Sudan University of Science &Technology
College of Post Graduate Studies

Application of Performance Approach to Provide Safety at Construction Projects -Case Study- Khartoum State

تطبيق طريقة الأداء لتوفير السلامة في مشاريع التشييد (دراسة حالة ـ ولاية الخرطوم)

A Thesis Submitted in Partial Fulfillment of the Requirements of Master Degree in School of Civil (Construction Management)

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جامعة السودان للعلوم والتكنولوجيا

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اقرار

انا الموقع أدناه أقر بأنني المؤلف الوحيد لرسالة الماجستير المعنونة

تطبيق طريقة الأداء لتوفير السلامة في مشاريع التشييد - دراسة حاله - ولاية الخرطوم

وهي منتج فكري اصيل . وباختياري أعطى حقوق طبع ونشر هذا العمل لكلية الدراسات العليا - جامعه السودان للعلوم والتكنولوجيا، عليه يحق للجامعه نشر هذا العمل للأغراض العلمية .

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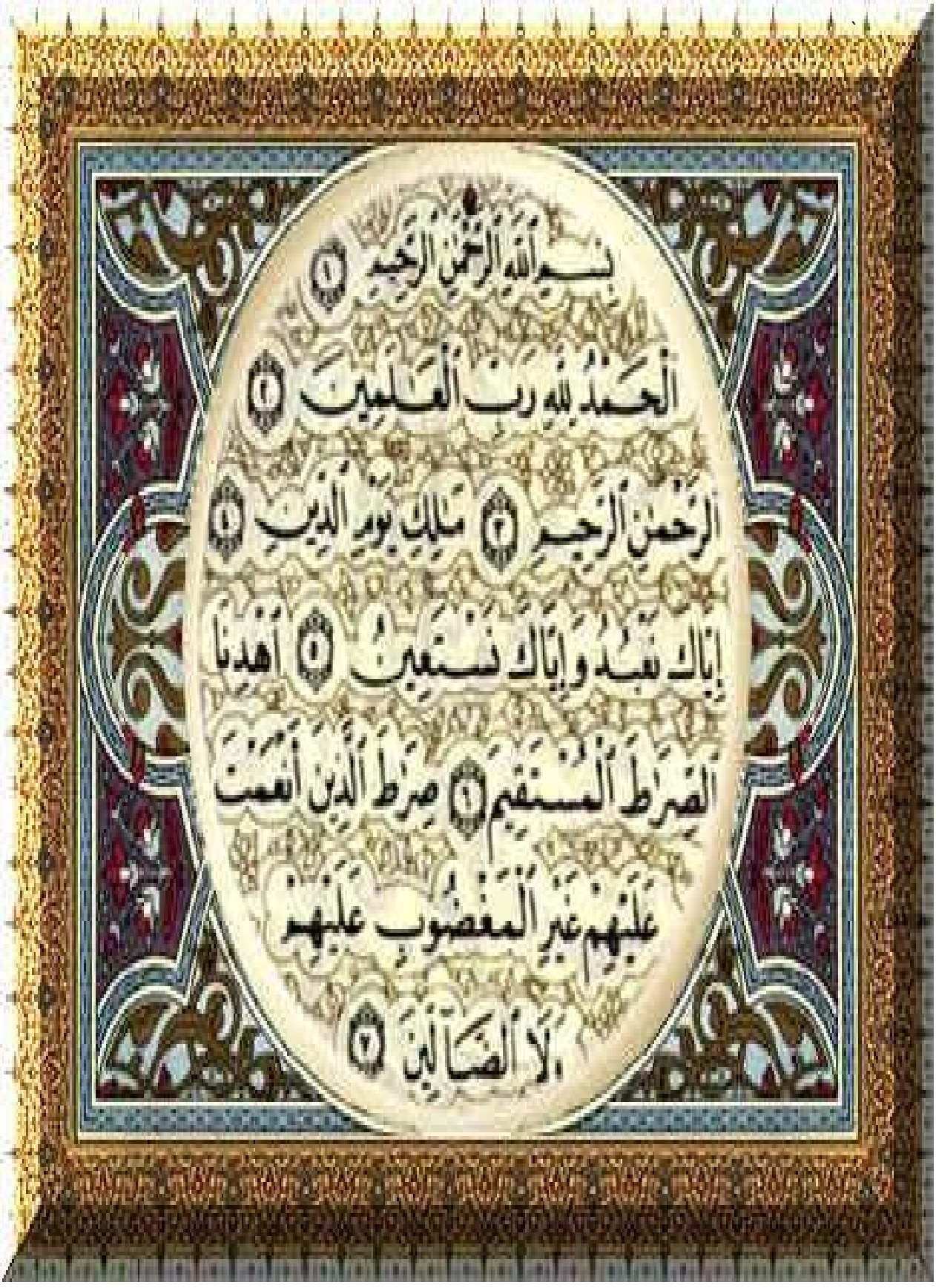
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الصراط المستقيم ⑥ صراط الذين أنعمت
عليهم غير المغضوب عليهم
ولا الضالين ⑦

Dedicated to My Beloved Parents

Whom are the source of my inspiration, encouragement, guidance and Happiness, and who share my goals and aspirations. *May Almighty ALLAH*

Bless and protect them

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LIST OF CONTENTS

LIST OF FIGURES

List of Tables

ABSTRACT

With rapid economic development and industrialization, the construction industry continues to rank among the most hazardous industries in the world. Therefore, construction safety is always significant concern for both practitioners and researchers. The objective of this study was to determine the feasibility and acceptance of performance approach to construction worker safety in Khartoum state.

The study highlighted on top management, expeditor and individual contactor Information was collected from a group of construction companies and a group of engineers, expeditor and managers locations within the state of Khartoum using the questionnaire system to obtain the necessary data for the study where total sample size of 50 samples.

The results of the study concluded that the safety economic performance approach is driven by the need to make building construction more cost effective, the need to ease the introduction of product or systems and process innovation, and the need to establish fair international trade agreements. The study showed that the performance approach was influential regarding to flexibility of approach, ease of implementation, support innovation, simplicity of interpretation and potential to improve safety performance on construction sites. And poor safety management at small and medium construction companies refers to, small companies look at safety as a cost factor and ignoring safety management plan, the culture of small companies, the nature of the project, labors experience and their quality the contractual relationship and law, poor documentation of accidents in previous similar projects, the poor of safety culture in the country, poor applications of polices and punishments, personal productive equipment (P.P.E) highly costs.

المستخلص

مع التطور الاقتصادي و الصناعي السريع استمر ترتيب صناعة التشييد من بين الصناعات الاكثر خطورة في العالم، و نتيجة لذلك السلامة في قطاع التشييد مهمة دائماً لكل من الباحثين و المختصين. إن الهدف من هذه الدراسة هو تحديد الجدوى و القبول لطريقة الاداء لسلامة العاملين في قطاع التشييد في ولاية الخرطوم.

إن الدراسة سلطت الضوء على الإدارات العليا للشركات و الخبراء المختصين في المجال و المقاولين تم جمع المعلومات من مجموعة من شركات التشييد و مجموعة من مهندسي و مدراء المواقع داخل ولاية الخرطوم بإستخدام نظام الاستبانة للحصول على البيانات اللازمة للدراسة حيث بلغ حجم العينة 50 عينةً.

خلصت الدراسة إلى ان الطريقة الامنه الاقتصادية إزدادت الحوجة لها للتقليل من التكلفة في تشييد المباني و الحوجة لسهولة تقديم المنتج أو النظام و الإبتكار في العمليات و الحوجة لإنشاء نظام عادل متفق عليه عالمياً. إن الدراسة أظهرت ان الطريقة الامنه الاقتصادية مؤثرة في سهولة تقديم تكنولوجيا جديدة و تقليل التكلفة و سهولة التنفيذ و سهولة فهم الموازنة للمتطلبات و مهمة لتحسين السلامة في مواقع التشييد و أن الضعف في إدارة السلامة في الشركات الصغيرة و المتوسطة العاملة في قطاع التشييد في قطاع الخرطوم يرجع إلى الأسباب الآتية:-

إن الشركات الصغيرة و المتوسطة تنظر للسلامة على انها مكلفة و إهدار للمال و مصدر لزيادة التكاليف والثقافة الربحية لهذه الشركات و طبيعة المشاريع و خبرة و كفاءة العاملين و العلاقات التعاقدية و القوانين و ضعف التوثيق للحوادث في المشاريع و ضعف ثقافة السلامة في الدولة و ضعف تطبيق القوانين و العقوبات و التكاليف الباهظة لأدوات السلامة الشخصية.

CHAPTER ONE

INTRODUCTION

CHAPTER ONE

1.1 Introduction

Construction safety is always a significant concern for both practitioners and researchers (Cigularov KP, et al, 2010).

One reason may be that the project management does not know how to evaluate the safety performance of a construction project.

The objective of this study was to determine the feasibility and acceptance of the safety economic performance approach to construction worker safety in Khartoum state.

It is imperative that in order to effectively manage the safety management system, composite performance evaluation system consisting of measurable and achievable indicators in many facets of safety management is required (Chang JI, Liang C-L, 2009). According to previous studies (Hsu IY, Su T-S, et al,(2012)and Fang D, XieF, et al(2004).), safety performance indicators can be divided into two types: passive indicators and active indicators.

Passive indicators refer to both before-the-accident and after-the-accident indicators. Before-the-accident indictors include unsafe behaviors and unsafe conditions. After-the-accident indicators refer to historical parameters such as near-miss rate, accident rate, and number of lost days.

Measurements when used in occupational safety and health management, such as insufficient descriptive data about injuries (Hsu IY, et al, 2012). Active safety performance involves implementing proactive practices ranging from safety inspections and safety trainings, to implementation of effective safety supervision and management. In addition, review of the construction safety performance literature introduces many different constructs compromising a variety of the contributing factors that affect the construction safety performance. Among these, for example, previous studies focused on safety climate and its dimensions (Siu O-l,et al, 2004).

While the safety climate-safety performance relationship is well documented (Gittleman JL, et al, 2010), the mechanism of this relationship is not clearly understood, especially in construction projects. (Wu et al, 2008) stated that although many studies reported that the higher the score of a safety climate, the better the safety performance, there has not been much discussion about the causality of safety climates (Wu T-C, Chen C-H, et al, 2008).

Today, further research is necessary to develop new applied theories, and make stronger recommendations (Khosravi Y, et al, 2014). In addition, more work is needed to integrate different safety constructs and contributing components in a holistic framework. Only through such integrated framework can a common understanding of safety performance be achieved. Considering all these components, the goal of this study was the to determine the feasibility and acceptance of the safety economic performance approach as safety an effective and safety approach to construction worker safety in Khartoum. Share their influence on safety performance via the general component of safety climate. The new structural model, which integrated the pervious constructs, can be used to provide better understanding of the links between safety performances

Indicators and contributing components, and make stronger recommendations for effective intervention in construction projects Ethical considerations (Iran J Public Health. Aug, 2014)

1.2 Research Problem Statement

Accidents, incidents, injuries and fatalities continue to occur unabated on Construction sites around the world at consistently high rates (Hinze, 1997; Center to Protect Workers' Rights, 1995; Berger, 2000).

There are various regulatory systems and standards in the construction industry in most countries. These systems and standards take the form of occupational safety and health laws, rules and regulations.

Many approaches to construction occupational safety and health management have evolved that have underpinned the design, implementation and enforcement of these regulatory systems and standards.

This study examines the safety economic performance approach to determine its appropriateness and acceptance as a safety and economic management approach.

There has not been any study that has attempted to measure the level of understanding nor the acceptability of the performance approach among contractors.

This study concern about examines the safety economic performance approach to determine its appropriateness, acceptance and its implementation as a safety management approach.

Finally, the study is highlighted to inform about the approach and provide a clearer understanding of the potential benefits of introducing and implementing it in the area of construction worker safety and health.

1.3 Research Objectives

The objectives of research were summarized as follows:

1- Determining the root cause of poor safety management at medium and small organizations at construction industry.
2- Determining the feasibility and acceptance of the safety economic performance approach as an effective and safety approaches to construction worker safety.
3- Increasing the understanding of the safety economic performance approach and its application to safety and health at construction industry.
4- Measuring top management's knowledge about the safety economic performance approach, their attitude and the implementation of performance approach within their organizations.
5- Identification of the factors that would prevent the safety economic performance approach from being implemented successfully.

1.4 Research significant

The purpose of this study is to examine safety economic performance-based approach to construction safety management as an effective and acceptable approach to improving safety and health on construction sites in Khartoum.

1.5 Research hypotheses:

1-Using the safety economic performance approach and its application will provide safety and health at construction industry.

2-Misunderstanding of safety concepts for top management lead to poor safety management

1.6 Research limitation

This study is conducted in Sudan at Khartoum state from (15th. Aug 2015 to 15th.Nov, 2015).

The study highlighted on top management, expeditor and individual contactor.

1.7 Research Methodology

The methodology of this study is consists of **data gathering** by the following:

- A review of the literature to determine what is known and determines current practice of the safety economic performance approach in the construction industry.
- A survey of the top management and expeditor of a sample of construction firms in Sudan to determine their attitudes and opinions about the performance approach and its Implementation in their organizations.

Then **analysis** those data by using:

- **Qualitative analysis** to classify data of questionnaire
- **Quantitative analysis** to determine the exact value of data of questionnaire

- figure (1-1) represent flow chart of research methodology

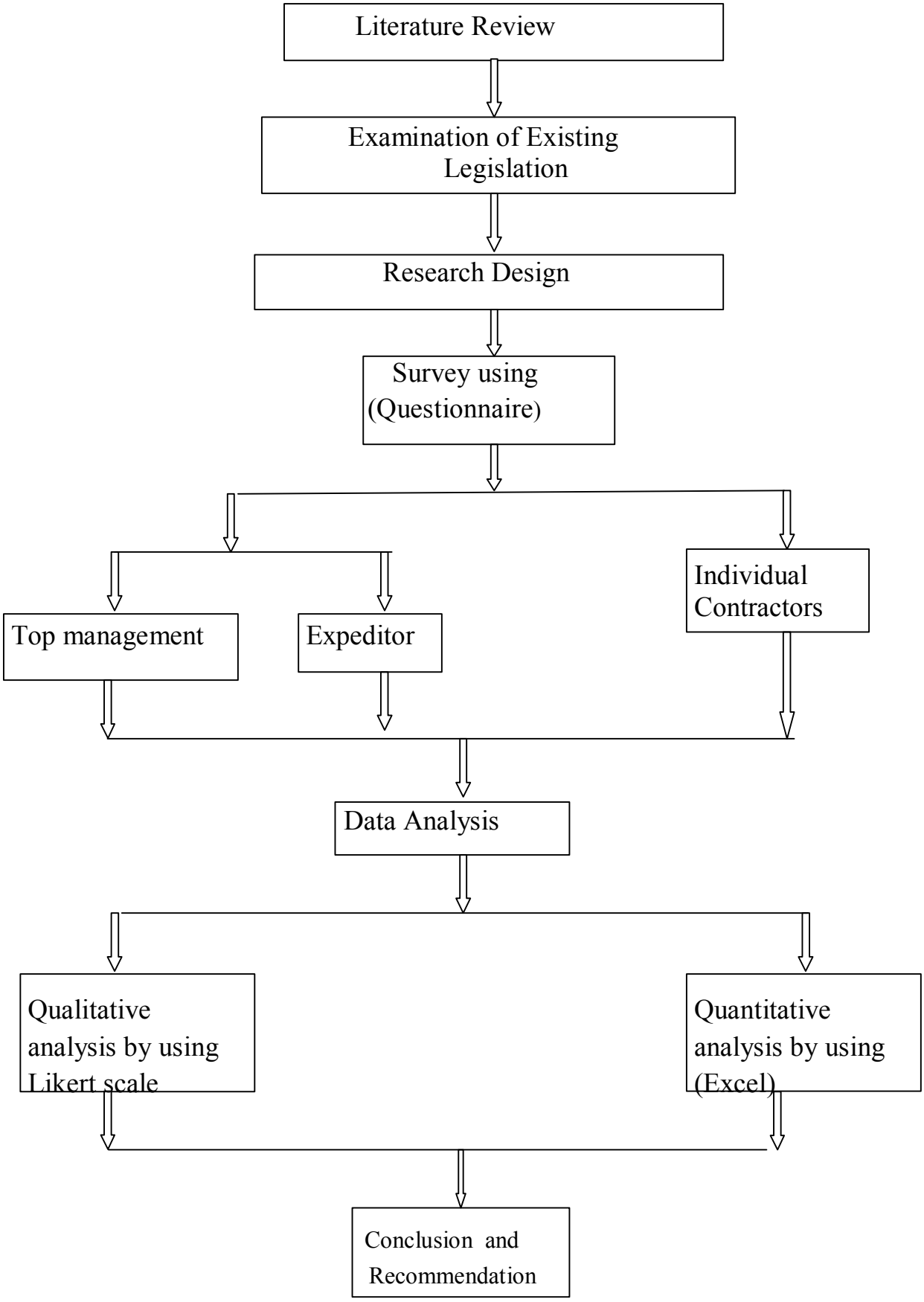

Figure (1-1): Flow-chart of research methodology

CHAPTER TWO

LITERATURE REVIEW

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter describes the review of relevant literatures that are related to this study. among issues addressed by the chapter include the understanding of the term safety economic performance approach and its process to be accomplished success, the factor affected safety economic performance approach, selecting method for evaluating of safety economic performance, the economic benefits of effective safety performance OSHA to SMEs, the influence of legislation on cost control, the importance of safety culture, major hazards and risks related to construction industry sector, role of top management at performance approach.

2.2 Safety Economic Performance Approach at Construction Industry

The state of the construction industry in a country is symptomatic of the state of its national economy. Put another way, the fate of any national economy cannot be separated from that of the construction industry. This is a consequence of the forward and backward linkages the construction sector forges with the rest of the economy (Drawer, 1980; Ahmad and Yan, 1996). The backward linkages refer, for instance, to the construction materials and services sectors of the economy. The forward linkages refer to the economic activities that result from the use of constructed buildings and facilities. This chapter shows that industrial sector, the construction industry is too important to ignore. For this reason, the nature and characteristics of the construction industry are examined. Against this background, the safety performance of the construction industry is critically discussed.

2.2.1 Importance of the Construction Sector

The Construction is one of the largest economic sectors in all countries around the world. The building and construction industry accounts, on average, for (7-12%) of a country's employment and Gross Domestic Product (GDP). According to the European Union's statistical unit (Euro stat (2013) , construction activities in the EU-27 provided in 2007 employment to an estimated 14.8 million persons. There were an estimated 3.1 million construction enterprises across the EU-27, which generated an estimated EUR 1,665 billion of turnover.

According to the statistical classification of economic activities in the EU, the construction industry covers NACE Section F (which is the same as NACE Division 45) (Euro stat, 2013). Based on this NACE classification, five subsectors, covering a different chronological stage of the construction process, are defined:

- Demolition and site preparation
- General construction activities
- Installation work
- Completion work
- renting of construction equipment

The largest of these five construction subsectors in the EU, both in terms of employment and value added, is the building of complete constructions (NACE Group 45.2). Building installation (NACE Group 45.3) and building completion (NACE Group 45.4) are the next largest subsectors. The two smallest subsectors are site preparation (NACE Group 45.1) and the renting of construction or demolition equipment with an operator (NACE Group45.5) (Euro stat, 2013).

The Council Directive 1992/57/EEC of 24 June 1992 on the implementation of minimum safety and health requirements at temporary or mobile construction sites (Construction Sites Directive 92/57/EEC)

categorizes 'construction work' into the following activities excavation, earthworks, construction, assembly and disassembly of prefabricated elements, conversion or fitting-out, alterations, renovation, repairs, dismantling and demolition, upkeep, maintenance - painting and cleaning work, drainage. Construction work applies thus to work during the whole-life cycle of a facility from its inception to its eventual demolition and any on-site recycling of its materials (Euro stat, 2013).

With 3.1 million enterprises, an annual turnover of almost € 1,600 billion, a total direct workforce of almost 14 million, the construction sector contributes at about 10% to the GDP of the European Union (Euro stat, 2013). Most construction enterprises serve a local market. Consequently, the construction sector is characterized by a high number of small enterprises, and relatively few large ones. The European construction sector is composed at about 99% of small and medium-sized enterprises (SMEs), who produce 80% of the construction industries output. The small enterprises (less than 50 employees) ensure 60% of the production and employ 70% of the sectors working population (Euro stat, 2013).

2.2.2 The Impact of OSHA on Organizations

Despite these researchers' findings, it is incontestable that the cost of poor safety and health can be substantial. For example, in the Irish economy, the cost of occupational injury and illness was estimated at almost €3.6 billion or about 2.5% of the Gross National Product per year (GNP1, Indecon, 2006). In the European Union (EU) in 2000, the cost of workplace accidents amounted to €55 billion, or the equivalent of 0.64% of the Gross Domestic Product (GDP) for the EU, while an average of 1,250 million working days are being lost each year due to health problems (EC, 2004). In Britain in 2001/02, the cost of workplace accidents and work-related ill health was substantial, costing employers between (€5.1 -

€10.2) (£3.9 - £7.8) billion, and costing individuals between (€13.2 - €19.2) (£10.1- £14.7) billion. The cost to the economy is estimated to be between (€17.1 - €29.0) (£13.1 -£22.2) billion, and to society as a whole between (€26.1 - €41.5) (£20 - £31.8) billion (HSE, 2004).

In the light of these figures, although some organizations might find it difficult to begin using economic analyses and evaluation to assess occupational health and safety, this should be seen as a necessity, particularly for organizations which may have to deal with limited resources and permanent competition in the market (Rydlewska-Liszkowska, 2005b). This is especially true of many SMEs.

The figures quoted above generally do not include the indirect costs that can arise from injury, ill, health or accidents. Dorman (2000) notes that some of the indirect costs of occupational accidents can include:

- Interruption of production immediately after the accident.
- Lowering morale of co-worker.
- Staff time taken up with investigating and preparing reports on the accident
- Recruitment and training costs for replacement workers.
- Reduced quality of recruitment pool.
- Damage to equipment and materials (if not identified and paid for through routine accounting procedures).
- Reduction in product quality following the accident.
- Reduced productivity of injured workers on light duty.
- Overhead costs of spare capacity maintained to lessen the potential effects of any accidents.

A review of the literature shows the range of factors that are used to gauge the impact of OSH on the economies of organizations. These range from estimating the cost of accidents at work (Bilban, 2006, Monnery,

1998; Rzepecki, 2005. Šukys, Čyras, Jakutis and Stankiuvien , 2004), to calculating wellness (Hunter, 1999), to understanding the costs and benefits of implementing OSH management systems in enterprises (Rzepecki, 2006), and to measuring sickness absence (Ahonen, 1998).

Other research has highlighted the value of insurance systems and insurance premiums in encouraging companies to investigate their OSH costs (Matetic and Ingram, 2001, Pawłowska and Rzepecki, 2000; Rzepecki, 2004, Rzepecki and Serafińska, 2003). Regardless of the ways organizations monitor OSH, safety and health must be viewed as an essential and achievable part of any business, (Fitzgerald, 2005) and one that needs to be monitored consistently. It is also important to be aware of non-economic factors such as the social and psychological effects of injury, accidents and ill-health which, while they cannot be captured in strictly monetary terms, may have an indirect impact on an organization's finances (Dorman, 2000; Lahiri, Gold and Levenstein, 2005) Primary safety and health hazards must be took into account as shown in table (2.1).

Table (2.1) The Primary safety and health hazards on U.S Construction sites

Deaths and injuries	
Types of injury Falls (more than 33% of deaths) Being struck by/against (falling object) - 22% of deaths Caught in/between (trench cave-ins) – 18% of deaths Electrocution – 17% of deaths Other – 10% of deaths	
Musculoskeletal disorders	
Cause of injury	Areas most affected
Lifting	Lower back, shoulders
Awkward postures	Knee, hip, shoulders, lower back
Repetitive motion	Shoulders, neck, wrists
Hand-tool vibration	Fingers, wrists
Chronic health hazards	
Hazard Noise Asbestos and manmade fibers Lead and other metals Solvents Hazardous wastes Heat and extreme cold	Organ or system most affected Hearing Lungs Kidneys, nervous and reproductive Systems Kidneys, liver, nervous system Kidneys, liver, nervous and reproductive systems Circulatory system

Source: Center to Protect Workers' Rights, 1993

2.3Definition of the prescriptive approach:

The prescriptive approach requires strict and enforced conformity to a safety standard, regulation or rule, and specifies in exacting terms the means or methods of how employers must address given conditions on construction sites.

2.4Definition of the safety economic performance approach:

The safety economic performance approach identifies important broadly- defined goals, ends or targets that must result from applying a safety standard and find the suitable alternative economic, regulation or rule without setting out the specific technical requirements or methods for doing so. the safety economic performance approach describes what has to be achieved to comply with the regulations using acceptable and leaves the means and methods of complying up to the contractor) safety is required during all process group FIG 2.1shows relationship between planning, construction and use.

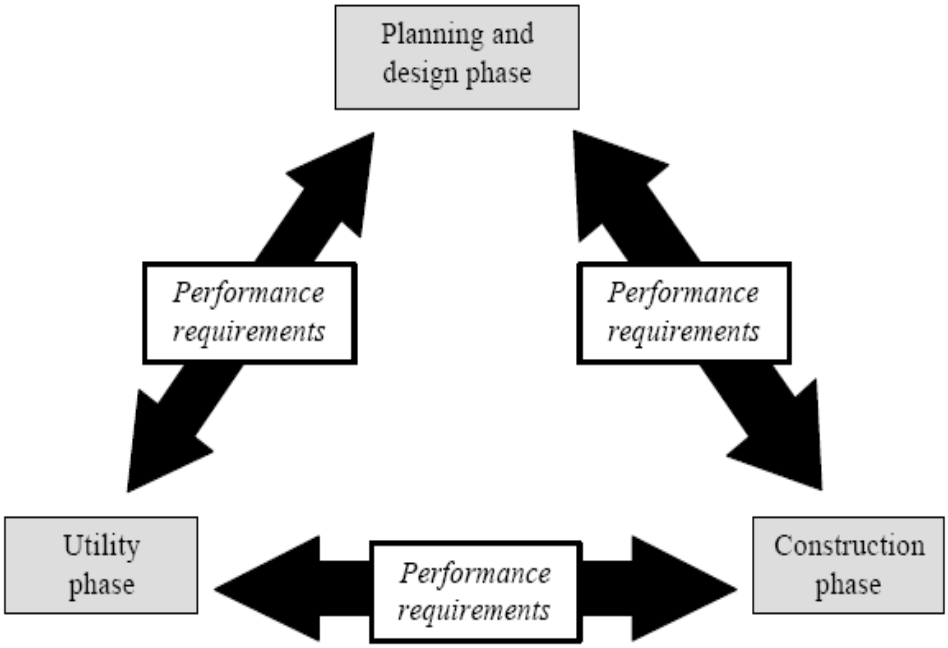

Fig 2.1 Relationship between planning, construction and use

Source (CIB, 1982).

2.5. Factors that affect the successful completion of a construction activity

Cost or budget, time of day, climate conditions, skills level of workers supervision available or require, equipment, code requirements, design, location of work, materials to be used, method of construction, hazards, worker attitude, available time or duration, quality standards desired, worker experience, working environment, risk level (CIB, 1982).

2.6 Understanding the Process of Safety performance

In order to encourage organizations, especially small and medium sized enterprises, to link OSH with efficient economic performance, it is necessary for them to understand the links between the two, so that they can clearly see what can be gained from moving in this direction. One of the first steps is to collate information about how the organization is performing and what factors are hindering performance. Performance can be assessed using various methods. Warren (2005) proposed a

logic model that could be used to understand how performance might be measured. This model is especially useful for SMEs because the factors it focuses on are transparent and easily discernible within an organization. This model uses a flow-through process with defined end results. Specifically, the inputs (overall investment in resources) directly influence the outcomes or end results (profits, productivity, quality). The factors that could be included in each area are outlined as follows:

- **Inputs** - resources such as money and staff time used to produce a desired result.
- **Activities** - the actions taken, for example training staff or regular maintenance of equipment, to guide resources towards a desired result.
- **Outputs** - products created and/or services delivered in a specific period, that could be the number of training programmers conducted, the number of classes taught, or the number of clients served.
- **Outcomes** - changes in knowledge, skills, attitudes, values, behavior or condition that show progress towards achieving the objectives of a particular programs of action and towards reinforcing the organization's overall aims. These outcomes can be assessed for their short-term, intermediate, or long-term impact. Table 2.2 below shows logic model for developing performance measure

Table 2.2 logic model for developing performance measures (Adapted from Warren, 2005)

INPUTS	ACTIVITIES	OUTPUTS	OUTCOMES
Money	Training	Number of staff trained	Reduced sick leave
Staff	Investments	Number of investments undertaken	Higher Productivity
Equipment	Maintenance	Number of equipment maintained	Increased profit
Supplies	Interventions	Types of interventions undertaken	Lower liabilities
Facilities			Healthier workforce
			Consistency in performance
			Better performance
			Fewer injures
			Increased output of goods and services

In addition for demonstrating how to develop performance measurements, Warren (2005) states that any performance measurement should be **SMART** – specific, measurable, achievable, relevant and time-based - and outlines five characteristics that should be applied to any such process. These are also applicable to OSH, and provide a basis that could be considered during the process of making changes in occupational safety and health policies and practices. They include being:

(I)Specific: performance criteria should be as specific as possible to make sure that it is easy to identify what is being measured.

(ii) Measurable: performance criteria need to be measurable, either in quantity or by quality, to check that stipulated goals are being met.

(iii) Achievable: unrealistic goals may cause disease within an organization. However, the challenge of goals that stretch an organization a little may be beneficial.

(iv)Relevant: The performance measurements should be relevant to the organization overall mission and to the strategic objectives of any programmed.

(v)Time-based: The performance measurements should be achievable within a specific period

2.6.1 Factor effect on safety Economic Performance Approach

The impacts of the historical, economical, psychological, technical, procedural, organizational and the environmental issues are considered in terms of how these factors are linked with the level of site safety. The historical factor is assessed by the background and characteristics of the individual, such as age and experience. The economic factor is determined by the monetary values which are associated with safety such as, hazard pay. The psychological factor is assessed by the safety behavior of fellow Workers on site including supervisors. The technical and procedural factors are assessed by the Provision of training and handling of safety equipment on site. The organizational and environ-mental factors are assessed by the type of policy that the management adopts to site safety. In-formation regarding these factors were correlated with accidents' records in a sample of 120 operatives. Results of the factor analysis suggest that variables related to the `organization policy' are the most dominant group of factors in unending safety performance in the United Kingdom Construction Industry.

2.6.2 Selection of Method for Evaluating of Safety Economic Performance in Construction Industry

Once performance measurement is understood, organizations can apply this to understanding the cost of ill-health and injury by using a cost- benefit ratio as a basic tool of economic assessment (Douphrate and Rosecrance, 2004; and to help build a value-for-money case for improving safety (Behm, Veltri and Kleinsorge, 2004).

One way to obtain this type of ratio is by using a Cost Benefit Analysis (CBA), a technique with which managers can assess the value of any particular action and then compare it with the value of other possible actions (Oxenburg and Marlow, 2005). A CBA is the method usually promoted in economic evaluations of occupational health outcomes, because it attempts to express any improvement in monetary terms and the financial advantage can be seen immediately. However, some researchers have suggested that the method of establishing the economic viability of an action should focus first on the consequences of that action (Goossens, Evers, Vlaeyen, Rutten-van Mölken and van derLinden, 1999). Cost-minimization analysis (CMA), for instance, is a process that seeks the least costly Alternative, while cost-effectiveness analysis (CEA) and cost-utility analysis (CUA) are measured in natural units or utilities (e.g. quality-adjusted-life-years), because their consequences differ. (Goossens et al. proposed that CEA and CUA are more appropriate ways of assessing the cost of conditions such as chronic musculoskeletal pain. Organizations may wish to select the option that is most appropriate for their needs. A review: OSH and Economic Performance in SMEs EU-OSHA - European Agency for Safety and Health at Work Niven (2000) highlights the fact that the main focus of financial concerns about occupational safety and health policies is the cost of interventions with few instances of formal economic evaluations.

Niven proposes that the latter should be used more often to demonstrate cost-effectiveness. However, organizations also need to examine non- economic factors when assessing workplace interventions, for example their culture or any management systems already i n place.

One such system could be a safety management policy focusing on process quality, efficiency, organizational culture, knowledge capital and aspects of personnel policy, such as the formal induction of a new member of staff to organizational processes, security culture, and potential risks and hazards. One tool that can be used to highlight all these specific factors when assessing the financial impact of OSH is the balanced scorecard. This is an organizational performance measurement system that has been successfully used to gauge the impact of safety and health policies. The scorecard identifies four categories or indicators: management, operational, customer satisfaction, and the learning and growth of individual personnel and the organization as a whole.

