SAFETY AWARENESS IN INFORMAL CONSTRUCTION SECTOR: A CASE STUDY OF NAIROBI CITY

BY

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DECLARATION

I, ROGERS OCHIENG NDEGE, hereby declare that

This research project is my original work and has

not been presented for a degree in any other

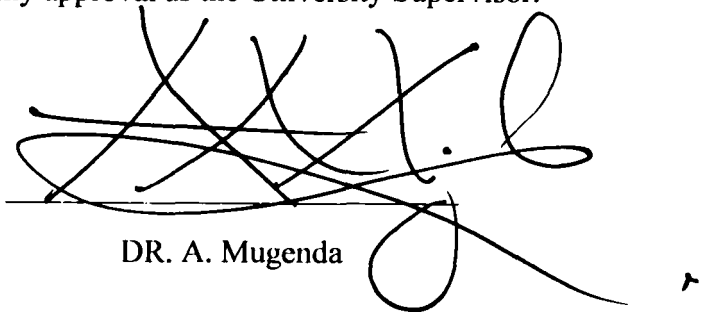
University.

Signed

DECLARATION OF THE SUPERVISOR

This research project has been submitted for examination

with my approval as the University Supervisor.



DR. A. Mugenda

DEDICATION

This work is affectionately dedicated to my lovely wife and children who have been, to me, endless sources of joy and inspiration.

And to the source and sustainer of all, the Lord Jesus Christ.

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ABSTRACT

This study is about safety awareness in the informal construction sector. Safety awareness as used in this study refers to a state of mind where one is constantly aware of the possibility of injury and therefore act to minimize the possibility of causing injury to himself or others (M.C.A., 2003).

The study investigates safety awareness in the informal construction sector with a view to recommending possible self-sustainable ways of improving safety awareness to help reduce accident prevalence in the sector. The study covers building project owners, site foremen, workers and site surveys. In particular, it examines compliance with safety requirements, and investigates behaviours, perceptions and attitudes associated with safety, and management practices and associated documentation relating to safety with a view to establishing how they on impact safety in the informal construction sector.

Basing on the findings, the study concludes that the informal construction sites sampled do not generally comply with safety requirements and their owners are safety ignorant. The study also concludes that although the sampled workers' perception of risk associated with working from heights is appropriate, their behaviours and attitudes associated with safety are inappropriate. Similarly, the study concludes that safety management practices and associated documentations are not only inappropriate but also almost non-existent in the informal construction sites surveyed.

The study recommends a massive and elaborate education campaign to create awareness of the benefits of workplace safety amongst the stakeholders, training and certification of workers/foremen, competent supervision on sites, random inspection by relevant authorities, an appropriate incident/accident reporting system and the formation of workers' associations in the informal construction sector.

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ACRONYMS

The following are the acronyms used in this study:

ACSNI:	Advisory Committee on Safety of Nuclear Installations
CIAC:	Construction Industry Advisory Committee
DOSHS:	Directorate of Occupational Safety and Health Services
EASN:	The East African Standard Newspaper
ECI	European Construction Institute
FOPWA:	The Factories and Other Places of Work Act Cap 514
HSL	Health and Safety Executive
IEA:	Informal Economic Activity
ILO:	International Labour Organization
MCA	Mineral Council of Australia
NZBR:	New Zealand Business Roundtable
OHS:	Occupational health and safety
PPE:	Personal Protective Equipment
ROK	Republic of Kenya
SMS:	Safety Management System
WHO:	World Health Organization

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

Construction activity plays a vital role in the process of economic growth and development, both through its products and through the employment created in the construction process (Doumbia-Henry, 2003). Sohail (1999) acknowledges construction industry's economic importance, as typically contributing 10 % of a developing country's GNP. According to United Nations Environmental Programme [UNEP] (1996), the industry does not only consume one-sixth to half of the world's wood, minerals, water, and energy but it also generates employment and income in a variety of technologies and practices on different scales.

BOMEL Consortium (2001) notes that construction activity presents hazards for people working in the industry as well as to the public in proximity to the sites. Similarly Sohail (1999) labels construction industry as very hazardous. According to the International Labour Organization [ILO] (1999), known injuries, accidents and work-related illness on construction sites frequently exceed those in any other manufacturing industry due to the following characteristics that make construction industry unique:

1. The high proportion of small firms and self employed workers
2. The variety and comparatively short life of construction sites
3. The high turnover of workers
4. The large numbers of seasonal and migrant workers, many of whom are unfamiliar with construction processes
5. Exposure to the weather, and
6. The many different trades and occupations within the industry.

According to Mitullah and Wachira (2003), the composition of the construction sector in Kenya has changed. The diverse private construction sector that mainly invests through the informal system now predominates in the building construction market.

The informal workforce lacks any significant degree of social protection mainly in terms of enforcement of minimum wages and other terms of employment such as leave, housing, OHS regulations, as well as workmen's compensation (Mitullah and Wachira, 2003). Cross (1994) notes that different groups of informal sector workers encounter different workplace safety problems. He attributes the acceptance of these situations by workers to their preoccupation with survival and inadequate awareness of workplace hazards.

Although the informal construction sector plays an important role in the Kenyan economy (by contributing up to 13.8% of the Gross Domestic Product [Republic of Kenya (ROK), 2000]), according to Wachira (2001) and Kinyanjui and Mitullah (1999), majority of the workers are hired as casual labourers without any benefit, and work under very difficult and dangerous conditions that sometimes result in serious accidents. Goldstein, Helmer and Fingerhurt (2001) similarly note that the working conditions for the majority of workers do not meet the minimum standards and guidelines set by ILO and World Health Organization (WHO) for Occupational Health and Safety (OHS) and social protection.

According to Senelwa (2002, September 28), unsafe and unhealthy environments have adverse effect on the performance of workers and result in higher medical and insurance costs. Therefore for any organization to succeed in its operations and enhance productivity, the safety of employees is of prime importance. Mwangi (1989) argues that the noble goal of improvement of the well being of the society at large will have been met when the well being of the people engaged in construction is preserved and perhaps even enhanced.

1.2 Problem Statement

Senelwa (2002, September 28) notes that in spite of the strictness of the law, compliance with safety requirements is wanting: employers in Kenya do not observe basic safety precautions leaving employees exposed to terrible working conditions. Mitullah and Wachira (2003) observe that most employers of informal workers ignore OHS issues. Similarly, Loewenson (1995) notes that the informal sector is characterized

by high exposures to OHS hazards. Mitullah and Wachira in their study of informal labour in the construction industry (a case study of Nairobi), suggest that the OHS problems informal construction workers face could be attributed to lack of information, education and health monitoring system on conditions of work within construction sites. Mitullah and Wachira call for the sensitization of workers on various hazards and means of prevention.

ILO (1999) underscores the importance of the maintenance of safe and healthy working environments in several of its articles. For example, it states:

> "National laws or regulations shall provide that workers shall have the right and the duty at any workplace to participate in ensuring safe working conditions to the extent of their control over the equipment and methods of work and to express views on the working procedures adopted as they may affect safety and health" (ILO, 1999, p. 10)

The employer who is required by the Factories and Other Places of Work Act 514 (FOPWA) to ensure the safety, health and welfare of the workers has not been able to do so (Senelwa, 2002, September 28, p. 24). The present practice of safety management in the construction industry has been unable to adjust to recent, rather rapid, changes in the economy and character of employment in Kenya. For example, labour protection laws do not apply to all industries: the registration of a construction site in Kenya is dependent upon the number of employees employed and the duration of the works (ROK, 1990, 1984).

Kamoing (1990, December 31) argues that the management of construction sites in Kenya is either too lax or not aware of safety as shown by the numerous past accidents. Many duty holders with knowledge of the existence of the regulations may not be aware of FOPWA abstract standards and their relevance to situations actually confronting them in workplaces. Consequently, the informal construction sector has a high rate of accidents (which mainly go unrecorded) that is a source of monumental human suffering and economic loss.

As the informal construction sector continues to have numerous accidents, the key question that is organizational to the study is how safety awareness can more effectively

be raised to make the sector more responsive to the safety regulatory efforts and be able to reduce the high number of accidents and their associated costs.

1.3 Research Objectives

The primary goal of this study was to investigate safety awareness in informal construction sector with a view to recommending possible effective ways of improvement in the sector. This goal was realized through the following objectives:

1. To examine compliance with safety requirements in the informal construction.
2. Investigate behaviours, perceptions and attitudes associated with safety in the informal construction.
3. To investigate management practices and associated documentation relating to safety with a view to establishing how they impact on safety in the informal construction.
4. Investigate the socio-economic background of the workers and foremen in the informal construction with a view to establishing its impact on compliance with safety requirements.
5. Recommend possible effective ways of raising safety awareness in the informal construction sector.

1.4 Research Questions

Throughout the study the following questions will be answered and discussed:

1. What is informal sector? What is informal construction sector? Who participate in the informal construction sector and why? What are the contributions and constraints of the informal construction sector towards economic development in Kenya?
2. How safe are the informal construction sites? How appropriate are the behaviours, perceptions and attitudes associated with safety in the informal construction sector? How knowledgeable about safety requirements are the workers, owners and foremen in the informal construction sector?

3. What management practices and associated documentation relating to safety are in the informal construction sector? How adequate are they in the promotion of compliance with safety requirements?
4. If the Government of Kenya, the project owners, workers, professionals and other stakeholders decide to help in the promotion of safety awareness in the informal construction sector, how and what should they do?

1.5. The Scope of the Study

The study was carried out in Nairobi since it had construction projects of varied sizes, complexity and type at various stages within close geographical proximity, characteristics that were favourable to the study in terms of time and money. Further more, as a capital of Kenya, Nairobi is the centre of construction activities in the country (Mwangi, 1989).

The ongoing informal construction works in Nairobi covered included commercial buildings (shops and warehouses), institutional buildings (schools, colleges, hospitals and hostels) and residential houses.

The study did not include safety aspects of materials and components, mechanical plant design and usage, clinical health effects on the worker and informal component production works, for example, steel window fabrication.

1.6 Justification and Significance of the Study

Workplace injury has direct medical, employment and earnings consequences for a worker (Camm, Boldt, and Ferch, 2000, p. 1) that are the focus of a growing body of global concern not only from labour unions, employers and governments, but also from environmental lobby groups (Senelwa, 2002, September 28).

Very little research has been done with the specific aim of analyzing safety awareness in the informal construction sector in Kenya. Mitullah and Wachira (2003) and Sohail (1999) recommend further research in this direction. But most importantly, the study provides important insights into the knowledge requirements for designing effective safety management systems for informal constructions. The high number of accidents in

the informal construction industry bespeaks of an urgent need for such systems of control.

