail et al. (2012) and Ansah (2014) and many others which are pointed out from their research that "It is widely accepted in the construction industry that training plays an important role in worker safety". Also result show that an existence of an occupational safety and health training program for workers playing an important factor for the safety.

On the other hand, *"Irregular meetings for occupational safety and health"* rank in fifth place with mean value 3.36 and 67.17 percent for RII. Test value shows a high decrease comparing to the first rank, with value 5.00, while P-Value shows the same (0.000) less than ✔ ●0.05,therefore the obtained results are agreed with Ansah (2014), which are pointed out from their research that "Workers attending safety meeting" was ranked

second with a mean= 4.3617 and SD =0.8704". Also result show that conducting an occupational safety and health regular meeting contributes to the success of safety plans.

Results of the entire field *"The occupational safety and health"* show that a mean index=3.58, and proportional weight (71.66%), with the fourth ranked (Table 4.18). that means the factor related to the Occupational Safety and Health affect in causes of fall accidents.

Table (4.19): RII's and Test values for factors related to the Occupational Safety and Health - worker point of view

No.	Statement	Mean	SD	RII (%)	Test Value	P-value (Sig.)	Rank
1.	Irregular meetings for occupational safety and health.	3.36	1.22	67.17	5.00	0.000*	5
2.	Absence the training program for workers on the occupational safety and health.	3.80	0.95	75.93	14.22	0.000*	1
3.	Lack of Safety culture.	3.50	1.07	70.00	7.94	0.000*	4
4.	Work in hazardous areas on site.	3.67	1.06	73.31	10.66	0.000*	2
5.	Absence of contingency arrangements when it occurs.	3.59	1.16	71.86	8.74	0.000*	3
	All paragraphs of the field	3.58	0.95	71.66	10.46	0.000*	

***The mean is significantly different from 3 SD: Std. Deviation RII: Relative importance Index**

4.2.3.2 Factors related to the Economic

From Table (4.20), it is shown that:

Table (4.20) represent the difference between five factors according to the Mean value, SD value, the percentage of RII, Test & P-value and the rank, results from the questionnaire answered by worker.

overall, *"Execute the works without fall prevention safety equipment"* the factor comes as number one with mean value 3.71, relative important index equals (RII) 74.28%, P-value less than ✔●0.05. This result agreed with agreed with Barlas and Izci (2018) which are pointed out from his research that "common causes of occupational accidents, one of them is misuse or failure of using equipment for falls prevention". Also result show that equipment for falls prevention playing an important role in occupational safety and health in the construction.

On the other hand, *"Absence encouragement system for application of safety"* rank in fifth place with mean value 3.41 and 68.21 percent for RII. Test value shows a sharp decrease comparing to the first rank, with value 5.65, while P-Value shows the same (0.000) smaller than ✔●0.05. The obtained results are agreed with Ansah (2014) which are pointed out from his research that "The lack of motivation in fostering a safety culture at both organizational and project levels has resulted in a poor safety record in general". Also result show that having a system of motivation or encouragement to application of safety are very important to the occupational safety and health in the construction.

Results of the entire field *"The economic"* show that a mean index=3.60, and proportional weight (71.94%), with the second ranked (Table 4.18). that means the factor related to the economic affect in causes of fall accidents.

In the workers questionnaire, the factor *"Execute the works without fall prevention safety equipment"* came in the first class. On the other hand, the factor *"Execute the works without fall prevention safety equipment"* in the engineer's questionnaire came in the first class. This result shows a consensus between the views of workers and engineers regarding the importance of turning off the work in case of falls prevention equipment's absence.

Table (4.20): RII's and Test values for factors related to the Economic - worker point of view

No.	Statement	Mean	SD	RII (%)	Test Value	P-value (Sig.)	Rank
1.	Absence encouragement system for application of safety.	3.41	1.24	68.21	5.65	0.000*	5
2.	Weak using modern equipment in construction projects.	3.70	0.97	74.07	12.34	0.000*	2
3.	Non-compliance with the working hours specified by law.	3.56	1.09	71.10	8.67	0.000*	4
4.	Irregular break hour for workers, which increase pressure on them and reduces the safety.	3.60	1.09	72.07	9.46	0.000*	3
5.	Execute the works without fall prevention safety equipment.	3.71	1.22	74.28	10.00	0.000*	1
	All paragraphs of the field	3.60	0.94	71.94	10.84	0.000*	

***The mean is significantly different from 3 SD: Std. Deviation RII: Relative importance Index**

4.2.3.3 Factors related to the Social

Table (4.21), it is shown that the results of questionnaires about five different factors in terms of mean, SD value, the percentage of RII, Test & P-value and the rank, answered by worker.

"Non-holding special training for workers on falls prevention" came in the first rank with mean value 3.80, relative important index equals (RII) 76.07%, Test-value =13.91, and P-value = 0.000 which is less than the level of significance ✔ ●0.05. The test shows positive results as the mean factor greater than the hypothesized value 3, and this result agreed Tam et al. (2004); Fang et al. (2004); Fang et al. (2006); Ertaş & Erdoğan (2017); Ansah (2014); Aksorn & Hadikusumo (2008) and Kartam, et al. (2000) and many others. They pointed out that "A successful safety program can be achieved if all employees are given periodic educational and training programs in order to improve their knowledge and skills on safety at work". Also result illustrates that the training is an important issue, which is affected directly in decreasing accidences.

On the last position, *"The spirit of cooperation and familiarity between employees not exist"* came with mean equal 3.30 and 65.93 percent for RII. Test value shows a sharp fall comparing to the first rank, with value 4.39, while P-Value remains constant, which is smaller than the level of significance ✔ ●0.05. As the mean value greater than the hypothesized value 3, the sign of this test is positive. The obtained results are agreed with Tam et al. (2004). They pointed out that "Good cooperation in safety exists in projects because effective safety enforcement and incentive schemes were applied to all subcontractors". Also result illustrates that cooperation among worker catalyze the occupational health and safety.

Regarding the whole field of *"Factors related to the Social"* it was ranked in the third position with mean=3.59, and relative important index equal (71.80%), Test value =12.62, and P-value = 0.000 which is smaller than the level of significance ✔ ●0.05. The sign of the test is positive, so the mean of this factor is significantly greater than the hypothesized value (Table 4.18). The respondents totally agree that the factors related to the Social affect in the causes of fall accidents in the construction industry.

In the workers questionnaire, the factor *"Non-holding special training for workers on falls prevention"* came in the first class. On the other hand, the factor "*Non-holding*

special training for workers on falls prevention" in the engineer's questionnaire came in the second class. The result here is that workers are more interested in training issues than engineers who care choosing the specification for the workers to work in the heights, this is due to the different functions and experiences of both parties.

Table (4.21): RII's and Test values for factors related to the Social - worker point of view

No.	Statement	Mean	SD	RII (%)	Test Value	P-value (Sig.)	Rank
1.	The spirit of cooperation and familiarity between employees not exist.	3.30	1.15	65.93	4.39	0.000*	5
2.	Non-holding special training for workers on falls prevention.	3.80	0.98	76.07	13.91	0.000*	1
3.	The absence of visits or social trips for employees.	3.50	1.08	70.07	7.97	0.000*	4
4.	Choosing unskilled workers to work on heights .	3.79	1.03	75.80	13.19	0.000*	2
5.	Not to carry on strict measures (Alert, Warning, penalties, fines, etc. ...) towards violators of the rules and conditions of the safety.	3.61	0.95	72.14	10.83	0.000*	3
	All paragraphs of the field	3.59	0.81	71.80	12.62	0.000*	

***The mean is significantly different from 3 SD: Std. Deviation RII: Relative importance Index**

4.2.3.4 Factors related to the Working Environment

Table (4.22) gives information about the mean value, SD value, percentage of RII, Test & P value and the Rank for ten different factors. This results from the questionnaire answered by workers.

It is clear that *"Working on heights without fencing"* rank as number one with mean value 3.91, relative important index equals (RII) 78.21%, Test-value =16.95, and P-value = 0.000 which is less than the level of significance ✔ ●0.05. The test shows positive results as the mean factor greater than the hypothesized value 3. This was in sharp contrast to the research conducted by Jannadi and Bu-Khamsin (2001) in his factor " Fence and access gates " which take 2.36 Mean Impact. On the other hand, the position of this result is close to the research conducted by Ertaş and Erdoğan (2017) which is referred to "Fencing" as common and very important factor. Also result show that fencing plays an important role in reducing accidences.

In term of Rank, *"No existence supervisor/engineer specialist in safety"* rank in the last position with mean value 3.48 and 69.52 percent for RII. Test value shows a sharp drop comparing to the first rank, with value 8.00. P-Value remains the same (0.000), again it is less than the level of significance ✔●0.05, As the mean value greater than the hypothesized value 3, the sign of this test is positive. The obtained results are agreed with the research conducted by Hassan et al. (2007). Hassan finds out that "Workers will work more safely with a supervisor". Also result illustrates that having a safety supervisor is important to keeping your work safe.