The model in Figure 2-2 below links OSH to the financial performance of enterprises in Germany and outlines the usefulness of a holistic approach: Germany (Langhoff and BAUA, 2002) Assessing the impact of OSH investments on the financial performance of enterprises

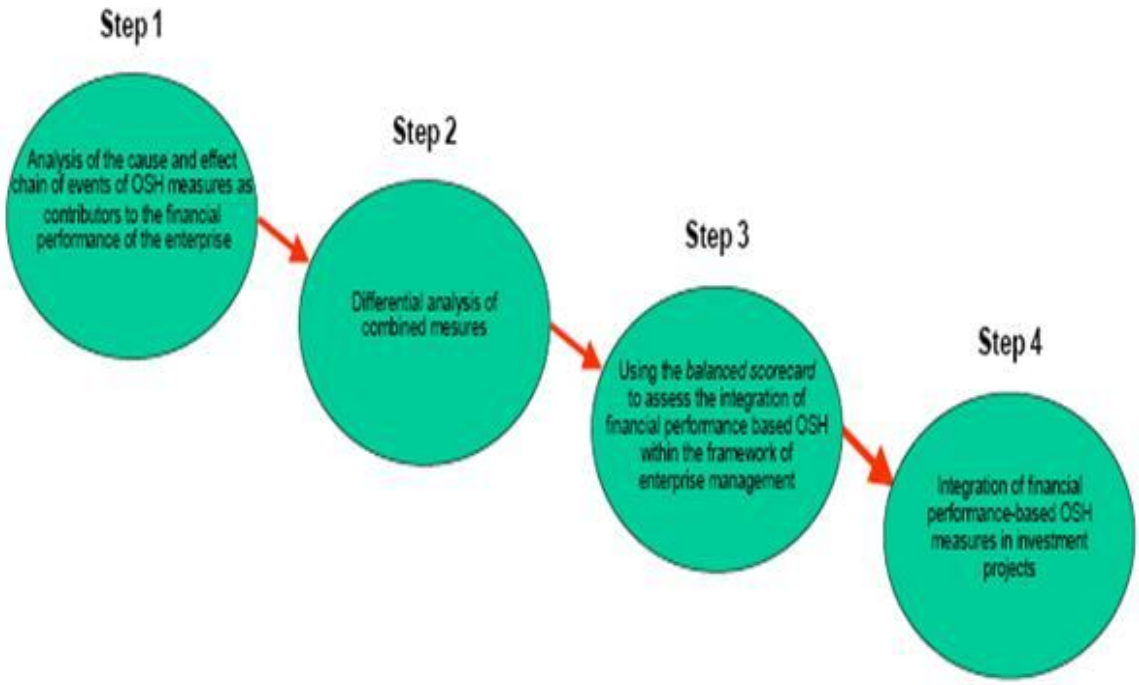

Figure (2.2) stages showing the impact of OSHA on financial performance (Langhoff and BAUA, 2002; Mearns and Håvold, 2003).

2.6.3. The Economic Benefits of Effective safety performance OSHA to SMEs

OSH that is reasonably or exceptionally effective and efficient can help SMEs to build better performing businesses ((EU-OSHA) - European Agency for Safety and Health at Work, 2007). Small businesses stand to suffer substantial losses as a result of poor OSH, but conversely can gain most if proper systems are in place ((EU-OSHA) - European Agency for Safety and Health at Work, no date).For example, research has shown that 60% of companies that have a disruption lasting more than 9days go out of business (HSE, 2005). Since SMEs generally lack readily available credit, it is therefore essential that they understand the economic benefits of improving their OSH performance (Dorman, 2000; Oxford Analytical Ltd., 2005).One Finnish study (Ahonen, 1998) was able

to show the economic benefits of achieving good OSH among SMEs. The study surveyed 340 companies across different sectors and found specific benefits that could be achieved over the course of a year Table (2.3) shows economic benefit of OSHA activities.

Table (2.3) economic benefit of OSHA activities

OSH activity	Economic benefit (estimated savings)		
	Low	High	Average
Reducing sickness absenteeism	€ 286 (FIM* 1,700)	€ 942 (FIM 5,600)	€ 448 (FIM 2,665)
Musculoskeletal disorders			€ 209 (FIM 1,245)
Work community measures			€ 82 (FIM 485)
Increased individual productivity	€ 622 (FIM 3,700)	€ 858 (FIM 5,100)	

*FIM = The Finnish MARKKA, and was the currency in use in Finland until 28.02.02 as legal tender. The Euro (€) was introduced on 01.01.02 and is the currency in use at present.

2.6.4Impact of Workplace Health Promotion Programs

Research has shown that the use of workplace-related health promotion programmers could lead to not only lower absenteeism but also lower health care costs (Aldana and Busse,2001),while fitness programs can also assist in a reduction of health care costs (Aldana, 2001). Other benefits to be gained from workplace health promotion programs include: managing back pain ,reducing the risk factors of musculoskeletal disorders (Seeley and Marklin, 2003); reducing MSD-related worker compensation costs and injury rates (Douphrate and Rosecrance, 2004) improving the overall quality of work life, improving product quality, improving production efficiency/productivity, and contributing to the profitability and strategic competitive advantage of the company implementing such measure (Douphrate and Rosecrance,2004). Shearn (2003) further outlined the benefits to be gained from health and

safety interventions, distinguishing between the direct benefits (mainly tangible – „hard") and the indirect benefits (mainly intangible – soft).

Direct Benefits were:

- Reduced insurance premiums
- Reduced litigation costs
- Reduced sick pay costs
- Improved production /productivity rates
- Reduced product and material damage
- Lower accident costs / production delays

Indirect Benefits were

- Reduced absenteeism
- Reduce staff turnover
- Improve corporate image
- Improved chances of winning contracts
- Improved job satisfaction / morale

Specifically, workplace health promotion should be incorporated into an organization's business strategy and aligned with its goals, and thereby be able to influence both individual and organizational outcomes (De Greef and Van den Broek, 2004). The conceptual framework presented in Figure (2.3) outlines and links the practices, interventions and outcomes of proactive safety and health practices.

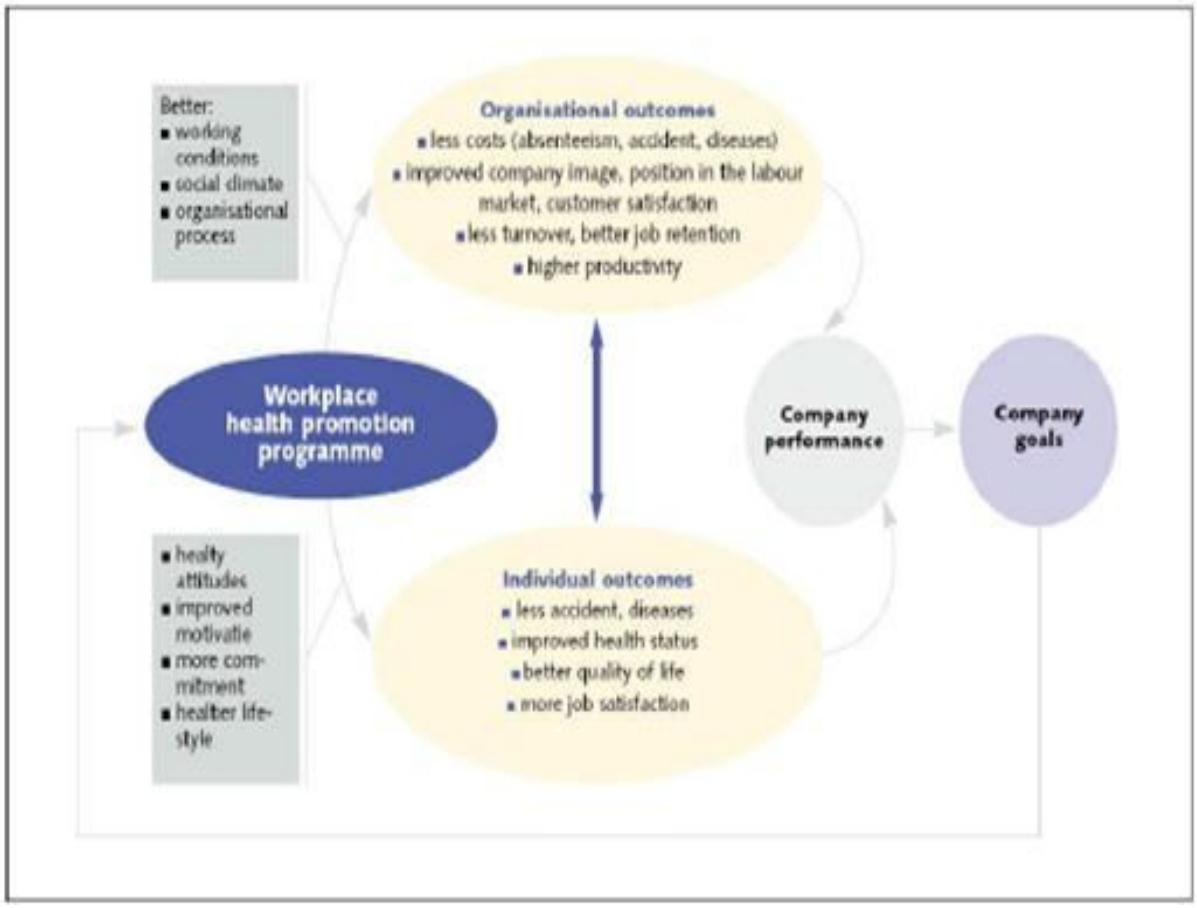

Figure (2.3) frame work for describing arguments based on the effect of outcomes of workplace health promotion

In Germany, the StBG‟s Employer‟s Model was introduced and focused specifically on improving OSH in SMEs, using a direct intervention approach. StBG's the Employer's Model (Schrandt, 2007).

2.7The Influence of Legislation on Cost Control

Legislation may sometimes be the most feasible option to encourage SMEs to make improvements in OSH. Indecent (2006) conducted two surveys, one targeting the construction companies and the other industries in general. The findings from the construction survey showed that more than half the respondents (54%) believed that health and safety legislation led to a reduction in the cost of accidents, and many (40%) believed that it reduced insurance costs. The majority said that they adrenalized a net benefit from the legislation. The survey of general industries found that the legislation reduced accident-related costs and

employers believed that the benefits of legislation outweighed its costs. Other research has shown that businesses do not find it problematic to comply with new directives, nor are they worried about the costs involved in implementing such regulations or Directives (Pawlowska and Pęciłło, 2003).

2.8The Importance of Safety Culture

One definition of safety culture (ACSNI, 1993) focuses on its impact on the organization: The product of individual and group values, attitudes, perceptions, competencies and patterns of behavior that determine the commitment to, and the style and proficiency of, an organization's health and safety management.

Organizations with a positive safety culture are characterized by communications founded on mutual trust, by shared perceptions of the importance of safety and by confidence in the efficacy of preventative measures.

Safety culture can encourage proactive accident prevention, and research has shown companies do recognize that an important component in creating and maintaining a safe environment is through culture change (Fitzgerald, 2005). In changing an organization's culture, it is important that leadership on safety issues is visible in the consistent behaviors of senior management, that active measurement of safety performance and reinforcement of positive behaviors are in place, and that there is a periodic review of the safety culture and the implementation of safety improvement plans (Fitzgerald, 2005).

Companies with a strong safety culture inherent in their organization will be most likely to be willing to look at ways of improving and maintaining a healthy working environment and, as a result, to link OSH

and economic performance. Such a linkage might happen more often if a SME has a stronger focus on external factors, such as social capital.

2.9. Health and Safety Plan

The information contained in the health and safety plan, while it is project specific, should include provisions covering the following:

- Existing off-site conditions.
- Existing on-site conditions.
- Existing records.
- The design.
- Construction materials.
- Site layout and management.
- Relationship with the client's undertaking.
- Site rules.
- Procedures for the continuing review of the health and safety plan (Joyce 1995).

2.9.1.Health and Safety File

The following information should be included in the health and safety file:

- Historic site data.
- Site survey information.
- Site investigation reports and records.
- Photographic record of essential site element.
- Statement of design philosophy, calculations, and applicable design standards.
- Drawings and plans used throughout the construction process, including drawings prepared for tender purposes.
- Record drawings and plans of the completed structure.

- Maintenance instructions.
- Instructions on the handling and/or operation of equipment together with the relevant maintenance manuals.
- Results of proofing or load tests.
- Commissioning test results.
- Materials used in the structure identifying, in particular, hazardous materials including data sheets prepared and supplied by suppliers.
- Identification and specification of in-built safety features, for example, emergency and firefighting systems and fail-safe devices.
- Method statements produced by the principal contractor and/or contractors (ACOP, 1995).

The following are typical examples of performance-based standards scaffolding and ladders:

- All scaffolding must be properly designed, constructed and maintained to ensure that it does not collapse or move accidentally.
- Work platforms, gangways and scaffolding stairways must be constructed, dimensioned, protected and used in such a way as to prevent people from falling or exposed to falling objects.

Demolition work:

- Where the demolition of a building or construction may present a danger.
- appropriate precautions, methods and procedures must be adopted
- The work must be planned and undertaken only under the supervision of a competent person.

2.9.2. Tools, OSH and Economics

The use of tools specific to economic calculations, if widely available and easy to use, can help organizations to generate information on the cost and effectiveness of interventions before, during, or after implementation. Moreover, analytical tools can place OSH on the same financial footing as other workplace interventions and thus ensure that it is in a stronger position to attract a share of limited resources (Oxen burg and Marlow, 2005).

2.10Major hazards and risks

The main hazards and risks of accidents in the construction sector can be categorized and described in the following way: (Publications Office of the European Union, 2011).

- Risks of slips, trips and falls.
- Risks related to instability.
- Risks related to traffic.
- Risks related to construction machinery.
- Risks of drowning.
- Risks related to electricity.
- Risks related to gas.
- Fire and explosion risks.
- Asphyxia risks.
- Risks related to sub-contracting.
- Risks related to green jobs.

2.11. The Role of Top Management at Performance Approach

The role that management's support, involvement and commitment have on the efficiency and success of any safety performance scheme. Covered the role and perceptions of supervisors on safety performance. guidance by CONIAC suggests the following:

1. The responsibilities for health and safety on each project should be clearly dined and re acted in contractual arrangements. Factors affecting safety performance (ESawachaet al.2012)
2. The management of health and safety should be an integral part of the management of the work, and whoever is responsible for coordination

The activities of others on site should ensure that health and Safety are effectively managed.

3. Hazards should be anticipated, suitable plant and equipment identified and someone made responsible for its provision and maintenance. Appropriate working method statements are invaluable, providing proactive commitment and understanding.
4. The design team should identify major factors which could affect health and safety and inform prospective contractors of them.
5. Prospective contractors should not be selected or placed on tender lists unless they can show competence in the management of Health and safety.
6. Common, price able items which are necessary for health and safety should be considered for inclusion in the contract documents.
7. The organization of site safety should planned in detail, rules established and performance monitored routinely and by special safety audits

2.11.1. Project Supervisor

The project supervisor while acting on behalf of the client is responsible for the design, and/or execution, and/or supervision of the execution of a project. The directive requires that the project supervisor take cognizance of all applicable general safety and health requirements during the stages of design and project preparation. Additionally the project supervisor is responsible for ensuring that the safety and health plans and files are accordingly adjusted.

2.11.2. Safety and Health Coordinators

The directive requires one or more safety and health coordinators to be appointed by the client or the project supervisor. Coordinators may be appointed for either or both the project preparations and project Execution stages and their duties in terms of each stage are different. Regarding the project preparations stage safety and health coordinators are responsible for the coordination of the implementation of the provisions that consequently arise out of the involvement of the project supervisor in the design and project preparation stages. Further they are responsible for the formulation of a safety and health plan as well as a file containing all the relevant safety and health information applicable to the project .During the project execution stage coordinators are required to coordinate all aspects of safety and health relative to the project and ensure strict compliance such provisions. Additionally they are required to facilitate cooperation between all contractors on the site, ensure that safe working procedures are followed and that only authorized persons are allowed onto the construction site. These coordinators do not relieve the client or project supervisor of any of their responsibilities in terms of the construction project.

2.11.3. Safety and Health Plan

Additionally, the client or the project supervisor is responsible for the compilation of a safety and health plan before actual work begins on site. These safety plans must take into account the work involving particular risks listed in Annex II of the directive.

2.11.4. Prior Notice

A prior notice must be submitted to the authorities responsible for safety and health at work on all construction sites where the work is scheduled to last longer than 30 working days and on which more than 20 workers are employed at the same time, or on which the amount of work to be carried out is scheduled to be more than 500 person days. This notice must be periodically updated if necessary and be displayed on the construction site.

2.11.5. Obligations of Employers

The directive in no way absolves employers from their responsibilities toward their workers, and requires them to take measures in compliance with the minimum safety and health requirements for construction sites

2.11.6. Workers

All workers must be informed and kept informed of all measures to be taken regarding their safety and health on the construction site. They are to be involved on a consultative and participatory basis in all matters of safety pertaining to their activities at the workplace.

2.11.7. Responsibilities of Principals

A principal is someone who forms a contract with a third party to carry out a building project or any part of such a project. Although the client has responsibility as a principal, other members of the project team can be principals at any one time, and all key participants in the construction process have a duty to provide for the health and safety

needs of their own areas of operation (Site Safe, 1999). The following are some of the issues which principals need to consider:

(i)-Designers and consultants possess adequate safety and health knowledge, expertise and experience;

(ii)-Contract periods and budgets make provision for safety and health aspects to be included in the project;

(iii)-Assessment of the ability of contractors to manage and control safety and health on the project;

(iv)-Provision for on-site safety and health monitoring;

(v)-Provision of all relevant safety and health information such as known hazards, to consultants and contractors.

(vi) -On-going coordination of information and activities between all participants in the construction of the project (Rogers, 1999; Site Safe,1999)

2.11.8. Responsibilities of Employers

Employers are responsible under the HSE Act 1992 to identify hazards and ensure that the proper controls are in place to manage them regarding the threat that they pose to employees and the general public. Regular reviews of the workplace have to conduct to ensure the effectiveness of the controls and to identify new hazards. Employers are required to provide adequate supervision and training to employees in the safe use of all plant, equipment and protective clothing that they may use or handle. Further they are required to record all accidents and investigate all accidents and near misses. Additionally, all employees have to be involved in the development of emergency

2.12. Implementing the performance approach

The tendency to protect self, family, and friends is a natural one that has been evident throughout the history of the human race. However, people have invariably been willing consequences. Accident prevention is

not the priority that it should be, for the most part, due to ignorance of hazards and the magnitude and consequences of potential accidents.
to take chances in exchange for possible gains - sometimes with tragic

2.13. Change and Change Management

The many forces of change rooted in the prevailing social, economic, and political conditions have created enormous pressure on all organizations to respond or risk stagnation and decline (Bonvillian, 1997).

In particular, organizations have to cope with globalization of the economy, new market opportunities, technological advancements, emergence of new management approaches and paradigms, and appropriate response to the needs of workers.

All people and organizations are affected by change.

According to (Bennis,1993), if change has now become a permanent and accelerating factor in American life, then adaptability to change becomes increasingly the most important single determinant of survival.

The profit, the saving, the Efficiency, and the morale of the moment become secondary to keeping the door open for rapid readjustment to changing conditions.

"Weather all (1995) goes even further by claiming that continuing change will be the constant in this present next century. Change has been described as being pervasive, important and most frustratingly, elusive (Weston, 1998:78). It is painful, illuminating, and time-consuming (Diamond, 1998). It is a process of transition and transformation of people and systems.

Change that might be temporary or permanent may, according to Whetton (2000) be broadly characterized into

-Functional change;

-Operational change;

-Novel change; and

-Repetitive change.

A model for determining the readiness of an organization for change is offered by Sink and Morris (1995) as follows:

C = (a) (b) (d) > R

Where:

C = readiness for change;

a = level of dissatisfaction with the status quo;

b = clearly understood and desired future state

d = practical first steps in the context of an overall strategy for actualizing the desired future state; and

R = perceived cost or risk of changing.

2.13.2. Risk Assessment

The contractor initially assesses the risks subjectively associated with each construction activity, assuming that planned or existing controls are in place. This assessment could form part of an integrated approach to risk management within the overall business strategy. Risk in this context refers to the likelihood that an accident might occur and the consequences of having an accident (BS 8800:1996). This assessment might be carried out by a specialized safety professional in the employ of the contractor .The determination of the severity or tolerability of the risks associated with the particular activity will be based on either the contractor's own experience or the experience of the industry. Severity of the risks will determine the level of resources that the contractor needs to allocate to reduce the risks themselves, and the exposure of workers to them. In particular, risk assessment needs to be carried out for situations where hazards appear to pose a significant threat and it is uncertain whether existing measures are adequate. By using a participative approach, management and workers agree safety procedures based on shared perceptions of the hazards and risks (BS8800:1996).

A risk assessment may be used to record the findings of an assessment effort. This form, for example, should cover:

- Details of the work activity;
- Hazard(s) and/or potential hazards;
- Controls in place;
- Levels of risk; and
- Action to be taken once assessment is completed (BS 8800:1996).

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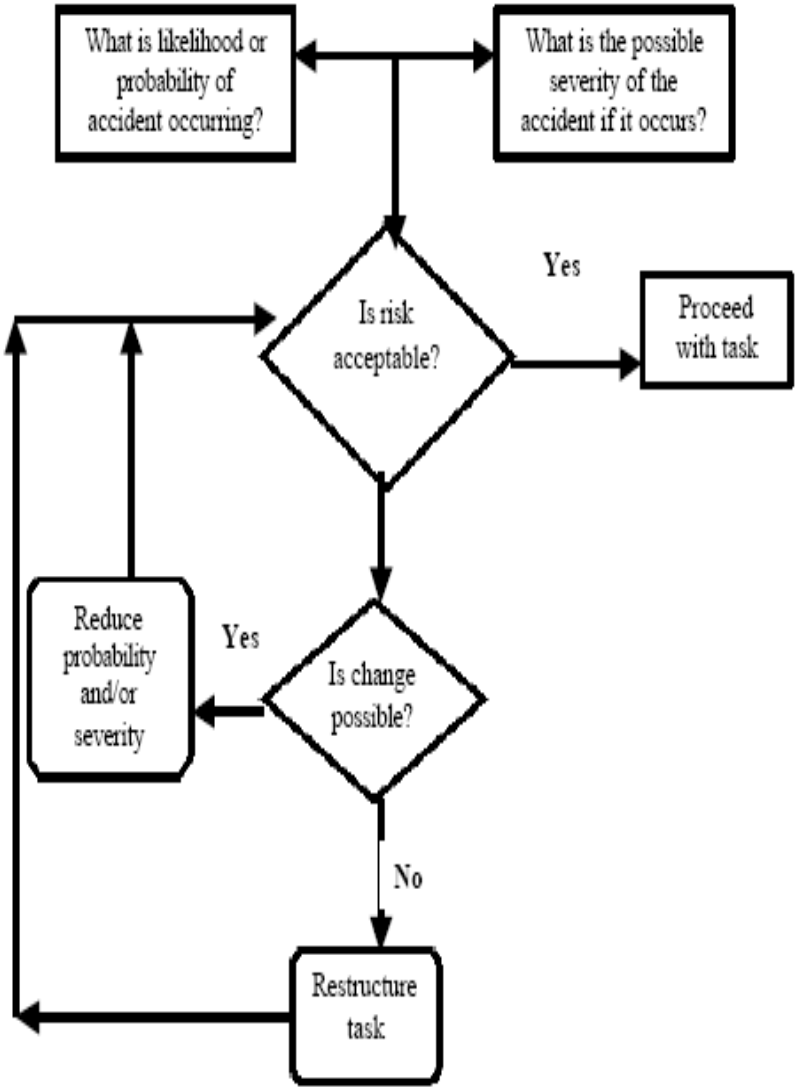

Figure 2.4 Simple risk assessment model source (BS8800:1996).

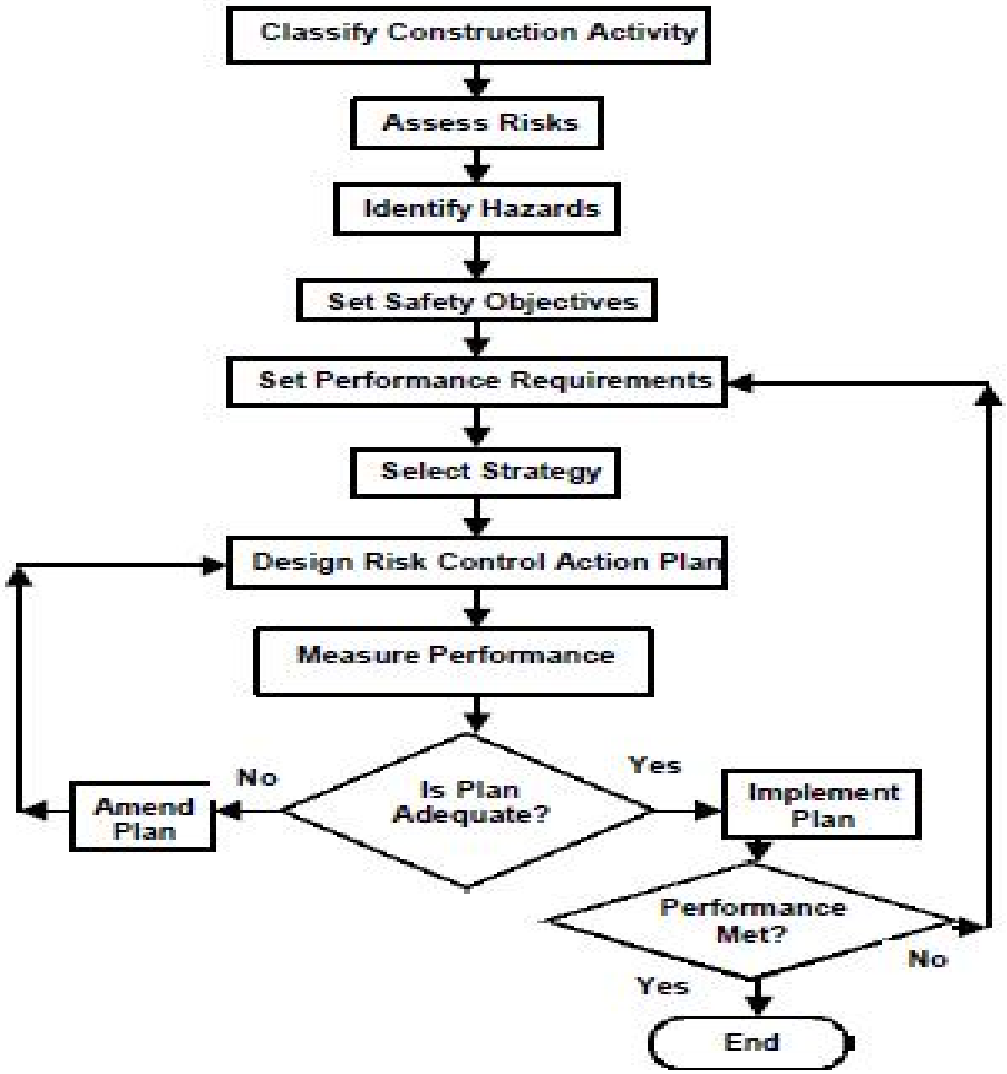

Figure (2.5) factors that affect the successful complication of construction activities source (BS8800:1996).

2.13.3. Set Safety Objectives and Performance Requirements

Objectives or user (worker) requirements should be specific, measurable, achievable, relevant and timely. Once key objectives have been selected, they need to be quantified. For example, objectives to increase or reduce something should specify a numerical figure and a date for their achievement; objectives to introduce a safety feature or eliminate a specific hazard should be achieved by a specified date; and objectives to maintain or continue existing conditions should specify the existing level of activity (BS8800:1996).

2.13.4. Select Strategy to Meet Performance Requirements

There are several possible strategies that could be used to meet the performance requirements and the safety objectives that have been set. In the example the contractor had several options with which to ensure that the safety objective was met of preventing falls from scaffolds - all of which would have satisfied the requirements of the performance-based regulations (BS 8800:1996). The contractor could have used any of the following:

- A new method.
- A newly developed individual fall arrest system.
- An innovative patented scaffolding system.
- An improvement to existing work practices within the organization.
- An established industry or company safe working practice.

CHAPTER THREE

RESARCH METHODOLOGY

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Introduction

This chapter is a review of the various approaches to data collection and analysis adopted in conducting this research; it explains the type of research strategy adopted the mode of data collection and the methodology used in carrying out this research. The study focuses on Determining the feasibility and acceptance of the safety economic performance approach

3.2. Research Strategy

Research strategy is defined as the way in which research objectives can be questioned. The type of research adopted for this research is the qualitative research.

The purpose for its adoption being the nature of the research, due to the subjective nature of the qualitative approach to research. It emphasizes meanings, experiences etc. The information that was gathered under this research is was two forms; exploratory a n d attitudinal.

The exploratory research dealt with the area of this research in which knowledge had been limited knowledge, it is enhance to show how much the average Sudanese tertiary institutions students have entrepreneurial orientation and mindset in their daily academic endeavors.

Attitudinal research as used in this research was used to evaluate top management's knowledge about the safety economic performance approach, their attitude and the implementation of performance approach within their organizations.

3.3. Research design

The research design employed in this study is descriptive statistics. Exposition is made on the sources of data, method of data collection,

sampling and sampling techniques, research instrument and data analysis method used.

3.4. Research Population

The study population for this study shall comprise the construction professionals who are in active practices in the study area. The professionals include Architects, Quantity Surveyors, Engineers, and Builders etc. Information about the professionals were obtained from the register of their various professional bodies to find out the list of those registered with their professional bodies. The list forms the basis for consultation and selection of sample for this study.

3.5. Sample Frame

A sample is a specimen or part of a whole (population) which is drawn to show what the rest is like (Naoum, 1999). For this research, a sample was drawn from a population and adequate measure was taken to ensure that the characteristics of the sample are the same as its population as a whole.

3.6. Sample Size

The sample size for a study is the representation of the population to be studied. The sample size for this study was obtained from the register of their various professional bodies.

3.7. Sampling Technique

For this research, a purposive sampling of the participants in the selected area was conducted. Purposive sampling technique by distributes questionnaire at his/ her convenience or as come in contact. The sample consists of professionals in diverse field of construction- Architects, Quantity Surveyors, Builders, and Engineers etc.

A total of fifty questionnaires were administered and fifty were retrieved. The retrieved questionnaires were used for analysis.

3.8. Data collection instrument

The instruments for the collection of data are the various modes available to extract data and information from respondents. As a result of the nature of the study, the instrument for data collection used for the study was questionnaire. The basic elements of all questionnaires are the questions; therefore, a careful thorough planning was required in the construction of the questions

(a) Identification of the first thought question; this is a form of precipitate from the objectives and the literature review. It forms the backbone upon which the questionnaire is constructed and at this stage; quite a number of questions were generated though the order and wording was not of consideration.

(b) Formulation of the final questions; at this stage the questions from the initial stage were fine-tuned and divided into two different sections to aid the respondents and also to facilitate easy analysis. The first section identifies the demographic information about the respondents. These include their academic and professional qualifications, years of work experience in service and other relevant information.

The questions contained in the questionnaire consists basically of factual questions which are required to gather facts related to the background of the individual respondents, their academic levels and their perception construction management techniques. The other questions which require some level of objectivity for its assessment.

The questionnaire approach was adopted because the purpose of this research is clear enough to be explained in a few paragraph and the respondents can make adequate contribution without ambiguity. Also as the questionnaire approach has the advantage of a wide coverage, wide consultation on the part of the respondent it is best suited for this research.

In order to guard against some of the disadvantages associated with the questionnaire approach, which include lack of control over respondent, ambiguity in the structure of the questions, fatigue due to excessive inflow of questionnaire to increase the reliability of the data and information gathered through the questionnaire approach.

3.9. Approach / Procedure for Data Collection

The approach adopted for carrying out this research was employed due to the nature of the investigation and the type of data and information that was required and available. The approach adopted for this research is the field work (primary data collection). The field work research refers to the methods of primary data collection and in this case the practical approach used is the problem solving approach. This involved Determine the feasibility and acceptance of the safety economic performance approach as an effective and safety approaches to construction worker safety in Sudan.

3.10. Method of data analysis

The methods of analysis used in this research were selected due to the type of data available for the analysis and the objectives of the research. Most of the questions were qualitative; hence the descriptive method of analysis is best suited for the analysis. Such methods include the frequency distribution; percentages, tabulations, charts Etc. Likert scales rating was used with interval 5 to 1 where 1 represents the least ranking and 5 represents the highest ranking which addressed issues on the objectives of this study.

3.11. Questionnaire:

A questionnaire survey was carried out to gather information from technical professionals who are involved in the construction industry. It is to get the opinion and understanding from the experienced respondents regarding safety economic performance approach.

The questionnaire is categorized into four sections as shown below:

1- The first section is related to the Personal Information which represent the qualification of engineers, Experience and specializations and the type of business of construction firms.

2- The second section assessment Information including engineers position within their organizations and the stability in their position respondent's organizations their size and fields of activities

3-Management Attitude to the Prescriptive and Performance Approaches which including definition of the prescriptive approach and Definition of the safety economic performance approach then the understanding scale from(1) to (5) where:

1= very poorly and 5=very well and Preference scale where:

1=support Safety economic performance approach

2=agree Safety economic performance approach

3=neutral

4= agree Prescriptive Approach

5=support Prescriptive Approach

Importance scale indicates that:

1=not important

2=less important

3=moderate

4= important

5= very important

Influence scale indicates that:

1=not influential

2=less influential

3=moderate

4= influential

5=very influential

Key questions which are:

1- In your opinion determine the reason for poor safety management at small and medium construction company?
2- How many recordable injuries did the company have last year?

CHAPTER FOUR

RESULTS AND DATA ANALYSIS

CHAPTER FOUR
ANALYSIS OF DATA AND DISCUSSION OF RESULTS

4.1. Introduction

This chapter presents the analysis and results of the data collected. It also explains the method of measurement used, method of coding and the type of analyses carries out. From this analysis, different conclusions are made as regards to determine the feasibility and acceptance of the safety economic performance approach as safety an effective and safety approach to construction worker safety in Khartoum.