1.7 Definition of Terms

1.7.1 Safety

According to Mwangi (1989), a construction site can be said to be safe when all the people concerned go about their daily work without " undue risk" of having accidents. It is a state of being free from harm or risk of injury or loss and since there is no time when a person can be totally free from risks, Mwangi argues that it is a matter of degree of risk. Accidents as used here is as defined by Boston University (1999) to include all sudden or non-sudden events that cause injury to a person irrespective of their severity. However lack of accidents on site does not necessarily equate to "safe site" as the site might be riddled with safety incidents. "Incidents" include near-miss events that have the potential of causing personal injury or property damage (Boston University, 1999, p. 1).

1.7.2 Safety Performance

Safety performance of an organization refers to the effectiveness of its safety control system (Körvers, Schaafsma, Brombacher and Sonnemans, (2001). Safety management systems are integrated organizational mechanisms designed to control OHS risks, ongoing OHS performance, and legislature compliance (Cooper, 1996). A good management system should be a fully integrated and cohesive, centred on policies, strategies and procedures that provide internal consistency and harmonization.

1.7.3 Safety Awareness

The Mineral Council of Australia [MCA] (2003) defines safety awareness as a state of mind where people are constantly aware of the possibility of injury, and act accordingly at all times. This implies (1) a constant and conscious effort to be aware of the working conditions especially their associated hazards, for example, through safety audits, safety inspections and sharing of safety information including means of mitigating against hazards through, for example, safety meetings and briefings, and (2) constantly behaving safely in the light of perceived risks.

1.7.4 Safety Management

Safety management involves the functions of planning, identifying problem areas, coordinating, controlling and directing the safety activities at the work site, all aimed at the prevention of accidents and ill health (ILO, 1999). It means applying safety measures before accidents happen.

1.7.5 Informal Economy

According to Morris and Pitt (1995), informal economies are defined as economic activities not included in a nation's data on gross domestic product, and not subject to formal contracts, licensing and taxation. These businesses generally rely on indigenous resources, small-scale operations, unregulated and competitive markets, and in addition, skills are mainly obtained outside the formal educational system.

Informal construction covers buildings including excavation and the construction, structural, alteration, repair, maintenance and demolition of all types of buildings or structures (ILO, 1999) that is neither included in the nation's gross domestic product nor subject to formal contracts, licensing and taxation within unregulated and competitive markets.

1.7.6 Supervisor

"Supervisor" refers to the first level of supervision, which on site is variously termed as "foreman", "charge hand", "ganger", and so forth (ILO (1999). ILO emphasizes a supervisor's competence, that is the possession of adequate qualifications, such as suitable training and sufficient knowledge, experience and skill for the safe performance of the specific work.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Overview of the Informal Economy

Despite decades of work, the informal sector is still a topic which elicits diverging views, sometimes passionately so, about how to define it, how to measure it and how to classify it and especially about how to respond to it. There is even a debate on what to call it (Bangasser, 2000, p. 3). However, Bangasser notes that there is now little divergence that the informal sector exists and will be with us for the foreseeable future. Bangasser attributes this consensus in large measure to the three-decade effort by ILO in developing the concept of the informal sector and implanting it into the development paradigm.

Ghersi (1997) offers a simple definition of this phenomenon as underground activities that have legal ends but employ illicit means, that is activities that may not intrinsically have a criminal content, but must be carried out illicitly, even though they are licit and desirable activities for the economy. Ghersi argues that from an economic point of view, the most important characteristic of informal activities is that those directly involved in them as well as the society in general benefit more if the law is violated than if it is followed. It is a situation whereby people want to work legally but cannot and therefore resort to working in an area of relative illegality created by the legal cracks in the society as a last alternative. Ghersi argues that although informality is socially and economically significant, informal activities have very low productivity.

ILO (2003) defines the informal sector as consisting of small-scale, self-employed activities (with or without hired workers), typically at a low level of organization and technology, with the primary objective of generating employment and incomes. The lack of proper recognition of the conducted activities by the authorities and their escape from the attention of the administrative machinery responsible for enforcing laws and regulations is clearly emphasized by ILO.

2.1.1 Origin and Basis for Informality

According to Ghersi (1997) the origin of informality can neither be found in a cultural shortcoming, a religious or an ethnic problem, but in the inefficiency of the law, that is the cost of legality. Consequently Ghersi argues that politicians, policymakers and, especially, lawyers do not understand that the law has a cost like everything else in terms of the amount of time and information necessary to comply with it.

2.1.2 Characteristics of Informal Economy

ILO (2003) gives the following as characteristics of the informal sector:

1. Informal sector enterprises usually employ fewer than ten workers, mostly immediate family members.
2. The informal sector is heterogeneous (major activities are retail trade, transport, repair, and maintenance, construction, personal, and domestic services, and manufacturing).
3. Entry and exit are easier than in the formal sector.
4. Capital investment is generally minimal.
5. Work is mostly labour intensive, requiring low-level skills.
6. Workers learn skills on the job.
7. The employer-employee relationship is often unwritten and informal, with little or no appreciation of industrial relations and workers' rights.
8. The informal sector works in conjunction with, rather than in isolation from, the formal economy. It has increasingly become integrated into the global economy.

According to Ghersi (1997) the informal sector constitutes a response by those excluded by and from the formal sector to integrate themselves into an economic activity due to widespread unemployment and underemployment in the formal sector. Many authors including Desoto (1989) argue that the bureaucratic barriers to formal and legal operation, including an array of permits and registrations, reduce the profit potential of a firm and reinforce the decision by hard working, competitive and innovative people to remain apart from the formal economy. The formal sector in economic sense refers to

those economic activities carried out in a country, which are officially recognized and enumerated in the event of trying to establish the Gross National Product from economic statistics collected.

Although the informal sector activities are largely ignored, rarely supported, often unregulated and sometimes actively discouraged by Governments, the sector has grown considerably: evidence suggests that employment has probably increased a good deal faster in the informal than in the formal sector (ILO, 1972).

Basing on the case of Peru, Ghersi (1997) classifies the informal economy as follows:

1. Informal construction: the development of the housing informal sector has great economic, social and political importance.
2. Informal commerce: the presence of informal activities in the commercial sector is the most notable, for example, street vendors in Peru (Ghersi, 1997).
3. Informal industry: this is made up of artisans and the fully informal industrialists who are employed illegally in the manufacturing sector, and
4. Informal services: this is quite high and the most remarkable case is in the public transportation.

2.2.0 The Informal Construction Sector

According to Holkeri (2001), the record of globalization is mixed: whereas some countries have been able to take advantage of the market economy, others have become more marginalized, disintegrated and impoverished. The market forces and economic growth have not been able to guarantee social justice, employment and development to all.

Wachira (2001) notes that informal construction has been growing in developing countries, particularly in, and around urban areas. Mitullah and Wachira (2003) attribute this growth to poor economic performance that has not only reduced urban growth but also drastically reduced employment opportunities in the formal economy. As per the ROK Economic Survey (2000), the private sector accounted for more than 90% of building construction output, most of which, according to Mitullah and Wachira, were

carried out through the informal sector. Wachira points out that the decline in economic growth in the late 1980s and 90s saw the government loose the leadership in the role of housing provision to the private sector that provides mainly low cost housing through the informal construction sector.

2.2.1 The Characteristics of Informal Construction Sector in Kenya

The Kenyan informal construction sector is characterized by the self employed workforce that does not have any employment contract with any employer and move around in areas where construction is prevalent and get hired by owners or foremen in charge of the construction on casual basis, mainly lasting for one day to a month depending on the pace of work, availability of materials and funding (Wachira, 2001, December, p. 25). However, some of the beliefs held about the informal economy are increasingly being challenged, especially in the informal construction sector.

Although many authors have argued that most informal entrepreneurs are in activities that are easy to enter with relatively low costs and few entry barriers, Mitullah, and Wachira (2003) observe that this conventional belief is now being challenged. According to Mitullah and Wachira, studies have established that the educational background of those operating in the sector has improved and education is used in sub sectors to vet new entrants, faulting the assumption of easy of entry. In many sub sectors, those wishing to join have to have the right networks relevant for linking the individual to the resources required and the site of operation (Graham, Mitullah and Kopiyo 1998, McCormick, Mitullah and Kinyanjui, 2001).

Many authors and researchers including Mitullah and Wachira (2003) argue that the assumption that there are no restrictions, rules, requirements or regulations to entry into the sector is due to ignorance of the dynamics of the sector: studies with a focus on both social capital and institutions have shown that the informal economy has its own regulations and dynamics including norms and rules of behaviour and operations. According to North (1990) and K'Obonyo et al. (1999) firms operating in the informal sector have their own self-regulatory mechanisms, albeit informal.

Mitullah and Wachira (2003) attribute non-compliance with official and administrative requirements, such as registration and payment of taxes to the cumbersomeness of registration and lack of significant benefit as a result of registration. Although this lack of registration is intended to escape manipulation by public officials, Mitullah and Wachira argue, it can backfire, as lack of legality means that they are more liable to manipulations (for example, K'Obonyo et al., 1999). Therefore, Mitullah and Wachira argue that the notion that the informal sectors avoid tax payment should be understood within this context. There is willingness to pay tax by firms operating in the informal sector as revealed by a study by Graham et al. (1998). Mitullah and Wachira advocate for the designing of appropriate payment schedules for the informal sector: firms find it difficult to accumulate the lump sum payment required by the authorities, but are willing to pay the required fees by installments. Mitullah and Wachira observe that the capacity to pay is reflected by the amounts paid as bribes that are well above the required licensing/registration fees.

According to Mitullah and Wachira (2003), majority of the buildings constructed informally do not abide by the existing by-laws, insurance cover, and other legal requirements. Many owners of developments do not submit their building plans together with proof of title to the land to local planning authorities, and since this is used as a basis for documentation for construction work, Mitullah and Wachira argue that a gap between the recorded statistics and actual construction is created. For example, Wells (2001) has shown this difference by comparing trends in recorded building activity and cement consumption in Nairobi.

Wachira (2001) notes that the informal housing employs non-traditional construction procurement methods in dealing with low-income earner clients. According to Mitullah and Wachira (2003), individuals develop many buildings in low and middle income (including peri-urban) areas with basic capital in an incremental manner making it difficult to easily quantify the value of such buildings completed each year. The owners mostly buy materials for construction at the various stages, and hire tradesmen to act as the foremen to oversee construction work. Owners have no control over material usage/wastage, although, together with their family members and friends, they do quality assurance by comparison with other existing developments.

According to Mitullah and Wachira (2003), building construction work is carried out by unregistered firms that, as a result of lack of registration with the Ministry of Public Works and Housing, lack credibility necessary for support, especially from the government and financial institutions. This denies them opportunities for support, coordination and networking necessary for improving business.