Concerning the whole fields affecting on causes of fall accidents in the construction industry form workers view *"Factors related to the Working Environment"* ranked in the first position with 3.61 for the mean, 72.23% for the relative important index equal ,14.71 for the Test value, and 0.000 for the P-value which is smaller than the level of significance ✔●0.05. The sign of the test is favorable, so the mean of this factor is significantly greater than the hypothesized value (Table 4.18). The respondents totally agree that the factors related to the working environment affect in the causes of fall accidents in the construction industry.

In the workers questionnaire, the factor *"Working on heights without fencing"* came in the first class. On the other hand, the factor *"Working on heights without fencing"* in the engineer's questionnaire came in the second class. The result here is that workers are more interested in working site conditions than engineers who care choosing the Contractors requiring the implementation of occupational safety and health standards, this is due to the different functions and experiences of both parties, and because the nature of workers' work is directly affected by working conditions and surrounding risks.

Table (4.22): RII's and Test values for factors related to the Working Environment - worker point of view

No.	Statement	Mean	SD	RII (%)	Test Value	P-value (Sig.)	Rank
1.	No existence supervisor/engineer specialist in safety.	3.48	1.01	69.52	8.00	0.000*	10

No.	Statement	Mean	SD	RII (%)	Test Value	P-value (Sig.)	Rank
2.	Weak of Supervision and periodic inspection of the relevant government agencies.	3.63	0.93	72.62	11.61	0.000*	3
3.	The absence of indicative and warning signals of safety.	3.57	0.98	71.38	9.93	0.000*	7
4.	Weather and climate through working.	3.57	0.96	71.45	10.10	0.000*	6
5.	First aid kit is unavailable.	3.54	0.93	70.83	9.91	0.000*	8
6.	No existence of safety and health Forman in the crew.	3.53	1.09	70.62	8.34	0.000*	9
7.	Unorganized or unarranged of the works on the site.	3.61	1.01	72.21	10.32	0.000*	4
8.	Non-Suitable equipment for the work nature.	3.67	0.92	73.38	12.39	0.000*	2
9.	Working on heights without fencing.	3.91	0.91	78.21	16.95	0.000*	1
10.	Exclusion of the participation of workers in the selection of special methods of protection and safety.	3.61	1.22	72.14	8.50	0.000*	5
	All paragraphs of the field	3.61	0.71	72.23	14.71	0.000*	

***The mean is significantly different from 3 SD: Std. Deviation RII: Relative importance Index**

4.2.4 Factors affecting the prevention of fall accidents in the construction industry

This part consists of results and discussion of factors that the prevention of fall accidents in the construction industry, these factors were grouped into two groups, the first group is *"Factors related to the workers"*; the second group is *"Factors related to the work performed"*. Table No. (4.23) shows the relative index and the ranks of each factor affecting the prevention of fall accidents in the construction industry. In the workers questionnaire, the term *"Factors related to the work performed"* came in the first class. On the other hand, the same factor in the engineer's questionnaire came in the first class. This result shows a consensus between the views of workers and engineers regarding the importance of factors related to the work performed.

Table (4.23): RII's and test values for factors affecting the prevention of fall accidents in the construction industry - worker point of view

No.	Item	Mean	SD	RII (%)	Test Value	P-value (Sig.)	Rank
1	Factors related to the workers.	3.40	0.75	68.01	9.08	0.000*	2
2	Factors related to the work performed.	3.72	0.80	74.43	15.44	0.000*	1
	All fields	3.55	0.70	71.00	13.33	0.000*	

***The mean is significantly different from 3 SD: Std. Deviation RII: Relative importance Index**

4.2.4.1 Factors related to the workers

Table (4.24) illustrates the questionnaire results for nine different factors in terms of the Mean Factor, SD factor, the percentage of RII, Test & P-value and the rank.

First of all, *"Test the physical condition of the worker"* rank as number one with mean value 3.61, relative important index equals (RII) 72.21%, Test-value 10.39, and P-value 0.000 which is less than the level of significance ✔●0.05. This test shows positive results as the mean factor greater than the hypothesized value 3, and this result agreed with the research conducted by Fung et al. (2005). Fung finds out that "a contributing hazard factor is a factor that can further explain immediate hazard factor, including safety management policy, manager and worker's mental or physical conditions, initial construction site conditions, and so on". Also result illustrates that physical condition of the worker is important to keeping your work safe.

The seventh position in rank list goes to *"Recruitment Skilled workers"* with mean value 3.26, RII 65.17%. Test value 3.95, while P-Value stay the same (0.000) which is smaller than the level of significance ✔●0.05. As the mean value greater than the hypothesized value 3 the test is positive therefore the obtained results are agreed with the research conducted by Barlas and Izci (2018) he finds out that skilled workers are less exposed to accidents than unskilled workers. Result illustrates that these factors point to the importance of safety attitudes in performing safely at work.

Regarding the whole fields affecting on prevention of fall accidents in the construction industry form workers point of view *"Factors related to the Workers"* occupied the second position in terms of the rank and mean value 3.40, RII percentage (68.01%), Test value 9.08, and P-value 0.000, which is under the level of significance ✔●0.05. The sign of the test is favorable, so the mean of this factor is significantly greater than the hypothesized value (Table 4.23). The respondents totally agree that the factors related to the Workers affect in the prevention of fall accidents in the construction industry.

Table (4.24): RII's and Test values for factors related to the Workers - worker point of view

No.	Statement	Mean	SD	RII (%)	Test Value	P-value (Sig.)	Rank
1.	Safety training for the worker.	3.57	1.36	71.45	7.19	0.000*	2
2.	Recruitment educated workers.	3.06	1.24	61.24	0.86	0.393	9
3.	Recruitment Skilled workers.	3.26	1.12	65.17	3.95	0.000*	7
4.	Determine specific age for workers.	3.08	1.22	61.52	1.06	0.291	8
5.	Check up the mental state of the worker.	3.53	0.98	70.69	9.24	0.000*	3
6.	Test the physical condition of the worker.	3.61	1.00	72.21	10.39	0.000*	1
7.	Determine if the worker qualified for work at heights.	3.36	1.17	67.17	5.20	0.000*	6
8.	Locate the safety culture of the Workers.	3.47	1.05	69.38	7.64	0.000*	5
9.	Follow up if the worker Takes the necessary measures for prevention and safety.	3.48	1.12	69.59	7.27	0.000*	4
	All paragraphs of the field	3.40	0.75	68.01	9.08	0.000*	

*The mean is significantly different from 3 SD: Std. Deviation RII: Relative importance Index

4.2.4.2 Factors related to the work performed

Table (4.25), shown the results of questionnaires about nine different factors related to work performed in terms of mean, SD factor, the percentage of RII, Test & P-value and the rank, answered by workers.

"Fencing the work area and especially the heights" had the highest value for the Mean (3.87) and ranked as the first. further relative important index equals (RII) 77.45%, Test-value 14.72, and P-value = 0.000 which is less than the level of significance ✔ ●0.05. The test shows positive results as the mean factor greater than the hypothesized value 3. This was in sharp contrast to the research conducted by Jannadi and Bu-Khamsin (2001), in his factor " Fence and access gates " which take 2.36 Mean Impact. On the other hand, the position of this result is close to the research conducted by Ertaş and Erdoğan (2017), which is referred to "Fencing" common and very important factor. Also result show that fencing plays an important role in reducing accidences.

While *"Works carried out must be not complex and tangled"* ranked as the last one with the mean factor, RII percentage and Test value, (3.51). (70.28%) and (8.13)

respectively, while. P-Test remains the same (0.000), again it is less than the level of significance ✔ ●0.05 .the mean value is greater than the hypothesized value 3 wherefore the test is positive. The obtained results are agreed with the research conducted by Enshassi et al. (2009) he finds out that the injury rate increases among subcontractors when there is complexity or difficulty appear on site, with relative important index equals 78%. Result illustrates that these factors point to the importance of the importance in arranging the workplace to reduce accidents.

Concerning the whole fields affecting on prevention of fall accidents in the construction industry form workers view *"Factors related to the work performed"* ranked in the first position with mean value 3.72, and the relative important index equal (74.43%), Test value =15.44, and P-value = 0.000 which is smaller than the level of significance ✔ ●0.05 .The sign of the test is favorable, so the mean of this factor is significantly greater than the hypothesized value (Table 4.23). The respondents totally agree that the factors related to the work performed affect in the prevention of fall accidents in the construction industry.

In the workers questionnaire, the factor *"Fencing the work area and especially the heights"* came in the first class. On the other hand, the same factor in the engineer's questionnaire came in the second class. This is due to the different functions and experiences of both parties, and because the nature of workers' work is directly affected by working conditions and surrounding risks.