4.2. Questionnaire Data Results:

4.2.1. Personal Information

The analysis of questionnaire survey with respect to the qualification of engineers was shown in Table (4.1.1) and Figure (4.1.1)

Table (4.1.1) The Qualifications of engineers

Qualification	Frequency	Valid percentage (%)	Cumulative Percentage (%)
Bachelor	34	68%	68%
Master	12	24%	92%
High Diploma	3	6%	98%
PHD	1	2%	100%
Total	50	100%	

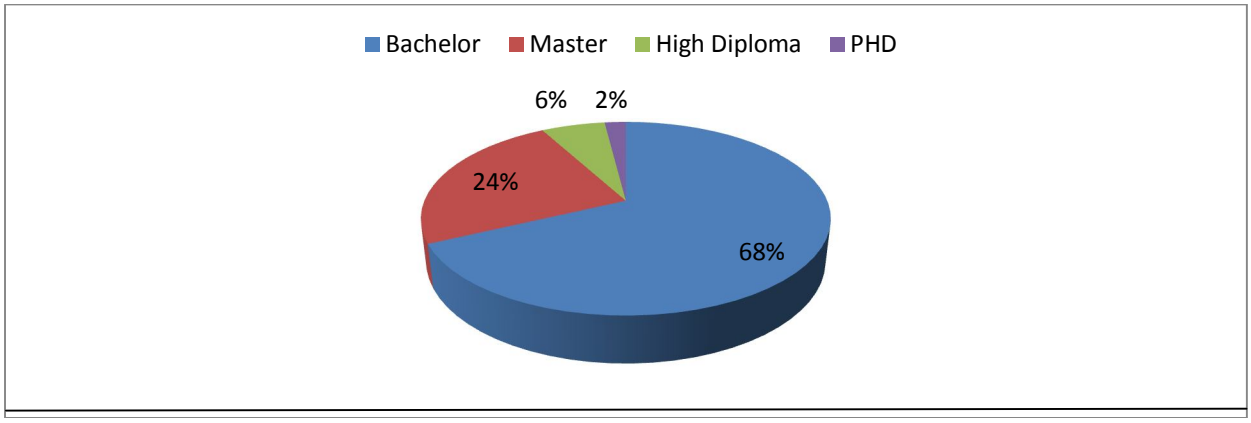

Figure (4.1.1) The Qualifications of engineers

The analysis of questionnaire survey with respect to the Experience of engineers was presented in Table (4.1.2) and Figure (4.1.2)

Table (4.1.2) Experience of Engineers

Experience	Frequency	Valid percentage (%)	Cumulative Percentage (%)
Less than5years	13	**26%**	**26%**
5-10 years	16	**32%**	**58%**
10-15 years	15	**30%**	**88%**
above 15years	6	**12%**	**100%**
Total	**50**	**100%**	

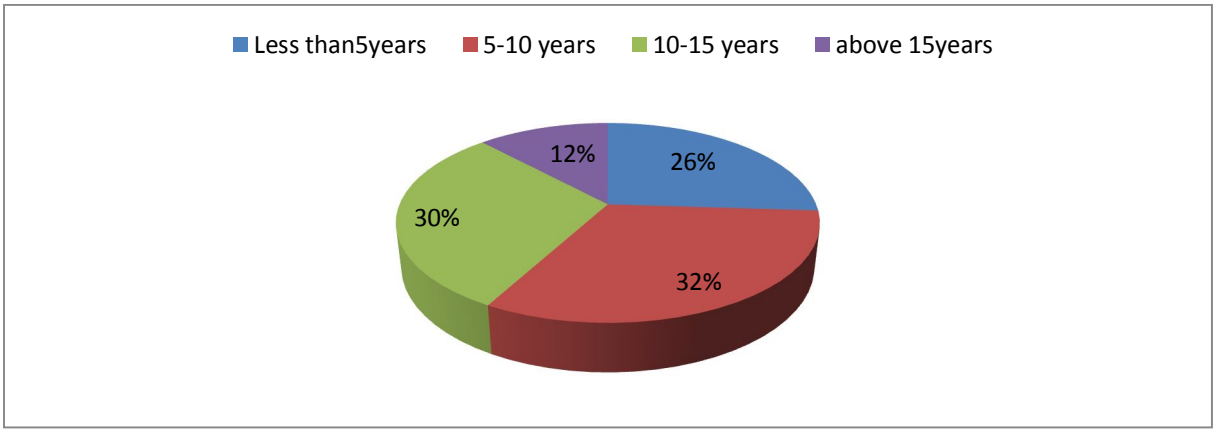

Figure (4.1.2) Experience of Engineers

The analysis of questionnaire survey with respect to the Specializations of Engineers was presented in Table (4.1.3) and Figure (4.1.3)

Table (4.1.3) The Specializations of engineers

Specialization	Frequency	Valid percentage (%)	Cumulative percentage (%)
Architect	17	34%	34%
Civil	24	48%	82%
Other Engineers	9	18%	100%
Total	50	100%	

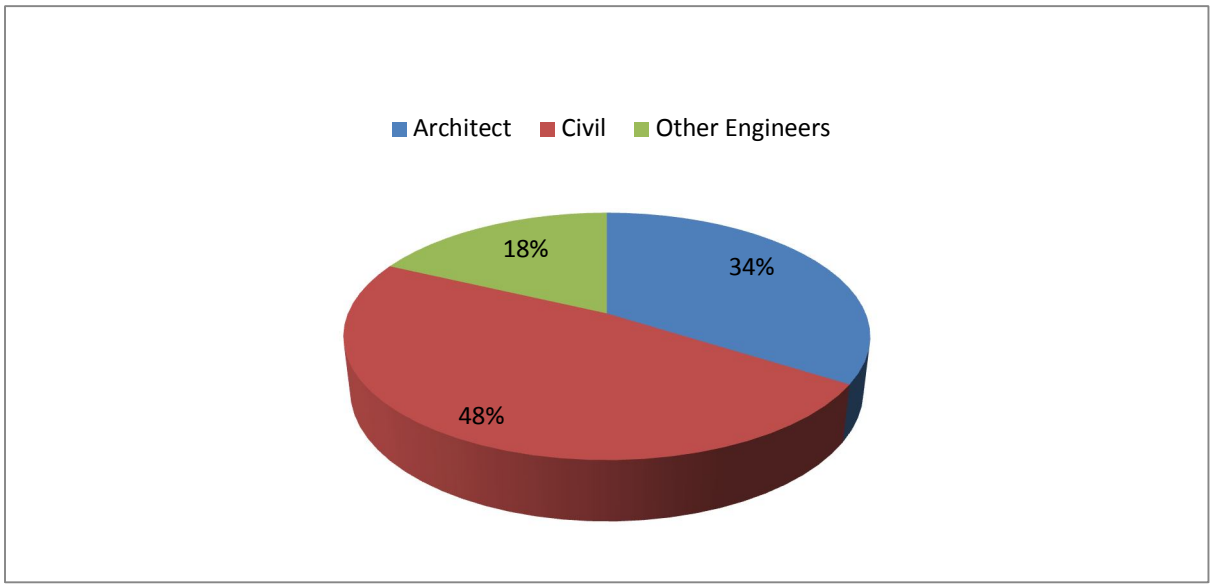

Figure (4.1.3) The Specializations of engineers

The analysis of questionnaire survey with respect to the type of business of constructions firms was presented as shown in Table (4.1.4) and Figure(4.1.4)

Table (4.1.4) Type of business of constructions firms

Type of Business	Frequency	Valid percentage (%)	cumulative Percentage (%)
Consulting	16	32%	32%
Contracting	23	46%	78%
Government Institutions	11	22%	100%
Total	50	100%	

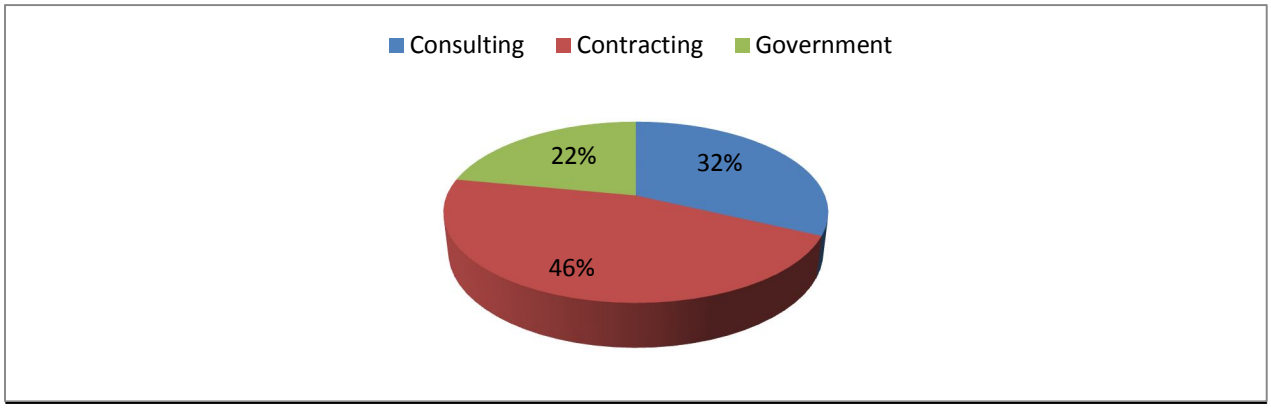

Figure (4.1.4) Type of business of constructions firms

(4.2.2) Assessment Information

The analysis of questionnaire survey with respect to the position of engineer in organization shown in Table (4.2.1) and figure (4.2.1)

Table (4.2.1) The position of engineer in organization

Position	Frequency	Valid percentage (%)	Cumulative percentage (%)
Site engineer	9	18%	18%
Office engineer	11	22%	40%
Project manager	10	20%	60%
Top manager	7	14%	74%
C.E.O	6	12%	86%
Safety engineer	4	8%	94%
Inspection engineer	2	4%	98%
Deputy deem	1	2%	100%

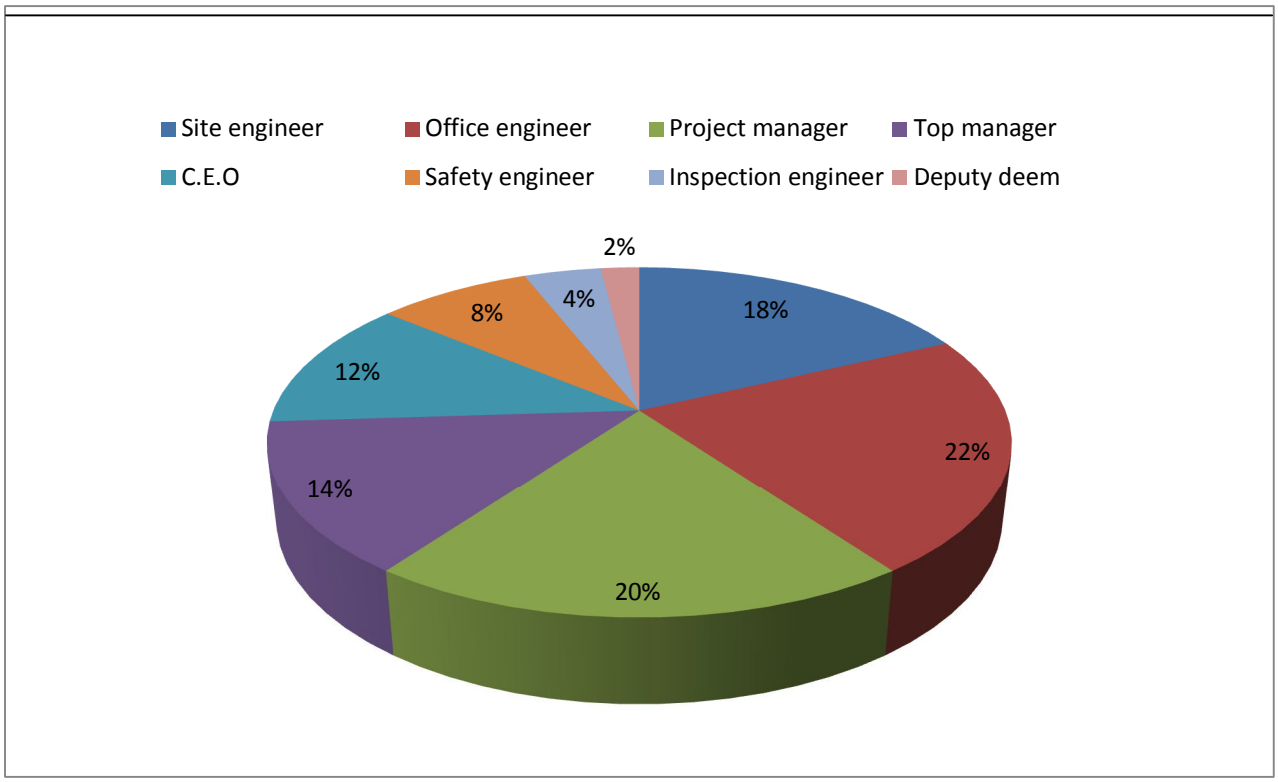

Figure (4.2.1) the position of engineer in organization

The analysis of questionnaire survey with the respect to the stability of engineer in his position in organization was shown in Table (4.2.2) and Figure (4.2.2)

Table (4.2.2) represents the stability of engineer in his position in organization

Stability	Frequency	Valid percentage (%)	cumulative Percentage (%)
Less than 2years	12	**24%**	24%
2-4 years	22	**44%**	68%
4-6 years	9	**18%**	86%
6-8 years	4	**8%**	94%
Above 8 years	3	**6%**	100%
Total	50	**100%**	

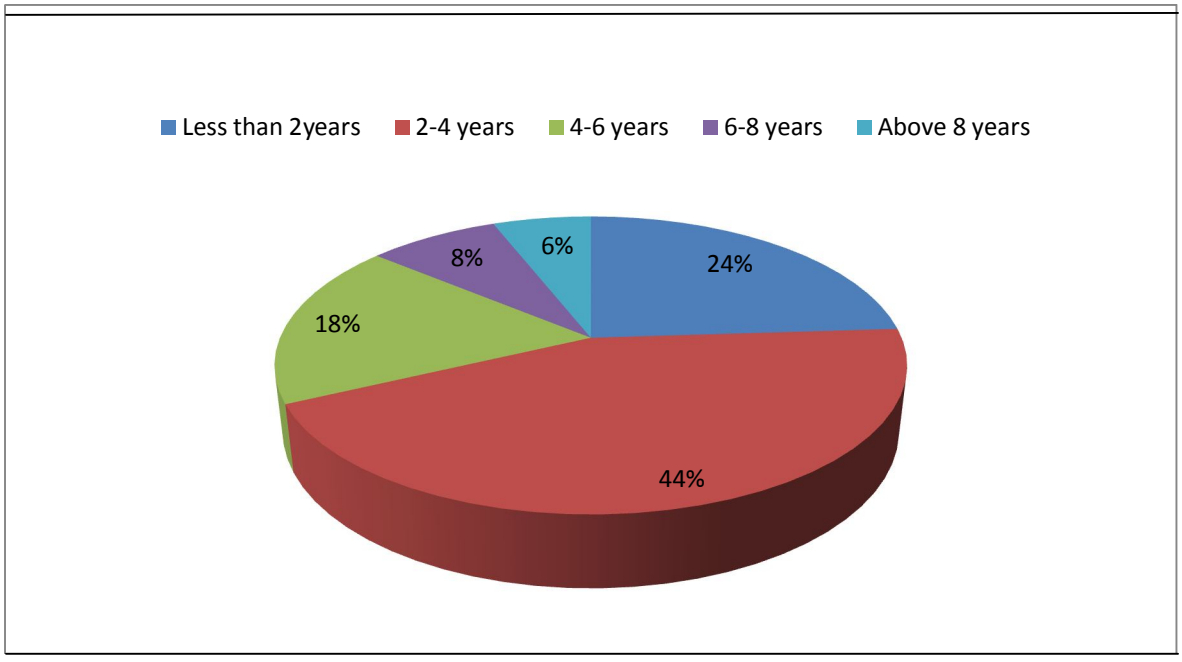

Figure (4.2.2) represents the stability of engineer in his position in organization

The analysis of questionnaire survey with the respect to the average number of employees was shown in table (4.2.3)

Table (4.2.3) represents the average number of employees

Average number of employees	Frequency	Valid percentage (%)	cumulative percentage (%)
Less than 50	16	32%	32%
50-100	14	28%	60%
100-150	8	16%	76%
150-200	7	14%	90%
Above 200	5	10%	100%
Total	50	100%	

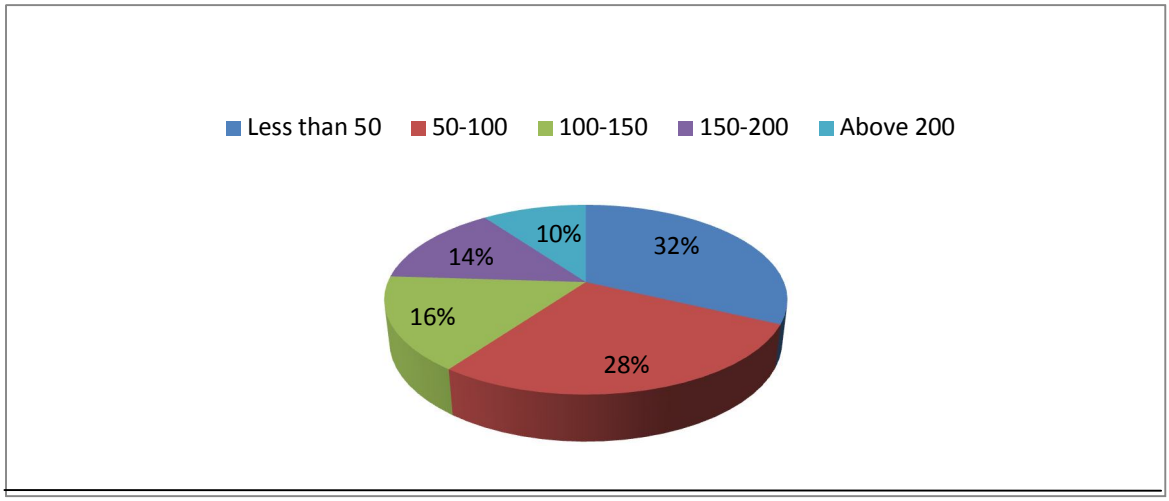

Figure **(4.2.3) represents the average number of employees**

The analysis of questionnaire survey with respect to the annual value of construction contracts was shown in Table (4.2.4) and Figure (4.2.4)

Table (4.2.4) represents the annual value of construction contracts

The annual value of construction contracts	Frequency	Valid percentage	Cumulative percentage
Less than 20,000$	6	12%	12%
20,000$-40,000$	12	24%	36%
40,000$-60,000$	13	26%	62%

60,000$-80,000$	8	16%	78%
80,000$-100,000$	5	10%	88%
Above 100,000$	6	12%	100%
Total	50	100%	

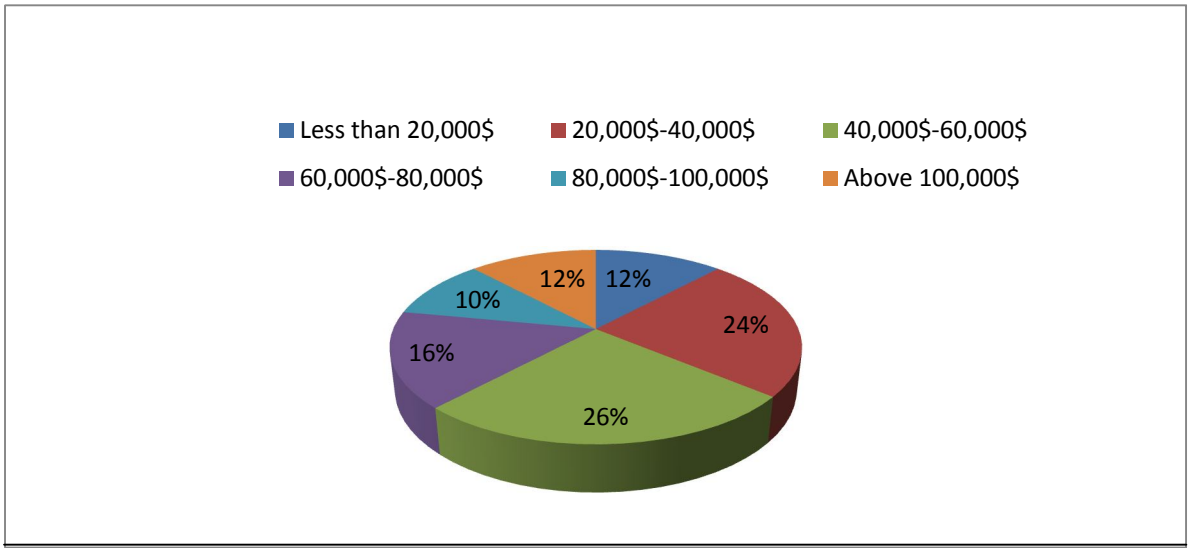

Figure (4.2.4) represents the annual value of construction contracts

The analysis of questionnaire survey with respect to the contracting arrangement the firm's revenue acquired was presented and shown in Table (4.2.5) and Figure (4.2.5)

Table (4.2.5) represents the contracting arrangement the firm's revenue acquired

Type of contract	Frequency	Valid percentage	Cumulative percentage
construction management (agency)	11	22%	22%
general contracting	18	36%	58%
Subcontracting	7	14%	72%
construction management at risk	2	4%	76%
specialty contracting	4	8%	84%
design-build	8	16%	100%
Total	50	100%	

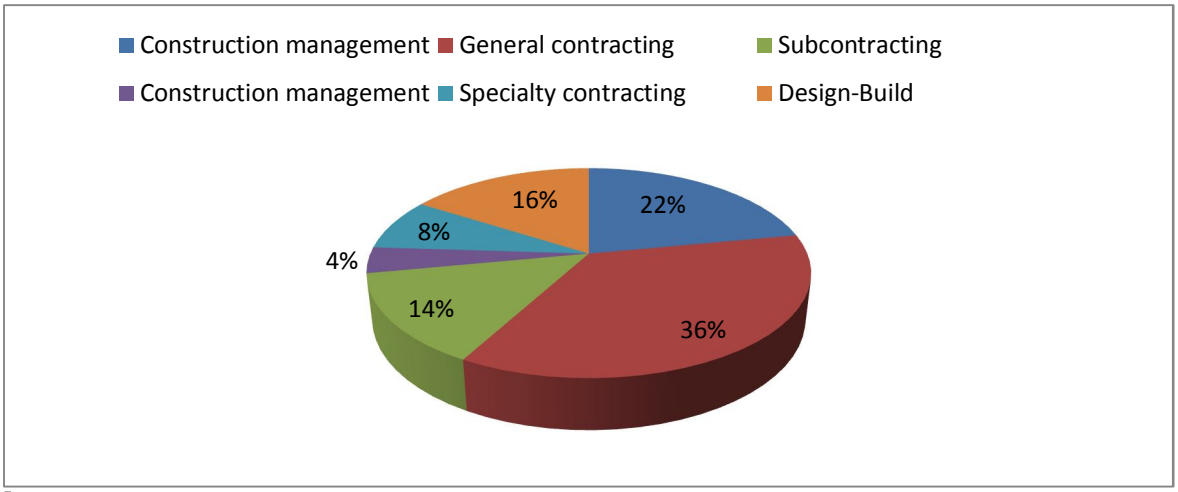

Figure (4.2.5) represents the contracting arrangement the firm's revenue acquired

The analysis of questionnaire survey with respect to the firm's area(s) of operation was presented and shown in table (4.2.6) and figure (4.2.6).

Table (4.2.6) represents the firm's area(s) of operation

Firm's area(s) of operation	Frequency	Valid percentage	cumulative percentage
international	**2**	**4%**	**4%**
national	**25**	**50%**	**54%**
regional	**15**	**30%**	**84%**
Local	**8**	**16%**	**100%**
Total	**50**	**100%**	

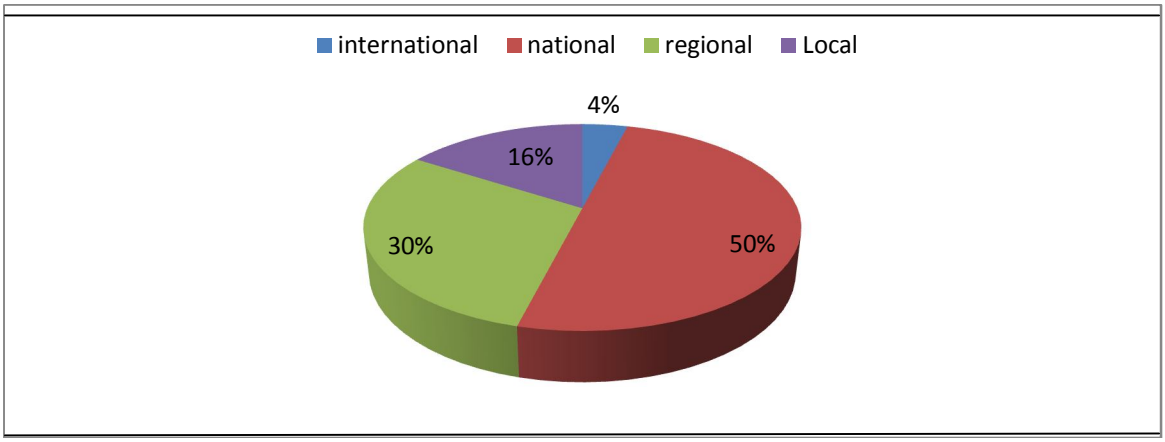

Figure (4.2.6) represents the firm's area(s) of operation

(4-2-3) preference scale

The analysis of questionnaire survey shows that the approach that engineers prefer to provide construction worker safety from table (4-3-1) by percentage:

Prescriptive approach **(54%),** Safety economic performance approach **(46%)**

Table (4.3.1) represents the approach that engineers prefer to provide construction worker safety

Type of approach	**Frequency**	**Valid percentage (%)**	**Cumulative Percentage (%)**
prescriptive approach	**27**	54%	54%
Safety economic performance approach	**23**	46%	100%
Total	**50**	100%	

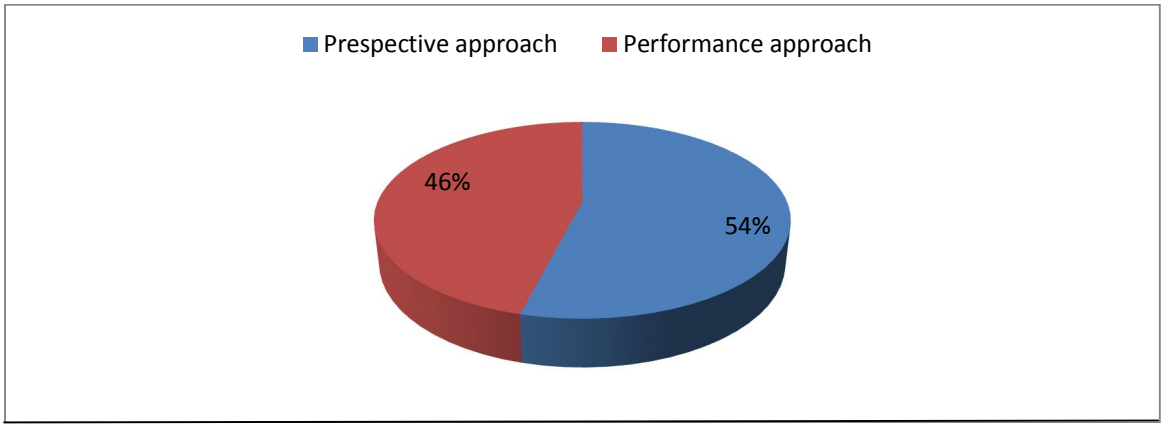

Figure (4.3.1) represents the approach that engineers prefer to provide construction worker safety

The analysis of questionnaire survey shows that the understanding of the concepts of prescriptive and safety economic performance standards as shown in table (4.3.2) and Figure (4.3.2)

Table (4.3.2) represents the understanding of the concepts of prescriptive and safety economic performance standards

Understanding scale	**Frequency**	**Valid percentage**	**cumulative percentage**
Very poorly	6	12%	12%
Poorly	9	18%	30%
Moderate	16	32%	62%
Well	14	28%	90%
Very well	5	10%	100%
Total	50	100%	

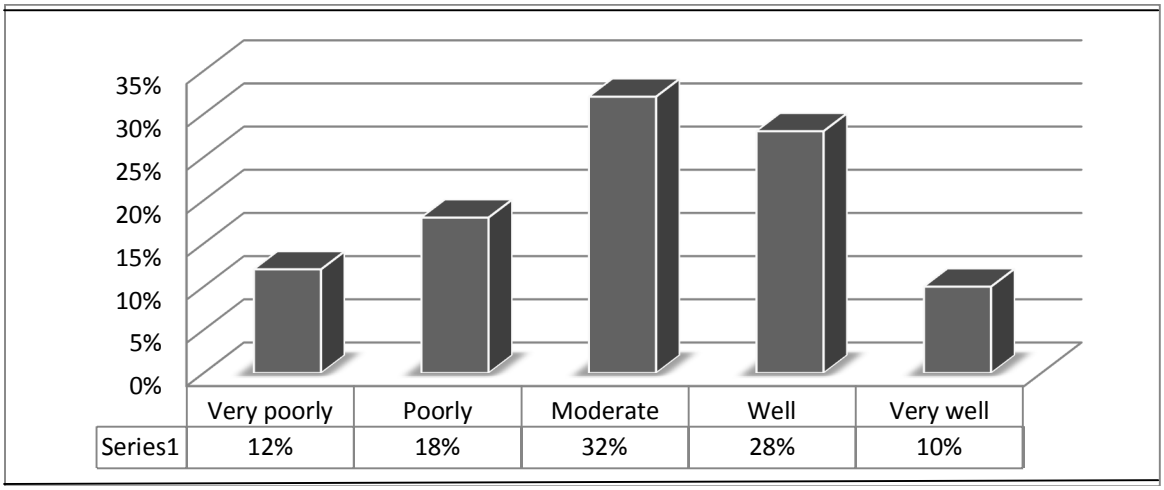

Figure (4.3.2) represents the understanding of the concepts of prescriptive and safety economic performance standards

(4 .2.4) The influential types of approaches

The analysis of questionnaire survey with respect to the type of approaches for ease of introducing of new technologies was shown in table (4.4.1) and figure (4.4.1)

Table (4.4.1) represents the types of approaches for Ease of introducing of new technologies

Types of approaches	Frequency	Valid percentage(%)	Cumulative Percentage(%)
Safety economic performance approach	17	34%	34%
Agree to performance Approach	9	18%	52%
Neutral	10	20%	72%
Resistance performance	5	10%	82%
perspective approach	9	18%	100%
Total	50	100%	

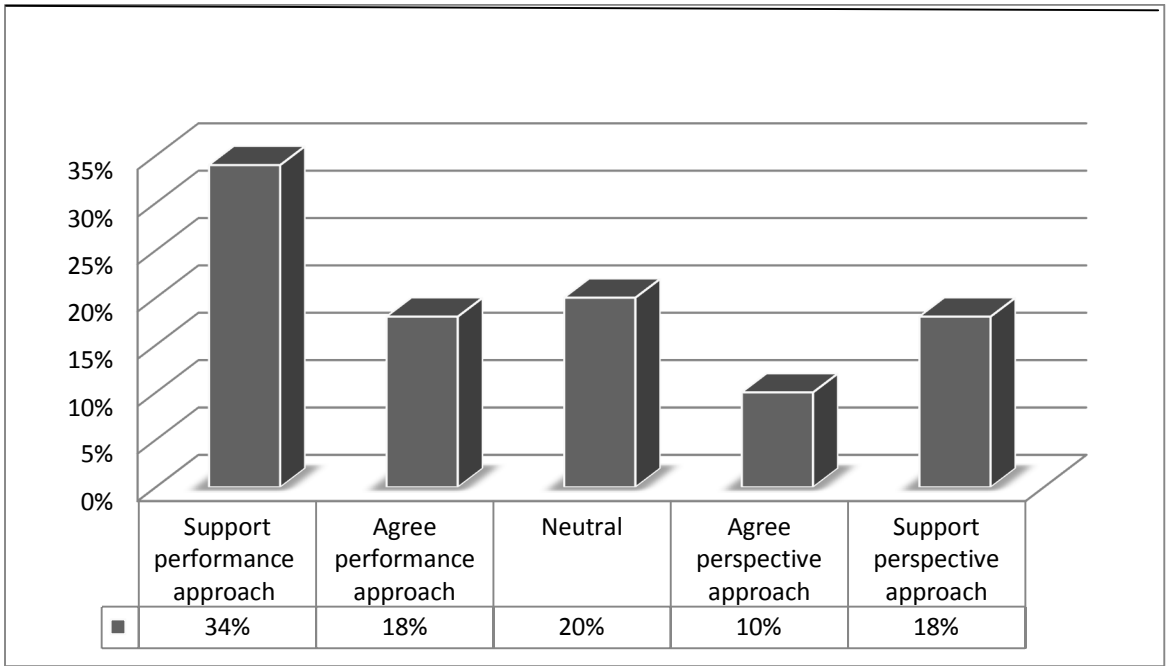

Figure (4.4.1) represents the types of approaches for Ease of introducing of new technologies

The analysis of questionnaire survey with respect to the cost effectiveness of approach was shown and presented in table (4.4.2) and Figure(4.4.2)

Table (4.4.2) represents the cost effectiveness of approach

Types of approaches	Frequency	Valid percentage (%)	cumulative Percentage (%)
Support Safety economic performance approach	12	26%	26%
Agree to performance Approach	7	14%	40%
Neutral	6	12%	52%
Agree to perspective approach	11	22%	74%
Support perspective approach	14	28%	100%
Total	50	100%	

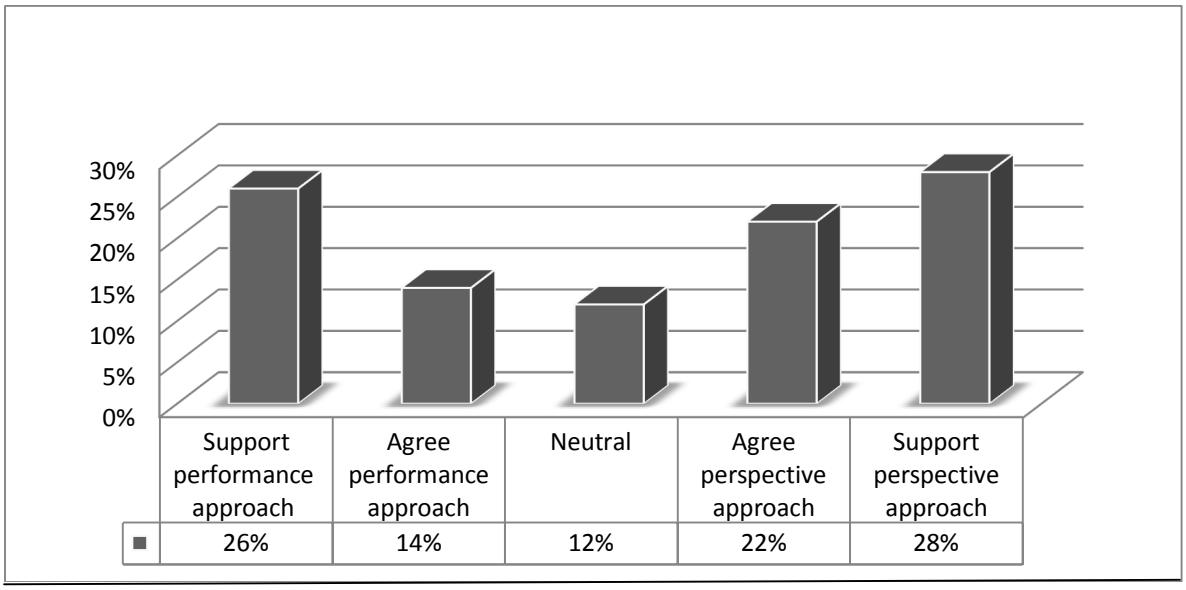

Figure (4.4.2) represents the cost effectiveness of approach

The analysis of questionnaire survey with respect to the flexibility of approach as shown in Table (4.4.3) and figure (4.4.3)

Table (4.4.3) represents the flexibility of approach

Types of approaches	Frequency	Valid percentage (%)	cumulative Percentage (%)
Support Safety economic performance approach	14	28%	28%
Agree to performance approach	10	20%	48%
Neutral	9	18%	66%
Agree to perspective approach	9	18%	84%
Support perspective approach	8	16%	100%
Total	50	100%	

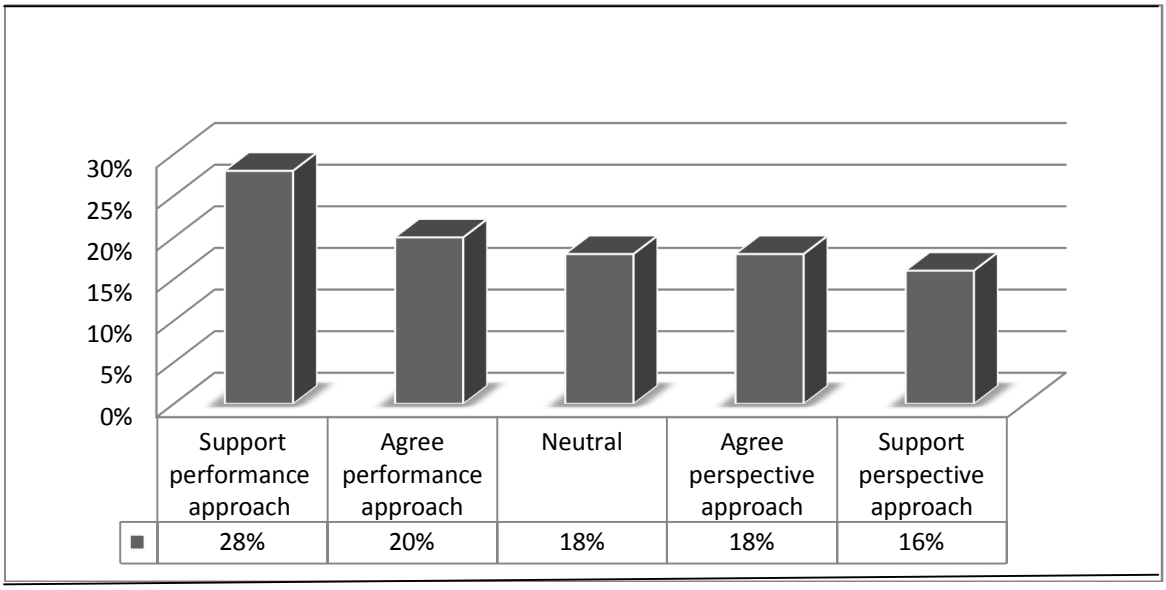

Figure (4.4.3) represents the flexibility of approach

The analysis of questionnaire survey with respect to the Type of approach for ease of implementation shown in Table (4.4.4).and Figure (4.4.4).