Most enterprises in the informal economy are owned and run by individuals, although some employ a few people. Firm size is limited by lack of access to capital, poor management, intense competition and inadequate marketing strategies (Mullei and Bokea, 1999). Thus small firms in Kenya rarely graduate into medium or large enterprises (Mitullah and Wachira, 2003, p. 6). Mitullah and Wachira observe that these firms are also characterized by low level of organization with little access to organized markets, formal credit and education/training. According to Oludhe (1990), these firms handle small jobs. However, Mlinga and Mlema (2000) in their study of the informal contractors in Tanzania note that the formal construction industries depend on the informal sector for labour due to the inability of large firms to employ a permanent labour force due to the lack of continuous workload. Mlinga and Mlema argue that these fluctuations in workload could be used as a catalyst for encouraging the development of an efficient informal construction sector that if properly harnessed could contribute to economic growth and provide employment and income to many.

Although the informal construction sector makes a significant contribution to GDP and employment in Kenya, Wachira (2001) notes that it lacks regular employment. Workers normally get work for one or a few days only consequently resulting into insecure and temporary employment. Wachira notes that workers in informal sector remain ununionised. Consequently, they suffer problems of insecurity and hazards of their work. However, some of these workers are beginning to realize the importance of unity by forming legal welfare organizations. For example, the Kenya Federation of Builders Association (KFBA), whose objectives include capacity building through training/seminars, promoting the well-being of members regarding work related illness and accidents, and ensuring discipline amongst members (Registrar of Societies, ROK, 2003).

Although many have advanced the argument that most of the workers in informal sector are illiterate or semi illiterate and ignorant, this has partly come under challenge. Many researchers including Mitullah and Wachira (2003), and Kinyanjui and Mitullah (1999) note that the workforce in the informal construction is increasingly getting educated with more than half of the employees in Kenya having attained at least secondary education. However research has shown that majority of the workers in the informal construction sector seem not to be aware of the safety requirements (Mitullah and Wachira, 2003). Kamoing (1990, December) notes that inadequate safety awareness as a problem in construction industry.

According to Wachira (2001), houses in the private sector are constructed by capital funding that is at best erratic and unpredictable, factors that contributed to the emergency of the vibrant informal sector with the ability to adapt to this unpredictable funding. Wachira notes that clients' access to capital funds for the projects is highly unpredictable, implying that construction duration is unknown and projects often experience stoppages depending on the availability of funds.

2.3 The Concept of Safety

According to Mwangi (1989), a state of safety is one in which no danger of a damage causing accident exists. Mwangi argues that safety should always be specified in terms of one or more risks. Total safety against a given risk is only considered to have been attained, that is 100% safe when the source of risk is eliminated. Therefore emphasis should be on the elimination of as many risks as possible as a key to the achievement of the highest degree of safety. Mwangi argues that unless removed, the persistence of unsafe situations and risks at the work environment will eventually lead to an accident. Due to the dynamic nature of construction, Mwangi argues for constant evaluation of workplace safety if an acceptable degree of safety is to be maintained.

Mwangi (1989) traces pioneer preventive action against occupational accidents to the need to improve on the unhealthiest working conditions and remedy the appalling lack of physical protection against the most dangerous occupational hazards. This was after it became clear that with proper planning, foresight and safeguarding, most accidents could

be prevented. According to Hogstedt and Pieris (2000, November), many occupational hazards can be avoided and controlled through the adoption of appropriate working practices by the workers. For example, by providing the worker with information, tools, work organization and work aids that enable a safe and decent work place. Hogstedt and Pieris emphasize the need for knowledge of hazards at work and how to avoid them.

The issues that make construction safety management very difficult are captured below:

"It is recognized that construction is a challenging regime in which to manage health and safety. It takes place in an inherently hazardous environment with direct exposures to height, forces, and power e.t.c: the conditions are constantly changing both physically and in relation to the parties involved, it embraces an enormous breadth of activities, project types and sizes of enterprises: it suffers a macho culture borne out of a rugged history: it runs with low margins and increased pressure on schedule and cost: and it is already subject to industry wide "initiatives" to improve productivity and so forth" (BOMEL Consortium, 2001, p. 8)

According to Dorman (2000), one of the more worrisome characteristics of precarious employment is the workers' little input into their work conditions. Aronsson (1999) found that non-permanent workers have less knowledge about their work environment: 30% feel constrained by their status to "refuse work environment deficiencies" while 41% found it more difficult for their voices to be heard. Dorman (2000) gives reasons for difficulties in OHS management in small and medium enterprises as:

1. Many OSH interventions have a substantial overhead cost, and the smaller the firm, the smaller the revenue base over which these costs can be distributed.
2. The level of expertise is frequently lower in small and medium enterprises.
3. The small and medium enterprise's environment is generally more competitive, and finance is more difficult to obtain, leading to shorter time horizons (lower investment in general) and fewer expenditures on what may be perceived as "nonessential" items.

Dorman (2000) argues that all groups that have lower socio-economic status generally seem to have more dangerous working conditions. Dorman concludes that precarious

employment generally present an obstacle to the improvement of OSH conditions and exacerbates the unequal exposure to those conditions within society.

2.3.1 Safety Management Systems

Flin, Mearns, O'Connor and Bryden (2000) define safety system as encompassing aspects of the organization's safety management system including safety committees, safety officers, safety equipment and safety polices, that is a system of structures, responsibilities and procedures. ILO (1999) gives the main objectives of effective safety management as making the environment safe, making the job safe, and making the workers safety conscious. Safety management comprises of safety policy and safety organization components (ILO, 1999 and Mwangi, 1989).

2.3.1.1 Safety Policy

Mwangi (1989) and Mol and Williams (1989) emphasize the need for employers to have written safety policies setting out OHS standards, which become the enterprise's objectives. This written policy should be signed by the company's chief executive officer and communicated to all personnel with the understanding that compliance is a condition of employment. Mol and Williams; Mwangi; and ILO (1999) advocate for the allocation of responsibility as set in the policy to a specific individual with authority to do so.

ILO (1999) lists matters that the safety policy should deal with as:

1. Arrangements for training at all levels with particular attention to workers such as scaffolders whose mistakes may be especially dangerous to other workers
2. Safety methods and systems of work for hazardous operations which should be prepared in conjunction with the workers carrying out these operations
3. The duties and responsibilities of supervisors and key workers
4. Arrangement by which information on safety and health is to be made known
5. Arrangements for setting up safety committees, and
6. The selection and control of subcontractors (to facilitate contracts with clearly set out responsibilities, duties and safety measures).

2.3.1.2 Safety Organization

Mwangi (1989) asserts that organizational framework must be set up to facilitate the implementation of the safety policy. Mwangi argues that a structure that clearly defines the duties and responsibilities of the various levels as far safety is concerned must be designed. It should ensure that safety is integrated rather than separated from production thereby facilitating total commitment to safety.

ILO (1999) notes that safety organization is determined by the size of the work site, the system of employment and the way in which the project is being organized. ILO emphasizes the maintenance of safety records for facilitation of identification and resolution of safety and health problems on site.

ILO (1999) gives examples of OHS duties that should be assigned to certain persons as:

A. Safety Officer/Manager

According to ILO (1999), every construction company of any size should appoint a properly qualified person or persons (with access to an executive director of the company) whose main responsibility is the promotion of OHS. The duties of such a person (or persons) would include:

1. The organization of information to be passed from management to all workers
2. The organization and conduct of safety training programmes, including induction training for all new workers on site
3. The investigation and review of the circumstances and causes of accidents and occupational diseases so as to advise on preventive measures
4. Acting as consultant and technical adviser to the safety committee, and
5. Participation in the pre-site planning.

B. Supervisors

Good planning and organization at each work site, and assignment of clear responsibility to supervisors are fundamental to safety in construction (ILO, 1999, p. 5).

ILO advises that each supervisor should seek to ensure within his area of competence that:

1. Working conditions and equipment are safe
2. Workplace safety is regularly inspected
3. Workers have been adequately trained for the job they are expected to do
4. Workplace safety measures are implemented
5. Best solutions are adopted using available resources and skills
6. Necessary (PPE) is available and used.

C. Workers

According to ILO (1999), every worker is under a moral and often under a legal duty (FOPWA sections 65, and 72 [2]) to take maximum care for his own safety and that of fellow workers. Workers may directly be involved in site safety conditions through:

1. "Tool box briefing" - a five to ten minutes session with the supervisor just prior to starting a task gives the workers and the supervisor a chance to talk about safety problems likely to be encountered and potential solutions to those problems.
2. "Safety check" - a check by the workers that the environment is safe before starting work may allow them to take remedial action to correct any unsafe situation that could later endanger them or other workers.

Larcher and Sohail (1999) give the following as the employees' legal duties:

1. Follow instructions given to them by their supervisors
2. Cooperate with their employers on health, and safety matters
3. Follow safety and health rules which apply to their job
4. Use the health and safety equipment provided
5. Report equipment defects to their supervisor, and
6. Take care of their own health and safety as well as of others affected by their work.

However, the workers contribution to safety is highly compromised by high worker turnover. Hinze (1978) showed that worker turnover is a key factor in safety performance. This may be even more serious in informal sector where, according to Mitullah and Wachira (2003) and Kinyanjui and Mitullah (1999), majority of the workers are hired as causal labourers for short durations and without any benefits.

Hinze (1978) in his exploration of the impact of new workers and worker turnover rate on safety identified the following:

1. Superintendents having the same crew from previous jobs had fewer injuries
2. Safety increases when the employer retains the worker for one year, and the benefits increase with longer continuous service.

Hinze (1978) defines turnover as the rate at which workers in construction firm or site leave their jobs and the rate at which new employees fill up their positions. However, Mwangi (1989) acknowledges the difficulty in measuring worker turnover in construction due to the short duration of projects and the multiplicity of skills and their requirement at different stages of the project. Mwangi argues that turnover in construction industry will remain high, and the only way to reduce its adverse effects is by helping the new workers adapt to new work environment as fast as possible.

Hinze (1981) in his pioneer study on safety identified particular factors with significant influence on worker safety as psychological climate of individual. The psychological climate referred to here include the worker's relationship and attitudes towards his fellow workers, the supervisors and the personnel department of the employer. The findings of the study showed that the psychological climate of an individual worker has a direct influence on his safety performance, for example:

1. Smaller gangs with cordial friendly relationships among its members were found to be safer
2. Workers who had supervisors who showed them respect and gratitude by incorporating or considering their suggestions were also found to be safer, and
3. The general pace of the work as set by the employer was also found to have an influence on the safety performance, for example workers who had strict deadlines to meet and those involved in competition with fellow workers were

found to get involved in accidents more than their counterparts with more relaxed work schedules.

D. Safety Committees

According to Cooper (1998), the general aim of a safety committee is to bring management and workers together in the safety process. Cooper argues that a safety committee can be seen as both an indirect measure of management commitment towards safety and a measure of the extend to which safety communication flows between workers and management.