Table (4.25): RII's and Test values for factors related to work performed - worker point of view

No.	Statement	Mean	SD	RII (%)	Test Value	P-value (Sig.)	Rank
1.	Works carried out must be not complex and tangled.	3.51	1.08	70.28	8.13	0.000*	9
2.	Respondance of the company to the workers view on protection requirements required in work.	3.75	0.98	74.97	12.98	0.000*	3
3.	Providing of Personal Protective Equipment (PPE).	3.68	0.99	73.66	11.75	0.000*	7
4.	Work area mobilization and protective equipment (safe entrances and exits, etc.).	3.69	0.97	73.72	12.04	0.000*	6

No.	Statement	Mean	SD	RII (%)	Test Value	P-value (Sig.)	Rank
5.	Providing safety signs and guidance.	3.62	1.05	72.34	9.98	0.000*	8
6.	Stop work in bad weather condition.	3.74	0.98	74.83	12.88	0.000*	4
7.	Working at night with adequate lighting.	3.84	1.01	76.76	14.11	0.000*	2
8.	Fencing the work area and especially the heights.	3.87	1.01	77.45	14.72	0.000*	1
9.	Periodic maintenance of tools and equipment.	3.71	1.13	74.14	10.70	0.000*	5
	All paragraphs of the field	3.72	0.80	74.43	15.44	0.000*	

***The mean is significantly different from 3 SD: Std. Deviation RII: Relative importance Index**

4.2.5 Test of hypothesis – worker point of view

4.2.5.1 Test of first hypothesis

There is a significant difference among respondents regard the fall accident causes and prevention in the construction industry due to personal information (position, years of experience, qualification, the number of projects in the last five years and age).

This part was to analyze the differences among respondents toward the fall accident causes and prevention in the construction industry due to personal information.

❖ **The position.**

There is no significant differences among respondents regard the fall accident causes and prevention in the construction industry due to their position

Table (4.26) shows that the p-value (Sig.) is greater than the level of significance ✔●0.05 for the fields "the Occupational Safety and Health" and the "Top Management", then there is insignificant difference among the respondents toward these fields due to position. It can be concluded that the personal characteristics' position has no effect on these fields. That indicates the compatibility in this area and factors among the respondents due to their position, which is agreed with Ansah (2014).

For the other fields, the p-value (Sig.) is smaller than the level of significance ✔●0.05, then there is significant difference among the respondents toward these fields due to

position. It can be concluded that the personal characteristics' position has an effect on the other fields. This result is agreed with Jannadi and Bu-Khamsin (2001).

The mean for the category "Semi-Skilled Labor" respondents have the highest among the other position categories and this category respondents is agreed for the other fields much more than the other position categories. This result is contrary to several previous studies in this area, as the skilled worker is a person with experience and knowledge of the dangers of work.

Table (4.26): One-way ANOVA of the fields and their p-value for position of worker

Section	Field	Test value	P-value (Sig.)	Means			
				Skilled Labor	Un-Skilled Labor	semi-Skilled Labor	Other
Factors affecting the causes of fall accidents in the construction industry	Factors related to the Occupational Safety and Health	1.889	0.132	3.61	3.36	3.70	3.54
	Factors related to the Economic	3.534	0.015*	3.58	3.50	3.75	2.82
	Factors related to the Social	5.401	0.001*	3.50	3.47	3.83	3.12
	Factors related to the Working Environment	3.408	0.018*	3.48	3.57	3.78	3.48
	All fields	3.268	0.022*	3.53	3.50	3.77	3.29
Factors affecting the prevention of fall accidents in the construction industry	Factors related to the Top Management	2.571	0.054	3.51	3.21	3.34	3.56
	Factors related to the work performed	2.818	0.039*	3.67	3.54	3.89	3.67
	All fields	1.845	0.139	3.59	3.38	3.61	3.61
All fields		2.136	0.096	3.56	3.45	3.70	3.42

❖ **The Experience.**

There is no significant differences among respondents regard the fall accident causes and prevention in the construction industry due to their experience.

Table (4.27) shows that the p-value (Sig.) is greater than the level of significance ✔●0.05 for the fields "the occupational safety and health, the economic, and the working environment", then there is insignificant difference among the respondents

toward these fields due to experience. It can be concluded that the personal characteristics' experience has no effect on these fields. That indicates the compatibility in this area and factors among the respondents due to their characteristics' experience, which is agreed with Ertaş and Erdoğan (2017).

For the other fields, the p-value (Sig.) is smaller than the level of significance ✔●0.05, then there is significant difference among the respondents toward these fields due to experience. It can be concluded that the personal characteristics' experience has an effect on the other fields.

The mean for the category "3- Less than 5" years respondents have the highest among the other experience categories, then It can be concluded that the category "3- Less than 5" respondents is agreed for the other fields much more than the other experience categories. This result is contrary to several previous studies in this area, as the person with more experience and knowledge of the dangers of work.

Table (4.27): One-way ANOVA of the fields and their p-value for experience of worker

Section	Field	Test value	P-value (Sig.)	Means					
				1 - Less than 3	3- Less than 5	5- Less than 10	10- Less than 15	15- Less than 20	More than 20 years
Factors affecting the causes of fall accidents in the construction industry	Factors related to the Occupational Safety and Health	2.004	0.078	3.32	3.62	3.45	3.78	3.78	3.66
	Factors related to the Economic	1.803	0.112	3.50	3.57	3.43	3.87	3.61	3.66
	Factors related to the Social	2.257	0.049*	3.76	3.79	3.34	3.63	3.58	3.79
	Factors related to the Working Environment	0.811	0.543	3.61	3.74	3.51	3.62	3.71	3.68
	All fields	1.204	0.307	3.57	3.70	3.44	3.70	3.67	3.70
Factors affecting the prevention of fall accidents in the construction industry	Factors related to the Top Management	3.087	0.010*	3.13	3.57	3.28	3.54	3.56	3.45
	Factors related to the work performed	2.598	0.026*	3.60	3.72	3.56	3.79	3.94	4.20
	All fields	3.112	0.009*	3.37	3.64	3.42	3.67	3.75	3.83
All fields		1.840	0.105	3.49	3.67	3.43	3.68	3.71	3.76

* The mean difference is significant at 0.05 level

❖ **The Qualification.**

There is no significant differences among respondents regard the fall accident causes and prevention in the construction industry due to their Qualification.

Table (4.28) shows that the p-value (Sig.) is greater than the level of significance ✔●0.05 for the fields "The top Management", then there is insignificant difference among the respondents toward these fields due to qualification. It can be concluded that the personal characteristics' qualification has no effect on these fields. That indicates the compatibility in this area and factors.

For the other fields, the p-value (Sig.) is smaller than the level of significance ✔●0.05, then there is significant difference among the respondents toward these fields due to qualification. It can be concluded that the personal characteristics' qualification has an effect on the other fields.

The mean for the category "Primary School" respondents have the highest among the other qualification categories, then It can be concluded that the category "Primary School" respondents is agreed for the other fields much more than the other qualification categories. The result is that the largest number of workers in this category are in construction projects in the Gaza Strip

Table (4.28): One-way ANOVA of the fields and their p-value for Qualification of worker

Section	Field	Test value	P-value (Sig.)	Means				
				Bachelor	Diploma	Secondary School	Primary School	Non-Educated
Factors affecting the causes of fall accidents in the construction industry	Factors related to the Occupational Safety and Health	6.402	0.000*	3.06	3.31	3.79	3.90	3.38
	Factors related to the Economic	6.391	0.000*	3.12	3.31	3.69	4.00	3.80
	Factors related to the Social	13.723	0.000*	2.95	3.34	3.56	4.18	3.88
	Factors related to the Working Environment	9.059	0.000*	3.26	3.36	3.70	4.02	3.58
	All fields	9.920	0.000*	3.12	3.34	3.68	4.04	3.66

Factors affecting the prevention of fall accidents in the construction industry	Factors related to the Top Management	1.707	0.148	3.46	3.32	3.50	3.44	3.09
	Factors related to the work performed	8.754	0.000*	3.59	3.40	3.75	4.14	4.07
	All fields	3.055	0.017*	3.53	3.36	3.63	3.79	3.58
All fields		6.711	0.000*	3.29	3.35	3.66	3.93	3.63

* The mean difference is significant at 0.05 level

❖ **The projects in the last 5 years**

There is no significant differences among respondents regard the fall accident causes and prevention in the construction industry due to the number of projects.in the last 5 years.

Table (4.29) shows that the p-value (Sig.) is greater than the level of significance ✔●0.05 for the fields "the Occupational Safety and Health, the Social, and the Working Environment", then there is insignificant difference among the respondents toward these fields due to number of projects. It can be concluded that the personal characteristics' number of projects has no effect on these fields. That indicates the compatibility in this area and factors.

For the other fields, the p-value (Sig.) is smaller than the level of significance ✔●0.05, then there is significant difference among the respondents toward these fields due to number of projects. It can be concluded that the personal characteristics' number of projects has an effect on the other fields.

The mean for the category "21- 30" projects respondents have the highest among the other number of projects categories, then It can be concluded that the category "21- 30" respondents is agreed for the other fields much more than the other number of projects categories. It is indicated that category "21- 30" projects respondents has an experience to determine the importance of factors.