Table (4.4.4) Type of approach for ease implementation

Types of approaches	Frequency	Valid percentage	Cumulative Percentage
Support Safety economic performance approach	17	34%	34%
Agree to performance approach	7	14%	48%
Neutral	6	12%	60%
Agree to perspective Approach	8	16%	76%%
Support perspective Approach	12	24%	100%
Total	50	100%	

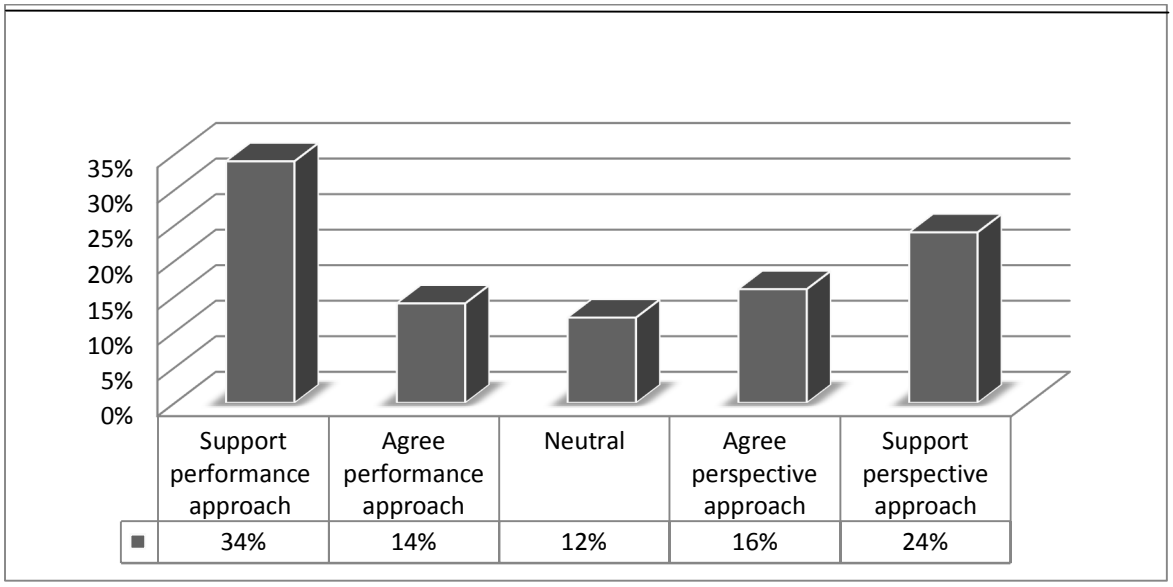

Figure (4.4.4) Type of approach for ease implementation

The analysis of questionnaire survey with respect to the type of approach for ease understanding compliance requirements was shown in Table (4.4.5) and figure (4.4.5)

Table (4.4.5) represents type of approach for ease understanding compliance requirements

Types of approaches	Frequency	Valid percentage (%)	Cumulative percentage (%)
Support Safety economic performance approach	8	16%	16%
Agree to performance Approach	12	24%	40%
Neutral	8	16%	56%
Agree to perspective Approach	13	26%	82%
Support perspective Approach	9	18%	100%
Total	50	100%	

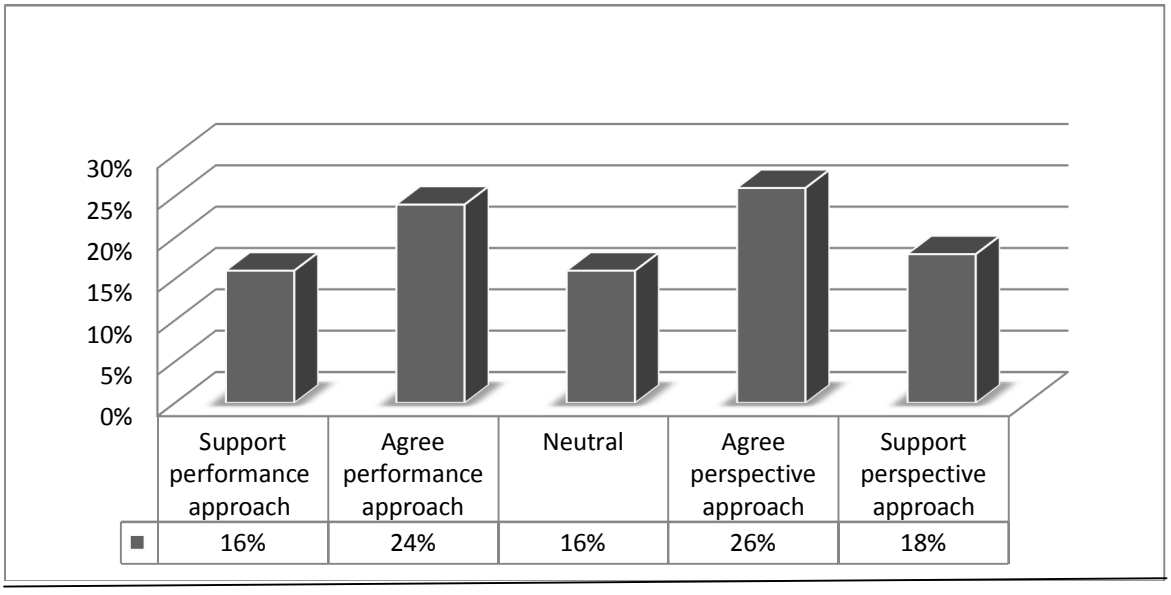

Figure (4.4.5) represents type of approach for ease understanding compliance requirements

The analysis of questionnaire survey with respect to the type of approach for supporting innovation was shown in Table (4.4.6) and figure (4.4.6)

Table (4.4.6) represents Type of approach for supporting innovation

Types of approaches	Frequency	Valid percentage(%)	Cumulative percentage(%)
Support Safety economic performance approach	16	32%	32%
Agree to performance Approach	6	12%	44%
Neutral	7	14%	58%
Agree to perspective Approach	11	22%	80%
Support perspective approach	10	20%	100%
Total	50	100%	

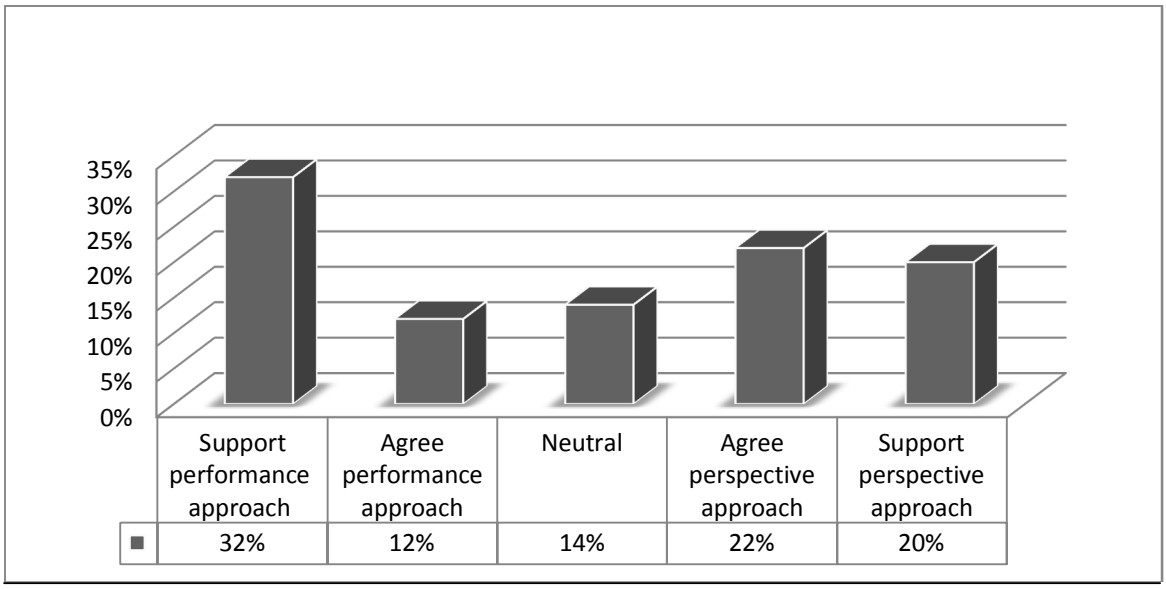

Figure (4.4.6) represents Type of approach for supporting innovation

The analysis of questionnaire survey with respect to the type of approach for Ease introducing of new materials was shown in Table (4.4.7) and Figure (4.4.7)

Table (4.4.7) represents Type of approach for Ease introducing of new materials

Types of approaches	Frequency	Valid percentage	cumulative percentage
Support Safety economic performance approach	11	22%	22%
Agree to performance Approach	9	18%	40%
Neutral	14	28%	68%
Agree to perspective Approach	11	22%	90%
Support perspective Approach	5	10%	100%
Total	50	100%	

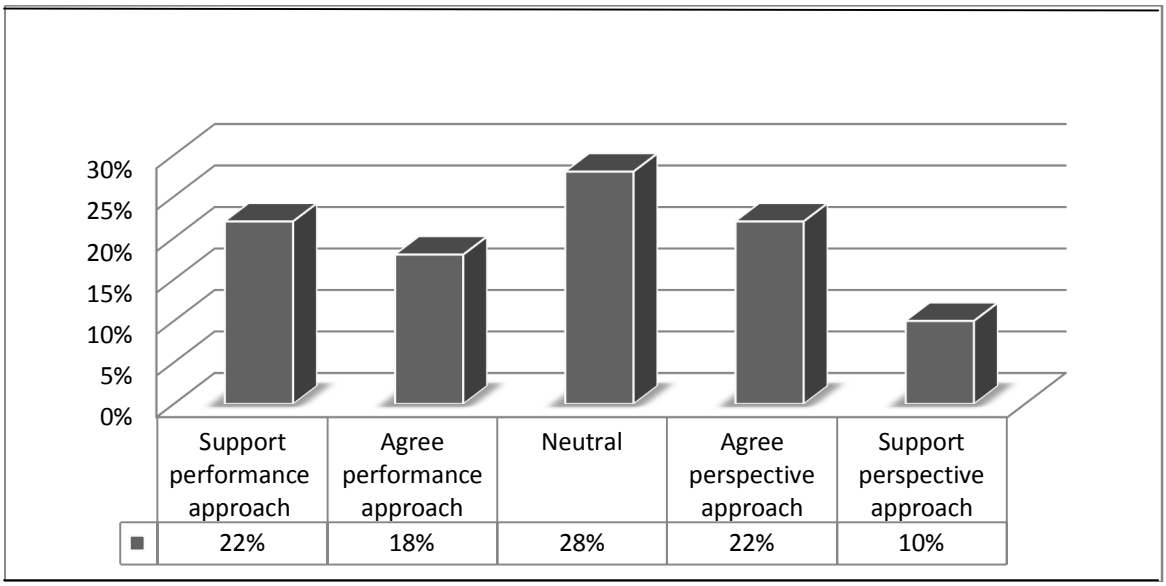

Figure (4.4.7) represents Type of approach for Ease introducing of new materials

(4.3 .5): Supported by the corporate culture, vision and mission of your organization

The analysis of questionnaire survey with respect to the type of approach for Potential improving safety performance was shown in Table (4.5.1) and figure (4.5.1)

Table (4.5.1) represents Type of approach for Potential improving safety performance

Types of approaches	Frequency	Valid percentage(%)	cumulative percentage(%)
Support Safety economic performance approach	9	18%	18%
Agree to performance approach	10	20%	38%
Neutral	7	14%	52%
Agree to perspective approach	13	26%	78%
Support perspective approach	11	22%	100%
Total	50	100%	

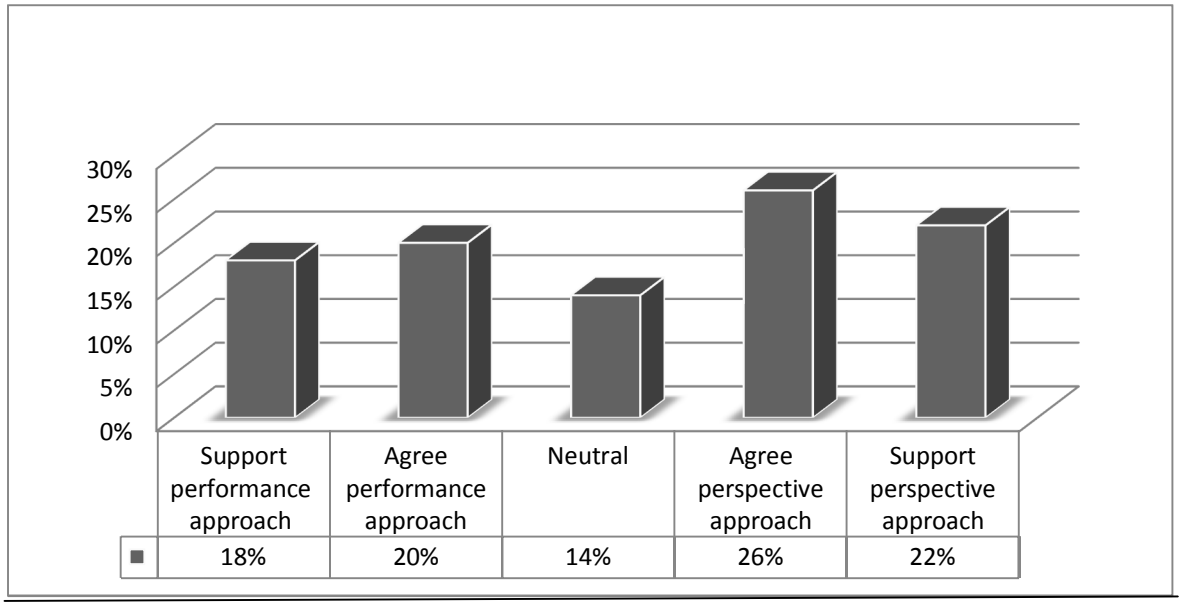

Figure (4.5.1) represents Type of approach for Potential improving safety performance

The analysis of questionnaire survey with respect to the type of approach for simplicity of interpretation was shown in Table (4.5.2) and Figure (4.5.2)

Table (4.5.2) represents which type of approach is simplicity of interpretation

Types of approaches	Frequency	Valid percentage (%)	Cumulative percentage(%)
Support Safety economic performance approach	14	28%	28%
Agree to performance Approach	9	18%	46%
Neutral	5	10%	56%
Agree to perspective Approach	6	12%	68%
Support perspective Approach	16	32%	100%
Total	50	100%	

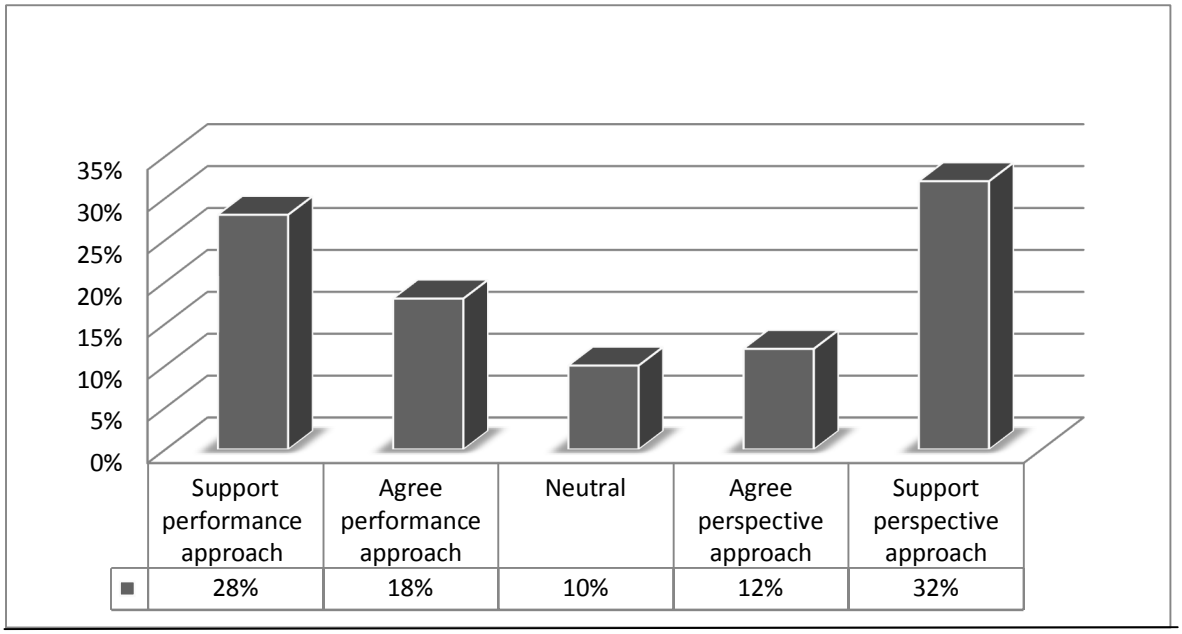

Figure (4.5.2) represents which type of approach is simplicity of interpretation

The analysis of questionnaire survey with respect to the Type of approach for Ease of compliance was shown in Table (4.5.3) and Figure (4.5.3)

Table (4.5.3) Represents Type of approach for Ease of compliance

Types of approaches	Frequency	Valid percentage(%)	cumulative percentage(%)
Support Safety economic performance approach	9	18%	18%
Agree to performance approach	8	16%	34%
Neutral	12	24%	58%
Agree to perspective approach	10	20%	78%
Support perspective approach	11	22%	100%
Total	50	100%	

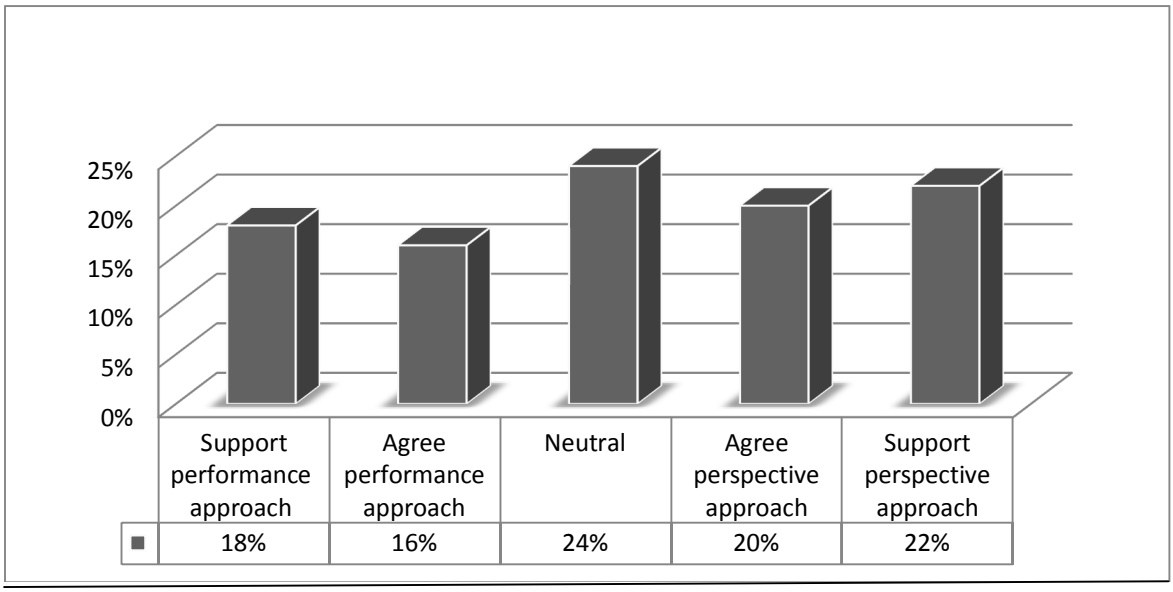

Figure (4.5.3) Represents Type of approach for Ease of compliance

(4.2.6)Importance scale

The analysis of questionnaire survey with respect to the Important of Cost effectiveness of approach was shown in Table (4.6.1) and figure (4.6.1)

Table (4.6.1) represents The Important of Cost effectiveness

Importance scale	Frequency	Valid percentage (%)	cumulative Percentage (%)
Not important	2	4%	4%
Less important	11	22%	26%
Moderate	9	18%	44%
Important	17	34%	78%
Very important	11	22%	100%
Total	50	100%	

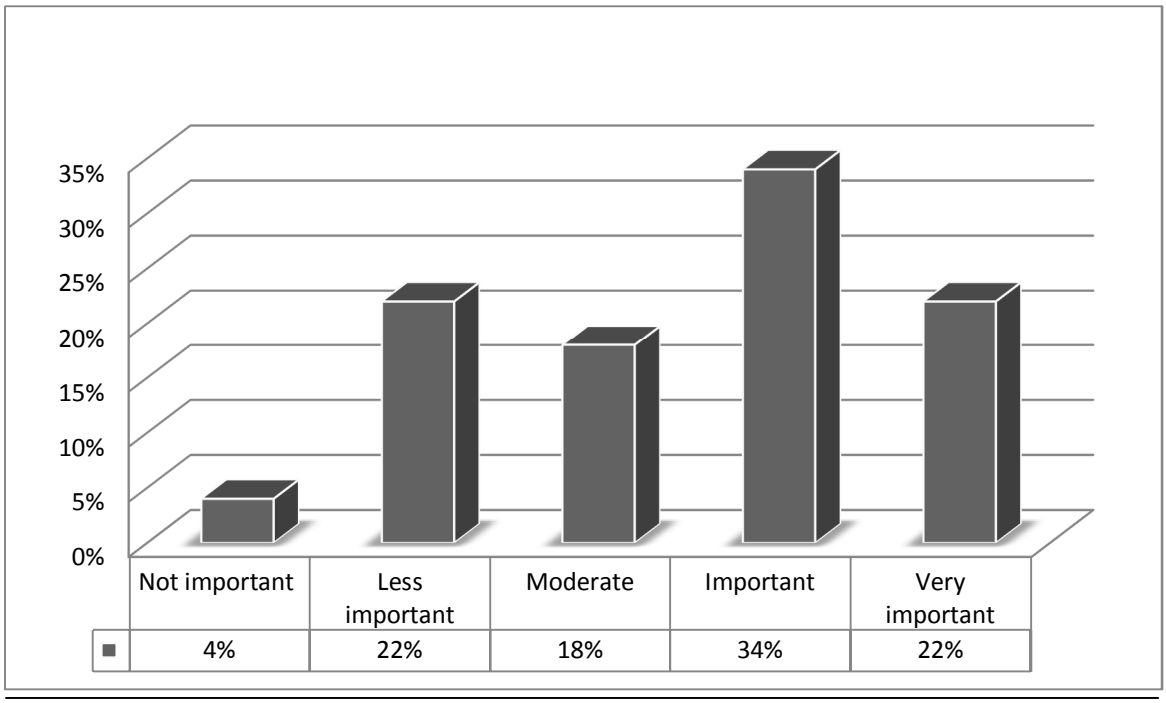

Figure (4.6.1) represents The Important of Cost effectiveness

The analysis of questionnaire survey with respect to The Importance for ease of implementation of the approach was shown in Table (4.6.2).and Figure (4.6.2)

Table (4.6.2) represents The Importance for ease of implementation of the approach

Importance scale	Frequency	Valid percentage (%)	cumulative Percentage (%)
Not important	3	6%	6%
Less important	9	18%	24%
Moderate	13	26%	50%
Important	12	24%	74%
Very important	13	26%	100%
Total	50	100%	

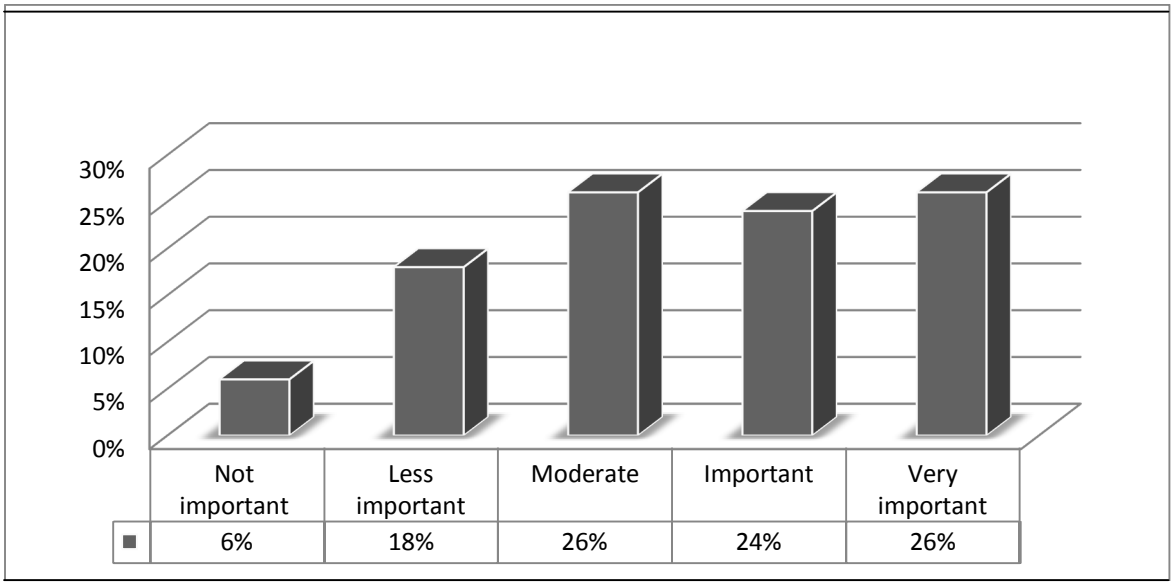

Figure (4.6.2) represents The Importance for ease of implementation of the approach

The analysis of questionnaire survey with respect to the Importance for ease of understanding compliance requirements was shown in Table (4.6.3) and Figure (4.6.3)

Table (4.6.3) Importance for ease of understanding compliance requirements

Importance scale	Frequency	Valid percentage (%)	cumulative Percentage (%)
Not important	1	2%	2%
Less important	4	8%	10%
Moderate	17	34%	44%
Important	16	32%	76%
Very important	12	24%	100%
Total	50	100%	

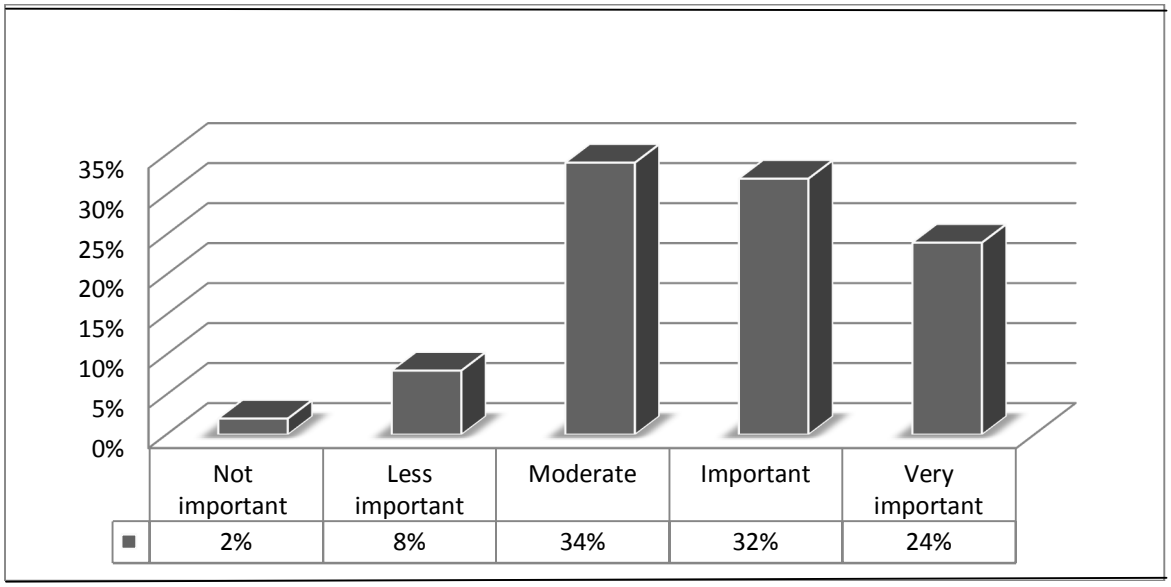

Figure (4.6.3) Importance for ease of understanding compliance requirements

The analysis of questionnaire survey with respect to the Importance of Support for innovation, new materials and technology was shown in Table (4.6.4) and figure (4.6.4)

Table (4.6.4) Importance of Support for innovation, new materials and technology

Importance scale	Frequency	Valid percentage(%)	Cumulative percentage(%)
Not important	4	8%	8%
Less important	14	28%	36%
Moderate	11	22%	58%
Important	12	24%	82%
Very important	9	18%	100%
Total	50	100%	