Sawacha, Naoum and Fong (1999) identified safety committees as an important factor in safety performance. Sawacha et al. suggest that organizations with effective safety committees are more likely to try and improve safety performance than those without. Lee and Harrison (2000) found a positive correlation between team briefings that include discussion of safety and positive attitude towards safety by staff. Section 65A (1) of FOPWA states that factories that regularly employ at least twenty employees shall have safety and health committees, on which the employers and the workers are represented (ROK, 1990). According to ILO (1999), the safety committee carrying out a site inspection together raises the level of safety consciousness at the site.

ILO (1999) points out that the duties of a safety committee should include:

1. Regular and frequent meetings to discuss OHS programme on site and to make recommendation to the management
2. Consideration of safety personnel
3. Discussion of accident and illness reports in order to make recommendations for prevention
4. Evaluating improvements made
5. Examination of suggestions made by workers and safety representatives
6. Planning and taking part in educational and training programmes. and information sessions.

E. Safety Representatives

According to ILO (1999), workers should, in accordance with national legislation, appoint representatives for dealing with OHS matters on site, for example, FOPWA section 65A (1) (ROK, 1990). These representatives must be experienced workers with the ability to recognize construction site hazards, although they are likely to require new skills in inspection and in information usage.

The functions of safety representatives should include:

1. Making representation to the management about workers safety
2. Attending meetings of safety committee inspections on site
3. Carrying out regular and systematic inspection on site
4. Investigating accidents in conjunction with the management to determine their causes and to propose remedies
5. Investigating complaints by workmates
6. Representing workers in discussions with government inspectors during their site visits.

F. Outside Agencies

ILO (1999) notes that many countries have laws and regulations that governing conditions of work in construction industry, enforceable by the labour inspectors. These national laws and regulations are often based upon international conventions, agreements, declarations and programmes drawn by different UN organizations including ILO and WHO.

2.3.2 Safety Factors

According to Stanton (1995), an understanding of the number and nature of the safety variables that are relevant to any given project situation and how to organize and combine these variables for effective and adaptive use are two knowledge prerequisites for effective safety management on construction projects. However, McDonald and Hrymak (2002) cautions that in spite of the good understanding of the extend and patterns of

accidents in the construction industry, there is only limited evidence about the full range of factors contributing to those patterns.

Hinze and Harrison (1981) found out that bigger firms had better safety performances.This was attributed to formal safety programmes as evidenced by prevalent use of accident reports, more formal training for new employees and safety personnel, more extensive use of safety incentives and more rigid company requirements on general safety. This, according to Mwangi (1989), reinforced a general feeling by some quarters in construction that small firms were responsible for the deplorable safety record of the industry.

Hinze and Harrison (1981) found the following as key factors in safety performance:

1. Field safety representatives hired by the corporate safety director
2. Field safety directors trained their subordinates
3. The safety director reports to the chief executive of the company
4. New workers received formal safety orientation
5. Safety awards were given to the workers and the foreman

Levitt and Parker (1976) in their study to establish whether a relationship existed between the accident rate and a company's policies and practices of top management, found seven practices that can be attributed to firms with excellent safety record:

1. They were well informed of the accident records of all their sites and could make evaluations of the records and take appropriate action accordingly
2. The managers used their records as a basis for staff evaluation thereby motivating the workers
3. They attached the same importance and concern to safety as to other issues like costs and time, making workers realize that safety had impact on profitability
4. They encouraged a cost reporting system that gave cost analysis of accidents occurring on their sites
5. They provided and encouraged the use of safety equipment on site at all times
6. Ensured training of new workers joining their sites on safety aspects of their work

7. They emphasized work planning as an aspect that could reduce accident occurrence.

Mwangi (1989) refers to these practices as constituting part of good safety management practice.

In a study to determine the relationship between job control in construction and safety performance, Hinze and Pannullo (1978) showed that safety performance tends to be better in those firms that have a closer job control and long continuous duration of employment of workers. Hinze and Pannullo defined job control as a combination of management ongoing knowledge of site conditions and its ability to react promptly to any special needs that arise on site. Job control was measured in terms of the nature and location of the site, the degree to which informal contacts occur between the top managers at the head office and the site personnel, top management's ability to physically monitor what was happening on sites and the channels of communications. Hinze and Pannullo also found that those factors that promoted safety were readily available in smaller firms.

In another study Hinze and Rabound (1988) identified appropriate means of achieving or maintaining acceptable safety performance. The key factors included:

1. Top management support which endorsed employing a full time safety officer
2. Regular safety meetings and performance monitoring undertaken for supervisors
3. Better work scheduling and discussion of safety issues in coordination meetings.

Jaselki, Anderson and Russel (1996) on their part recommended steps to achieve outstanding safety performance as including:

1. Strengthening upper management's attitude towards the importance of safety
2. Reducing project management team turnover
3. Ensuring the field safety representatives spend 30-40% of the time on safety issues
4. Increasing the number of formal safety meetings with supervisors and specialist contractors to once a week
5. Increase the number of informal safety inspections to four times per week

6. Reduce the amount of money fined for poor safety performance.

Zimilong (1985) investigated the motivation for safe behaviour as a function of risk estimation and found that workers were more likely to underestimate high-risk situations if they had worked over along time with these hazards. Zimilong highlighted the importance of comparing perceived and actual risks, and recommends putting programmes in place to instruct employees about the actual hazards in order to reduce the discrepancies between subjective risk estimates and objective risks.

Hinze and Figone (1988, 1988b) investigated the influence of the general contractor on specialty contractors for small, medium and large-scale projects. Additional factors that improved safety performance were found to be:

1. Companies that negotiated a majority of prime contracts were safer
2. Small projects, projects with fewer specialty contractors and negotiated contracts resulted in fewer accidents
3. Daily inspections and good housekeeping
4. Less schedule pressure
5. Involvement of specialty contractors in meetings with owners/clients
6. Project schedule produced with onsite departments.

Liska (1993) introduced the concept of zero accidents techniques shown below to reduce the possibility of accidents:

1. Safety planning including goals, personnel, policies and procedures, fire inspection programmes and safety gadgets
2. Safety training and orientations
3. Safety incentives
4. Alcohol and substance abuse programmes
5. Record keeping and follow up
6. Regular safety meetings
7. PPE employed.

Hislop (1991) recommended that safety programme which could compliment Liska's techniques should include:

1. A comprehensive safety policy statement
2. Review of constructibility
3. Pre-construction meetings (safety review)
4. Inspection
5. Good housekeeping

Samuelson (1977) points out that the future of OHS in construction depends on collaboration of many parties including labour, industry, academia, private organizations and the government. Samuelson and Levitt (1982) provide owners' guidelines for selecting safe contractors and monitoring safety performance. They name strategies that impact safety performance to include:

1. Use of short-term permits to regulate hazardous operations
2. Stressing safety during periodic visits
3. Incorporating detailed job specific safety requirements in the specification
4. Periodic inspections
5. Awards for safety practices
6. Considering safety as a criterion in pre-selection of contractor for bids

According to Tarjan and De Veen (1998), safety needs to be costed and paid for by the employer either directly or indirectly. Tarjan and De Veen argue that although safety may cost money to the client, it is worth paying for it to avert the economical or social losses associated with lack of OHS responsibilities. Tarjan and De Veen's study indicated that in addition to the written legal contractual requirements, people's perceptions of safety requirements are key factors in addressing safety on construction sites. Tarjan and De Veen note that monitoring and advocacy could be the tools to ensure that minimum OHS requirements are met.

The construction Industry Advisory Committee [CIAC] (1987) suggested that the safety records and relevant information should be considered at the time of short-listing the contractors: contractors should submit accident records with follow up actions and

safety policies. Sweeney (1997) faults the state of construction safety as evaluated on the basis of compensation claims. Sweeney argues that in a developing country's context, the financial compensation and claims may not be a realistic criterion for evaluating the industry's health and safety performance due to the following:

1. There are no reliable information to refute corporate claims
2. There is not a strong culture of compensation, insurance or claims in many developing countries
3. The rights of the workers are either non-existent or not enforced.

However, Sweeney acknowledges that OHS costs in developing countries remain significant as the economic and social costs to workers and society.

2.3.3 Safety Culture

Cooper (2000) defines culture as a concept that describes the shared corporate values within an organization that influences the attitudes and behaviours of its members. According to Flin et al. (2000), safety climate can be seen as the current surface features of safety culture that are discerned from the employees' attitudes and perceptions. The Advisory Committee on Safety of Nuclear Installations (ACSNI) HSE (1993) defines safety culture as the product of individual and group values, attitudes, perceptions, competences and patterns of behaviour that determine the commitment to and the style and proficiency of an organization's OHS management.

Organizations with a positive safety culture are characterized by communications founded on mutual trust, shared perceptions of the importance of safety and by confidence in the efficacy of preventive measures. Lee and Harrison (2000) note that although definitions vary, there is consensus towards safety culture being proactive stance to safety.

According to HSL (2002), studies have found the presence of subcultures within organizations, suggesting the absence of cohesive safety culture. HSL notes that subcultures are likely to develop when employees within the same organization experience different working conditions. The work groups are likely to view risk differently depending on the type of work they do. HSL emphasizes that subcultures are

not as undesirable as they can provide useful contextual insight into the different risk and hazards experienced by work groups.

According to HSL (2002), the following can be seen as indicators of positive safety culture:

A. Managers planning work effectively

Part of the managerial commitment to health and safety involves managing production pressures so as not to pressurize employees into cutting corners and committing unsafe acts.

B. Managers getting actively involved in active monitoring

HSL (200) notes that managers can get actively involved in the assessment of safety performance through conducting safety tours. These are non-detailed inspections carried out as a way of demonstrating leadership and commitment.

C. Managers getting involved in reactive monitoring

These includes investigations of accidents which caused injury or damage to property, near-miss occurrences and cases of occupational ill health

D. Managers sitting on safety committees

According to HSL (2002), an effective safety committee is likely to be part of an overall positive safety culture within the organization. Coyle and Leopold (1981) gives the following as features of an effective safety committee:

1. The presence of a senior manager to approve decisions, and show that priority is given to health
2. Recognition of the safety officer's role should be recognized and granting all members equal opportunity to raise issues
3. Feedback should be regular from and to workers
4. Regular meetings at pre-arranged times
5. Committee membership should reflect representation within the company
6. Regular attendance from all members is important in order to build solid relationships

7. All members to have effective OHS training
8. Compact but manageable size

Other elements include (Dickety, Collins, and Williams, 2002)

9. Minutes from each meeting to be recorded and circulated to the workforce
10. OHS actions are assigned to individuals with time frames for review used as an opportunity to follow up actions from previous incident investigations as well as discussing accident trends, and near miss incidents.

2.3.4 Risk

According to HSL (2002), the concept of risk as regards safety climate covers a wide range of issues such as self-reported risk taking, perceptions of risk within the workplace as well as attitudes towards risk and safety. For example, Cox, and Cheyne (2000) found 'personal, appreciation of risk' (how employees view the risk associated with work) and 'personal priorities and need for safety' (employees' health and safety management, and their need to feel safe) to be a useful indicator in their safety climate assessment.