Table (4.29): One-way ANOVA of the fields and their p-value for the number of projects in the last 5 years for worker

Section	Field	F	P-value	Means

				Less than 10	11 – 20	21- 30	More than 30
Factors affecting the causes of fall accidents in the construction industry	Factors related to the Occupational Safety and Health	2.616	0.051	3.52	3.63	4.00	3.25
	Factors related to the Economic	3.381	0.019*	3.46	3.73	4.00	3.53
	Factors related to the Social	0.924	0.430	3.58	3.54	3.92	3.28
	Factors related to the Working Environment	0.522	0.667	3.60	3.63	3.71	3.43
	All fields	1.540	0.204	3.56	3.62	3.87	3.38
Factors affecting the prevention of fall accidents in the construction industry	Factors related to the Top Management	3.177	0.025*	3.42	3.27	3.80	3.30
	Factors related to the work performed	2.718	0.045*	3.61	3.82	3.97	3.97
	All fields	1.781	0.151	3.51	3.55	3.88	3.61
All fields		1.573	0.196	3.54	3.59	3.88	3.48

* The mean difference is significant at 0.05 level

❖ **The age.**

There is no significant differences among respondents regard the fall accident causes and prevention in the construction industry due to their age.

Table (4.30) shows that the p-value (Sig.) is smaller than the level of significance ✔ ●0.05 for all the fields, then there is significant difference among the respondents toward these fields due to age. It can be concluded that the personal characteristics' age has an effect on these fields. It shows that the diversity of experiences and qualification due to the worker age affects the judgment of the individual.

The mean for the category "Less than 20" years respondents have the highest among the other age categories for the fields (the Economic, the Social, the Working Environment, and the work performed) then It can be concluded that the category "Less than 20" respondents is agreed for the fields "the economic, the social, the working environment, and the work performed" much more than the other age categories. The above category "Less than 20" is the most among the categories that have work and practice on the ground and on the site.

The mean for the category "More than 50" years respondents have the highest among the other age categories for the fields (the Occupational Safety and Health, and the Top Management) then It can be concluded that the category "More than 50" respondents is agreed for the fields (the Occupational Safety and Health, and the Top Management) much more than the other age categories. It is shown that "More than 50" category have a highest rate of experience, due to number of years.

Table (4.30): One-way ANOVA of the fields and their p-value for age of worker

Section	Field	Test value	P-value (Sig.)	Means				
				Less than 20	20 - Less than 30	30 - Less than 40	40 - Less than 50	More than 50
Factors affecting the causes of fall accidents in the construction industry	Factors related to the Occupational Safety and Health	11.958	0.000*	4.32	3.23	3.54	4.13	4.51
	Factors related to the Economic	8.731	0.000*	4.52	3.28	3.58	4.12	3.98
	Factors related to the Social	9.517	0.000*	4.60	3.35	3.56	3.99	4.24
	Factors related to the Working Environment	11.677	0.000*	4.72	3.39	3.56	4.01	4.04
	All fields	13.286	0.000*	4.57	3.33	3.56	4.05	4.17
Factors affecting the prevention of fall accidents in the construction industry	Factors related to the Top Management	4.118	0.003*	3.33	3.15	3.43	3.64	3.66
	Factors related to the work performed	11.484	0.000*	4.40	3.43	3.66	4.23	4.21
	All fields	8.455	0.000*	3.86	3.29	3.55	3.93	3.93
All fields		11.777	0.000*	4.28	3.31	3.56	4.00	4.07

*** The mean difference is significant at 0.05 level**

4.2.5.2 Test of second hypothesis

There is a significant relationship between groups of fall accidents causes and prevention in the construction industry.

From Table No. (4.31), it is shown that:

- **(H1):** there is a significant relationship at the level of significance ✔ ●0.05, between the occupational safety and health regard to causes of fall accidents and prevention in the construction industry.
- **(H2):** there is a significant relationship at the level of significance ✔ ●0.05, between the economic regard to causes of fall accidents and prevention in the construction industry.
- **(H3):** there is a significant relationship at the level of significance ✔ ●0.05, between the social regard to causes of fall accidents and prevention in the construction industry.
- **(H4):** there is a significant relationship at the level of significance ✔ ●0.05, between the working environment regard to causes of fall accidents and prevention in the construction industry.

Table (4.31): Correlation coefficient between causes of fall accidents and prevention - worker point of view

Field	Statistics	prevention
The Occupational Safety and Health regard to causes of fall accidents	Pearson correlation (r)	0.823*
	P-value (Sig.) (2-tailed)	0.000
the Economic regard to causes of fall accidents	Pearson correlation (r)	0.758*
	P-value (Sig.) (2-tailed)	0.000
the Social regard to causes of fall accidents	Pearson correlation (r)	0.682*
	P-value (Sig.) (2-tailed)	0.000
the Working Environment regard to causes of fall accidents	Pearson correlation (r)	0.800*
	P-value (Sig.) (2-tailed)	0.000

****Correlation is significant at the 0.05 level.**

4.2.5.3 Test of third hypothesis

There is a significant positive effect of the groups of fall accident causes (independent variables) on the prevention (dependent variable) in the construction industry, worker point of view.

Table (4.32) shows Stepwise regression is used and the following results were obtained:

- Multiple correlation coefficient R = 0.873 and R-Square= 0.761 this means 76.1% of the variation in the prevention is explained by the groups of "the occupational safety and health, the working environment, and the economic".
- Analysis of Variance for the regression model. F=304.253, Sig. = 0.000, so there is a significant relationship between the dependent variable the prevention and the independent groups "the occupational safety and health, the working environment, and the economic".
- The Working Environment appears to be the strongest factor among others.
- Based on Stepwise regression method, the group "the social" have insignificant effect on the prevention.
- The estimated regression equation is:

The prevention = 0.696+ 0.298× (the Occupational Safety and Health) + 0.366× (The Working Environment) + 0.128× (The Economic).

The estimated regression equation is used to predict the value of the prevention for any give values (responses) to the independent groups "the occupational safety and health, the working environment, and the economic".

Those results demonstrate the existence of a significant positive effect of the groups of causes (the occupational safety and health, the working environment, and the economic) on the prevention of fall accidents in the construction industry. This means and clearly shows that the Occupational Safety and Health and the Working Environment, have the highest direct impact in relation to the prevention of fall accidents in the construction industry, from the worker' point of view. The obtained results are agreed with Ansah (2014) and Kartam, et al., (2000).

The difference in views between engineers and workers is due to teams of experience on the ground and in the workplace, as well as the nature of the tasks and responsibilities assigned to each. The administrative and managerial responsibility lies with the engineers in organizing the work and distributing it among the workers, so they (engineers) are more interested in the social and work environment. On the other hand, workers are more interested in aspects occupational safety and health and the

working environment, for their direct contact with the implementation of the works on the site. The obtained results are agreed with Jannadi and Bu-Khamsin (2001).

Table (4.32): Result of Stepwise regression analysis - worker point of view

Group	β	T	Sig.	R	R-Square	F	Sig.
(Constant)	0.696	6.616	0.000*	0.873	0.761	304.253	0.000**
The Occupational Safety and Health	0.298	7.590	0.000*				
The Working Environment	0.366	8.120	0.000*				
The Economic	0.128	3.491	0.001*				

* The variable is statistically significant at 0.05 level
** The relationship is statistically significant at 0.05 level

Chapter 5
Conclusions and Recommendations

Chapter 5
Conclusions and Recommendations

The purpose of this chapter is to present a brief summary of this research and as well as its conclusions by revisiting the research objectives and key findings, an overview discussed to assess the extent to which the research objectives were met. It introduces practical recommendations and recommendation for future research

5.1 Summary of the research

Throughout the methodology approached in previous chapters, the following results came up with specific conclusions regarding fall accident causes and prevention in the construction industry in Gaza strip. The questionnaire was distributed to two target groups, engineers and workers. The questionnaire includes factors affecting fall accident causes and prevention in the construction industry, were synthesized in the main two parts in the survey, which were shown to be reliable. Part one factors related to the causes of fall accidents in the construction industry, distributed to four mean groups as factors related to the occupational safety and health, economic, social, working environment. While part two factors related to the prevention of fall accidents in the construction industry, distributed to three mean groups as factors related to the top management, work performed, economic, workers.

5.2 Conclusions of the research objectives and hypotheses

In achieving the aim of the research, five primary objectives have been outlined and made through the findings of the analyzed collected questionnaires. The outcomes were found as follows:

5.2.1 Outcomes related to objective one:

The objective was: To determine the factors of causes and prevention for fall accidents in construction industry.

Through previous study and papers related to our subject shown the most factors that causes and prevention of fall accident in construction industry over the world.

5.2.2 Outcomes related to objective two:

The objective was: Rank of the most common causes and prevention for fall accidents in the construction industry regarding the nature of respondent involved.

The study findings of RII test for causes fields was ranked that "factors related to the working environment", "factors related to the economic", "factors related to the occupational safety and health" and "factors related to the social" respectively In other hands the most common causes and prevention for fall accident are:

- **From engineering point of view:**

  A- The most common causes are:

  1. Contractors neglect implementing the safety standards.
  2. Lack of safety climate and occupational safety and health.
  3. Execute the works without fall prevention safety equipment.
  4. Working on heights without fencing. (RII = 78.40%)
  5. No existence of safety and health Forman in the crew.
  6. Choosing unskilled workers to work in the heights.