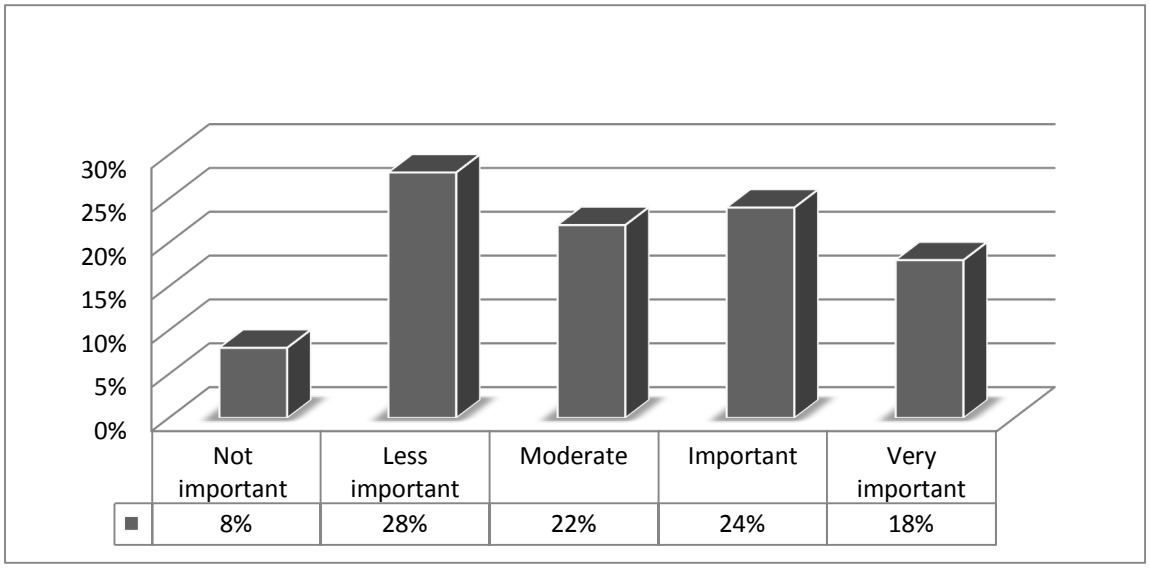

Figure (4.6.4) Importance of Support for innovation, new materials and technology

The analysis of questionnaire survey with the respect to the Potential to improve safety performance on sites was shown in Table (4.6.5) and Figure (4.6.5)

Table (4.6.5) represents The Potential to improve safety performance on sites

Importance scale	Frequency	Valid percentage (%)	Cumulative Percentage (%)
Not important	1	2%	2%
Less important	11	22%	24%
Moderate	14	28%	52%
Important	13	26%	78%
Very important	11	22%	100%
Total	50	100%	

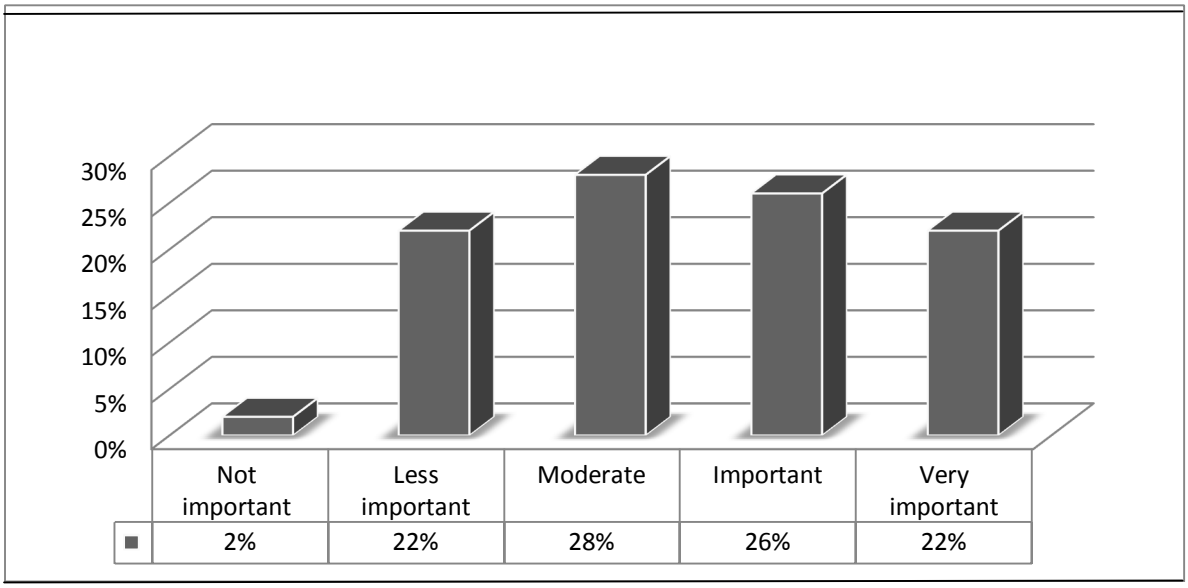

Figure (4.6.5) represents The Potential to improve safety performance on sites

(4.2.7) Influence scale

How influential are the following in driving change within your organization

The analysis of questionnaire survey with the respect to the scale of influence to improve financial performance was shown in Table (4.7.1) and Figure (4.7.1)

Table (4.7.1) represents the scale of influence to improve financial performance

Influence scale	Frequency	Valid percentage(%)	cumulative percentage(%)
Not influential	2	4%	4%
Less influential	5	10%	14%
Moderate	11	22%	36%
Influential	15	30%	66%
very influential	17	34%	100%
Total	50	100%	

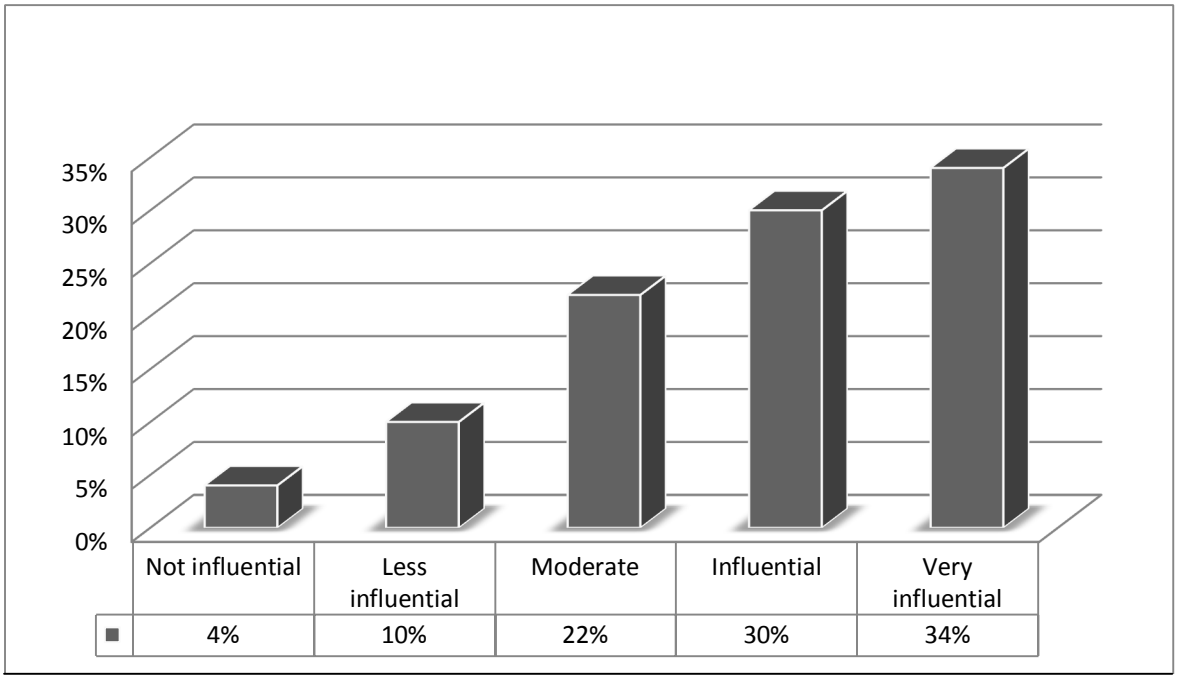

Figure (4.7.1) represents the scale of influence to improve financial performance

The analysis of questionnaire survey with the respect to the scale of influence only as staff turnover occurs was shown in Table (4.7.2) and figure (4.7.2)

Table (4.7.2) represents the scale of influence only as staff turnover occurs

Influence scale	Frequency	Valid percentage (%)	cumulative Percentage (%)
Not influential	6	12%	12%
Less influential	12	24%	36%
Moderate	18	36%	72%
Influential	10	20%	92%
very influential	4	8%	100%
Total	50	100%	

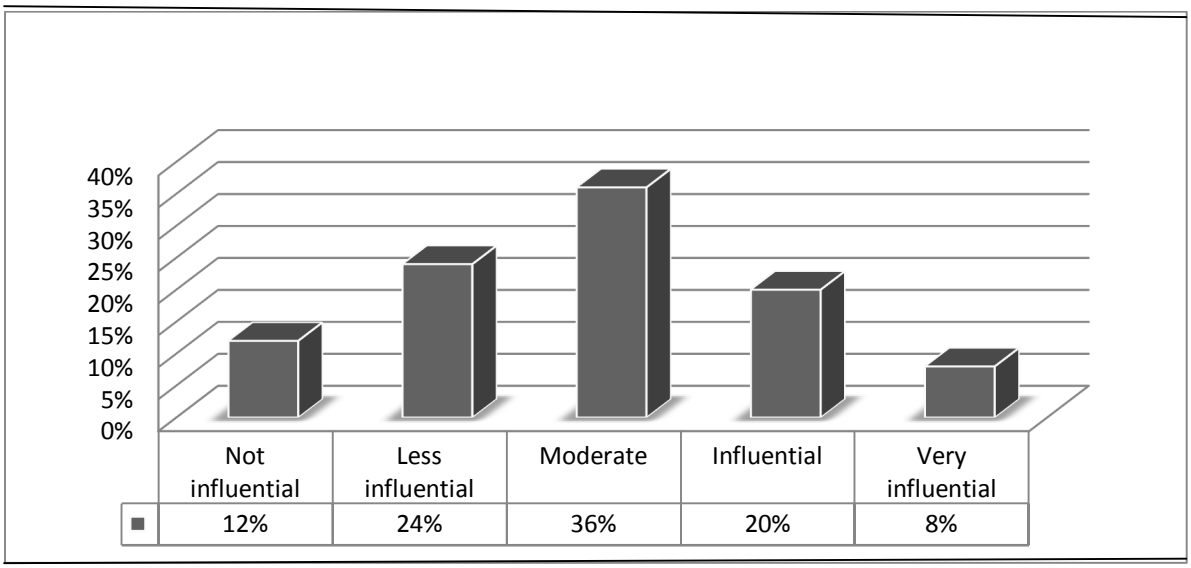

Figure (4.7.2) represents the scale of influence only as staff turnover occurs

The analysis of questionnaire survey with the respect to the scale of influence when new technology is introduced as shown in Table (4.7.3) and Figure (4.7.3).

Table (4.7.3) represents the scale of influence when new technology is introduced

Influence scale	Frequency	Valid percentage (%)	cumulative Percentage (%)
Not influential	2	4%	4%
Less influential	8	16%	20%
Moderate	18	36%	56%
Influential	12	24%	80%
very influential	10	20%	100%
Total	50	100%	

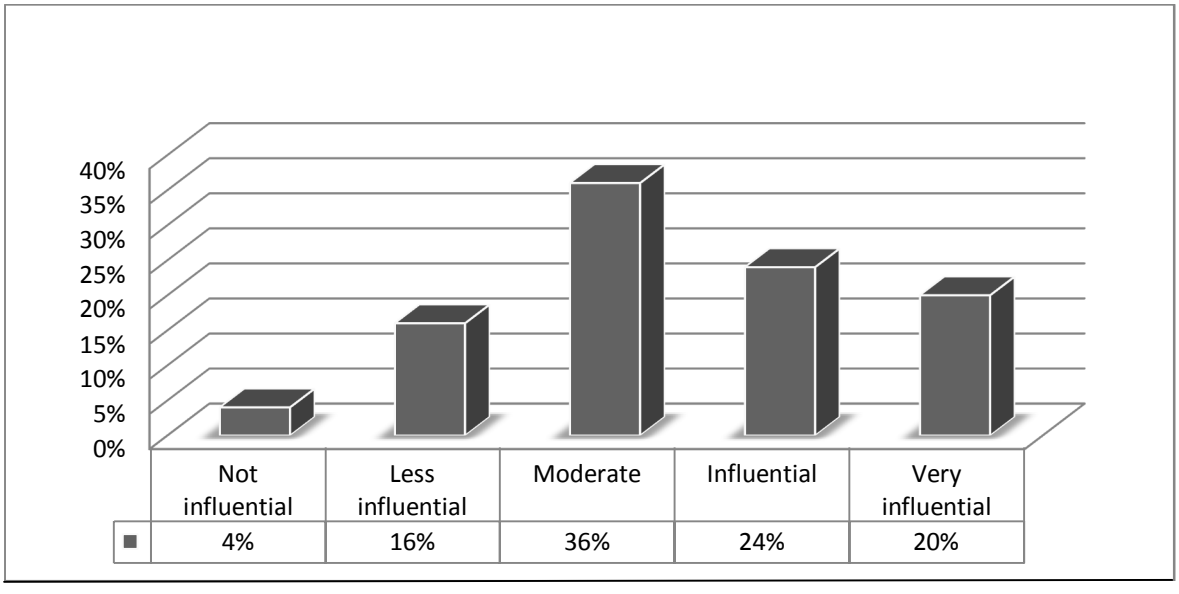

Figure (4.7.3) represents the scale of influence when new technology is introduced

The analysis of questionnaire survey with the respect to the scale of influence to keep up with competitors was shown in table (4.7.4) and Figure (4.7.4).

Table (4.7.4) represents the scale of influence to keep up with competitors

Influence scale	Frequency	Valid percentage (%)	Cumulative percentage (%)
Not influential	1	2%	2%
Less influential	5	10%	12%
Moderate	11	22%	34%
Influential	14	28%	62%
very influential	19	38%	100%
Total	50	100%	

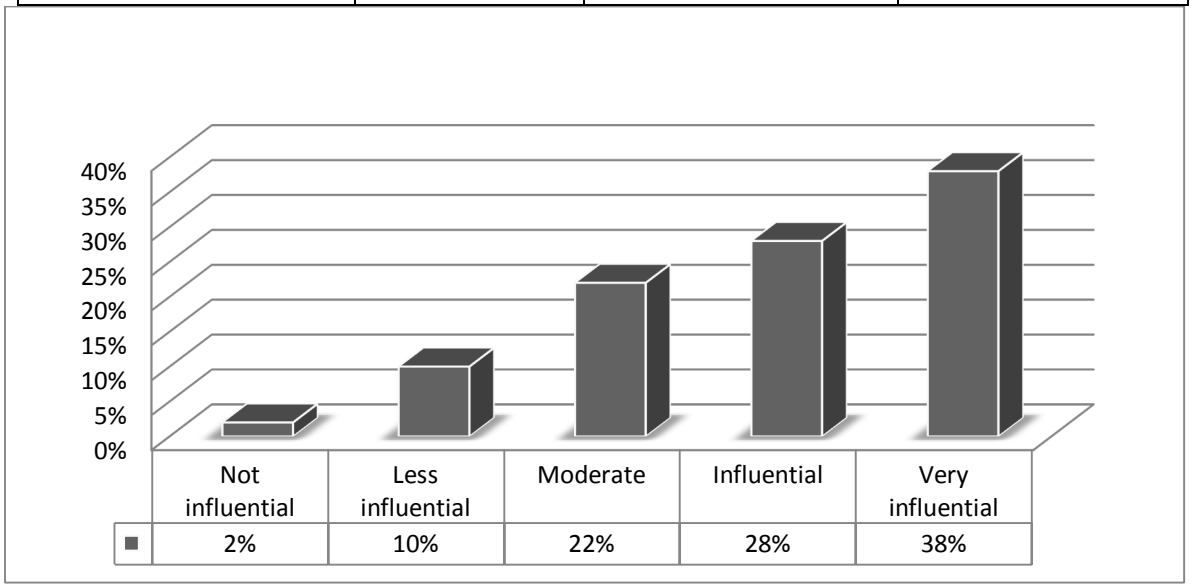

Figure (4.7.4) represents the scale of influence to keep up with competitors

The analysis of questionnaire survey with the respect to the scale of influence to improve your safety record was shown in Table (4.7.5) and Figure (4.7.5).

Table (4.7.5) represents the scale of influence to improve your safety record

Influence scale	Frequency	Valid percentage (%)	cumulative percentage (%)
Not influential	1	2%	2%
Less influential	6	12%	14%
Moderate	11	22%	36%
Influential	18	36%	72%
very influential	14	28%	100%
Total	50	100%	

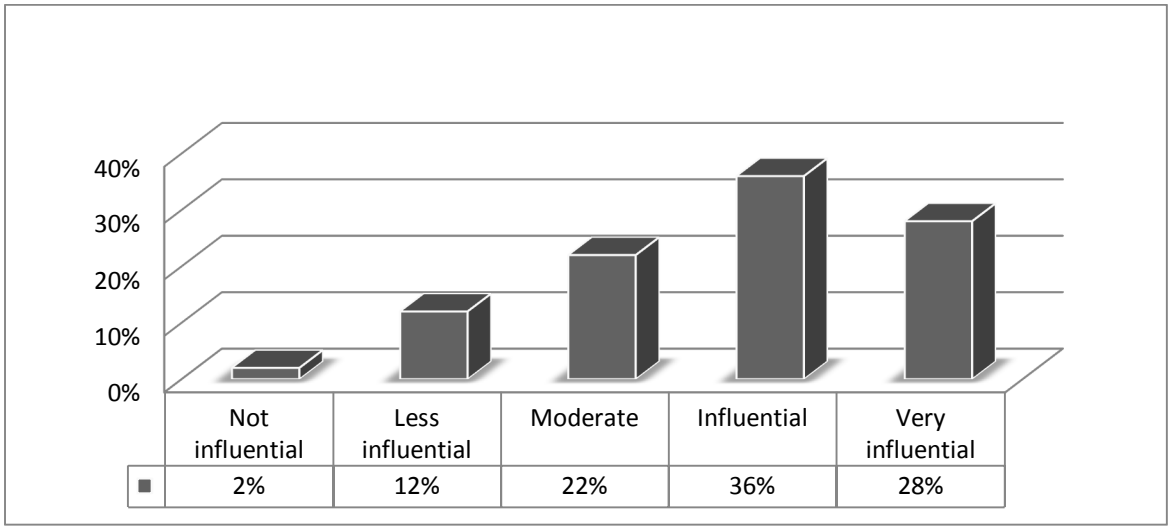

Figure (4.7.5) represents the scale of influence to improve your safety record

The analysis of questionnaire survey with the respect to the scale of influence only after accidents occur was shown in Table (4.7.6) and Figure (4.7.6)

Table (4.7.6) represents the scale of influence only after accidents occur

Influence scale	Frequency	Valid percentage (%)	cumulative Percentage (%)
Not influential	7	14%	14%
Less influential	16	32%	46%
Moderate	14	28%	74%
Influential	8	16%	90%
very influential	5	10%	100%
Total	50	100%	

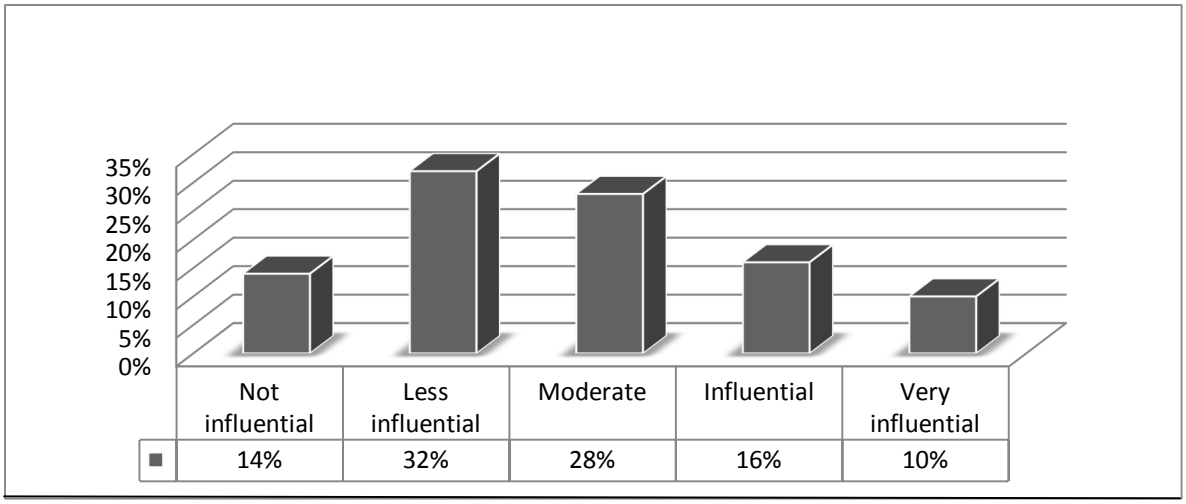

Figure (4.7.6) represents the scale of influence only after accidents occur

The analysis of questionnaire survey with the respect to the scale of influence to meet worker demands was shown in Table (4.7.7) and Figure (4.7.7)

Table (4.7.7) represents the scale of influence to meet worker demands

Influence scale	Frequency	Valid percentage	cumulative percentage
Not influential	4	8%	8%
Less influential	9	18%	26%
Moderate	16	32%	58%
Influential	12	24%	82%
very influential	9	18%	100%
Total	50	100%	

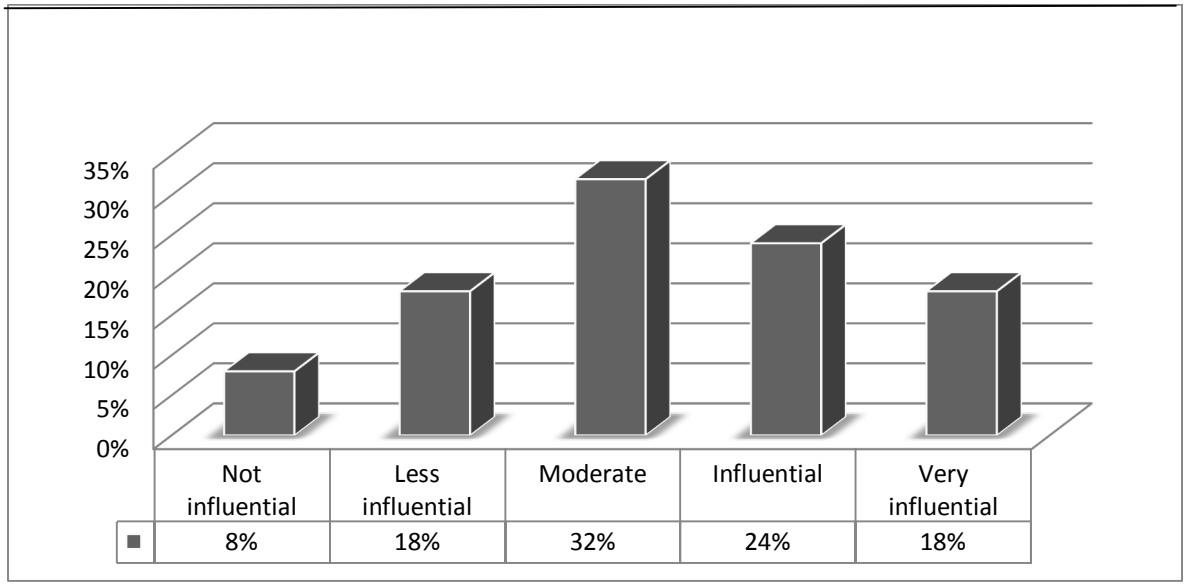

Figure (4.7.7) represents the scale of influence to meet worker demands

The analysis of questionnaire survey with the respect to the scale of influence to generate quality improvements was shown in Table (4.7.8) and Figure (4.7.8)

Table (4.7.8) represents the scale of influence to generate quality improvements

Influence scale	Frequency	Valid percentage (%)	Cumulative Percentage (%)
Not influential	3	6%	6%
Less influential	8	16%	22%
Moderate	13	26%	48%
Influential	15	30%	78%
very influential	11	22%	100%
Total	50	100%	

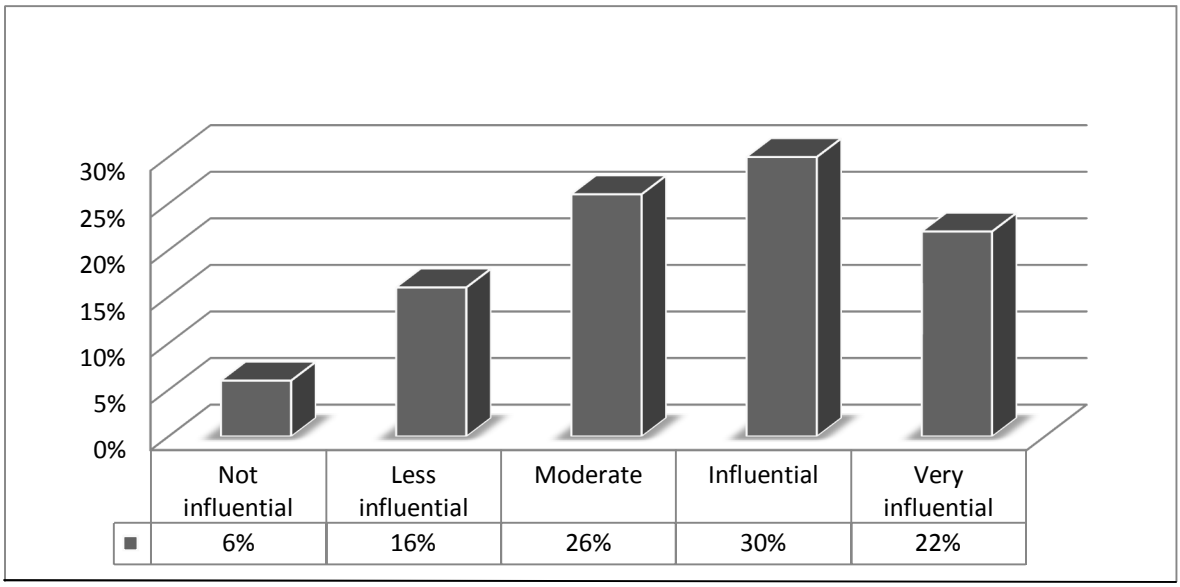

Figure (4.7.8) represents the scale of influence to generate quality improvements

The analysis of questionnaire survey with the respect to the scale of influence to exploit new market opportunities was shown in Table (4.7.9).

Table (4.7.9) represents the scale of influence to exploit new market opportunities

Influence scale	Frequency	Valid percentage(%)	Cumulative percentage(%)
Not influential	1	2%	2%
Less influential	12	24%	26%
Moderate	14	28%	54%
Influential	10	20%	74%
very influential	13	26%	100%
Total	50	100%	

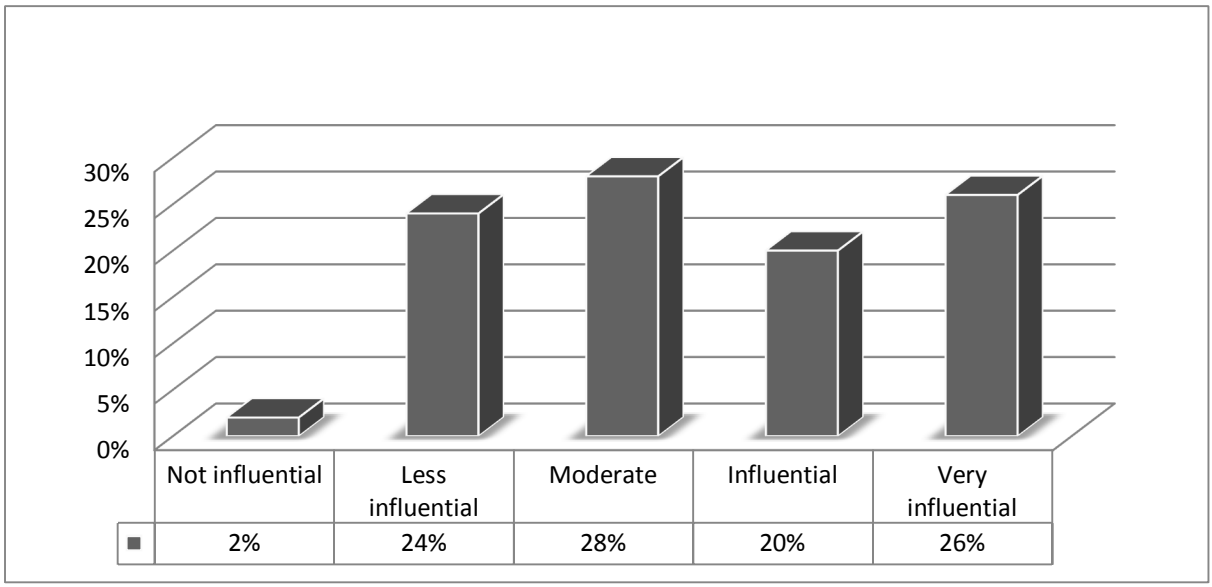

Figure (4.7.9) represents the scale of influence to exploit new market opportunities

The analysis of questionnaire survey with the respect to the scale of influence to management initiatives was shown in Table (4.7.10) and Figure (4.7.10)

Table (4.7.10) represents the scale of influence respond to management initiatives

Influence scale	Frequency	Valid percentage (%)	Cumulative percentage (%)
Not influential	3	6%	6%
Less influential	9	18%	24%
Moderate	17	34%	58%
Influential	13	26%	84%
very influential	8	16%	100%
Total	50	100%	

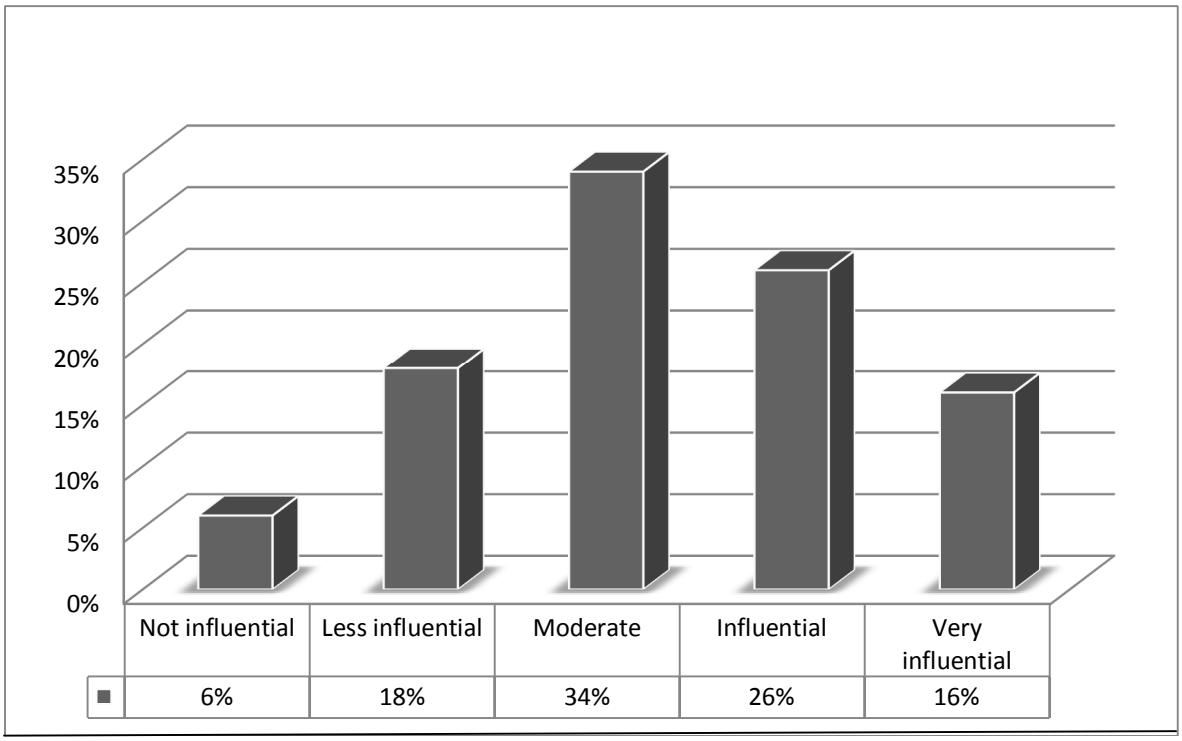

Figure (4.7.10) represents the scale of influence respond to management initiatives

The analysis of questionnaire survey with the respect to the scale of influence to respond to third party claims was shown in Table (4.7.11).

Table (4.7.11) represents the scale of influence to respond to third party claims

Influence scale	Frequency	Valid percentage (%)	Cumulative Percentage (%)
Not influential	2	4%	4%
Less influential	9	18%	22%
Moderate	16	32%	54%
Influential	13	26%	80%
very influential	10	20%	100%
Total	50	100%	

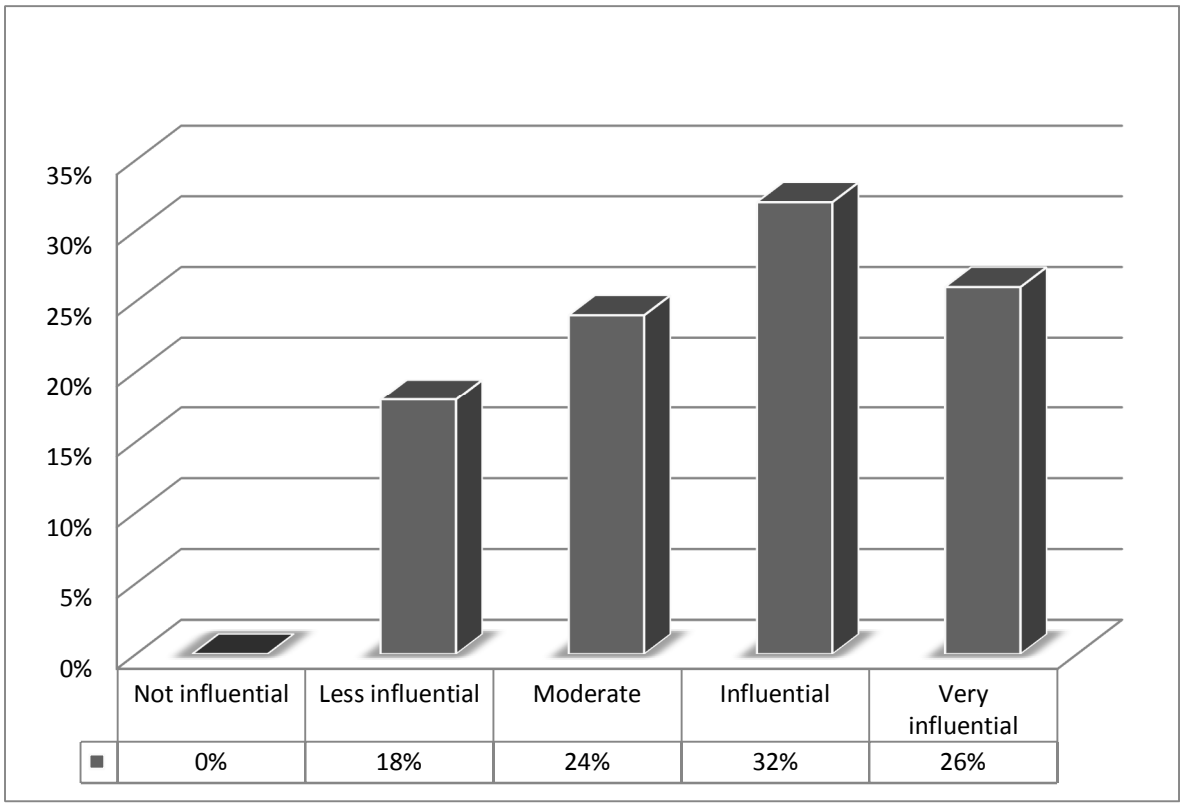

Figure (4.7.11) represents the scale of influence to respond to third party claims

The analysis of questionnaire survey with the respect to the scale of influence to Comply with owner/client requirements was shown in Table (4.7.12).