Rundmo (2000) found that the emotional perception of risk along with safety attitudes, assessment of safety climate and perceived 'safety status' (for example, employee's influence on and communication with management, availability of PPE, training, and so forth) appeared to influence employee's judgment of risk. He notes that a management priority of safety over production has an indirect effect on risky behaviour, whilst acceptability of rule violation was found to be the strongest predictor of behaviour.

2.3.5 Safety Education and Training

Mwangi (1989) notes the importance of safety education and training in the establishment of an effective safety programme. According to Mwangi, education primarily deals with the development of the mind, the broadening one's knowledge and understanding in a particular area. For example, developing safety mindedness, that is a creation of awareness of the importance of eliminating accidents and development of mental awareness in recognizing and correcting conditions and practices that might lead

to injury. Mwangi gives the primary goal of training as the development of skill in the safe performance of certain tasks, for example, use of safe work techniques and practices.

Due to dynamism in the areas of OHS and technology, Mwangi (1989) emphasizes the need for continuous safety education/training for all in construction industry, for example, the management need technical awareness for carrying out their responsibilities of forecasting dangers in new production and budget allocations for safety and its associated cost.

2.3.6 Competence

According to HSL (2002), competence factors include workers perception of employees' qualifications, knowledge and skills, and relates to selection, training and competence standards (procedures for ensuring competence and training). ILO (1999) defines a competence as possession of adequate qualifications, such as suitable training and sufficient knowledge, experience and skill for the safe performance of the specific work. ILO charges competent authorities with the role of defining appropriate criteria for the designations of such competent persons and their duties.

2.3.7 Safety Communication

Mwangi (1989) argues that the process of imparting specialized knowledge is not complete until it reaches the targeted group in good time, without distortion and achieves the desired effect. Mwangi argues that safety communication can be most effective if it is preceded by the creation of awareness in the entire work environment. Parker and Oglesby (1972) argue that the industry as a whole, from top management to the lowest level employee, employer agencies as well as trade unions, must be aware of the great gains to be achieved from the creation of a safe work environment.

According to Wong (2003), workers are, in reality, reluctant to join training course even if they recognize the correlation between unsafe working practice and accidents because of missed earnings due absence from work. Wong (2003) gives the factors that affect safety communication between the main contractor and the subcontractors as industry nature, industry culture, organization culture, type of client, organization

structure, relationship of main and sub-contractors, communication barriers, communication means, content of information, values of communicators, provision of continuous training, and workers attitude.

Glendon and Mckenna (1995) suggest that organizations with a positive safety culture are characterized by effective communication that is founded on shared beliefs of the importance of safety and mutual trust as well as confidence in efficacy of preventive measures. Ryan (1991) identified effective communication that leads to collective goals and the means to achieve them as a critical indicator of safety culture. HSE (2000) suggest that managers can communicate to employees in three ways:

A. Visible behaviours

Employees easily recognize what senior managers regard as important, and will adapt their own behaviour accordingly. Managers can show their commitment to OHS by

1. Taking regular OHS tours on site
2. Regular attendance of OHS committee meetings
3. Through active involvement in investigations of accident, incidents and ill-health

B. Written communication of:

1. OHS policy statements
2. Statement concerning OHS roles, and responsibilities
3. Performance standards
4. Findings from risk assessments
5. Risk control information and practice

D. Face to face discussions between employees and managers enable employees make personal contribution in addition to making employees feel involved in the organization's OHS. Opportunities for talking include:

1. During planned meetings or briefing from which information is cascaded through the workforce
2. Management meetings should include OHS issues on the agenda
3. Through regular 'tool-box talks'

2.3.8 Awareness and Knowledge

Oxford Advanced Learner's dictionary defines awareness as having knowledge of something or being interested in and knowing about something. According to Meager, Tyers, Perryman and Willison, (2002), awareness occurs when an individual is sufficiently informed about a subject that he becomes conscious of its existence and its broader subject matter. Knowledge, on the hand requires a theoretical or practical understanding of the subject. For example, knowledge of a piece of legislation implies that the individual could demonstrate some understanding of the detailed provisions of the legislation. Meager et al. consider knowledge a 'stronger' concept than awareness since it is possible to demonstrate awareness without having substantive knowledge of a subject matter, but not vice versa.

Salter (2002) in his study on OSH programme in the informal sector in Manila observes low awareness of the magnitude of OHS problems amongst informal sector workers despite the acute OHS problems they face. Salter notes an even lower level of awareness of ways to improve their working conditions. The study found that informal sector operators and workers were preoccupied with their survival. Accordingly, Salter argues that approaches for improving OHS in the informal sector must first overcome this lack of interest.

2.3.9 Accident Causation Models

Stanton (1995) notes that researchers have formulated the impact of the five enduring variables on safety performance and many accident causation models involving the interaction of these variables. Six of these models were geared towards management action and seemed to account for the important organizational, individual, environmental, and technical factors that are involved.

2.3.9.1 Heinrich's Domino Theory Model

According to Stanton (1995), Herbert W. Heinrich proposed a theory of accident causation in 20s based on the examination of thousands of insurance records of industrial accidents, becoming the first comprehensive effort ever to explain the industrial accident

phenomena scientifically. Stanton notes that industrial accidents had previously been believed to be a matter of fate.

Heinrich (1941) conceptualized a domino theory of accident causation that states:

1. Injuries are caused by accidents
2. Accidents are caused by unsafe acts and conditions
3. Unsafe acts and conditions are caused by the faults of persons, and
4. Faults of persons are caused by the social environment and ancestry.

This was a serious attempt by Heinrich (1941) to show that removing any one of the dominos in the sequence could interrupt the accident sequence. Heinrich asserted that the bull's eye of the accident prevention target was the unsafe act of a person or a mechanical or physical hazard.

2.3.9.2 Bird's Modified Domino Theory Model

According to Stanton (1995), many researchers felt that Heinrich's theory attributed too much cause to factors internal to workers and neglected the importance of external factors. Consequently, Bird, and O'Shell (1973) revised Heinrich's Domino theory, introducing the thought of managerial error into the accident causation sequence.

According to Stanton (1995), Bird's modified domino theory is not as widely accepted by construction managers as Heinrich's model, probably because Heinrich's model lets them "off the hook". Blaming workers is easier and less costly than training workers, changing how an operation is performed or making environmental modifications. Stanton further argues that although Heinrich seemed to emphasize the fault of the worker, on the contrary, a careful study of his writings suggests over emphasis of the notion. Stanton gives Bird's revised domino theory as:

1. Injuries are caused by accidents
2. For every accident there are immediate causes that are related to operational errors
3. Operational errors are only symptoms of deeper underlying or basic causes related to management errors, and

. The absence of a system of effective control permits the existence of the factors referred to as basic causes.

.3 Kjellen and Larsson's Accident Research Model

ellen and Larsson (1981) developed an accident causation model as a result of rch work within the Occupational Accident Research Unit (OARU) of the Royal ute of Technology in Stockholm, Sweden to serve as a common conceptual ework for the members of the OARU, and as a basis for research into the lopment of a systematic safety management system. The model operates on two s of the accident sequence and the underlying determining factors.

e accident sequence is a chain of deviations in the planned production process or environment that results in an injury or property loss. The determining factors are tural properties of the production system that influence the accident sequence ectly and change slowly in comparison with it. The researchers divided the mining factors into three categories namely physical/technical, nizational/economic and social/individual.

.4 Dawson, Poynter and Stevens' Hazards Control Model

wson, Poynter and Stevens (1983) on the basis of their study of the safety rammes of eight petrochemical facilities in Great Britain, proposed a safety gement model designed around technical controls and motivational controls.

wson et al defined technical controls as controls that are employed against specific ds. These controls might involve modifying physical or technical characteristics of working environment, modifying specific behaviour patterns of individuals or ucturing the way workers and the environment interact. Motivational controls were ed as controls that are concerned with the development and maintenance of general awareness and management support of technical controls. Motivational ols realistically address the need to purposely manage the motivation to implement ical controls in an environment where the chief concern is the generation of profits. hree principal elements of motivational controls they identified are: setting a safety

tone for the organization, definitions of safety responsibility, and developing mechanisms of accountability for safety performance.

2.3.9.5 Dedobbeleer's Safety Behaviour Model

Dedobbeleer (1985) in her study of the factors that influence construction workers' safety behaviour on nine building construction projects in the Baltimore, Maryland metropolitan area, hypothesized a safety behaviour model where workers' safety behaviour depended on three primary factors: predisposing factors that related to workers' safety knowledge, attitudes, and other personal characteristics, enabling factors that related to the availability of safety training, safety equipment, and safety instructions, and reinforcing factors that related to management's attitude toward safety, foremen's enforcement of safe conditions and practices and co-workers' attitudes toward safety. A basic premise of her study was that workers' safety behaviour is determined by the combined influence and interaction of these three primary factors. The study found that a combination of predisposing and enabling factors explained 51% of the variance in workers' safety behaviour. The study also found that reinforcing factors affected safety behaviour, but indirectly, through predisposing factors.

2.3.9.6 LaFlamme's Four-Level Systems Model

LaFlamme (1990) devised a four-level model based on a systems approach comprising of work organization, working situation, accidental sequence and the accident. According to LaFlamme, work organization is a spatial variable, while working situation, accident sequence and the accident are temporal variables. The work organization level involves structural background factors (human and technical) that influence safety performance. The factors at this level concern the design, organization, implementation and control of work processes. The factors at the second level, working situation, concern the nature of the tasks to be performed, the work environment, the machines and tools required and the characteristics of the persons who will do the work. The third level, accident sequence, starts when a disturbance occurs in the working situation (system). The sequence can be interrupted by any of the components in the system involved. For example, an alert

foreman who averts an electrical accident by pointing out an overhead power line to a mobile crane operator. If the accident sequence is interrupted, the system will recover to a safe state again, otherwise it will end as an accident (the fourth level) resulting in an injury, property loss or near miss.

2.3.10 Risk Assessment

The European Agency for Safety and Health at Work [EASHW] (2004) defines risk assessment as a careful examination of what, in the work environment, could cause harm to people so that judgment could be made as to whether enough precautions have been taken or more should be done to prevent harm. It involves identifying the hazards present and then evaluating the extend of the risks involved, taking into account existing precautions. EASHW notes that risk assessment results should help users choose which good practice measures are most appropriate.

According to Mol and Williams (1989), the analysis of safety hazards found on inspections and investigations, and follow-up to insure that corrective action has been taken is a vital aspect of a construction company's safety program. Mol and Williams emphasize systematic approach both for effectiveness and for showing the management's true commitment to safety.