  B- The most common preventions are:

  1. Stop work in bad weather condition.
  2. Fencing the work area and especially the heights.
  3. Periodic maintenance of tools and equipment.

- **From worker point of view:**

  A- The most common causes are:

  1. Working on heights without fencing.
  2. Non-holding special training for workers on falls prevention.
  3. Absence the training program for workers on the occupational safety and health.
  4. Choosing unskilled workers to work on heights.
  5. Execute the works without fall prevention safety equipment.
  6. Weak using modern equipment in construction projects.

  B- The most common preventions are:

  1. Fencing the work area and especially the heights.
  2. Working at night with adequate lighting.

3. Respondance of the company to the workers view on protection requirements required in work.

5.2.3 Outcomes related to objective three

The objective was: To research the relationship between the groups of causes and the prevention in the construction industry.

The study findings that there is a significant relationship at the level of significance ✔ ●0.05, between the causes of fall accidents (occupational safety and health, the economic, the social and the working environment) and the prevention in the construction industry form view of engineering and workers. ***This result agreed the second hypotheses***.

5.2.4 Outcomes related to objective four

The objective was: To introduce a quantified model to test the effect of causes on the prevention for fall accidents.

According to engineering point of view; show that the social and the working environment groups had significant effect on the prevention (78.2%), and the social appears to be the strongest group. In addition, the occupational safety and health, the working environment and the economic groups had significant effect on the prevention (76.1%), and the working environment appears to be the strongest group from workers point of view. ***This result agreed the third hypotheses.***

5.2.5 Outcomes related to objective five

1. **The objective was:** To suggest recommendations to minimize the causes and enhance the prevention for fall accidents.

The recommendation to minimize the causes and enhance the prevention of fall accidents are:

- Providing the safety equipment in the work site including safety built and net.
- Fencing the work area and especially the heights should be provided.
- Recruit the suitable workers to work on heights with age, weight, health and psychological status, and education and training qualities.

- Training in the occupational safety issues must be held for workers, especially heights training.
- The contractors shall implement all safety requirements within the workplace and providing safety climate.
- Provide a safety engineer/foreman within the crew/team in construction work site.
- The works must stop in bad weather condition and at night without adequate lighting.
- Provide periodic maintenance of tools and equipment.
- The company might respond to the workers point of view on protection requirements required in work.

5.3 Outcomes related to diagnoses of the fall accidents causes and prevention:

- 46% of engineering indicate that the training is sometimes held and this affects negatively and directly on safety performance in the construction projects. An approved training system for construction projects should be implemented to reduce and prevent falls.
- Also; safety professional supervisors are not available at any time; therefore, they must be available.
- In additional; confirms the absence of a statistical record of accidents, which affects the accumulation of experience and knowledge to prevent falling accidents.
- Emphasizes the absence of standards and policies related to accidents, which necessitates working on providing them.
- 47% of sites have an accident, which is a large percentage. most accidents were fall accidents
- The most Fall accident are form Roof and scaffolds and workers are the main group which had accident
- 80.9% of accidents could have been avoided if safety standards were followed.

5.4 Outcomes related to differences of respondents regard the fall accident causes and prevention in the construction industry:

There is no significant difference among respondents regard the fall accident causes and prevention in the construction industry due to personal information (position, years of experience, qualification, the number of projects in the last 5 years and age) form view of engineering and workers. ***This result agreed the first hypotheses.***

5.5 General recommendations of this study

The fall one of the most serious accidents in the construction industry and based on results of this research, the recommendations are:

1) Ministry of labor should enact special legislations and laws for protection of falls which compel all parties to take all occupational safety measures in construction projects
2) Safety Engineers should follow works policies in which stop works activities during bad weather situations and other risky working conditions.
3) Ministry of public works must assert of a safety requirement in the project's budget.
4) In Bidding phase, the bid award should not be for the lowest price, in addition, to consider the company accident record which it would adversely affect the safety performance of construction projects.
5) Promote a culture of safety for stakeholders (owners, engineers, workers, etc. ...) and improve the safety environment that leads implement safety standards.
6) Raising awareness of safety factors for construction workers through appropriate training programs and safety rules and procedures.
7) Ensure the work environment such as lights, safety signs, personal protective equipment and fencing as far as available to protect the keep workers in safe.
8) Government agencies and stakeholders must warn and punish contractors and anyone in charge who do not comply with safety procedures.
9) The engineer must choose skilled workers by indicating all the safety measurements and all safety standards that compel on the worker to reducing the fall accidents.

10) The governmental agencies should consider the periodic inspections for construction projects.
11) The contractor must decrease the pressure on the worker by giving suitable rest hour and consider the working hours that specified by the law.

5.6 Recommendations for Future Research

Due to the wide scope of the area in providing adequate, fall protections and safety issues, it was not possible to cover all areas in this research. Therefore, the following issues are recommended for further research:

- Effect of Occupational fatality and disability on claim rates, risks, and cost in the Gaza Strip construction industry.
- Research in the direct and indirect costs of accidents compeering with the benefits of implementing safety systems.
- Research to create a fall protections management system in the construction industry the Gaza Strip.
- Integrative research of the relationship between safety, schedule and cost in the construction industry the Gaza Strip.

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Appendices

Appendix 1: Engineers Questionnaire English

The Islamic University Gaza

Higher Education Deanship

Faculty of Engineering
Construction Management

الجامعة الإسلامية - غزة

عمادة الدراسات العليا

كلية الهندسة – إدارة التشييد

FALL ACCIDENT CAUSES AND PREVENTION IN THE CONSTRUCTION INDUSTRY

حـــوادث الســـقـوط في المـشـــــاريع الإنـشـــــائيـــة، المســـببـــات والـــوقـــايـــة

QUESTIONNAIRE

(ENGINEERS)

Researcher:

Mahmoud Maliha

Supervised by:

Dr.Kalled Al Hallak

The Islamic University – Gaza - Palestine

June, 2017

QUESTIONNAIRE

FALL ACCIDENT CAUSES AND PREVENTION IN THE CONSTRUCTION INDUSTRY

Introduction:

Globally, occupational health and safety issues are very important in the construction industry, in spite of this growing interest in occupational health and safety, it is still recording the highest rate of accidents among the various sectors.

Many local and international statistics shows that Falls From Height (FFH) is the most serious and frequent appearances.

This research aims to identify the causes of this kind of serious incidents and the prevention methods.

I extend my sincere thanks and gratitude for your contribution portion of your valuable time to answer this questionnaire and emphasize to you the confidentiality of information, and it is only for the purposes of scientific research.

Researcher

QUESTIONNAIRE

Part I: Primary questions related to the respondent:

(General Note: select one choice only unless otherwise stated)

1. Position :

☐ Project manager (company) ☐ Site engineer (company)
☐ Project manager (consultant) ☐ Site engineer (consultant)
☐ Other……..

2. Years of experience in the line of work:

☐ From 1 to less than 3 years ☐ From 3 to less than 5 years
☐ From 5 to less than 10 years ☐ From 10 to less than 15
☐ From 15 to less than 20 years ☐ More than 20 years

3. Qualification:

☐PhD ☐Master: ☐B.Sc.: ☐Diploma:

4. Number of projects executed in the last five years:

☐Less than 10 ☐11 – 20 ☐21- 30 ☐More than 30

Part II: Questions related to factors affecting the causes of fall accidents in the construction industry.

(General Note: select one choice only unless otherwise stated)

Please indicate (in your opinion) the level of influencing for each factor in the following statements regarding ،Mark the appropriate number based on the five-point scale below:

Symbol	Effects' degree
1	Very High influence
2	High influence
3	Moderate influence
4	low influence
5	Very low influence

No.	Factors	Effects' degree				
		1	2	3	4	5
	1- Factors related to the Occupational Safety and Health.					
1.	Working without Occupational Safety and Health Plan.					
2.	No Clear legislation and laws regard for occupational safety and health in the construction site.					

No.	Factors	Effects' degree				
		1	2	3	4	5
3.	Irregular meetings for occupational safety and health.					
4.	Lack of safety climate and occupational safety and health.					
5.	Absence the training program for workers on the occupational safety and health.					
6.	Lack of Safety culture.					
7.	Documentary/records system for fall accidents in construction projects is unavailable.					
8.	Absence of contingency arrangements when it occurs.					
9.	There is no specialized organization for safety and health, such as OSHA.					
	2- Factors related to the Economic.					
1.	Absence encouragement system for application of safety.					
2.	Weak using modern equipment in construction projects.					
3.	No budget for implementing the safety plans and their requirements.					
4.	Non-compliance with the working hours specified by law.					
5.	Irregular break hour for workers, which increase pressure on them and reduces the safety.					
6.	lowest prices are the only standard for bidding award.					
7.	Execute the works without fall prevention safety equipment.					
8.	Unclear safety requirements items included through contracting.					
	3- Factors related to the Social.					
1.	The spirit of cooperation and familiarity between employees not exist.					
2.	Non-holding special training for workers on falls prevention.					
3.	lack of coordination between the operators of the project (contractor, owner, donor, etc...) and the relevant government agencies (Ministry of Labor, civil defense, police, etc. ...).					
4.	The absence of visits or social trips for employees.					
5.	Choosing unskilled workers to work on heights .					
6.	Not to carry on strict measures (Alert, Warning, penalties, fines, etc. ...) towards violators of the rules and conditions of the safety.					
	4- Factors related to the Working Environment.					
1.	Contractors neglect implementing the safety standards.					
2.	No existence supervisor/engineer specialist in safety.					