Table (4.7.12) represents the scale of influence to Comply with owner/client requirements

Influence scale	Frequency	Valid percentage (%)	Cumulative Percentage (%)
Not influential	0	0%	0%
Less influential	9	18%	18%
Moderate	12	24%	42%
Influential	16	32%	74%
very influential	13	26%	100%
Total	50	100%	

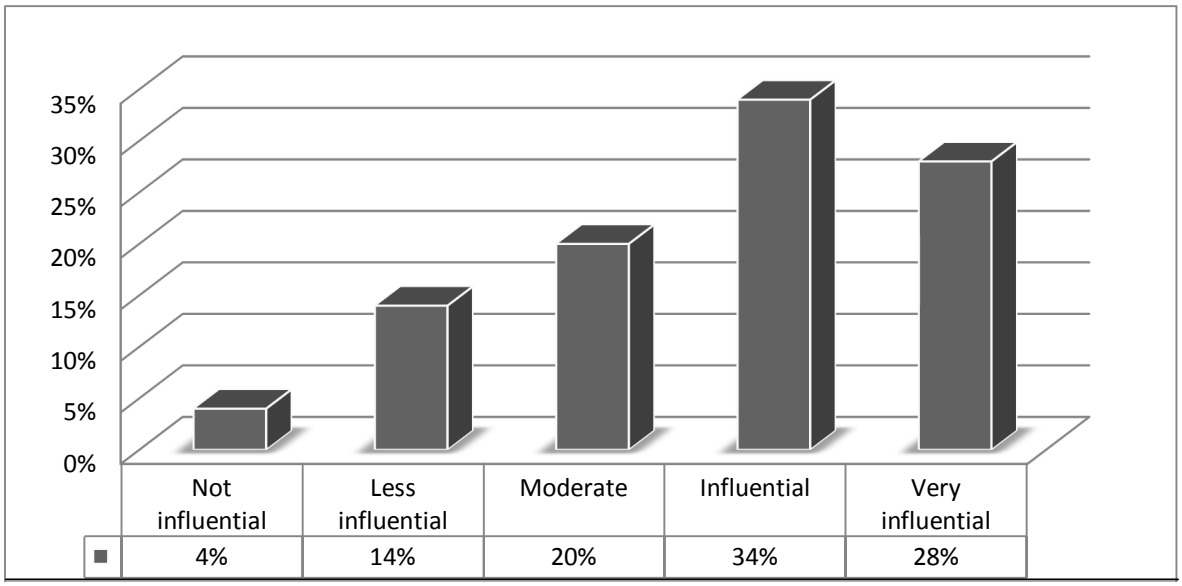

Figure (4.7.12) represents the scale of influence to Comply with owner/client requirement

The analysis of questionnaire survey with the respect to the scale of influence to meet new insurance requirements was shown in Table (4.7.13).

Table (4.7.13) represents the scale of influence to meet new insurance requirements

Influence scale	Frequency	Valid percentage (%)	Cumulative Percentage (%)
Not influential	2	4%	4%
Less influential	7	14%	18%
Moderate	10	20%	38%
Influential	17	34%	72%
very influential	14	28%	100%
Total	50	100%	

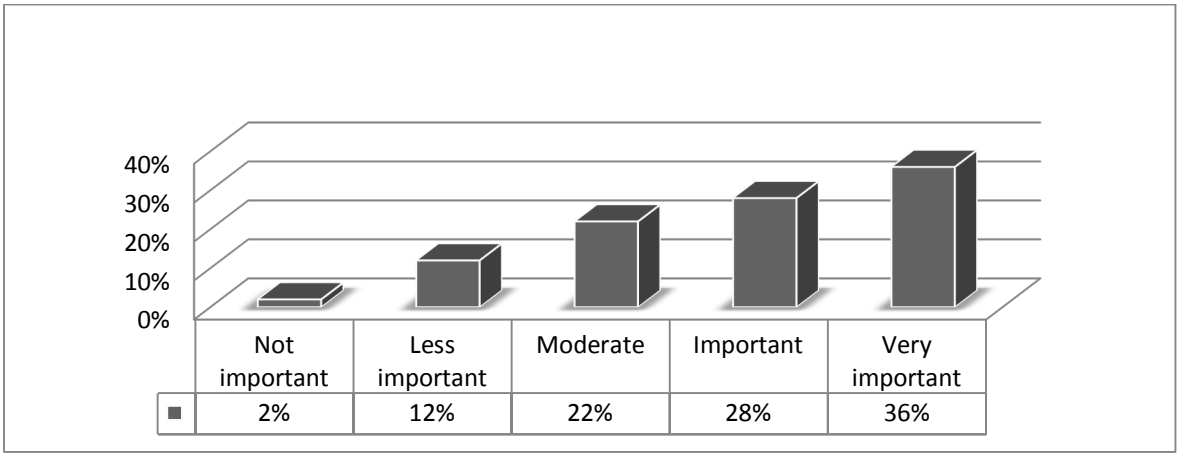

Figure (4.7.13) represents the scale of influence to meet new insurance requirements

(4.2.8) Importance scale

The analysis of questionnaire survey with the respect to the scale of importance for introducing a change to improve safety performance was shown in Table (4.8.1).

Table (4.8.1) represents the scale of importance for introducing a change to improve safety performance

Importance scale	Frequency	Valid percentage(%)	Cumulative percentage(%)
Not important	1	2%	2%
Less important	6	12%	14%
Moderate	11	22%	36%
Important	14	28%	64%
Very important	18	36%	100%
Total	50	100%	

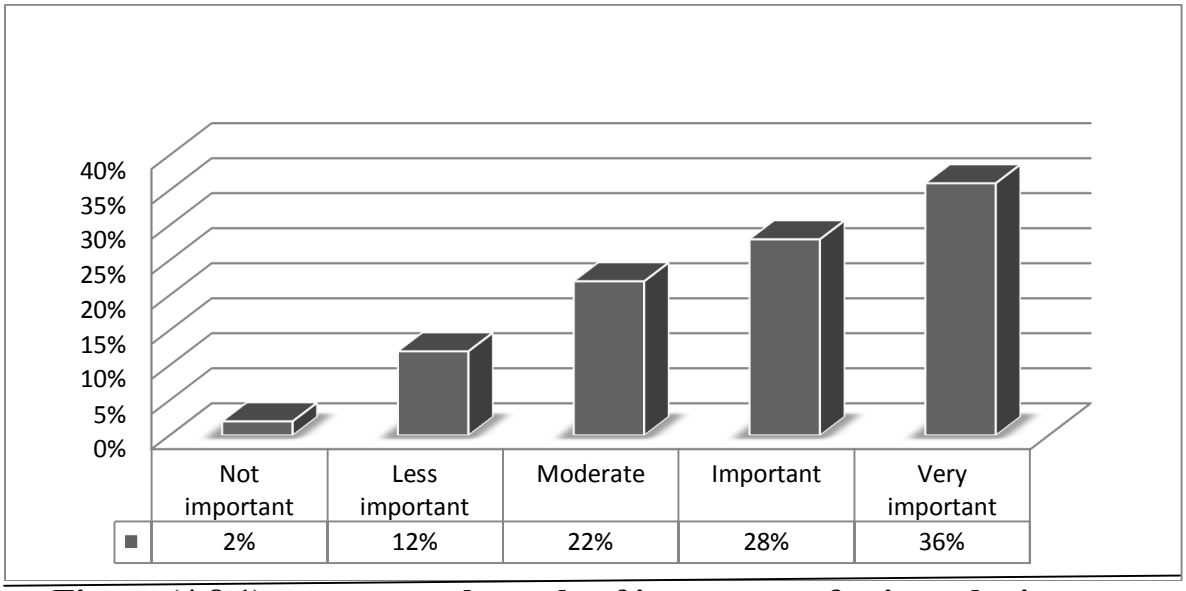

Figure (4.8.1) represents the scale of importance for introducing a change to improve safety performance

The analysis of questionnaire survey with the respect to the scale of importance to break down the resistance of workers to change by convincing them to accept the change was shown in Table (4.8.2) and Figure (4.8.2)

Table (4.8.2) represents the scale of importance to break down the resistance of workers to change by convincing them to accept the change

Importance scale	Frequency	Valid percentage(%)	Cumulative percentage(%)
Not important	2	4%	4%
Less important	6	12%	16%
Moderate	13	26%	42%
Important	17	34%	76%
Very important	12	24%	100%
Total	50	100%	

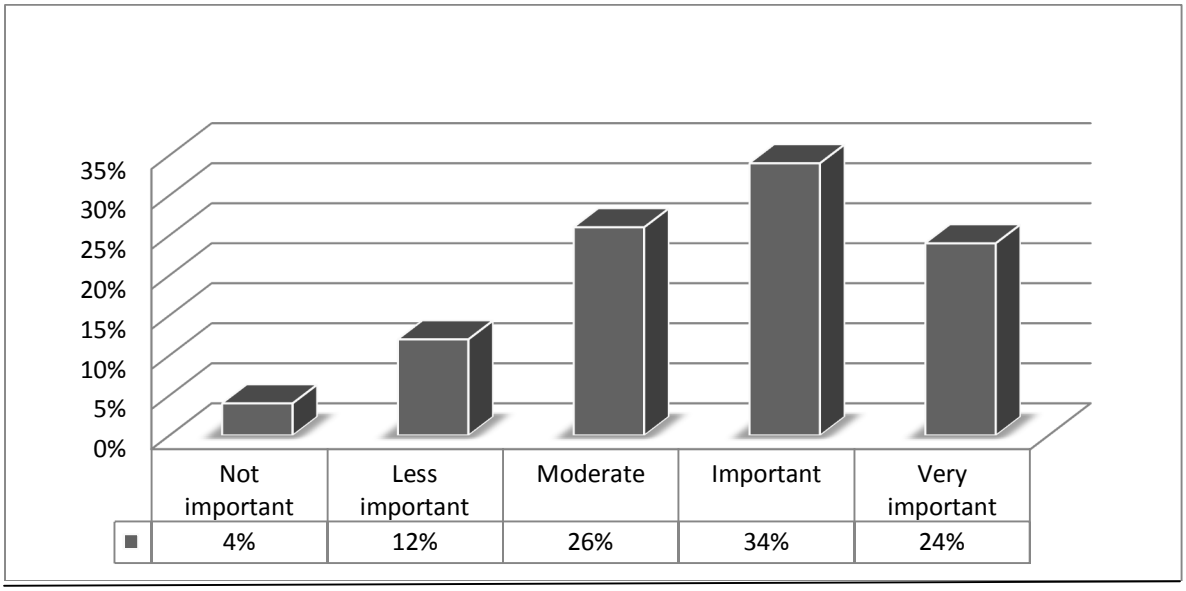

Figure (4.8.2) represents the scale of importance to break down the resistance of workers to change by convincing them to accept the change

The analysis of questionnaire survey with the respect to the scale of to build credibility and trust with the workers before implementing a change was shown in Table (4.8.3) and Figure (4.8.3)

Table (4.8.3) represents the scale of importance to build credibility and trust with the workers before implementing a change

Importance scale	Frequency	Valid percentage (%)	Cumulative percentage (%)
Not important	1	2%	2%
Less important	6	12%	14%
Moderate	11	22%	36%
Important	15	30%	66%
Very important	17	34%	100%
Total	50	100%	

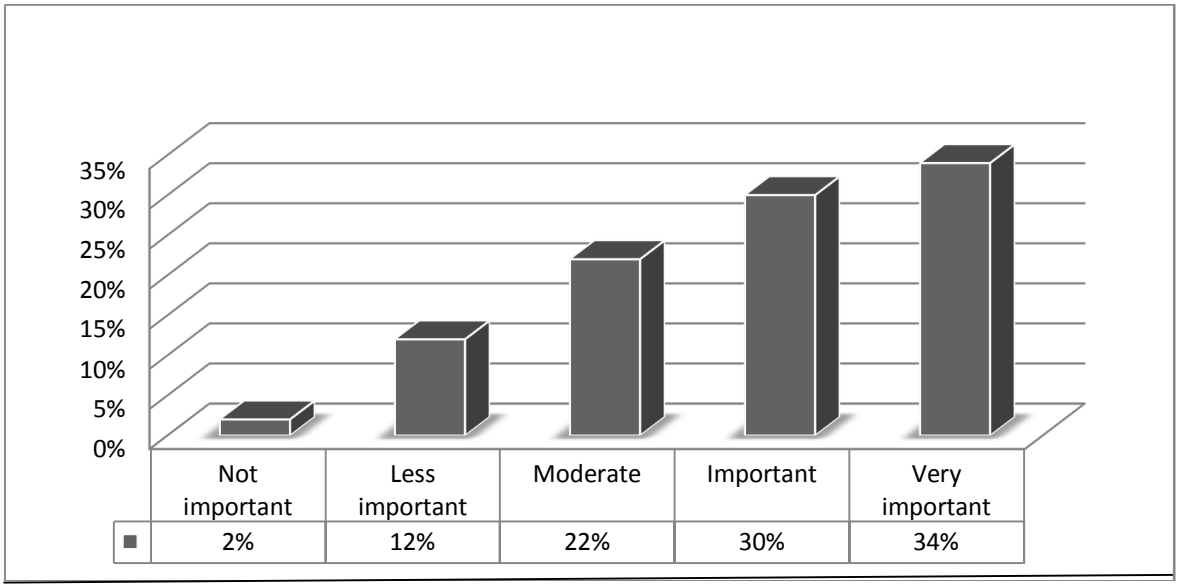

Figure (4.8.3) represents the scale of importance to build credibility and trust with the workers before implementing a change

The analysis of questionnaire survey with the respect to the scale of importance to enlist the opinions of workers on a proposed change before it is implemented was shown in Table (4.8.4) and Figure (4.8.4)

Table (4.8.4) represents the scale of importance to enlist the opinions of workers on a proposed change before it is implemented

Importance scale	Frequency	Valid percentage(%)	cumulative percentage(%)
Not important	1	2%	2%
Less important	7	14%	16%
Moderate	12	24%	40%
Important	16	32%	72%
Very important	14	28%	100%
Total	50	100%	

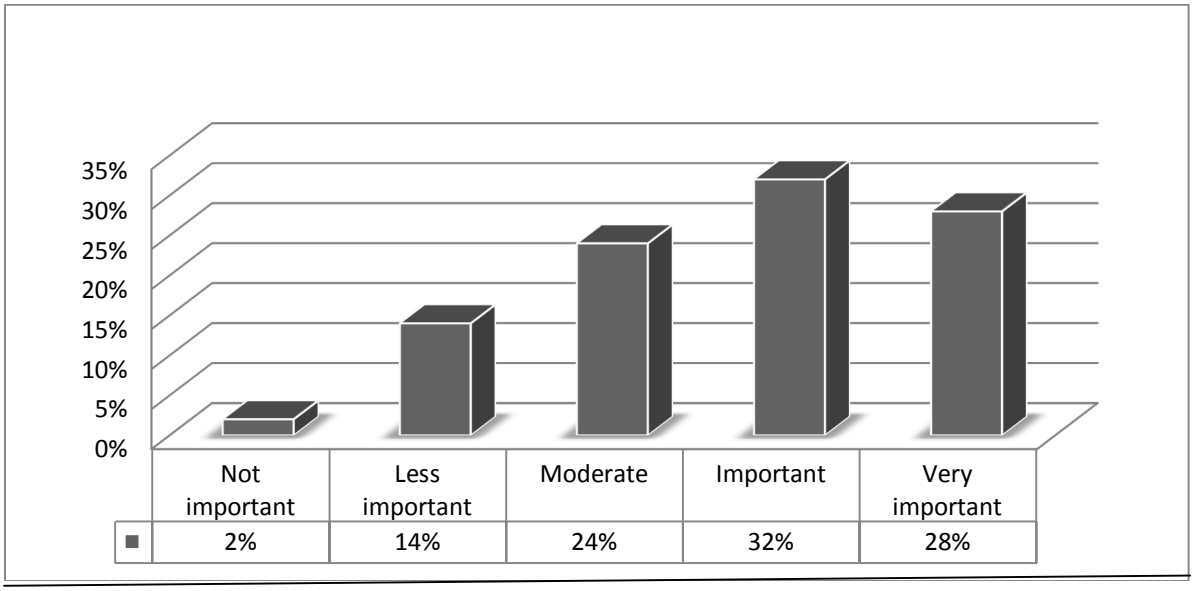

Figure (4.8.4) represents the scale of importance to enlist the opinions of workers on a proposed change before it is implemented

The analysis of questionnaire survey with the respect to the scale of importance regarding to the receptiveness of first-line supervisors (foremen) to change was shown in Table (4.8.5)

Table (4.8.5) represents the scale of importance regarding to the receptiveness of first-line supervisors (foremen) to change

Importance scale	Frequency	Valid percentage (%)	cumulative Percentage (%)
Not important	1	2%	2%
Less important	6	12%	14%
Moderate	18	36%	50%
Important	16	32%	82%
Very important	9	28%	100%
Total	50	100%	

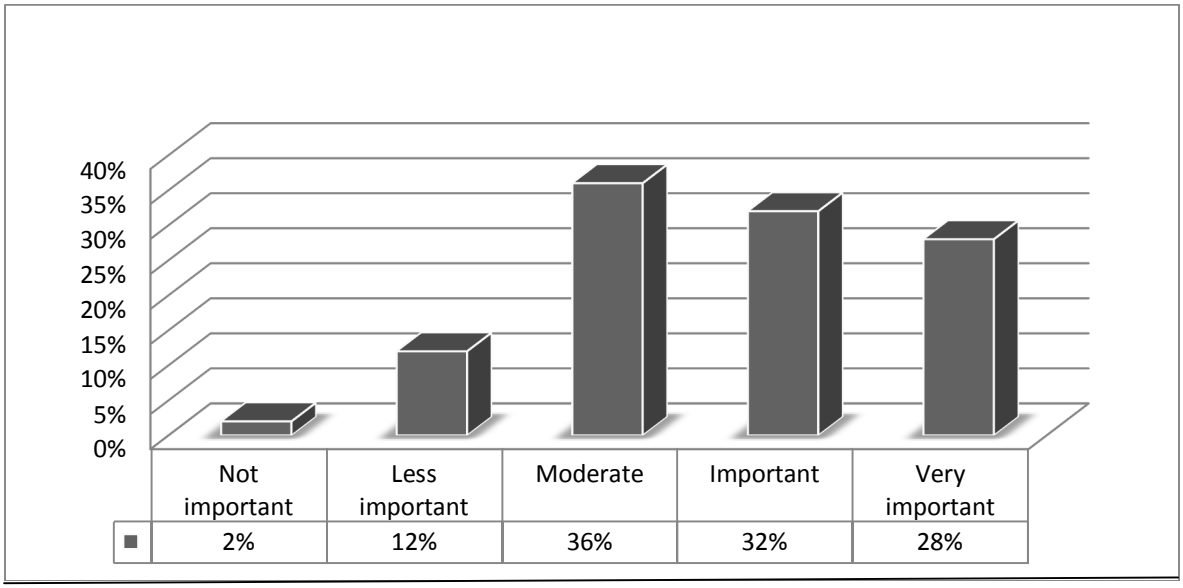

Figure (4.8.5) represents the scale of importance regarding to the receptiveness of first-line supervisors (foremen) to change

(4.2.9) Importance to consider the following factors to be for the implementation of new approaches

The analysis of questionnaire survey with the respect to get top management support was shown in Table (4.9.1)

Table (4.9.1) represents the scale of importance to get top management support

Importance scale	Frequency	Valid percentage (%)	cumulative Percentage (%)
Not important	0	0%	0%
Less important	9	18%	18%
Moderate	12	24%	42%
Important	11	22%	64%
Very important	18	36%	100%
Total	50	100%	

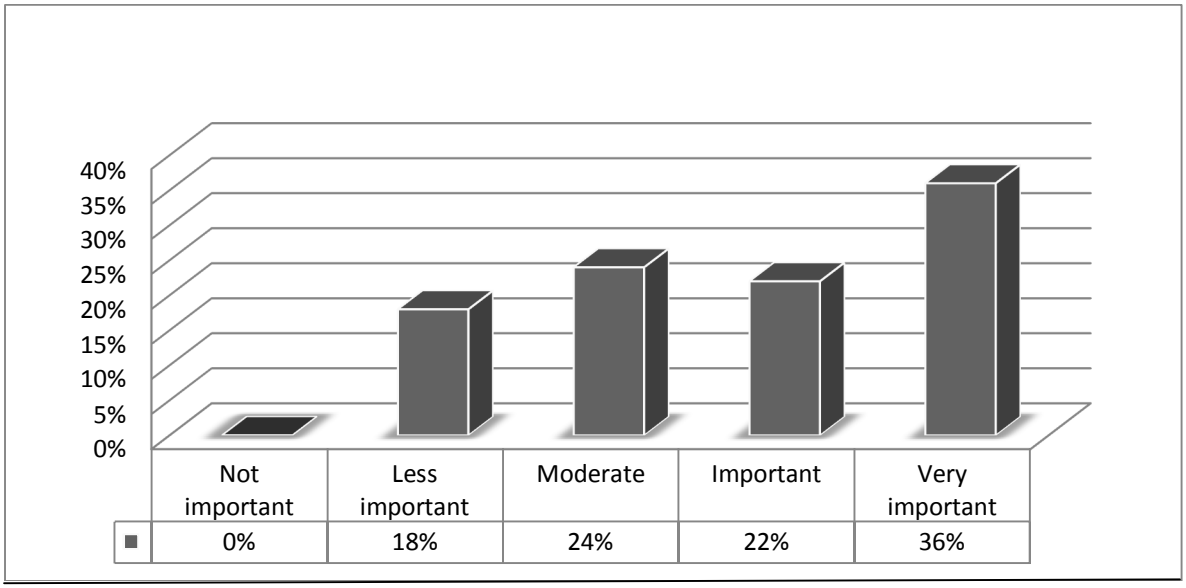

Figure (4.9.1) represents the scale of importance to get top management support

The analysis of questionnaire survey with the respect to get mutual trust between workers and management was shown in Table (4.9.2) and Figure (4.9.2)

Table (4.9.2) represents the scale of importance to get mutual trust between workers and management

Importance scale	Frequency	Valid percentage(%)	cumulative percentage (%)
Not important	0	0%	0%
Less important	9	18%	18%
Moderate	12	24%	42%
Important	17	34%	76%
Very important	12	24%	100%
Total	50	100%	

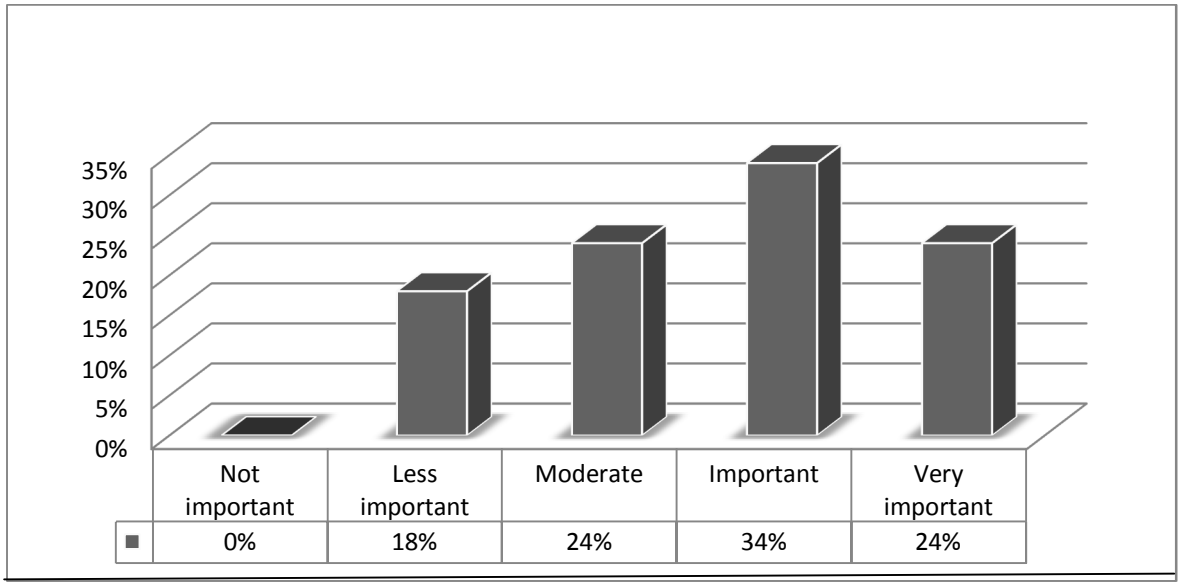

Figure (4.9.2) represents the scale of importance to get mutual trust between workers and management

The analysis of questionnaire survey with the respect to the scale of importance for Incentives and rewards for supporting the change was shown in Table (4.9.3) and Figure (4.9.3)

Table (4.9.3) represents the scale of importance for Incentives and rewards for supporting the change

Importance scale	Frequency	Valid percentage (%)	cumulative Percentage (%)
Not important	0	0%	0%
Less important	8	16%	16%
Moderate	12	24%	40%
Important	16	32%	72%
Very important	14	28%	100%
Total	50	100%	

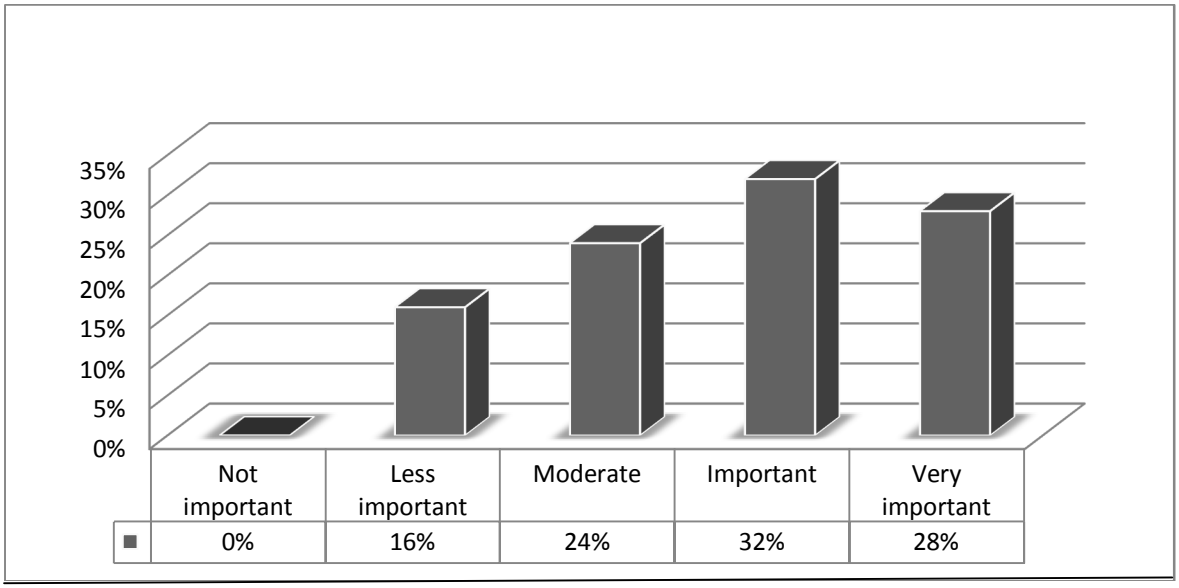

Figure (4.9.3) represents the scale of importance for Incentives and rewards for supporting the change

The analysis of questionnaire survey with the respect to the scale of importance for continuous improvement of safety performance was shown in Table (4.9.4) and Figure (4.9.4)

Table (4.9.4) represents the scale of importance for continuous improvement of safety performance

Importance scale	Frequency	Valid percentage	cumulative percentage
Not important	0	0%	0%
Less important	7	14%	14%
Moderate	17	34%	48%
Important	14	28%	76%
Very important	12	24%	100%
Total	50	100%	

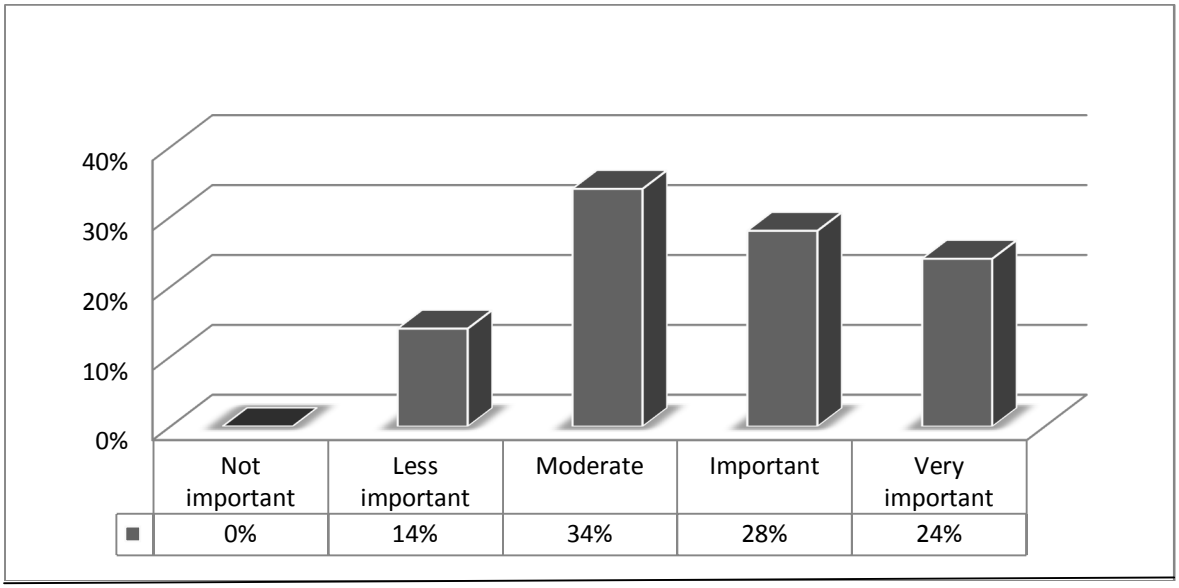

Figure (4.9.4) represents the scale of importance for continuous improvement of safety performance

The analysis of questionnaire survey with the respect to the scale of importance for open communication was shown in Table (4.9.5) and Figure (4.9.5)

Table (4.9.5) represents the scale of importance for open communication

Importance scale	Frequency	Valid percentage (%)	cumulative Percentage (%)
Not important	0	0%	0%
Less important	5	10%	10%
Moderate	11	22%	32%
Important	18	36%	68%
Very important	16	32%	100%
Total	50	100%	

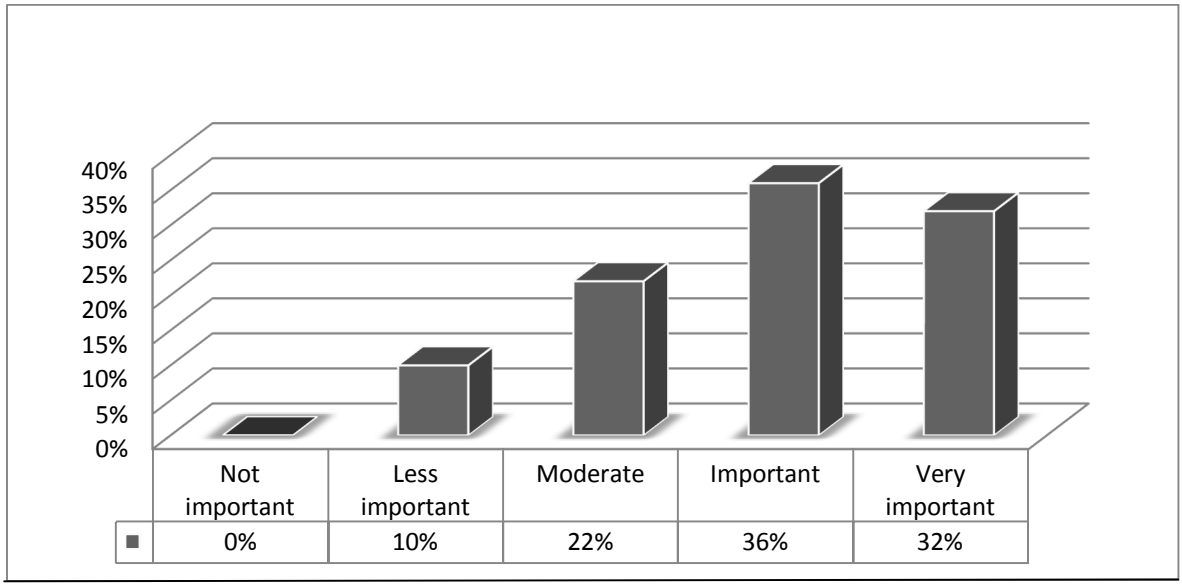

Figure (4.9.5) represents the scale of importance for open communication

The analysis of questionnaire survey with the respect to the scale of importance for effective coordination of construction activities was shown in Table (4.9.7) and Figure (4.9.7)