2.3.11 Contractor Selection

According to Samuelson and Levitt (1982), studies have been carried out to determine how clients can contribute to the propagation of safe construction. Stemming from earlier findings that over time some contractors have consistently been found to maintain much safer records than others, a study was carried out to determine how clients could select only safe contractors for their projects. It was argued that clients who selected safe contractors stood to gain considerably in terms of cost reduction, and savings in contract time. Accordingly, the selection of safe contractors could be based on:

1. OSH incidence rates for recordable injuries and illness as per the legal safety requirements (Mwangi, 1989, and Stanford University, 1990). However this is

subject to serious under reporting, for example McDonald and Hrymak, (2002); HSE, (1988); and Duff, Robertson, Cooper and Phillips, (1993)

2. The scrutiny of the firm's safety management programme otherwise known as the management safety accountability system
3. Experience modification rates for workers' compensation insurance
4. Contractor safety attitudes and practices

(Stanford University, 1990).

Stanford University (1990) notes that companies that hold their project management accountable for accidents along with productivity, schedules, quality and so forth, have better safety records. Basing on the results from the research on the effects of top management on safety performance in construction, Stanford University (1990) suggested the following as measures of managerial accountability for safety:

1. The recipients of accident reports and frequency of distribution of the reports (field superintendents, vice president of construction, and president of firm).
2. The frequency of project safety inspections and the degree to which they include project and field superintendents.
3. The frequency of safety meetings for field supervisors
4. The compilation method for accident records and the frequency of reporting
5. The compilation method for accident costs and the frequency of reporting.

Stanford University (1990) argues that owners can carry out their moral obligation to provide safe work environment and therefore minimize injuries by hiring contractors with good safety performance. Mwangi (1989) emphasizes the examination of the firm's safety management programme, safety policies and the type of safety personnel employed by the firm as the most feasible pre-qualification criteria. Mwangi further argues that as a business entity with a major objective of profit maximization, economic factors override all the others in shaping the contractor's general attitude towards safety. Mol and Williams (1989) argue for the consideration of frequency and severity of accident when looking at the company's accident history. Mol and Williams discourage

the tendency to incorrectly assume that accidents that incur only minor costs are unimportant.

2.3.12 Management Commitment

While acknowledging the relative scarcity of literature on safety on construction sites in comparison to the industrial sectors, Mol and Hrymak (2002) point out the following as areas of interest for predicting individual safety behaviour and organizational safety performance: compliance with procedure, effective management systems, organizational climates and cultures, and performance in the face of risks.

According to Stanton (1995), many human, technical and environmental variables that influence project safety performance may be classified in accordance with the level at which they come into play: they change as construction activities change, and may therefore, be regarded as temporal variables. Stanton argues that these temporal safety variables are activated by a few relatively enduring safety variables at the project organizational level namely: management commitment, motivational controls, technical controls, worker group processes and workers' characteristics. The variables at the project organizational level are in turn influenced by factors outside the project organization that include the safety cultures of the general contractor and subcontractor firms, their safety budgets for the project, owner-emphasis on safety, liability concerns, union influence, the influence of insurance carriers and the impact of OSH agencies.

According to HSL (2002), aspects of management relating to management and supervisor include perception of management attitudes and behaviours in terms of safety and production along with other issues such as discipline and selection. HSL points out a major problem with research into management commitment to safety as the ambiguous use of the label 'manager' that makes it difficult to discern the management level being investigated, for example supervisor, middle or senior manager.

A major drawback in relying on employees' perception of management commitment is that they may be subject to negative stereotyping by other staff, perhaps as a result of existing mistrust within the workplace such as trade union and management disputes. Therefore, HSL (2002) argues that how management attitudes are transmitted to

employees needs to be considered to ensure that the latter perceives management commitment to safety accurately. Employees' perception of management attitudes and behaviours towards safety, production and issues such as planning, discipline, and so forth were the most useful measurements of an organization's safety climate, for example, Cox and Flin (1998), and Means, Flin, Fleming and Gordon (1997) note that ultimately, the management's attitudes and behaviours in terms of safety influence many aspects of safety behaviour including:

1. The success of safety initiatives
2. The reporting of near-miss occurrences, incidents and accidents
3. Employees taking work related risks
4. Influencing production pressures
5. Implementing safety behaviour interventions
6. Health interventions
7. The effectiveness and credibility of safety committees.

2.3.13 Safety Performance

Safety performance, referred to as the effectiveness of the safety control system, is very difficult to measure (Körvers et al., 2001). All interventions oriented to improve safety in the workplace have accident reduction as the ultimate objective, and thus the criteria against which to measure the effectiveness such interventions (McDonald and Hrymak, 2002). Although accident frequency has been suggested as "the most objective measure of safety performance", scientific literature highlights that an accident is, to some degree, a chance event requiring a combination of circumstances (McDonald and Hrymak, 2002). Additionally the following difficulties are encountered in the usage of accident frequency as a measure of safety performance:

1. Better safety performance of a business or progressive improvement of safety as a result of a successful intervention brings accident rate to a lower level than before increasing the difficulties of identifying it accurately, and a decrease in accuracy

in measuring the amount of improvement due to the intervention over time (Duff et al., 1993)

2. Accidents, especially less serious ones, are subject to gross underreporting (HSE, 1988), and
3. Managers may also be careful in releasing information that could affect the future stability of their business or be used in any away against them (HSE, 1988).

McDonald and Hrymak (2002) conclude that, whatever the objective, accident frequency cannot be considered a robust measure for research purposes.

Duff at el. (1993), basing on compliance with safety procedures in particular situations or by means of individual behaviour, designed an objective and reliable measure of safety measurement in terms of percentages of compliance as opposed to frequency of accidents.

On the other hand, HSL (2002) gives the following as ways in which safety performance could be measured:

1. Measuring near miss occurrences
2. Accident data collection
3. Measuring behaviour
4. Self-report methods
5. Literature on bonus schemes, and
6. Safety audits

A. Measuring Behaviour

Glendon and Litherland (2001) used behavioural sampling to measure safety performance. This involved random sampling of employee behaviour such as manual handling and using trained observers to evaluate the proportion of unsafe working behaviours. However, HSL (2002) argues that safety behaviour may be useful complement to measures of safety climate rather than an accurate indicator per se. For example, Cox and Cheyne (2000) used employee interviews and attitude assessment in addition to behavioural indicators.

B. Safety Audits

According to HSL (2002), audits are useful for gauging the extend to which the organization's policies and procedures are being followed, and how they might be improved. They provide the organization with feedback that enables the organization to maintain, reinforce and develop its ability to manage and reduce risks. HSL emphasizes the use of competent people with relevant training in auditing.

Glendon and McKenna (1995), and HSL (2002) note that during an audit the inspector may wish to consider the following factors:

I. Working conditions

1. Environmental factors: lighting, noise, ventilation and relative humidity should be at optimum levels for maximum worker comfort. Excess of these conditions can result in physical stress.
2. Workplace layout: this should be such that people and traffic are kept separate, there is adequate space for movement between operating positions, access to and egress from the area should be safe and unobstructed.
3. Design of controls: this should be within comfortable reach, and dials easily seen.
4. Work rate: too fast or indeed too slow work rates can result in fatigue. Too fast work rate is a recipe for unsafe acts. Flin et al (2000) referred to work pace and workload factors as work pressure. They suggest that the balance between pressure for production and safety is a related theme that is recognized as a key component of safety (ACSNI, 1993). Lee and Harrison (2000) in their study of nuclear power workers' perception of priority of production over safety found that pressure to put production before safety was perceived to come from management rather than peers or safety representatives. Dickey et al (2002) found that work pressure within the foundry industry led some workers to cutting corners and committing unsafe acts.

5. Posture: work systems and processes should be designed to minimize strain and to allow postures to remain comfortable.
6. Influences on performance
    i. Fatigue – work schedules that require workers to work long hours or at night can result in fatigues that ultimately result in greater errors and accidents.
    ii. Time pressures – establish whether there are time pressures on employees to meet production demands.
    iii. Training and experience – similarly establish whether workers are adequately trained for the job, whether they get refresher training.

II. Housekeeping

Some companies use the prevailing housekeeping standards as an indirect measure of safety performance (Human Factors Group Safety Culture, 2002, p. 32). Cooper (1998) suggests that poor housekeeping can result from extreme production pressures in combination with limited storage facilities. These, Cooper argues, lead employees to believe that housekeeping is unimportant mainly because they are used to working in areas with poor housekeeping standards without any accidents occurring as a result.

McCon (1997) suggests that efficient housekeeping results in lower injury rate. Japanese housekeeping has evolved into a productivity tool referred to as 5S (Sort, Systematize, Sweep, Standardize, Self-discipline) technique. HSL (2002) emphasizes that 5S is based on the premise that a clean and organized workplace will be more efficient, and productive, as it will improve employee morale and reduce hazards.

III. Communications

Establish whether there are systems for communication to come from employees or management based on one-way communications only.

VI. Bonus schemes

Literature on bonus schemes suggests that financial incentives to improve productivity can lead to safety being compromised. Sawach, Naoum and Fong (1999) found that employees who were eligible for hazard pay were found to be at greater risk of having an accident, and it may be seen as an inducement to take risks. Productivity bonus acts as an incentive to work faster, and thus to commit unsafe acts. Collective bonus schemes on the other hand, Collinson (1999) argues, can lead to the workers being pressurized not to report accidents by colleagues unwilling to lose their bonus.

V. Near-miss Occurrence

According to HSL (2002), investigation of near-miss occurrences is a very useful measure of OHS performance as well as enabling organizations to learn from such errors. The process involves the analysis of events that may have led to accidents with a view to preventing more serious outcomes in the future.

HSL (2000) notes that only a handful of organizations are willing to avail this type of information. Organizations need openness with a "no-blame culture" to promote the reporting of near-miss occurrences amongst their workers. However, Pigeon (1998) argues that a "no blame culture" is not the answer, and instead boundaries need to be established between culpable and tolerable mistakes, as some degree of responsibility and accountability is needed. Marsden (2001) agrees with the setting up of boundaries and proposes the idea of a 'just culture' to distinguish between acceptable and unacceptable behaviour and discriminate between intent and non-intent as well as simple and gross negligence.

Mearns et al. (2001) in their attempt to benchmark and monitor safety climate across nine offshore oil and gas installations found that the employee's perception of management commitment was positively correlated with the willingness to report incidents and their perception of the supervisor's competence.

2.3.14 Functional Effectiveness of OSH Approaches

According to McDonald and Hrymak (2003), although support intervention that can demonstrably improve safety is the major goal of any safety research, thorough empirical

studies are rare, and normally focus on changing individual behaviour. Duff et al. (1993) and Robertson, Duff, Marsh, Phillips, Weyman and Cooper (1999) in their phased study, specifically, on the effects of feedback, goal setting, and training on safety performance, found out that the techniques used produced marked improvement in site safety, participative goal setting being the most effective of the three. The study also noted the following:

1. A continuous and consistent intervention along the lifecycle of the site was recommended to achieve the maximum benefit
2. The role of management commitment is vital in the effectiveness of the intervention methods used.