No.	Factors	Effects' degree				
		1	2	3	4	5
3.	Weak of Supervision and periodic inspection of the relevant government agencies.					
4.	The absence of indicative and warning signals of safety.					
5.	Do not consider the company record regarding incidents in bidding awarding.					
6.	Weather and climate through working.					
7.	First aid kit is unavailable.					
8.	No existence of safety and health Forman in the crew.					
9.	Unorganized or unarranged of the works on the site.					
10.	Non-Suitable equipment for the work nature.					
11.	Working on heights without fencing.					
12.	Exclusion of the participation of workers in the selection of special methods of protection and safety.					

Part III: Questions related to factors affecting the prevention of fall accidents in the construction industry.

No.	Factors	Effects' degree				
		1	2	3	4	5
	1- Factors related to the Top Management.					
1.	Commit the managers of the project on safety.					
2.	Implementing the safety legislation by the government.					
3.	Providing Safety supervisor or engineer.					
4.	Size of the company/contractor and record of the safety implementation in the projects.					
5.	Decreasing the pressure on the worker.					
6.	Commit the project time schedule.					
7.	Provide the safety climate in the work environment.					
	2- Factors related to the work performed					
1.	Works carried out must be not complex and tangled.					
2.	Providing of Personal Protective Equipment (PPE).					
3.	Work area mobilization and protective equipment (safe entrances and exits, etc.).					
4.	Providing safety signs and guidance.					

No.	Factors	Effects' degree				
		1	2	3	4	5
5.	Stop work in bad weather condition.					
6.	Working at night with adequate lighting.					
7.	Fencing the work area and especially the heights.					
8.	Periodic maintenance of tools and equipment.					
	3- Factors related to the Economic.					
1.	Paying the medical expenses of injured workers.					
2.	Provide insurance/compensation for workers.					
3.	Apply a financial motivation award for the safety commitment.					
4.	Allocate a specific budget for safety requirements.					

Part IV: General Questions (diagnosing the fall accidents causes and prevention):

A. Is there training program for the staff regarding the occupational safety and health administrative and in fall protection in particular in your institute / company?

Always ( ), Often ( ) Sometimes ( ), rarely ( ) never ( ),

B. Is there a working visits and tests for safety in your workplace?

Always ( ), Often ( ) Sometimes ( ), rarely ( ) never ( ),

C. Is there a recording and documentation for the incidents and irregularities relating to safety through projects that have been implemented?

Always ( ), Often ( ) Sometimes ( ), rarely ( ) never ( ),

D. Are there a clear policy of your institution / company / workplace regarding the safety and fall accidents prevention?

Yes ( ), No ( )

Is there an accident in the project site?

Yes ( ) No ( )

If yes

1- What is the type of accident?

Fall ( ) from work equipment ( ) collapse in the building or support ( )

Fire or explosion ( ) other .....

If the answer fall

2. What is the nature of the fall?

From roof ( ) from scaffolds ( ) from stairs ( )

From Cranes ( ) installation of the elevator ( )

Form the openings in the ceiling (such as the elevator hole) ( ) other.....

3. The nature of the injured person

worker ( ) skilled worker ( ) Visiting ( ) Engineer ( )

Other…….

4. The accident can be avoided?

Yes ( ) No ( )

Thanks for your cooperation…

Researcher

Appendix 2: Engineers Questionnaire Arabic

The Islamic University – Gaza

Higher Education Deanship

Faculty of Engineering
Construction Management

الجامعة الإسلامية - غزة

عمادة الدراسات العليا

كلية الهندسة – إدارة التشييد

FALL ACCIDENT CAUSES AND PREVENTION IN THE CONSTRUCTION INDUSTRY

حوادث السقوط في المشاريع الإنشائية، المسببات والوقاية

QUESTIONNAIRE

(إستبانة خاصة بالمهندسين)

الباحث

محمود مليحة

المشراف

د خالد الحلاق

The Islamic University – Gaza - Palestine

June, 2017

إســــــتبـــــانـــــة

حـــوادث الســـقـوط في المـشـــــاريع الإنـشـــــائيـــة، المســـببـــات والـــوقـــايـــة

مقدمة:

عالميا، تعد المسائل المتعلقة بالصحة والسلامة المهنية من الأمور المهمة جدا في صناعة الإنشاءات، وعلى الرغم من هذا الاهتمام المتزايد بالصحة والسلامة المهنية، فلا يزال قطاع الإنشاءات يسجل المعدل الأعلى للحوادث من بين مختلف القطاعات، وتشير العديد من الإحصاءات المحلية والدولية إلى أن حوادث السقوط من المرتفعات هي الأكثر خطورة تكررا وظهورا.

تهدف هذه الدراسة للتعرف على مسببات هذا النوع من الحوادث الخطيرة وطرق الوقاية منها.

أتقدم لكم بجزيل الشكر والامتنان لمساهمتكم بجزء من وقتكم الثمين للإجابة على هذه الاستبانة ونؤكد لسيادتكم على سرية المعلومات، وأنها لأغراض البحث العلمي فقط.

الباحث

إســـتبـــانـــــة

القسم الأول: التعريف:

5. الموقع الوظيفي:

☐ مدير مشروع (الشركة) ☐ مهندس موقع (الشركة) ☐ مدير مشروع (استشاري)
☐ مهندس موقع (استشاري) ☐ اخرى.....

6. عدد سنوات الخبرة:

☐ من 1 حتى أقل من 3 ☐ من 3 حتى أقل من 5
☐ من 5 حتى أقل من 10 ☐ من 10 حتى أقل من 15
☐ من 15 حتى أقل من 20 ☐ 20 سنة فأكثر

7. التعليم :

☐ دكتوراه ☐ ماجستير ☐ بكالوريوس ☐ دبلوم

8. عدد المشاريع التى نفذتها / إشتركت بها خلال الأعوام الخمسة الماضية:

☐ 10 فأقل ☐ 11 – 20 ☐ 21- 30 ☐ أكثر من 30

القسم الثاني: أسئلة متعلقة بالعوامل المؤثرة علي ظهور حوادث السقوط في المشاريع الإنشائية.

يرجى بيـــان (بحسب رأيـك) مستوى التأثير لكل عامل في العبـــارات التالية. حدد العدد المناسب على أساس درجة التأثير في المقياس من خمس نقاط الموضح أدناه:

الدرجة	درجة التأثير
1	درجة التأثير منخفظة جدا
2	درجة التأثير منخفظة
3	درجة التأثير متوسطة
4	درجة التأثير عالية
5	درجة التأثير عالية جدا

رقم	العوامل	درجة التأثير				
		1	2	3	4	5
	1-عوامل لها علاقة بالسلامة والصحة المهنية.					
1	العمل بدون خطة للسلامة والصحة المهنية.					
2	عدم وجود تشريعات وقوانين واضحة خاصة بالسلامة والصحة المهنية في الموقع.					
3	اجتماعات غير منتظمة خاصة بالسلامة والصحة المهنية.					
4	قلة مناخ السلامة والصحة المهنية.					
5	غياب برنامج تدريب العاملين على السلامة والصحة المهنية.					
6	قلة الثقافة المتعلقة بالسلامة والوقاية المهنية					