Table (4.9.7) represents the scale of importance for effective coordination of construction activities

Importance scale	Frequency	Valid percentage (%)	Cumulative Percentage (%)
Not important	0	0%	0%
Less important	9	18%	18%
Moderate	17	34%	52%
Important	13	26%	78%
Very important	11	22%	100%
Total	50	100%	

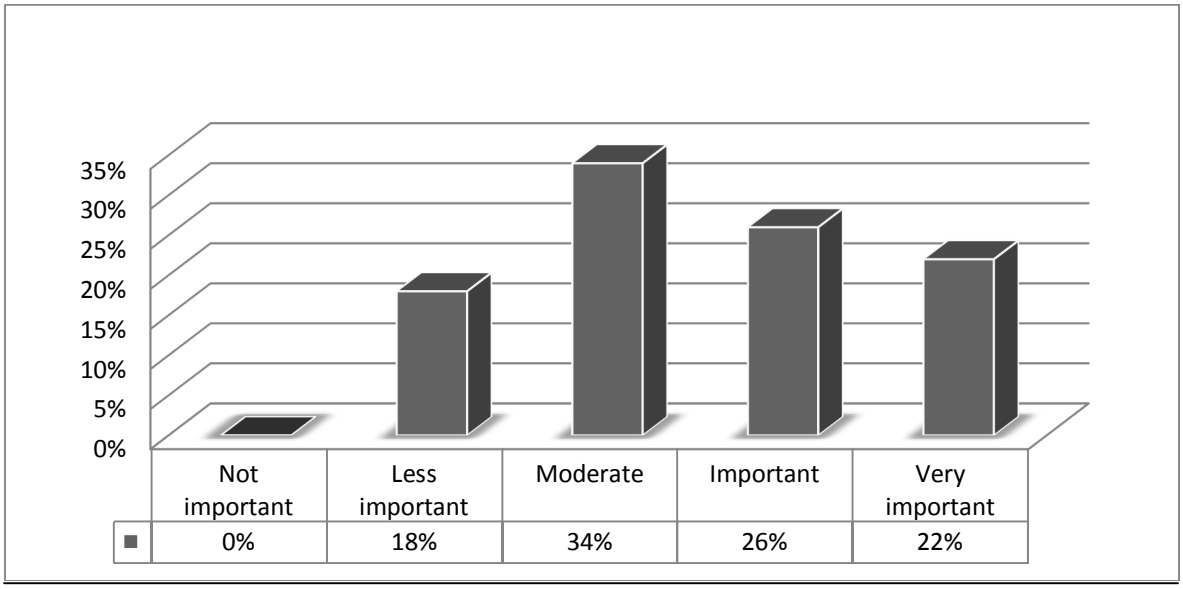

Figure (4.9.7) represents the scale of importance for effective coordination of construction activities

(4.2.10) Joint labor/management problem solving

The analysis of questionnaire survey with the respect to the scale of importance for providing adequate resources was shown in Table (4.10.1) and Figure (4.10.1)

Table (4.10.1) represents the scale of importance for providing adequate resources

Importance scale	Frequency	Valid percentage (%)	cumulative Percentage (%)
Not important	1	2%	2%
Less important	6	12%	14%
Moderate	13	26%	40%
Important	16	32%	72%
Very important	14	28%	100%
Total	50	100%	

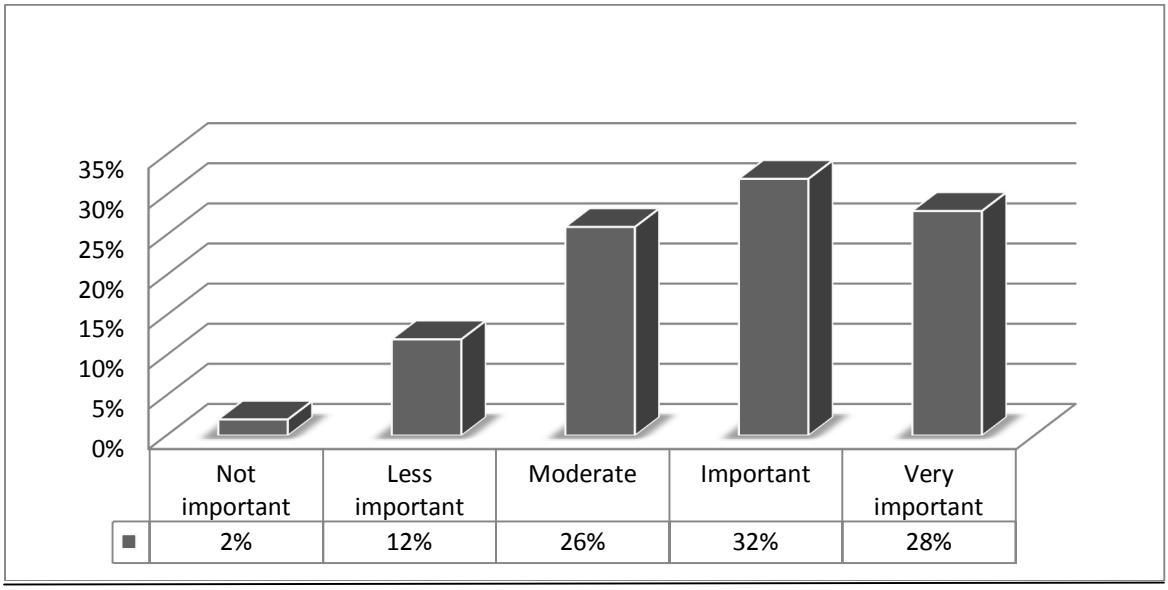

Figure (4.10.1) represents the scale of importance for providing adequate resources

The analysis of questionnaire survey with the respect to the scale of importance for worker creativity was shown in Table (4.10.1) and Figure (4.10.1)

Table (4.10.2) represents the scale of importance for worker creativity

Importance scale	Frequency	Valid percentage (%)	cumulative Percentage (%)
Not important	1	2%	2%
Less important	15	30%	32%
Moderate	13	26%	58%
Important	12	24%	72%
Very important	9	18%	100%
Total	50	100%	

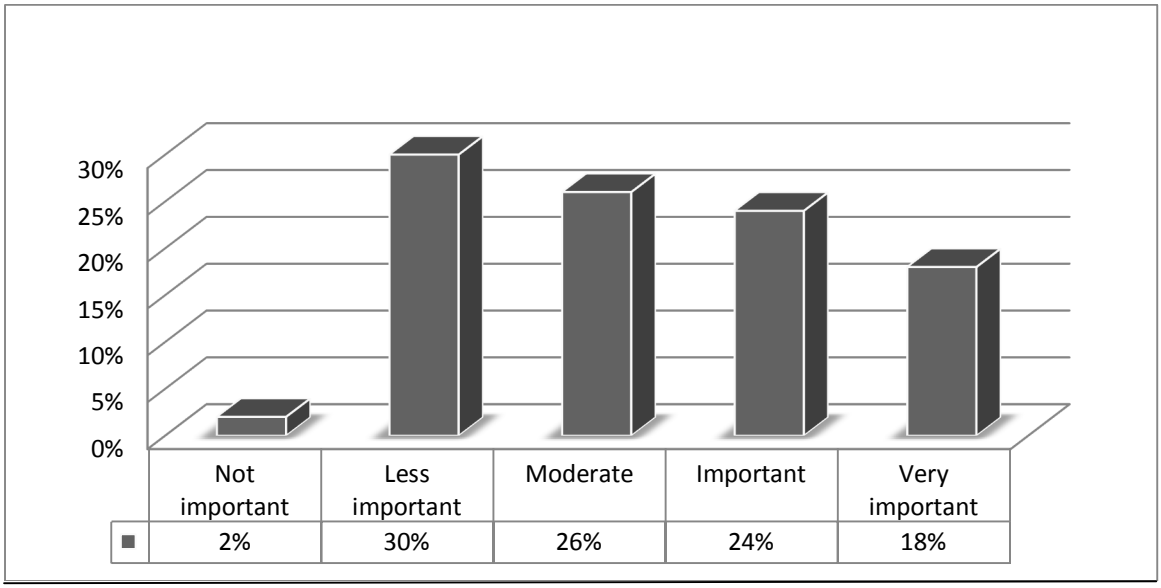

Figure (4.10.2) represents the scale of importance for worker creativity

The analysis of questionnaire survey with the respect to the scale of importance for workshops and training was shown in Table (4.10.3) and Figure (4.10.3)

Table (4.10.3) represents the scale of importance for workshops and training

Importance scale	Frequency	Valid percentage (%)	cumulative Percentage (%)
Not important	1	2%	2%
Less important	15	30%	32%
Moderate	13	26%	58%
Important	12	24%	72%
Very important	9	18%	100%
Total	50	100%	

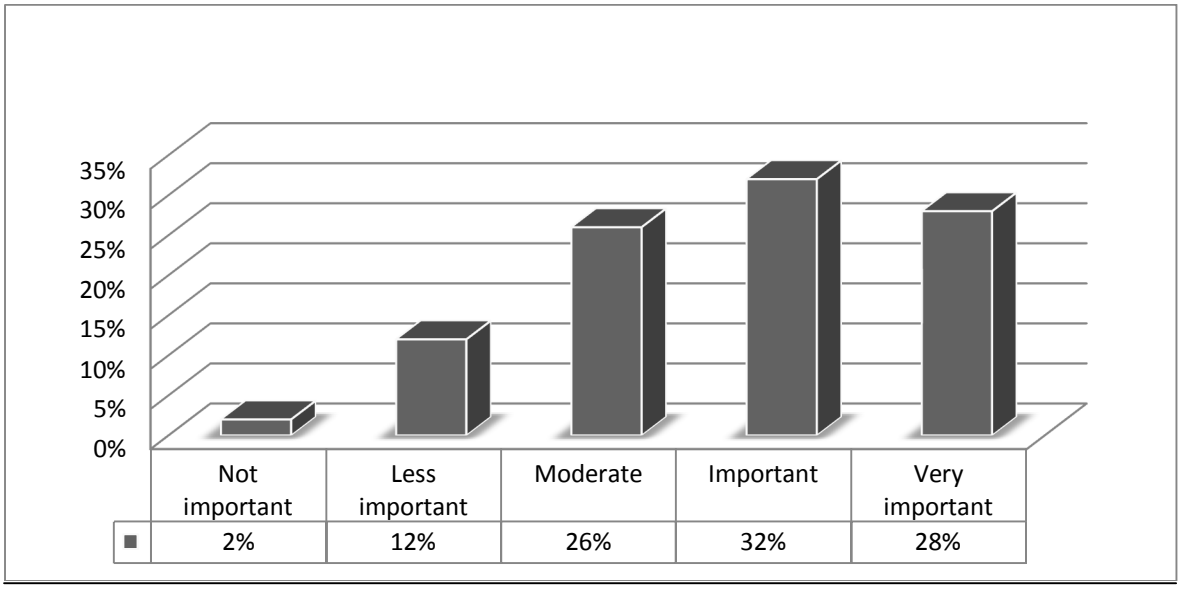

Figure (4.10.3) represents the scale of importance for workshops and training

(4.2.11) Importance regarding the following actions for the successful implementation of a new approach to construction worker safety and health

The analysis of questionnaire survey with the respect to the scale of importance for Demonstrate consistent and decisive personal leadership was shown in Table (4.11.1) and Figure (4.11.1)

Table (4.11.1) represents the scale of importance for demonstrate consistent and decisive personal leadership

Importance scale	Frequency	Valid percentage(%)	cumulative percentage(%)
Not important	1	2%	2%
Less important	14	28%	30%
Moderate	16	32%	62%
Important	11	22%	84%
Very important	8	16%	100%
Total	50	100%	

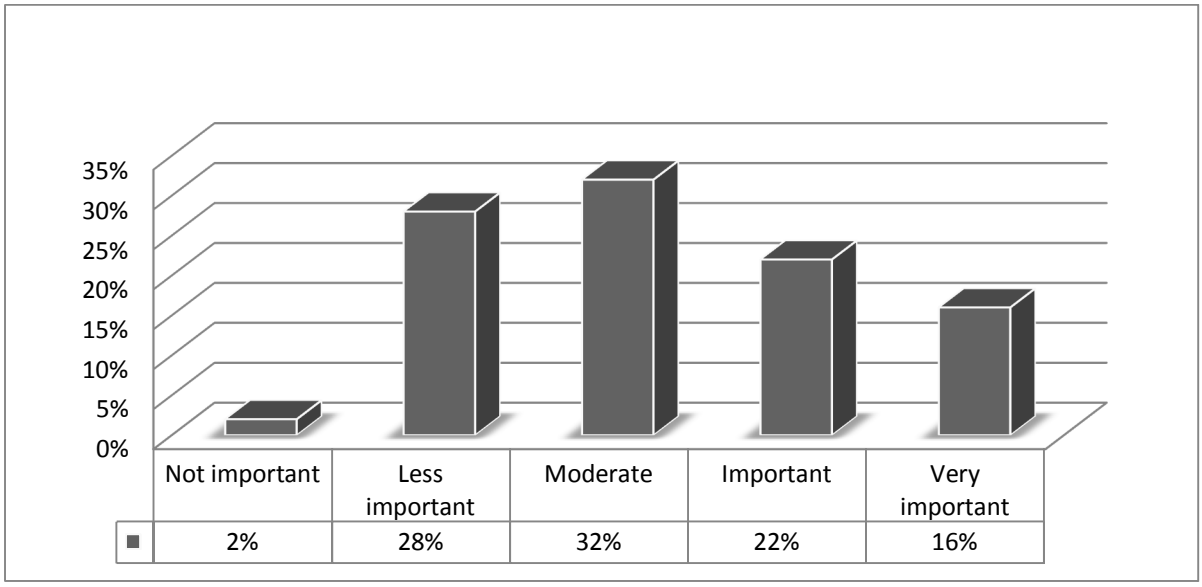

Figure (4.11.1) represents the scale of importance for demonstrate consistent and decisive personal leadership

The analysis of questionnaire survey with the respect to the scale of importance to allocate adequate financial, equipment and staff resources was shown in Table (4.11.2) and Figure (4.11.2)

Table (4.11.2) represents the scale of importance to allocate adequate financial, equipment and staff resources

Importance scale	Frequency	Valid percentage(%)	cumulative percentage(%)
Not important	0	0%	0%
Less important	10	20%	20%
Moderate	14	28%	48%
Important	16	32%	80%
Very important	10	20%	100%
Total	50	100%	

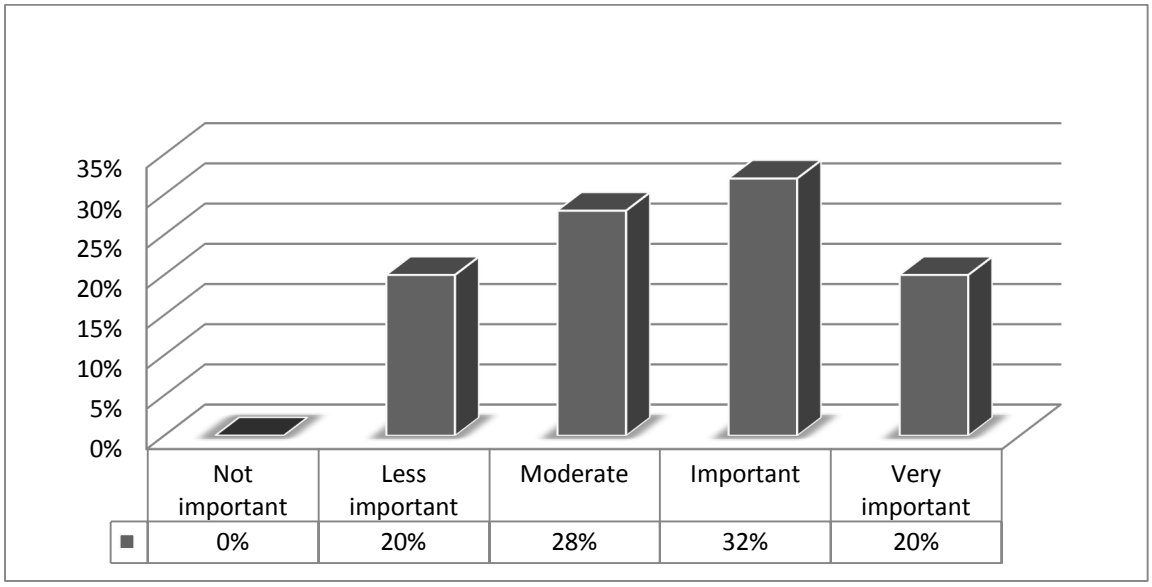

Figure (4.11.2) represents the scale of importance to allocate adequate financial, equipment and staff resources

The analysis of questionnaire survey with the respect to the scale of importance to amend corporate vision and mission was shown in Table (4.11.3)

Table (4.11.3) represents the scale of importance to amend corporate vision and mission

Importance scale	Frequency	Valid percentage	cumulative percentage
Not important	0	0%	0%
Less important	14	28%	28%
Moderate	16	32%	60%
Important	11	22%	82%
Very important	9	18%	100%
Total	50	100%	

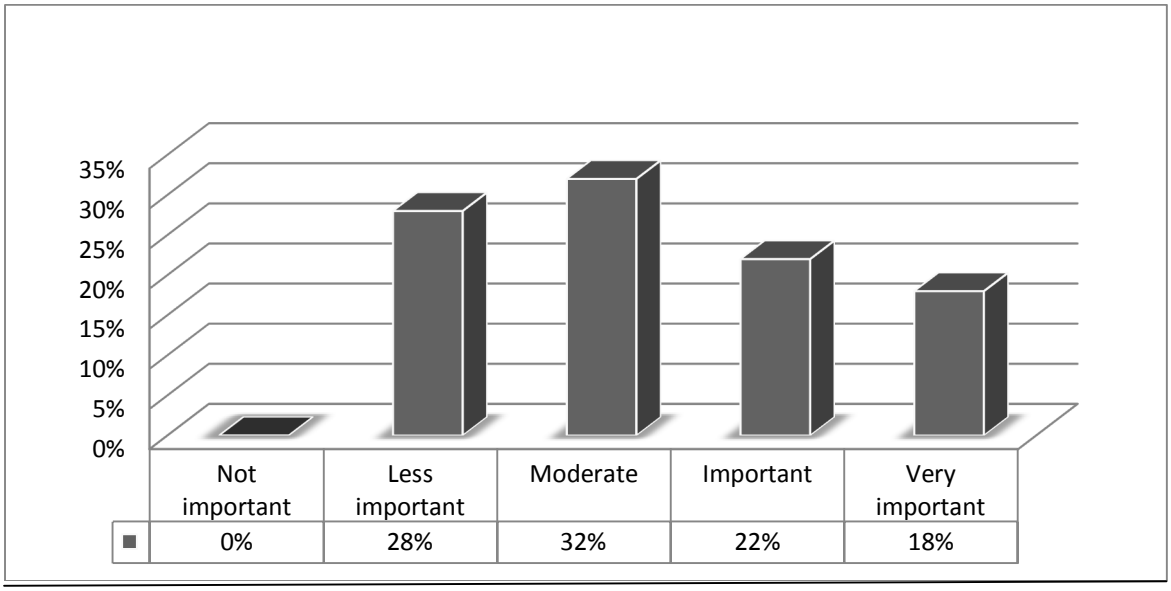

Figure (4.11.3) represents the scale of importance to amend corporate vision and mission

The analysis of questionnaire survey with the respect to the scale of importance to motivate workers to implement changes for continuous improvement was shown in Table (4.11.4) and Figure (4.11.4)

Table (4.11.4) represents the scale of importance to motivate workers to implement changes for continuous improvement

Importance scale	Frequency	Valid percentage(%)	cumulative percentage(%)
Not important	0	0%	0%
Less important	9	18%	18%
Moderate	13	26%	44%
Important	16	32%	76%
Very important	12	24%	100%
Total	50	100%	

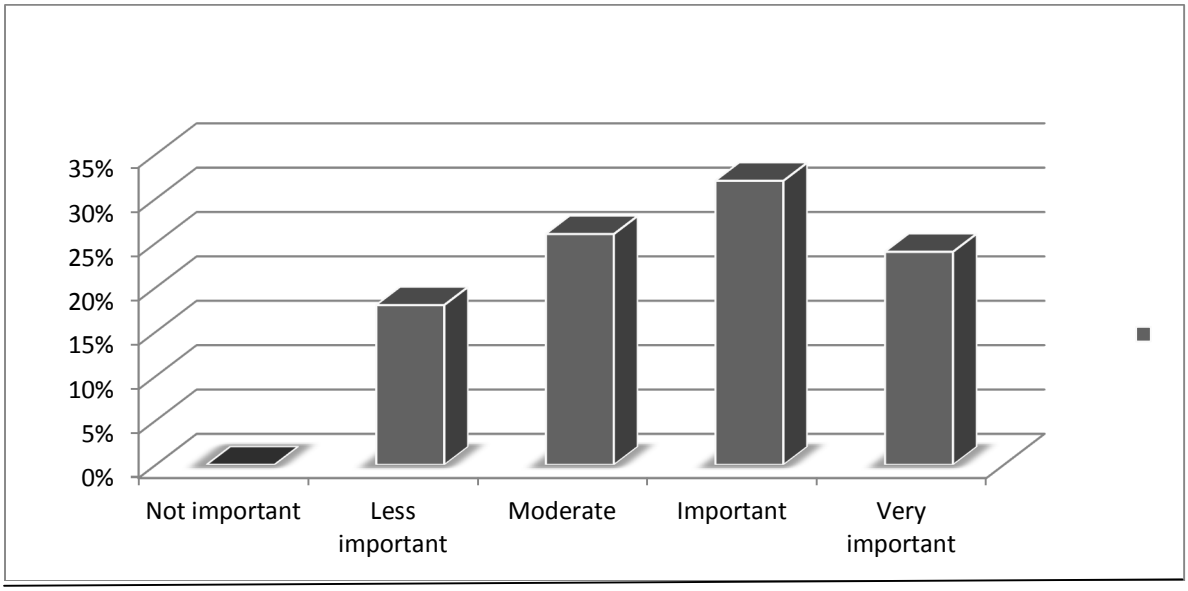

Figure (4.11.4) represents the scale of importance to motivate workers to implement changes for continuous improvement

The analysis of questionnaire survey with the respect to the scale of importance to encourage worker participation at all levels was shown in Table (4.11.5) and Figure (4.11.5)

Table (4.11.5) represents the scale of importance to encourage worker participation at all levels

Importance scale	Frequency	Valid percentage	cumulative percentage
Not important	0	0%	0%
Less important	7	14%	14%
Moderate	11	22%	36%
Important	18	36%	72%
Very important	14	28%	100%
Total	50	100%	

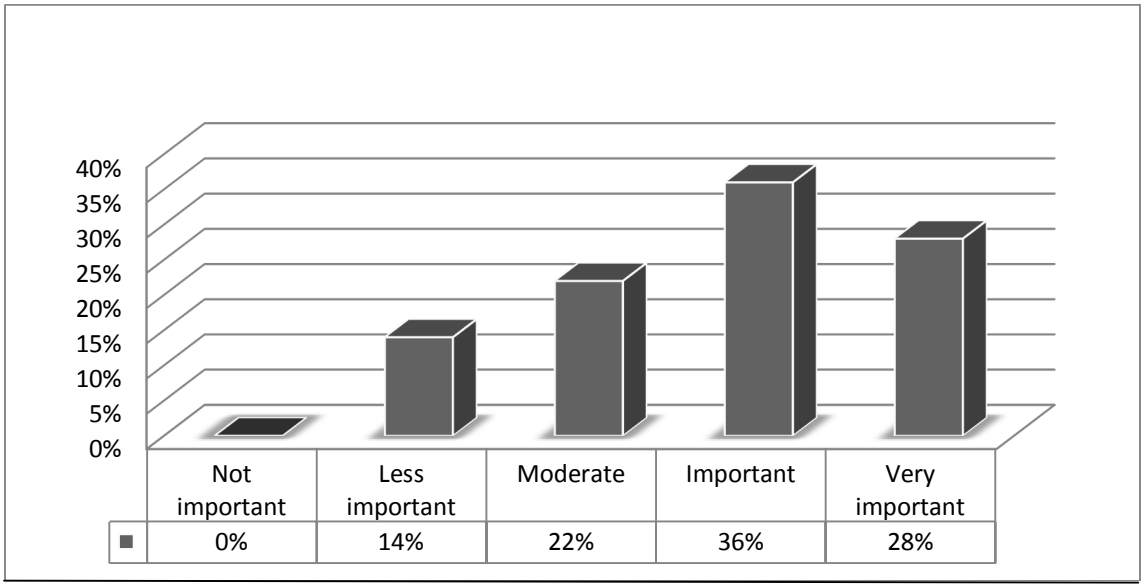

Figure (4.11.5) represents the scale of importance to encourage worker participation at all levels

The analysis of questionnaire survey with the respect to the scale of importance to Change the organization's systems, policies and procedures to augment the changes Introduce and support appropriate training programs was shown in Table (4.11.6) and Figure (4.11.6)

Table (4.11.6) represents the scale of importance to Change the organization's systems, policies and procedures to augment the changes Introduce and support appropriate training programs

Importance scale	Frequency	Valid percentage(%)	cumulative percentage(%)
Not important	11	22%	22%
Less important	16	32%	54%
Moderate	14	28%	82%
Important	5	10%	92%
Very important	4	8%	100%
Total	50	100%	

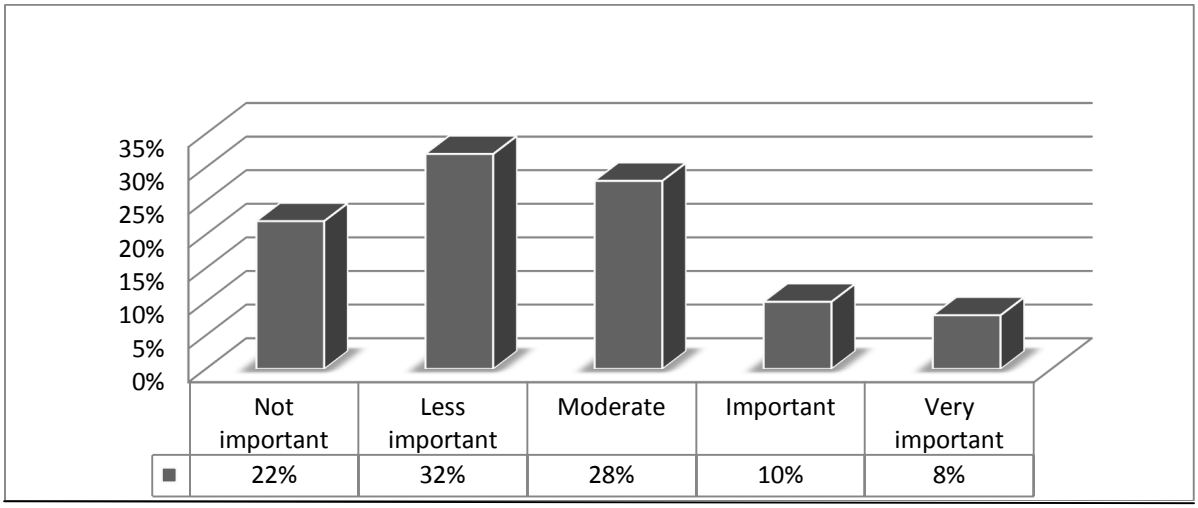

Figure (4.11.5) represents the scale of importance to encourage worker participation at all levels

The analysis of questionnaire survey with the respect to the scale of importance measure and evaluate progress of the changes regularly introducing new plans of action if necessary was shown in Table (4.11.7).

Table (4.11.7) represents the scale of importance to measure and evaluate progress of the changes regularly introducing new plans of action if necessary

Importance scale	Frequency	Valid percentage(%)	cumulative percentage(%)
Not important	0	0%	0%
Less important	8	16%	16%
Moderate	12	24%	40%
Important	16	32%	72%
Very important	14	28%	100%
Total	50	100%	

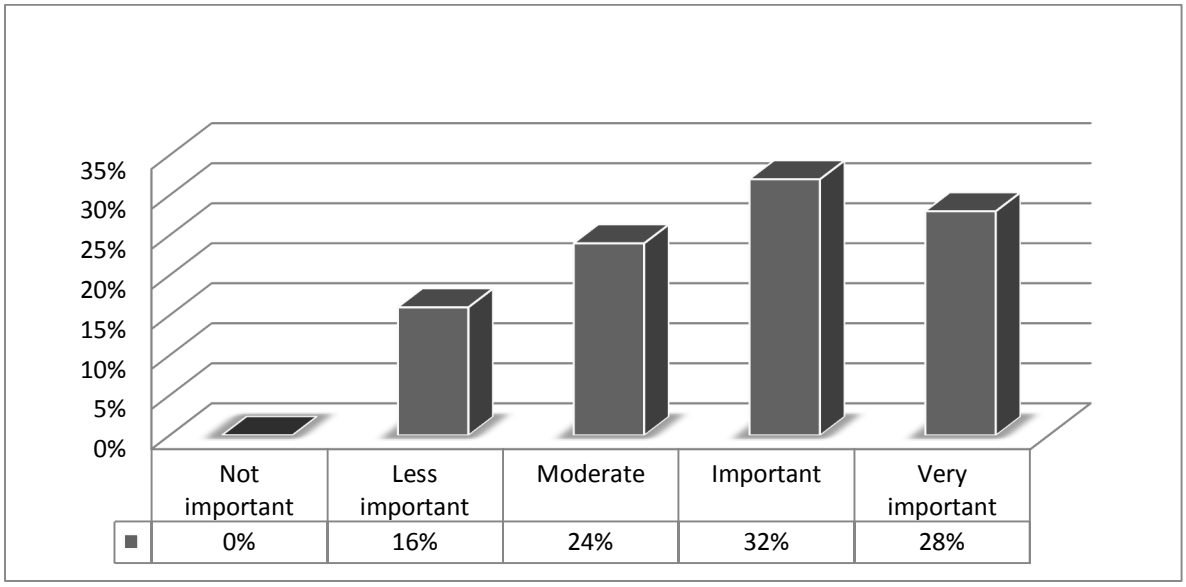

Figure (4.11.7) represents the scale of importance to measure and evaluate progress of the changes regularly introducing new plans of action if necessary

The analysis of questionnaire survey with the respect to the scale of importance compare the performance of the company with competitors was shown in Table (4.11.8)

Table (4.11.8) represents the scale of importance to compare the performance of the company with competitors

Importance scale	Frequency	Valid percentage	cumulative percentage
Not important	0	0%	0%
Less important	7	14%	14%
Moderate	11	22%	36%
Important	17	34%	70%
Very important	15	30%	100%
Total	50	100%	

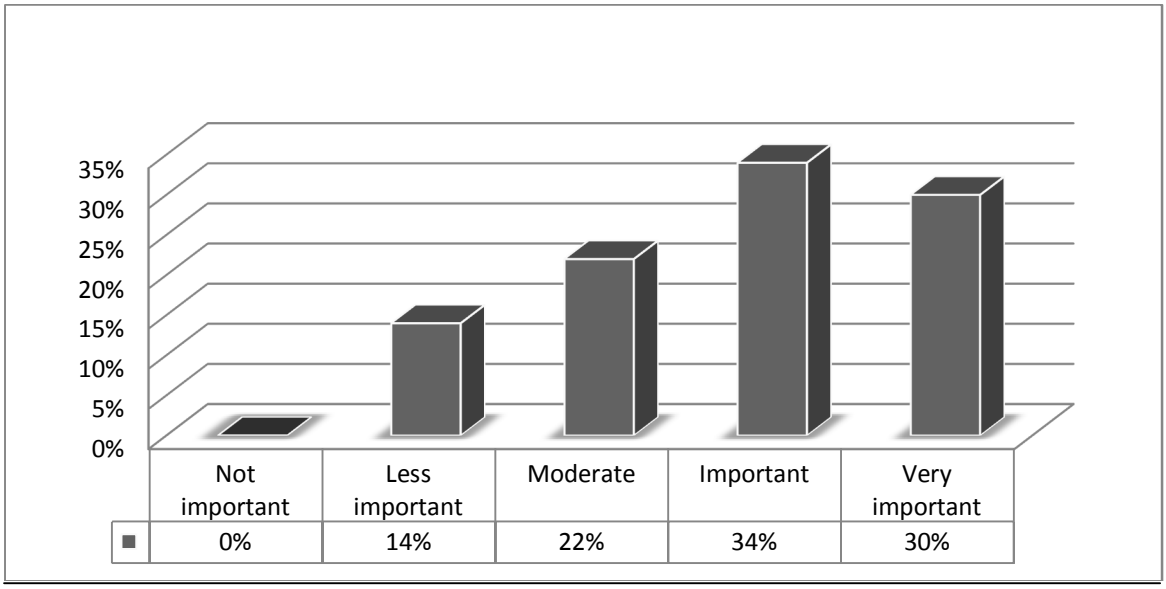

Figure (4.11.8) represents the scale of importance to compare the performance of the company with competitors

The analysis of questionnaire survey with the respect to the scale of importance to reward workers for being innovative and looking for new solutions was shown in Table (4.11.9)

Table (4.11.9) represents the scale of importance to reward workers for being innovative, and looking for new solutions