On similar premises as Duff et al. (1993), Lingard and Rowlinson (1998) in their Hong Kong construction industry study, concluded that safe behaviour could only be achieved where a basic safety infrastructure is already in place.

Marsh, Davies, Philips, Duff, Robertson, Weyman, and Cooper (1998) in support for the behavioural programmes, argue that accidents are relatively infrequent, and can be difficult to investigate objectively after the event. Further, reacting to accidents rather than proactively tackling the most likely causes of accidents suggests that fate may have too much influence in dictating the application of resources. Similarly, Marsh et al. (1998) argue that attitudes can prove difficult to change because of attention, understanding and perception factors, attitudinal measures can only be validated by a criterion such as behaviour, and the relationship between attitudes and behaviours has been shown to be not necessarily direct. Festinger (1957) argues that an attitude change may not lead to behaviour change, however behaviour change can lead to a change in attitude. Consequently, Marsh et al. (1998) note that behavioural programmes focus directly and proactively on potentially risky behaviour.

According to Saarela et al. (1989, cited in Duff et al., 1993), although safety campaigns directed at increasing worker safety awareness are said to be effective in improving safety performance, systematic research suggests that posters and campaigns have limited success, and do not make a lasting impact on the accident/injury rate.

McDonald and Hrymak (2003), Mohamed (1999), the European Construction Institute [ECI] (1996) and Whittington, Livingston and Lucas (1992) attribute safety failure to the ineffectiveness of the safety management systems. According to Whittington et al. (1992), construction industry's characteristics that lead to the poor safety record are deep rooted, and the site level problems could often be traced to management issues such as poor contractor selection, lack of supervision or inadequate training. Similarly, ECI (1996) attributes safety problems in construction industry to the lack of a systematic approach to the management of risk. Mohamed (1999) attributes the lack of a proactive zero accident culture prevalence in construction industry to inability to manage workplace safety.

Whittington et al. (1999) indicated the following fundamental flaws in the way the industry and potential clients respond to safety management demands:

1. Dealing with safety at a late stage of the project cycle
2. Undue emphasis on the failure of individual workers resulting in short term measures rather than resolving underlying organizational problems.
3. Competitive tendering resulting in a failure to address safety requirements at bidding stages.
4. Safety issues being inadequately addressed in planning and scheduling of work.
5. Lack of safety performance monitoring and feedback.
6. A lack of opportunities for formal project reviews to include organizational learning and proactive safety management.

Cooper (1998) argues that people often behave unsafely because they have never been hurt before while doing their job in an unsafe way. Over an extended period of time, therefore, the lack of any injuries for those who are consistently unsafe is actually reinforcing the very behaviours that in all probability will eventually lead them to be seriously injured.

According to Cooper (1999), employees will find it hard to follow certain safety rules and procedures if they are consistently (certain) rewarded by an immediate (soon) timesaving that achieves extra production (positive) by behaving unsafely. For example,

a worker faced with a ten to fifteen minute period to put on the correct clothing and equipment to enter a mandatory PPE area to read a gauge that takes only 10 seconds.

Cooper (1999) argues that line managers turning a blind-eye, or actively encouraging employees to take short cuts for the sake of production sometimes further reinforce unsafe behaviour. Cooper argues that this has negative effects that are not always immediately apparent: firstly, employees learn that unsafe behaviour pays; secondly, it wastes resources as the very behaviours that companies spend a lot of time, money and effort trying to eradicate are reinforced; and thirdly, by condoning unsafe behaviour, line managers transmit conflicting messages that undermines employee's confidence in the whole of management's commitment to safety.

Cooper (1994) notes that safety training is considered one of the fundamental methods for improving safety, based in part on the implicit assumption that safety training in itself is a good thing, in that those who know what to do, will automatically conduct themselves in a safe manner for extended periods of time. Cooper notes that this has not been clearly successful. Despite the notion that safety training will cure most ills in regard to accidents, evidence exists showing that it is not always effective (Hale, 1984), which may be related to the variability of the quality of training given (Cooper, 1994).

2.4 Site Safety Measures and Controls

These are controls employed against specific hazards, and they might involve modifying physical or technical characteristics of the working environment, modifying specific behaviour patterns of individuals, or restructuring the way workers and the environment interact (Dawson et al, 1983).

2.4.1 Site Planning and Layout

Mwangi (1989) argues that accident prevention cannot be a reality if situations that cause accidents are not foreseen and avoided. ILO (1999) notes that badly planned and untidy site are the underlying causes of many accidents resulting from falls and collision between workers and plant Therefore, proper planning by the management is an essential part of preparation and budgeting for the safe and efficient running of construction

operation. ILO identifies space constraints, particularly in urban work sites, as the most common biggest limiting factor: a layout that caters best for the safety and health of workers may appear to be difficult to reconcile with productivity.

According to ILO (1999), consideration should be given to the following before the commencement of work on site:

1. The sequence in which work will be done, especially hazardous operations
2. Access for workers on and around the site.

   Routes should be free from obstruction and from exposure to falling materials, materials-handling equipment and vehicles. Suitable warning notices should be posted. Edge protection will be required at the edge of floor opening and stairs, and wherever there is a drop of 2m or more.
3. Routes for vehicular traffic should be "one way" as far as practicable.
4. Storage areas for materials and equipment need to be as close as possible to the appropriate workstations.
5. The location of construction machinery.
6. The location of trade workshops
7. Location of medical and welfare facilities
8. Artificial lighting at places where work continues or workers pass after dark
9. Site security – the site should be fenced in order to keep out unauthorized persons, children in particular, and to protect the public from site hazards
10. Arrangements to keep the site tidy and for the collection and removal of waste
11. The need for low voltage electric power supplies for temporary lighting, portable tools and equipment
12. Training needs of both workers and supervisors

2.4.2 Site Tidiness

ILO (1999) notes that a worker can make a major contribution to safe working conditions on site by paying attention to tidiness. ILO emphasizes the following steps to ensure tidiness on site:

1. Clean as you go instead of leaving rubbish and scrap for the next person to clear
2. Keep gangways, working platforms and stairways clear of equipment and materials not in immediate use
3. Clean up spilled oil and grease
4. Deposit waste material at a recognized disposal point
5. Remove or hammer down any nails you see projecting from timber.

2.4.3 Excavations

Excavation work can be highly dangerous and even some of the experienced workers have been caught by sudden and unexpected collapse of the unsupported sides of the trench (ILO, 1999, p. 13). ILO lists the following as the main causes of accidents resulting from excavation work:

1. Workers trapped and buried in an excavation owing to the collapse of the sides
2. Workers struck and injured by material falling into the excavation
3. Workers falling into the excavation
4. Unsafe means of access and insufficient means of escape in case of flooding
5. Vehicles driven into or too close to the edge of the excavation
6. Asphyxiation or poisoning by fumes heavier than air entering the excavation.

ILO (1999) gives the following as safety precautions to prevent the collapse of excavations and falls:

1. The sides of the trench should be slopped or battered to safe angle of repose or be supported by timbering or other means to prevent a collapse
2. Planning for enough materials to support the length of the trench to be cut, for the trench support must be installed without delay as excavation progresses

3. Shoring should be erected, altered or dismantled only by a competent worker operating under supervision
4. Erect suitable barriers high enough (approximately 1m) to prevent falls
5. Inspection of excavations by competent persons

2.4.4 Scaffolding

Falls of persons, materials and objects from heights represent the most serious safety risk in the construction industry (ILO, 1999). ILO defines scaffolding as a temporary structure supporting one or more platforms, and which is used either as a workplace or for storage of materials in the course of any type of construction work, including both maintenance and demolition work.

Scaffolds must be properly constructed of sound material that is of proper strength to provide one with both means of safe access and safe place of work (ILO, 1999). Emphasis should be put on the competence of persons involved in erection, alteration or dismantling of the scaffolds.

2.4.6 Working Platforms and Gangways

ILO (1999) points out that scaffold boards, which make up a working platform, should rest squarely and evenly on the transoms to prevent the risk of tripping. Where the ends of the boards meet, transoms must be doubled and be so spaced that no board overhangs by more than four times its thickness. Both working platforms and gangways should be of adequate width for their purpose and should preferably be horizontal. According to ILO, the working platform or cradle should be inspected before each use and at least once a week. The safe working load should be clearly marked on the platform.

ILO (1999) argues that the provision of secure guardrails and the toe boards at every point at which one may fall more than 2m is critical if falling accidents are to be prevented. Guardrails should be fitted on the inside of the uprights, and be between 90cm and 115cm above the platform to prevent the users from easily falling over or under the rail. ILO notes that the toe boards, which are also intended to prevent material being

knocked over the edge of the platform, must rise at least 15cm above the working platform. However, if materials are stored to greater heights than 15cm, then additional boards may be necessary or space filled with wire mesh.

According to ILO (1999), without proper precautions, roof work is among the most hazardous of construction operations. For example, the most common accidents to workers are due to falls from the edge of roofs, falls through openings in roofs, and falls through fragile roof materials.

2.4.7 Ladders

Every year many workers are killed or severely injured while using ladders of all types (ILO, 1999, 27). Because a ladder is so readily available and inexpensive, its limitations are easily overlooked. ILO points out the following limitations of a ladder if properly used:

1. It enables only one person to climb or descend at any one time
2. It enables only one person to work from it at any one time
3. If not lashed at the top, it requires two workers for use – one on the ladder and the other at the bottom
4. Leaves only one hand free: carrying tools or loads up the ladder is difficult and dangerous and the quantity which can be carried is limited
5. It restricts movement
6. It has to be safely situated and secured
7. It has limitations on heights at which it can be used.

According to ILO (1999), the ladder slipping at the base or at the top cause more than half of ladder accidents. Therefore a ladder must have its foot on a firm and level base. For safe use of ladders, ILO emphasizes the observation of the following precautions:

1. Ensure there are no overhead power lines with which the ladder might make contact
2. The ladder should extend at least 1m above the landing place

3. One should be able to step off the ladder without being required to climb over
4. Never use a ladder too short or stand a ladder on something such as a box
5. Face the ladder when ascending or descending
6. Ensure that there is sufficient space behind the rungs to provide a proper footing
7. Extension of ladders must leave an overlap of at least two rungs for sections up to about 5m in length, and at least three rungs for sections of more than 5m in length.
8. Always make sure that your footwear is free from grease before you begin to climb
9. If possible carry tools in pockets or bag
10. Try not to carry materials while climbing ladders – use hoist instead
11. Don't overreach or overbalance, instead move the ladder
12. Always raise and lower extension ladders from the ground and hooks or locks must be properly engaged before starting to climb.

ILO (1999) emphasizes proper care of ladders that should involve:

1. Regular inspection of ladders by competent person and removal from service of damaged ones
2. Ladders should be capable of being individually identified
3. Ladders not in use should not be left on the ground so that they are exposed to weather
4. Ladder should not be hung from its rungs or from one stile as this tends to pull out the rungs

2.5 Economics of Safety

Dorman (2000) argues that since occupational injury and illness stem from work, an economic activity, they are also matters of economics especially in terms of both causes and consequences. Economic analysis can help show when safeguarding working

conditions is complementary to other social goals, and it can illuminate the tradeoffs when it is not (Dorman, 2000).