رقم	العوامل	درجة التأثير				
		1	2	3	4	5
7	عدم توفر نظام توثيق / تسجيل لحوادث السقوط في المشاريع الإنشائية.					
8	غياب الترتيبات لحالات الطوارئ خلال العمل.					
9	لا يوجد مؤسسة متخصصة بالوقاية والسلامة مثل منظمة OSHA					
	2- عوامل لها علاقة اقتصادية.					
1	عدم وجود نظام تحفيز لتطبيق السلامة.					
2	ضعف استخدام المعدات الحديثة في مشاريع البناء.					
3	عدم تخصيص مبلغ من الموازنة لتنفيذ خطط السلامة.					
4	عدم الالتزام بساعات العمل المحددة قانونا.					
5	عدم انتظام ساعات راحة للعمال وزيادة الضغط عليهم.					
6	أقل الأسعار في المناقصات هي المعيار الوحيد للترسية.					
7	استئناف الأعمال في حالة عدم وجود وسائل الوقاية من الحوادث والسقوط.					
8	عدم وجود بنود واضحة لمتطلبات السلامة والصحة المهنية في تعاقدات المشاريع.					
	3- عوامل لها علاقة بالمناخ الاجتماعي.					
1	لا يوجد روح التعاون والألفة بين العاملين.					
2	عدم تلقي العاملين تدريب متخصص في الوقاية من حوادث السقوط.					
3	فلة التنسيق بين القائمين على المشروع (المقاول، المالك، الممول، إلخ..) والجهات الحكومية ذات العلاقة (وزارة العمل، الدفاع المدني، الشرطة، إلخ..).					
4	غياب الزيارات والرحلات الاجتماعية للعمال.					
5	اختيار عمال غير مهرة للعمل في المرتفعات					
6	عدم اتخاذ تدابير صارمة (تنبيه، تحذير، عقوبات، غرامات، إلخ...) تجاه المخالفين لشروط وقواعد السلامة والوقاية المهنية.					
	4- عوامل لها علاقة بمناخ العمل.					
1	تجاهل المقاولين تنفيذ معايير السلامة.					
2	عدم توفير مشرف / مهندس مختص بالسلامة.					
3	ضعف الإشراف والتفتيش الدوري من الجهات الحكومية ذات العلاقة.					
4	عدم وجود الإشارات الإرشادية والتحذيرية.					
5	تجاهل سجل الشركة المتعلق بالحوادث خلال ترسية العطاءات.					
6	المناخ والطقس أثناء العمل.					
7	عدم وجود صندوق إسعافات أولية.					
8	لا يوجد مراقب عمال متخصص بالسلامة في طاقم العمال.					
9	غياب تنظيم وترتيب الاعمال في موقع العمل.					
10	المعدات غير مناسبة لطبيعة العمل					
11	العمل في المرتفعات بدون وجود سياج حماية من السقوط.					
12	اهمال مشاركة العمال في اختيار الاساليب الخاصة في الحماية ووسائل الامان					

القسم الثالث: أسئلة متعلقة بالعوامل المؤثرة علي منع حوادث السقوط في المشاريع الإنشائية.

رقم	العوامل	درجة التأثير				
		1	2	3	4	5
	1-عوامل لها علاقة بالإدارة العليا.					
1	التزام الإدارة في المشروع بالسلامة.					
2	تطبيق الحكومة لشروط السلامة والصحة المهنية.					
3	وجود مشرف متخصص بالسلامة.					
4	حجم الشركة / المقاول المنفذ للمشروع وتاريخه في تطبيق السلامة والصحة المهنية.					
5	تقليل الضغط على العامل.					
6	الالتزام بالجدول الزمني للمشروع.					
7	توفير مناخ سلامة في بيئة العمل.					
	2- عوامل لها علاقة بطبيعة العمال.					
1	الأعمال المنفذة غير معقدة ومتشابكة.					
2	توفر وسائل الوقاية الشخصية مثل (الخوذة، الحذاء، السترة).					
3	ترتيب المكان ووسائل الحماية (المداخل والمخارج الأمنة، إلخ).					
4	وجود الإشارات والعلامات الإرشادية.					
5	ايقاف اعمل في الحالة الجوية السيئة.					
6	العمل ليلا مع وجود إضاءة كافية.					
7	تسييج مناطق العمل وخاصة المرتفعات.					
8	الصيانة الدورية للأدوات والمعدات خلال العمل.					
	3- عوامل لها علاقة اقتصادية.					
1	دفع النفقات الطبية للعمال المصابين.					
2	توفير التأمين / التعويضات للعمال.					
3	مكافئات مالية على تطبيق السلامة.					
4	توفير موازنات محددة لمتطلبات السلامة.					

القسم الرابع: أسئلة عامة (تشخيص الأسباب والوقاية لحوادث السقوط):

أ- هل يتم تدريب الطواقم الإدارية والعاملة على تطبيق إجراءات الأمن والسلامة فيما يتعلق بحوادث السقوط بالمشاريع الهندسية عندكم؟

دائماً ( ) غالبا ( ) احياناً ( ) نادراً ( ) ابداً ( )

ب- هل يتم عمل زيارات وفحوصات لسلامة مكان العمل؟

دائماً ( ) غالبا ( ) احياناً ( ) نادراً ( ) ابداً ( )

ت- هل يتم تسجيل وتوثيق الحوادث والمخالفات المتعلقة بالسلامة خلال المشاريع التي تم تنفيذها؟

دائماً ( ) غالبا ( ) احياناً ( ) نادراً ( ) ابداً ( )

ث- هل يوجد سياسة واضحة للمؤسسة / للشركة / مكان العمل اتجاه الوقاية والسلامة من حوادث السقوط في المشاريع التابعة لها؟

نعم ( ) لا ( ) الى حد ما ( )

ج- هل حدثت حالة إصابة عمل في المشروع؟

نعم ( ) لا ( )

إذا كانت الإجابة نعم

1- ما هو نوع الحادث؟

سقوط( ) من معدات العمل( ) انهيار في المبنى او بالدعم( ) حريق او انفجار( ) غير ذلك.....

اذا كانت الاجابة سقوط

2- ما هي طبيعة السقوط

من السطح( ) من السقالات (البقوم) ( ) من السلالم( ) الرافعات( )

من تركيب المصعد( ) من الفتحات في السقف(مثل فتحة المصعد) ( ) غير ذلك.....

3- طبيعة الشخص المصاب

عامل( ) عامل ماهر( ) مهندس( ) زائر( ) غير ذلك( )

4- هل كان بالإمكان تجنب الحادث؟

5- نعم ( ) لا ( )

شاكرين لكم حسن تعاونكم معنا...

الباحث

Appendix 3: Workers Questionnaire English

The Islamic University Gaza

Higher Education Deanship

Faculty of Engineering
Construction Management

الجامعة الإسلامية - غزة

عمادة الدراسات العليا

كلية الهندسة – إدارة التشييد

FALL ACCIDENT CAUSES AND PREVENTION IN THE CONSTRUCTION INDUSTRY

حـــوادث الســـقـوط في المـشـــــاريع الإنـشـــــائيـــة، المســـببـــات والـــوقـــايـــة

QUESTIONNAIRE

(WORKERS)

Researcher:

Mahmoud Maliha

Supervised by:

Dr.Kalled Al Hallak

The Islamic University – Gaza - Palestine

June, 2017

QUESTIONNAIRE

FALL ACCIDENT CAUSES AND PREVENTION IN THE CONSTRUCTION INDUSTRY

Introduction:

Globally, occupational health and safety issues are very important in the construction industry, in spite of this growing interest in occupational health and safety, it is still recording the highest rate of accidents among the various sectors.

Many local and international statistics shows that Falls from Height (FFH) is the most serious and frequent appearances.

This research aims to identify the causes of this kind of serious incidents and the prevention methods.

I extend my sincere thanks and gratitude for your contribution portion of your valuable time to answer this questionnaire and emphasize to you the confidentiality of information, and it is only for the purposes of scientific research.

Researcher

QUESTIONNAIRE

Part I: Primary questions related to the respondent:

(General Note: select one choice only unless otherwise stated)

9. Position :

☐ Skilled Labor ☐ Un-Skilled Labor

☐ semi-Skilled Labor ☐ Other……

10. Years of experience in the line of work:

☐ From 1 to less than 3 years ☐ From 3 to less than 5 years

☐ From 5 to less than 10 years ☐ From 10 to less than 15

☐ From 15 to 20 years ☐ More than 20 years

11. Age: .....

12. Qualification:

☐B.Sc.: ☐Diploma: ☐Secondary School:

☐Primary School: ☐Non-Educated

13. Number of projects work in the last five years:

☐Less than 10 ☐11 – 20 ☐21- 30 ☐More than 30

Part II: Questions related to factors affecting the causes of fall accidents in the construction industry.

(General Note: select one choice only unless otherwise stated)

Please indicate (in your opinion) the level of influencing for each factor in the following statements. Mark the appropriate number based on the five-point scale below:

Symbol	Effects' degree
1	Very High influence
2	High influence
3	Moderate influence
4	low influence
5	Very low influence

No.	Factors	Effects' degree				
		1	2	3	4	5
1- **Factors related to the Occupational Safety and Health**						
1.	Irregular meetings for occupational safety and health.					
2.	Absence the training program for workers on the occupational safety and health.					
3.	Lack of Safety culture.					

No.	Factors	Effects' degree				
		1	2	3	4	5
4.	Work in hazardous areas on site					
5.	Absence of contingency arrangements when it occurs.					
	2- Factors related to the Economic.					
1.	Absence encouragement system for application of safety.					
2.	Weak using modern equipment in construction projects.					
3.	Non-compliance with the working hours specified by law.					
4.	Irregular break hour for workers, which increase pressure on them and reduces the safety.					
5.	Execute the works without fall prevention safety equipment.					
	3- Factors related to the Social.					
1.	The spirit of cooperation and familiarity between employees not exist.					
2.	Non-holding special training for workers on falls prevention.					
3.	The absence of visits or social trips for employees.					
4.	Choosing unskilled workers to work on heights .					
5.	Not to carry on strict measures (Alert, Warning, penalties, fines, etc. ...) towards violators of the rules and conditions of the safety.					
	4- Factors related to the Working Environment.					
1.	No existence supervisor/engineer specialist in safety.					
2.	Weak of Supervision and periodic inspection of the relevant government agencies.					
3.	The absence of indicative and warning signals of safety.					
4.	Weather and climate through working.					
5.	First aid kit is unavailable.					
6.	No existence of safety and health Forman in the crew.					
7.	Unorganized or unarranged of the works on the site.					
8.	Non-Suitable equipment for the work nature.					
9.	Working on heights without fencing.					
10.	Exclusion of the participation of workers in the selection of special methods of protection and safety.					