Importance scale	Frequency	Valid percentage(%)	cumulative percentage(%)
Not important	1	2%	2%
Less important	7	14%	16%
Moderate	14	28%	44%
Important	16	32%	76%
Very important	12	24%	100%
Total	50	100%	

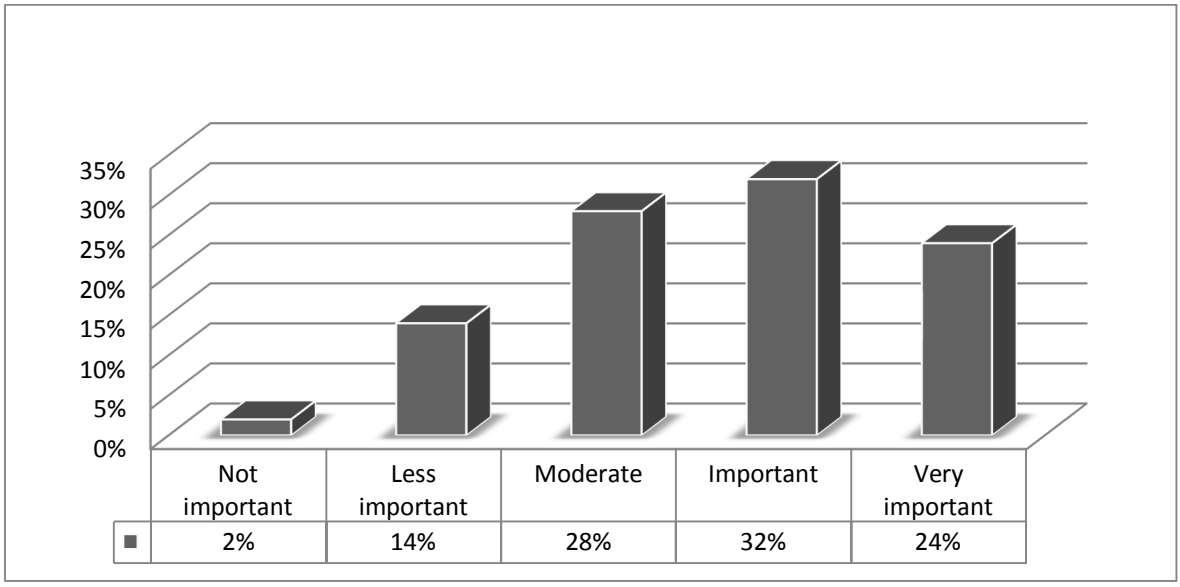

Figure (4.11.9) represents the scale of importance to reward workers for being innovative, and looking for new solutions

The analysis of questionnaire survey with the respect to the scale of importance to change the organizational structure and hierarchy to make it more flexible and responsive to change was shown in Table (4.11.10)

Table (4.11.10) represents the scale of importance to change the organizational structure and hierarchy to make it more flexible and responsive to change

Importance scale	Frequency	Valid percentage(%)	cumulative percentage(%)
Not important	17	34%	34%
Less important	16	32%	66%
Moderate	11	22%	88%
Important	4	8%	96%
Very important	2	4%	100%
Total	50	100%	

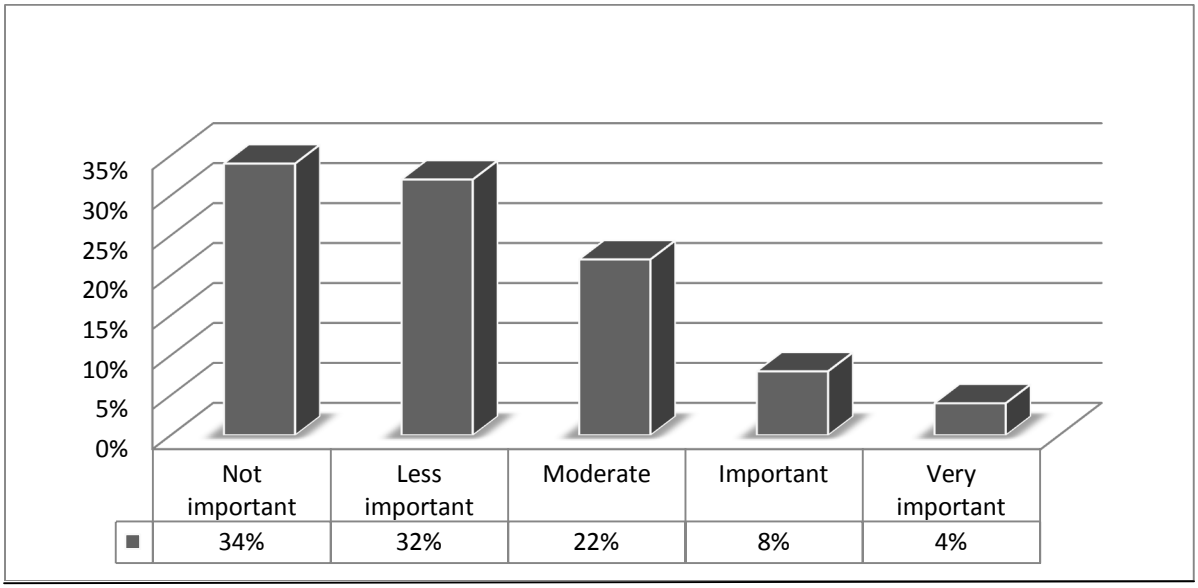

Figure (4.11.10) represents the scale of importance to change the organizational structure and hierarchy to make it more flexible and responsive to change

(4.2.12) Recordable injuries did the company have last Year

The analysis of questionnaire survey with the respect to recordable injuries did the company have last year was shown in Table (4.12.1) and Figure (4.12.1)

This may indicate the poor safety management at small and medium construction firms

Table (4.12.1) represents How many recordable injuries did the company have last year

Number of injuries	Frequency	Valid percentage	cumulative percentage
Less than 5 workers	11	22%	22%
5-10 workers	16	32%	54%
10-15 workers	14	28%	82%
15-20 workers	5	10%	92%
Above 20 workers	4	8%	100%
Total	50	100%	

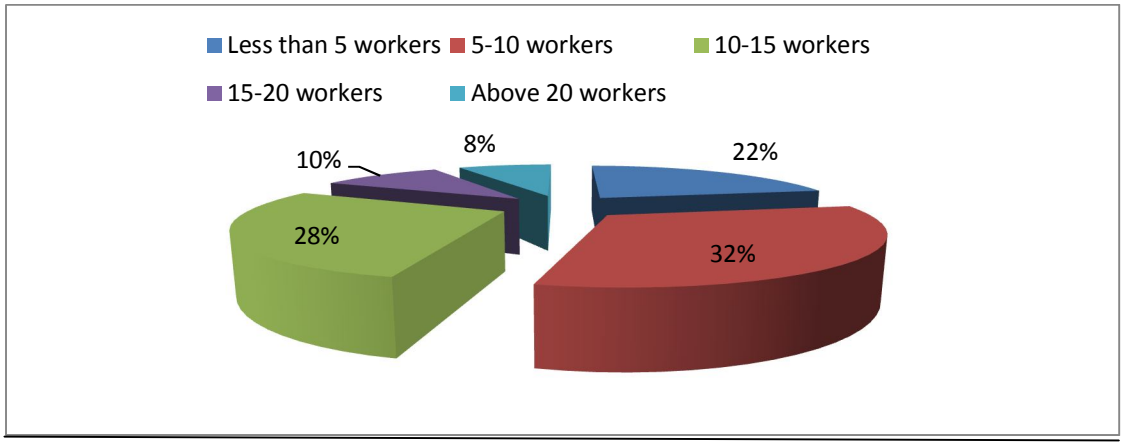

Figure (4.12.1) represents How many recordable injuries did the company have last year

The reasons for poor safety management at small and medium construction companies refer to:-

1- Small companies look at safety as a cost factor and ignoring safety management plan.
2- The culture of small companies.
3- The nature of the project.
4- Labors experience and their quality.
5- The contractual relationship and law.
6- Poor documentation of accidents in previous similar projects.
7- The poor of safety culture in the country.
8- Poor applications of policies and punishment.
9- Personal protective equipment (P.P.E) highly costs.

4.3 Questionnaire data analysis:

4.3.1 Personal Information:

4.3.2 Assessment Information:

1. 46% of Questionnaire survey was distributed to top management positions. These positions were not directly related to safety and health. These management positions are:
   a. Project manager 20%.
   b. CEO 12%.
   c. Top manager 14%.

   The management position related to safety and health was:
   - Safety engineer 8%.
   - Inspection engineer 4%.
   - Deputy engineer 2%.

   These results may agree with the hypotheses due to poor knowledge of safety and health concepts.
2. (a) The duration for the samples of the questionnaire which represent the current position within their firm ranged from 10 months to 12 years and the mean was between (2years – 4 years).
3. (a) The average number of employee ranged from 10 workers to 450 workers with mean 75 workers. The firms ranged from (0-100) workers represents 40% and the most frequently was less than 50 which may indicate that those are small firms.
4. The annual value of the construction contracts ranged from less than 20,000 to 100,000 and (33%) ranged between 20,000 – 80,000.
5. The approximate total annual value of construction contracts is derived from the contract arrangements, were 72% of the questionnaire survey their contracts were:
   - Construction management (agency) 22%.
   - General contract 36%.
   - Subcontract 14%.

   This may indicate that the safety and health concepts are ignored at the construction's firm due to their type of contract. This result may agree with the hypotheses.
6. Less than 5% of the questionnaire sample's firms are internationals.

4.3.3 Management attitude to the prescriptive and performance approach:

4.3.3.1 Preference Scale:

1- Which approach to construction worker safety do you prefer?

a. 54% of the questionnaire sample's preferred and use perspective approach. Which may response to the hypotheses using the safety at construction project due to poor safety management at the construction projects in Khartoum state
b. 40% of the questionnaire samples were having (poorly, very poorly) understanding of the concepts of the safety economic performance approach.
c. 38% of the questionnaire samples were having (well, very well) understanding of the concepts of the safety economic performance approach.

   This may agree with the first hypotheses, due to the (poor - and very poor) understanding of the safety economic approach.

2- How influential are the types of approaches to each of the following issues?

a. Ease of introduction of new technologies:
b. 52% of the questionnaire survey respond to (agree or support) the safety economic performance approach.
c. 28% of the questionnaire survey respond to (agree or support) the perspective approach.

This may reject the first hypotheses.

3- Cost effectiveness of approach:

a. 38% of the questionnaire survey respond to (support or agree) the safety economic performance approach.

b. 50% of the questionnaire survey respond to (support or agree) the perspective approach. This may agree with the first hypotheses.

4- Flexibility:

a. 58% of the questionnaire survey respond to (support or agree) the safety economic performance approach.
b. 34% of the questionnaire survey respond to (support or agree) the perspective approach.

The highest frequency (28%) was supporting the safety economic approach, and the lowest frequency was (16%) supporting the perspective approach. This may agree with the first hypotheses.

5- Ease of implementation:

a. 44% of the questionnaire survey respond to (support or agree) the safety economic performance approach.
b. 40% of the questionnaire survey respond to (support or agree) the perspective approach.

The highest percentage respond to (34%) was supporting the safety economic performance approach, and the lowest percentage (16%) was supporting the perspective approach. This may agree with the first hypotheses.

6- Ease of understanding compliance requirements:

a. 40% of the questionnaire survey respond to (support or agree) the safety economic performance approach.
b. 44% of the questionnaire survey respond to (support or agree) the perspective approach.

The highest percentage (26%) was Agree to perspective approach, and the lowest percentage (16%) was supporting the performance approach. This may reject with the first hypotheses.

7- Support for innovation:

   a. 44% of the questionnaire survey respond to (support or agree) the safety economic performance approach.
   b. 42% of the questionnaire survey respond to (support or agree) the perspective approach.

   The highest percentage (32%) was supporting the safety economic performance approach, and the lowest percentage (12%) was supporting the perspective approach. This may agree with the first hypotheses.

8- Ease of introduction of new materials:

   a. 40% of the questionnaire survey respond to (support or agree) the safety economic performance approach.
   b. 32% of the questionnaire survey respond to (support or agree) the perspective approach.

   The highest percentage (22%) was supporting the safety economic performance approach, and the lowest percentage (10%) was supporting the perspective approach. This may reject with the first hypotheses.

9- Supported by the corporate culture, vision and mission of your organization:

10- Potential to improve safety performance:

   a. 38% of the questionnaire survey respond to (support or agree) the safety economic performance approach.
   b. 48% of the questionnaire survey respond to (support or agree) the perspective approach.

   The highest percentage (26%) was Agree to perspective approach, and the lowest percentage (18%) was supporting the performance approach. This may reject with the first hypotheses.

11- Simplicity of interpretation:

a. 46% of the questionnaire survey respond to (support or agree) the safety economic performance approach.

b. 44% of the questionnaire survey respond to (support or agree) the perspective approach.

The highest percentage (32%) was supporting the perspective approach, and the lowest percentage (18%) was supporting the performance approach. This may reject with the first hypotheses.

12- Ease of compliance:

a. 34% of the questionnaire survey respond to (support or agree) the safety economic performance approach.

b. 42% of the questionnaire survey respond to (support or agree) the perspective approach.

The highest percentage (22%) was supporting the perspective approach, and the lowest percentage (16%) was supporting the performance approach. This may reject with the first hypotheses.

4.3.3.2 Importance Scale:

i. How important do you regard the following regarding an approach to construction safety and health management?

a. Cost effectiveness of approach:

- 56% of the questionnaire survey responds to (important or important)

- 26% of the questionnaire survey responds to (not important or less important)

- The highest percentages (34%) see the safety economic performance approach important, and the lowest percentages (4%) see the perspective approach not important. This may reject the second hypotheses.

b. Ease of implementation of the approach:

- 50% of the questionnaire survey responds to (important or important)
- 24% of the questionnaire survey responds to (not important or less important)
- The highest percentages (26%) see the safety economic performance approach important, and the lowest percentages (6%) see the perspective approach not important. This may reject the second hypotheses.

c. Ease of understanding compliance requirements:

- 56% of the questionnaire survey responds to (important or very important)
- 10% of the questionnaire survey responds to (not important or less important)
- The highest percentages (32%) see the safety economic performance approach important, and the lowest percentages (2%) see the perspective approach not important. This may reject the second hypotheses.

d. Support for innovation, new materials and technology:

- 36% of the questionnaire survey responds to (important or very important)
- 42% of the questionnaire survey responds to (not important or less important)
- The highest percentages (28%) see it less important, and the lowest percentages (8%) see it not important. This may reject the second hypotheses.

e. Potentials to improve safety performance on sites:

c. 24% of the questionnaire survey responds to (important or very important)

d. 48% of the questionnaire survey responds to (not important or less important)

e. The highest percentages (26%) see it important, and the lowest percentages (2%) see it not important. This may reject the second hypotheses.

i. If the company were to consider introducing a change to improve safety performance how important would be the willingness of workers to accept the change before the change is implemented?

f. 14% of the questionnaire survey responds to (important or very important)

g. 64% of the questionnaire survey responds to (not important or less important)

h. The highest percentages (36%) see it very important, and the lowest percentages (2%) see it not important. This may reject the second hypotheses.

3- How important would it be to break down the resistance of workers to change by convincing them to accept the change?

- 16% of the questionnaire survey responds to (important or very important)
- 58% of the questionnaire survey responds to (not important or less important)
- The highest percentages (34%) see it as an important, and the lowest percentages (4%) see it not important. This may reject the second hypotheses.

4- How important would it be to build credibility and trust with the workers before implementing a change?

- 14% of the questionnaire survey responds to (important or very important)
- 68% of the questionnaire survey responds to (not important or less important)

- The highest percentages (34%) see it very important, and the lowest percentages (2%) see it not important. This may reject the second hypotheses.

5-How important would it be to enlist the opinions of workers on a proposed change before it is implemented?

- 16% of the questionnaire survey responds to (important or very important) the safety economic performances approach.
- 60% of the questionnaire survey responds to (not important or less important) the perspectives approach.

The highest percentages (32%) see it as an important, and the lowest percentages (2%) see it not important. This may reject the second hypotheses.

6- How important do you regard the receptiveness of first-line supervisors (foremen) to change?

- 14% of the questionnaire survey responds to (important or very important)
- 60% of the questionnaire survey responds to (not important or less important)
- The highest percentages (32%) see it as an important, (2%) see it not important. This may reject the second hypotheses.

7- How important do you consider the following factors to be for the implementation of new approaches?

a. Top management support:

- 18% of the questionnaire survey responds to (important or very important)
- 58% of the questionnaire survey responds to (not important or less important)
- The highest percentages (36%) see it as very important, and the lowest percentages (0%) see it not important. This may reject the second hypotheses.

b. Mutual trust between workers and management:

- 18% of the questionnaire survey responds to (important or very important)
- 58% of the questionnaire survey responds to (not important or less important)
- The highest percentages (34%) see it as an important, and the lowest percentages (0%) see it as not important. This may reject the second hypotheses.

c. Incentives and rewards for supporting the change:

- 16% of the questionnaire survey responds to (important or very important)
- 60% of the questionnaire survey responds to (not important or less important)
- The highest percentages (32%) see it as an important, and the lowest percentages (0%) see it not important. This may reject the second hypotheses

d. Continuous improvement of safety performance:

- 14% of the questionnaire survey responds to (important or very important)
- 52% of the questionnaire survey responds to (not important or less important)
- The highest percentages (28%) see it as an important, and the lowest percentages (0%) see it not important. This may reject the second hypotheses.

e. Open communication:

- 10% of the questionnaire survey responds to (important or very important).
- 68% of the questionnaire survey responds to (not important or less important).

The highest percentages (36%) see it as an important, and the lowest percentages (0%) see it as not important. This may reject the second hypotheses.

f. Effective coordination of construction activities:

- 18% of the questionnaire survey responds to (important or very important)
- 48% of the questionnaire survey responds to (not important or less important)
- The highest percentages (26%) see it as an important, and the lowest percentages (0%) see it as not important. This may reject the second hypotheses.

8-Joint labor/management problem solving

a. Adequate resources:

- 14% of the questionnaire survey responds to (important or very important).
- 60% of the questionnaire survey responds to (not important or less important)
- The highest percentages (32%) see it as an important, and the lowest percentages (2%) see it as not important. This may reject the second hypotheses.

b. Creativity:

- 32% of the questionnaire survey responds to (important or very important)
- 42% of the questionnaire survey responds to (not important or less important)
- The highest percentages (24%) see it less important, and the lowest percentages (2%) see it not important. This may reject the second hypotheses.

c. Workshops and training

- 28% of the questionnaire survey responds to (important or very important)
- 44% of the questionnaire survey responds to (not important or less important)
- The highest percentages (26%) see it less important, and the lowest percentages (2%) see it as not important. This may reject the second hypotheses.

9-How important do you regard the following actions for the successful implementation of a new approach to construction worker safety and health

a. Demonstrate consistent and decisive personal leadership:

- 30% of the questionnaire survey responds to (important or very important).
- 38% of the questionnaire survey responds to (not important or less important)
- The highest percentages (28%) see it less important, and the lowest percentages (2%) see it not important. This may reject the second hypotheses.

b. Allocate adequate financial, equipment and staff resources:

- 20% of the questionnaire survey responds to (important or very important).
- 52% of the questionnaire survey responds to (not important or less important)
- The highest percentages (20%) see the safety economic performance approach important, and the lowest percentages (0%) see the perspective approach not important. This may reject the second hypotheses.

c. Amend corporate vision and mission:

- 28% of the questionnaire survey responds to (important or very important)

- 40% of the questionnaire survey responds to (not important or less important)
- The highest percentages (28%) see it as less important, and the lowest percentages (0%) see it not important. This may reject the second hypotheses.

d. Motivate workers to implement changes for continuous improvement:

- 18% of the questionnaire survey responds to (important or very important)
- 56% of the questionnaire survey responds to (not important or less important)
- The highest percentages (32%) see it as an important, and the lowest percentages (0%) see it not important. This may reject the second hypotheses

e. Encourage worker participation at all levels:

- 14% of the questionnaire survey responds to (important or very important)
- 62% of the questionnaire survey responds to (not important or less important)
- The highest percentages (36%) see it as an important, and the lowest percentages (0%) see it as not important. This may reject the second hypotheses.

f. Change the organization's systems, policies and procedures to augment the changes Introduce and support appropriate training programs:

- 54% of the questionnaire survey responds to (important or very important)
- 18% of the questionnaire survey responds to (not important or less important)

- The highest percentages (32%) see it less important, and the lowest percentages (8%) see it very important. This may agree the second hypotheses.

g. Measure and evaluate progress of the changes regularly introducing new plans of action if necessary:

- 16% of the questionnaire survey responds to (important or very important)
- 60% of the questionnaire survey responds to (not important or less important)
- The highest percentages (32%) see it as an important, and the lowest percentages (0%) see it not important. This may reject the second hypotheses.

h. Compare the performance of the company with competitors:

- 14% of the questionnaire survey responds to (important or very important) the safety economic performances approach.
- 64% of the questionnaire survey responds to (not important or less important) the perspectives approach.

The highest percentages (34%) see it as an important, and the lowest percentages (0%) see it as not important. This may reject the second hypotheses.

i. Reward workers for being innovative, and looking for new solutions:

- 16% of the questionnaire survey responds to (important or very important) the safety economic performances approach.
- 56% of the questionnaire survey responds to (not important or less important) the perspectives approach.

The highest percentages (32%) see it as an important, and the lowest percentages (2%) see it as not important. This may reject the second hypotheses.

j. Change the organizational structure and hierarchy to make it more flexible and responsive to change:

- 66% of the questionnaire survey responds to (important or very important) the safety economic performances approach.
- 12% of the questionnaire survey responds to (not important or less important) the perspectives approach.

The highest percentages (34%) see it not important, and the lowest percentages (4%) see it as very important. This may agree with the second hypotheses.

4.3.3.3 Influential Scale:

i. How influential are the following in driving change within your organization:

1. To improve financial performance:

-14% of the questionnaire survey responds to (not influential or less influential)

-64% of the questionnaire survey responds to (influential or very influential)

-The highest percentages (34%) see it very influential, and the lowest percentages (4%) see it as an influential. This may reject the second hypotheses.

2. Only as staff turnover occurs:

-36% of the questionnaire survey responds to (not influential or less influential)

-28% of the questionnaire survey responds to (influential or very influential)

-The highest percentages (24%) see it less influential, and the lowest percentages (8%) it very influential. This may agree with the second hypotheses.

c. When new technology introduced:

20% of the questionnaire survey responds to (not influential or less influential)

-44% of the questionnaire survey responds to (influential or very influential)

-The highest percentages (24%) see it as influential, and the lowest percentages (4%) see it as not influential. This may reject the second hypotheses.

D. To keep up with competitors:

-12% of the questionnaire survey responds to (not influential or less influential)

-66% of the questionnaire survey responds to (influential or very influential)

-The highest percentages (38%) see it very influential, and the lowest percentages (2%) see it not influential. This may reject the second hypotheses.

e. To improve your safety record:

-14% of the questionnaire survey responds to (not influential or less influential)

-64% of the questionnaire survey responds to (influential or very influential)

-The highest percentages (36%) see it influential, and the lowest percentages (2%) see it not influential. This may reject the second hypotheses.

a. Only after accidents occur:

- 46% of the questionnaire survey responds to (not influential or less influential)

- 26% of the questionnaire survey responds to (influential or very influential)

- The highest percentages (32%) see it less influential, and the lowest percentages (10%) see it as very influential. This may reject the second hypotheses.

g. To meet worker demands:

-26% of the questionnaire survey responds to (not influential or less influential)

-42% of the questionnaire survey responds to (influential or very influential).

- The highest percentages (24%) see it as an influential, and the lowest percentages (8%) see it not influential. This may reject the second hypotheses.

h. To generate quality improvements:

-22% of the questionnaire survey responds to (not influential or less influential)

-52% of the questionnaire survey responds to (influential or very influential)

-The highest percentages (30%) see it as an influential, and the lowest percentages (6%) see it not influential. This may reject the second hypotheses.

i. To exploit new market opportunities:

- 26% of the questionnaire survey responds to (not influential or less influential)

- 46% of the questionnaire survey responds to (influential or very influential) perspectives approach.

-The highest percentages (26%) see the safety economic performance approach very influential, and the lowest percentages (2%) see the perspective approach not influential. This may reject the second hypotheses.

j. Respond to management initiatives:

- 24% of the questionnaire survey responds to (not influential or less influential) the safety economic performances approach.

- 42% of the questionnaire survey responds to (influential or very influential) the perspectives approach.

The highest percentages (26%) see the safety economic performance approach very influential, and the lowest percentages (6%) see the perspective approach not influential. This may reject the second hypotheses.

k. Respond to third party claims:

22% of the questionnaire survey responds to (not influential or less influential) the safety economic performances approach.

46% of the questionnaire survey responds to (influential or very influential) the perspectives approach.

The highest percentages (26%) see the safety economic performance approach very influential, and the lowest percentages (4%) see the perspective approach not influential. This may reject the second hypotheses.

L. Comply with owner/client requirements:

18% of the questionnaire survey responds to (not influential or less influential) the safety economic performances approach.

58% of the questionnaire survey responds to (influential or very influential) the perspectives approach.

The highest percentages (32%) see the safety economic performance approach very influential, and the lowest percentages (0%) see the perspective approach not influential. This may reject the second hypotheses.

n. Meet new insurance requirements:

-18% of the questionnaire survey responds to (not influential or less influential) the safety economic performances approach.

-62% of the questionnaire survey responds to (influential or very influential) the perspectives approach.

-The highest percentages (34%) see the safety economic performance approach very influential, and the lowest percentages (4%) see the

perspective approach not influential. This may reject the second hypotheses.

CHAPTER FIVE

CONCLUTION AND RECOMONDATION

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

The study concluded that the top management at construction projects are often Ignore safety management plan and look at it as cost factor. This may result at high turnover of employee at small and medium construction Firms which depends on type of contracts that involved in high risks and hazardous to increase their annual incomes. More than half of the questionnaire samples respond to perspective approach due to poor understood of performance approach concepts.

Performances approach has many characteristics: Flexibility of approach, Ease of implementation, Support innovation and Simplicity of interpretation.

The study concluded that despite of the importance of the cost effectiveness of approach, ease of implementation of approach, ease of understanding the compliance requirement, support innovation, meeting worker demands and generate quality improvement. The top management of the small and medium construction firms disregards those concepts to capture the heights profits as possible which may lead to increasing risk related to safety and causes internecine injures. Those accidents could be reduced by: improving safety records at previous similar projects, providing insurance coverage for the employees, continuous improvement for the safety performance, open communication, incentive and reward workers who follow up with the safety management plan and encouraging workers to participate at all levels.

Main reasons for safety managements refer to:-

-Small companies look at safety as a cost factor and ignoring safety management plan.

- The culture of small companies.

- The nature of the project.

- Labors experience and their quality.

- The contractual relationship and law.

- Poor documentation of accidents in previous similar projects.

-The poor of safety culture in the country.

-Poor applications of policies and punishment.

-Personal protective equipment (P.P.E) highly costs.

5.2 Recommendations for Future Research:-

Less than 5% of the sample of this study engaged in international construction operations. There is a need to conduct research with construction firms that engage heavily in international construction operations to determine whether the performance approach addressed the international concerns that have arisen due to some of the difficulties presented by prescriptive codes and standards.

The sample for this study was taken from the construction firms within Khartoum State where the perspective approach are used. As part of comparative study, it might be useful to conduct a survey of the top management of firms As a result of the confusion about the content of project-specific safety and health plans.in Khartoum, a further research project could involve the development and

design of model safety and health plans that could serve as master documents or standard templates.

There are problems being encountered in Khartoum with the poorly defined competence and qualification requirements of project supervisors and safety coordinators.

Worker participation on a consultative and participatory basis is required for the successful implementation of the performance approach. Research needs to be conducted to measure the level of worker participation in all matters of construction safety, Injury prevention methods regarding equipment and procedures.

There is a need to develop appropriate tools to determine user needs at the design stage that include the safety needs of construction workers. These could include computer-driven application software tools.

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APPINDEX

MANAGEMENT ATTITUDE QUESTIONNAIRE

Survey of Management Attitude of Construction Firms in Khartoum

Section I: Personal Information

Consists of personal information about you, please tick {X} in front of what suits your condition

Qualification:

Bachelor.....Master .....HighDiploma .....phD.....

Experience:

Less than 5 years..... 5-10 years.....10-15 years.....above 15years.....

Specialization:

Architect..... Civil..... Other Engineer.....

Type of Business

Consulting..... Contracting.....Government Institutions.....

Section 2: assessment Information

1(a) what is your position within your organization?

……..……

1(b) approximately how long have you held your current position? ……..… years

2(a).Approximately what is the average number of employees in your firm?

…..… employees

2(b).What is the approximate annual value of construction contracts?

$……..… million

2(c).Under which contracting arrangement is the firm's revenue acquired?

…..…% construction management (agency); …..…% general contracting;

...……% subcontracting; …...…% construction management at risk;
…...… % specialty contracting; …...… % design-build; ……
% other (specify) ……... ……

2(d).Describe the firm's area(s) of operation.
…...… % international; …...… % national; …...… % regional; …...… % local

Section 3: Management Attitude to the Prescriptive and Performance Approaches

Before responding to the questions in this section, study the definitions of the prescriptive and performance Approaches

Definition of the prescriptive approach:

The prescriptive approach requires strict and enforced conformity to a safety standard, regulation or rule, and specifies in exacting terms the means or methods of how employers must address given conditions on Construction sites. (The prescriptive approach describes the means and methods to comply with the regulations)

Definition of the safety economic performance approach:

The safety economic performance approach identifies important broadly-defined goals, ends or targets that must result from Applying a safety standard and find the suitable alternative economic, regulation or rule without setting out the specific technical requirements or methods for doing so. The safety economic performance approach describes what has to be achieved to comply with the regulations using acceptable and leaves the means and methods of Complying up to the contractor)

The following questions concern your understanding, beliefs and opinions on the prescriptive and performance approaches to construction worker safety and health. Please check or circle the answer that best approximates your opinion.

3. Assuming that you were erecting scaffolding on a project in a country where both approaches were acceptable and legitimate, which approach would you prefer?

……...… prescriptive approach ……...… performance approach

4. Please explain why you made this choice (in Q3)

...

...

...

5. How well do you feel that you understand the concepts of prescriptive and performance standards? (On a scale of 1 (very poorly) through 5 (very well), circle your choice

1 2 3 4 5

Very poorly Very well

.Table (1); Preference scale

Preference scale	Safety economic performance approach(1)	(2)	(3)	(4)	Prescriptive Approach (5)
, (1) which approach to construction worker safety do you prefer?					
.(2) How influential are the types of approaches to each of the following issues?					
(a) Ease of introduction of new technologies					
(b) Cost effectiveness of approach					
(c) Flexibility					
(d) Ease of implementation					
(e) Ease of understanding compliance requirements					
(f) Support for innovation					
(g) Ease of introduction of new materials					

(3) Supported by the corporate culture, vision and mission of your organization					
(a) Potential to improve safety performance on sites					
(b) Simplicity of interpretation					
(c) Ease of compliance					

Table (2); Importance scale

Importance scale	Not important(1)	(2)	(3)	(4)	Very important (5)
.(1) How important do you regard the following regarding an approach to construction safety and health management?					
(a) Cost effectiveness of approach					
(b) Ease of implementation of the approach					
(c) Ease of understanding compliance requirements					
(d) Support for innovation, new materials and technology					
Potential to improve safety performance on sites					

	Not influential(1)	**(2)**	**(3)**	**(4)**	**Very influential(5)**
(1)How influential are the following in driving change within your organization?					
(a) To improve financial performance					
(b) Only as staff turnover occurs					
(c) When new technology is introduced					
(d) To keep up with competitors					
(e) To improve your safety record					
(f) Only after accidents occur					
(g) To meet worker demands					
(h) To generate quality improvements					
(i) To exploit new market opportunities					
(j) Respond to management initiatives					
(k) Respond to third party claims					
(L) Comply with owner/client requirements					
(n) Meet new insurance requirements					

Table (4); importance scale

Importance scale	Not important(1)	(2)	(3)	(4)	Very important (5)
(1)If the company were to consider introducing a change to improve safety performance how important would be the willingness of workers to accept the change before the change is implemented?					
(2)How important would it be to break down the resistance of workers to change by convincing them to accept the change?					
(3)How important would it be to build credibility and trust with the workers before implementing a change?					
(4)How important would it be to enlist the opinions of workers on a proposed change before it is implemented?					
(5)How important do you regard the receptiveness of first-line supervisors (foremen) to change?					
(6)How important do you consider the following factors to be for the implementation of new approaches? (a)Top management support					
(b)Mutual trust between workers and management					
(c)Incentives and rewards for supporting the change					

(d)Continuous improvement of safety performance					
(e)Open communication (f)Effective coordination of construction activities					
(7)Joint labor/management problem solving					
(a)Adequate resources					
(b)Creativity					
(c)Workshops and training					
(8)How important do you regard the following actions for the successful implementation of a new approach to construction worker safety and health?					
(a)Demonstrate consistent and decisive personal leadership					
(b)Allocate adequate financial, equipment and staff resources					
(c)Amend corporate vision and mission					
(d)Motivate workers to implement changes for continuous improvement					
(e)Encourage worker participation at all levels					
(f) Change the organization's systems, policies and procedures to augment the changes Introduce and support appropriate training programs					

(g)Measure and evaluate progress of the changes regularly introducing new plans of action if necessary					
(h) Compare the performance of the company with competitors					
(i)Reward workers for being innovative, and looking for new solutions					
(j)Change the organizational structure and hierarchy to make it more flexible and responsive to change					

How many recordable injuries did the company have last year? ……..… injuries

Please offer any additional comments you have on the subject of performance and prescriptive regulations and standards in the space provided below:

……..……

……..……

……..……

……..……

……..……

……..……

Thank you for contributing to the improvement of the safety and health effort on construction sites

Please return your completed questionnaire as soon as possible