Part III: Questions related to factors affecting the prevention of fall accidents in the construction industry.

No.	Factors	Effects' degree				
		1	2	3	4	5
1-	**Factors related to the workers.**					
1.	Safety training for the worker↘					
2.	Recruitment educated workers.					
3.	Recruitment Skilled workers.					
4.	Determine specific age for workers.					
5.	Check up the mental state of the worker.					
6.	Test the physical condition of the worker.					
7.	Determine if the worker qualified for work at heights.					
8.	Locate the safety culture of the Workers.					
9.	Follow up if the worker Takes the necessary measures for prevention and safety.					
	2-Factors related to the work performed					
1.	Works carried out must be not complex and tangled.					
2.	Respondance of the company to the workers view on protection requirements required in work.					
3.	Providing of Personal Protective Equipment (PPE).					
4.	Work area mobilization and protective equipment (safe entrances and exits, etc.).					
5.	Providing safety signs and guidance.					
6.	Stop work in bad weather condition.					
7.	Working at night with adequate lighting.					
8.	Fencing the work area and especially the heights.					
9.	Periodic maintenance of tools and equipment.					

Thanks for your cooperation…

Researcher

Appendix 4: Workers Questionnaire Arabic

The Islamic University – Gaza

الجامعة الإسلامية - غزة

Higher Education Deanship

عمادة الدراسات العليا

Faculty of Engineering
Construction Management

كلية الهندسة – إدارة التشييد

FALL ACCIDENT CAUSES AND PREVENTION IN THE CONSTRUCTION INDUSTRY

حـــوادث الســـقـوط في المـشـــــاريع الإنـشـــــائيـــة، المســـببـــات والـــوقـــايـــة

QUESTIONNAIRE

(إستبانة خاصة بالعمال)

الباحث

محمود مليحة

المشراف

د خالد الحلاق

The Islamic University – Gaza - Palestine

June, 2017

إســـــــتبـــــــانـــــــة

حـــوادث الســـقـوط في المـشـــــاريع الإنـشـــــائيـــة، المســـببـــات والـــوقـــايـــة

مقدمة:

عالميا، تعد المسائل المتعلقة بالصحة والسلامة المهنية من الأمور المهمة جدا في صناعة الإنشاءات، وعلى الرغم من هذا الاهتمام المتزايد بالصحة والسلامة المهنية، فلا يزال قطاع الإنشاءات يسجل المعدل الأعلى للحوادث من بين مختلف القطاعات، وتشير العديد من الإحصاءات المحلية والدولية إلى أن حوادث السقوط من المرتفعات هي الأكثر خطورة تكررا وظهورا.

تهدف هذه الدراسة للتعرف على مسببات هذا النوع من الحوادث الخطيرة وطرق الوقاية منها.

أتقدم لكم بجزيل الشكر والامتنان لمساهمتكم بجزء من وقتكم الثمين للإجابة على هذه الاستبانة ونؤكد لسيادتكم على سرية المعلومات، وأنها لأغراض البحث العلمي فقط.

الباحث

إســـتبـــانـــــة

القسم الأول: التعريف:

1. الموقع الوظيفي:

☐ عامل ماهر (فني) ☐مساعد عامل ماهر ☐ عامل
☐ اخرى.....

2. عدد سنوات الخبرة:

☐ من 1 حتى أقل من 3 ☐ من 3 حتى أقل من 5
☐ من 5 حتى أقل من 10 ☐ من 10 حتى أقل من 15
☐ من 15 حتى أقل من 20 ☐أكثر من 20 سنة

3. العمر :.....

4. التعليم :

☐ بكالوريوس ☐ دبلوم ☐ ثانوي ☐ابتدائي ☐ لا يوجد

5. عدد المشاريع التي عملت بها خلال الأعوام الخمسة الماضية:

☐حتى 10 ☐11 – 20 ☐21- 30 ☐ أكثر من 30

القسم الثاني: أسئلة متعلقة بالعوامل المؤثرة علي ظهور حوادث السقوط في المشاريع الإنشائية.

رجى بيـــان (بحسب رأيـك) مستوى التأثير لكل عامل في العبـارات التالية، عَلِم العدد المناسب على أساس درجة التأثير في المقياس من خمس نقاط الموضح أدناه:

الدرجة	درجة التأثير
1	درجة التأثير منخفضة جدا
2	درجة التأثير منخفضة
3	درجة التأثير متوسطة
4	درجة التأثير عالية
5	درجة التأثير عالية جدا

رقم	العوامل	درجة التأثير				
		1	2	3	4	5
	1-عوامل لها علاقة بالسلامة والصحة المهنية.					
1	اجتماعات غير منتظمة خاصة بالسلامة والصحة المهنية.					
2	غياب برنامج تدريب العاملين على السلامة والصحة المهنية.					
3	قلة الثقافة المتعلقة بالسلامة والوقاية المهنية					
4	العمل في المناطق الخطرة في الموقع					
5	غياب الترتيبات لحالات الطوارئ خلال العمل.					
	2- عوامل لها علاقة اقتصادية.					
1	عدم وجود نظام تحفيز لتطبيق السلامة.					
2	ضعف استخدام المعدات الحديثة في مشاريع البناء.					
3	عدم الالتزام بساعات العمل المحددة قانونا.					
4	عدم انتظام ساعات راحة للعمال وزيادة الضغط عليهم.					

رقم	العوامل	درجة التأثير				
		1	2	3	4	5
5	استئناف الأعمال في حال عدم وجود وسائل الوقاية من الحوادث والسقوط.					
	3- عوامل لها علاقة بالمناخ الاجتماعي.					
1	لا يوجد روح التعاون والألفة بين العاملين.					
2	عدم تلقي العاملين تدريب متخصص في الوقاية من حوادث السقوط.					
3	غياب الزيارات والرحلات الاجتماعية للعمال.					
4	اختيار عمال غير مهرة للعمل في المرتفعات					
5	عدم اتخاذ تدابير صارمة (تنبيه، تحذير، عقوبات، غرامات، إلخ...) تجاه المخالفين لشروط وقواعد السلامة والوقاية المهنية.					
	4- عوامل لها علاقة بمناخ العمل.					
1	عدم توفير مشرف / مهندس مختص بالسلامة.					
2	ضعف الإشراف والتفتيش الدوري من الجهات الحكومية ذات العلاقة.					
3	عدم وجود الإشارات الإرشادية والتحذيرية.					
4	المناخ والطقس أثناء العمل.					
5	عدم وجود صندوق إسعافات أولية.					
6	لا يوجد مراقب عمال متخصص بالسلامة في طاقم العمال.					
7	غياب تنظيم وترتيب الاعمال في موقع العمل.					
8	المعدات غير مناسبة لطبيعة العمل					
9	العمل في المرتفعات بدون وجود سياج حماية من السقوط.					
10	اهمال مشاركة العمال في اختيار الاساليب الخاصة في الحماية ووسائل الامان					

القسم الثالث: أسئلة متعلقة بالعوامل المؤثرة علي منع حوادث السقوط في المشاريع الإنشائية.

رقم	العوامل	درجة التأثير				
		1	2	3	4	5
	1- عوامل لها علاقة بالعمال					
1	تدريب العمال حول السلامة.					
2	تعين عمال متعلمين.					
3	اختيار عمال المهرة					
4	تقليل العمر لدى العامل					
5	الحالة النفسية للعامل.					
6	الحالة الجسدية للعامل.					
7	سنوات الخبرة للعامل.					
8	وجدود وعي للعامل بخطورة بعض الاعمال.					
9	الاخذ بالتدابير الازمة للوقاية والسلامة.					
	2- عوامل لها علاقة بطبيعة العمل					
1	الأعمال المنفذة غير معقدة ومتشابكة.					
2	استجابة الشركة لآراء العمال للمتطلبات الحماية الخاصة بالأعمال					
3	توفر وسائل الحماية والوقاية مثل (الخوذة، الحذاء، السترة)					

رقم	العوامل	درجة التأثير				
		1	2	3	4	5
4	ترتيب المكان ووسائل الحماية (المداخل والمخارج الأمنة، إلخ).					
5	وجود الإشارات والعلامات الإرشادية.					
6	ايقاف اعمل في الاحوال الجوية السيئة.					
7	العمل ليلا مع وجود إضاءة كافية.					
8	تسييج مناطق العمل وخاصة المرتفعات.					
9	الصيانة الدورية للأدوات والمعدات خلال العمل.					

شاكرين لكم حسن تعاونكم معنا...