Apart from humanitarian reasons for prevention of personal injury and loss of life, increased attention to OHS is essential to the long-term economic health of the construction industry. Costs related to construction accidents are borne by owners, directly or indirectly and an effective construction-safety program can lower these cost (Stanford University, 1982, p. 4). By the same reason, Mwangi (1989) justifies the need for clients to take keen interest, and indeed contribute to the provision for a safe work environment.

According to Stanford University (1990), owners must consider the following three kinds of costs when dealing with safety in construction:

1. Direct cost of accidents and insurance, for example, workers' compensation, liability exposures and property insurance among others.
2. Indirect costs of accidents, for example, loss of productivity, disrupted schedules, administrative time for investigation and reports, training and personnel replacement, wages paid to the injured worker(s) and other workers for time not worked, clean up and repair, adverse publicity, third party liability claims against the owner and equipment damage.
3. Costs of safety programs, for example, salaries for safety, medical and clerical personnel, safety meetings, inspection of tools and equipment, orientation sessions, site inspections, PPE, health programmes and miscellaneous supplies and equipment.

Mol and Williams (1989) note that indirect costs associated with accidents sites are among factors hardly accounted for when the cost of an accident is determined. Although often subjective in nature and difficult to calculate, they are nonetheless very real costs that must be paid for by the contractor. Mol and Williams further argue that because these expenses are usually hidden in total labour costs, the management does not get an accurate picture of the true economic damage caused by job-site accidents.

2.5.1 Safety and Productivity

Mwang (1989), Joy (1991) and Heizer and Render (1999) refer to productivity as the relationship between the output produced and the inputs which go into production, that is the ratio of output to value of units of labour. Joy also refers to it as "the result of productive efforts". According to Hazier and Render, of the three productivity variables of capital, management, and labour, the latter accounts for one sixth of the annual productivity increment.

Heizer and Render (1999) name basic education appropriate for an effective labour force, diet for the labour force and social overhead that make labour available, such as transportation and sanitation as contributing to productivity growth. Mwangi (1989) names technological innovation, in addition to those mentioned by Heizer and Render as the main factors which contribute to productivity growth. Hinze (1981) argues that technological innovation can worsen the safety problem and thus need for a more effective and efficient approach to the industrial safety problem.

According to Mwangi (1989) a link between safety and productivity is by virtue of labour being a source of productivity growth. Mwangi observes that attitudes, discipline, education and skills embodied in the labour force do influence productivity levels considerably. Mwangi emphasizes the key characteristics of workers that set them apart from the rest of the productivity growth factors. These qualities stem from workers being mortal human beings with human fears, dreams and aspirations. Improvements in OHS raises morale and productivity due to the fact that the employees can concentrate more on their work without fear of personal injury.

Many agree that high productivity leads to high living standards. Joy (1991) observes that manpower and productivity hold the key to profitability in construction. This is further emphasized as stated below:

"against a traditional approach whereby improving health and safety at the workplace was seen as an additional cost, often an impediment to the economic development of the enterprise, an innovative "high road" approach is progressively emerging whereby workers' health, safety and well-being become integral parts of the economic sustainability and organizational development of enterprises." Martino (2001, p. 1)

According to Mwangi (1989), every government has a role to play in ensuring OHS of all its citizens, and how importantly the government takes OHS depends on the policy makers' perception of the concept of development. New Zealand Business Roundtable [NBR] (2002) argues that identifying and measuring the economic costs of OHS can motivate greater awareness of workplace death and injuries to employers and greater awareness among the governments of the impact of OSH problems on economic growth and development. Mwangi emphasizes the paramount position of the quality of life in social economic development of a country.

Mwangi (1989) defines "total accident costs" as the sum of the direct costs of the accident and the cost of the accident prevention programmes designed to avoid them. Mwangi notes that the appropriate approach is trying to minimize the costs since a site cannot be totally free from risks. The costs of accidents will fall as safety measures are increased, that is as risks are reduced, the accident costs will fall, but in order to reduce risks money must be spent on accident prevention. Mol and Williams (1989) note that beyond the moral and legal responsibilities that a construction company has for the safety of its employees, economic interests dictate the desirability of a comprehensive safety programme.

According to Stanford University (1990) the cost of administering a construction safety program amounts to about 2.5% of direct labour cost. However Gallagher (1999) raises the possibility that cost benefit analysis might, in some instances, not be able to prove that safety pays. In Gallagher's view, irrespective of the economics of safety, there are moral reasons for preventing accidents. Jacobson and Sullivan (2001) argue that because the indirect costs are less obvious they are taken to be less important as drivers of firms' behaviour. Each individual employer sees only his costs and revenues and their impact on profits: the effects of illness or injury on family and community are externalities that, like in the case of pollution, firms are not mostly charged for in normal market operations. Dorman (2000) asserts that the most important costs of accidents and diseases are non-economic. These include the direct physical cost to the victim, the emotional cost to the victim's family and community and damage to social values like justice and solidarity.

Jacobson and Sullivan (2001) seem to suggest a regulatory regime that, for example, imposes fines on firms for unsafe practices as one way of internalizing these costs. This

however, Jacobson and Ziene (1998) argue, creates disincentives to firms and (in some cases) workers to report accidents. Jacobson and Sullivan argue that the ideal regulatory system would be one that makes it extremely difficult for any firm to operate without taking all costs, economic and human, private and social, direct and indirect, variable and fixed, into consideration. This seems to answer Dorman's interesting question that may be applicable to the Kenyan situation:

"Given the substantial economic costs imposed on the victims of occupational injury and disease, as well as their family and those in their immediate community, who is likely to pay them?" (Dorman, 2000, p. 7)

2.5.2 Motivators for OHS Responsibilities

Mwangi (1989) defines the legislative responsibility as a set of rules and regulations included in legislation pertaining to safety of workplaces aimed at protecting the employed persons and the general public from hazards of work activity. Mwangi notes that these are minimum standards and a prudent employer should always ensure they meet the humane and economic considerations.

According to Mwangi (1989), employers are motivated to perform their responsibilities by two incentives, that is statutory obligation and economic considerations. Mol and Williams (1989) note that there is a direct and substantial monetary gain that can be realized by reducing the number and severity of construction accidents. These corrective actions should be directed so that they yield the highest benefit to cost ratio. Unfortunately, many contractors are not aware of the specific areas where their safety performance could and/or should be improved (Mol and Williams). Jacobson and Sullivan (2001) note that many people, including shareholders and employees, could be made better off (the shareholders through higher profits, the employees through not suffering accidents) without anyone else being made worse off.

2.6 OHS Legislation in Kenya

According to Muchiri (1992), an effective system of OSH must rest on sound statutory requirements. OHS in Kenya is governed by FOPWA and enforced by the Directorate of Occupational Health and Safety Services in the Ministry of Labour. Muchiri (1992) traces the origin of OHS legislation in Kenya to the enactment of the largely British Factories Act of 1937 based Factories Act, Cap 514 of the laws of Kenya in 1951. He attributes this inception to the high number of occupational accidents taking place in Kenyan workplaces at that time.

The original Factories Act has undergone a number of amendments (the1990 Factories [amendment] Act and 1972 and 1962 revisions) to extend its coverage, improve its administration (Muchiri, 1992, and ROK, 1990) and to overcome the emerging challenges in OHS. The 1990 amendment is notable for broadening the scope of the Act to include "Other places of Work", allowing fair flexibility to the Minister for Labour to set rules/regulations without the need for frequent laborious parliamentary amendments. Consequently, emergent risks and problems can be addressed relatively quickly (FOPWA section 16:3).

Generally, the latest amendment (1990) has the following developments in workplace safety:

1. The Act was extended to cover "Other Places of Work"
2. Formation of a National Advisory Committee on OHS
3. Approvals of plans of factory premises
4. Powers to deal with eminent danger including the introduction of prohibition and improvement notices
5. Introduction of Safety Committees for premises employing more than 20 persons
6. The marking of containers holding hazardous substances
7. Research and related activities
8. Medical examination rules
9. Curbing of atmospheric pollution by industries
10. Introduction of OHS Fund, and

11. Increased penalties.

(ROK, 1990 and Muchiri, 1992)

2.6.1 Administration and Enforcement of the Act

The Directorate of Occupational Health and Safety Services in the Ministry of Labor is responsible for the enforcement of FOPWA (FOPWA section 67). According to Muchiri (1992) the directorate became fully fledged department in 1978, has specialized services under (1) Occupational Health Unit, (2) Occupational Hygiene Unit, (3) Engineering (Technical) Unit, and (4) Training Unit. OHS officers, who are Government appointees, enforce the Act (FOPWA section 68). They are empowered under section 69 of this Act to:

1. Enter any factory by day or night, to carry out inspection
2. Interview anyone or examine any documents they consider relevant as long as any information obtained in the course of their duties is strictly confidential
3. Prosecute anyone who contravenes the Act or rules there under, regardless of whether such a person is an employer or employee, and
4. Issue improvement and prohibition notices to deal with eminent danger.

The Act also provides for appeal against any decision by the Directorate by the employer or any aggravated person to a 3-member Factories Appeal Board, which is appointed by the Minister for Labour and chaired by a Judge of the High Court or a nominee of the Chief Justice.

The Act is divided into two main subdivisions namely the Principal Act and the subsidiary legislation.

2.6.1.1 The Principal Act

The provisions apply to all factories and other places of work as defined in the Act without exception, regardless of whether such premises belong to or are occupied by an individual, corporation or the Government.

2.6.1.2 General Provisions

Broadly, the Act aims at safeguarding the health, safety and welfare of workers in factories and other places of work. Its salient features include:

1. Approval of factory plans with regard to new installations, alterations or extensions of existing premises
2. Registration of factories before commencement of operations
3. Establishment of health and safety committees in workplaces employing more than 20 persons
4. Safety with regard to pressure vessels, lifting equipment and cylinders for compressed, liquefied and dissolved gases
5. Control of emissions into the general atmosphere and workplaces
6. Monitoring of the work environment and medical examination of workers
7. Provision of research into OHS
8. Establishment of the National Advisory Committee, made up of representatives from various government ministries and institutions, and from employer and employee organizations, with a primary function of advising the Minister for Labour on matters related to the administration of the Act
9. Creation of health and safety fund, the aim being to provide pertinent services of the various industries and other places of work
10. Prescribes training in OHS at the workplace level
11. Requires that OHS officers maintain trade secrets
12. Prescribe appropriate penalties against breaches of the Act
13. Provision for general welfare, such as first aid, drinking water, sanitary facilities and so forth
14. Grants permission to take photographs in factories and other places of work, and
15. Reporting occupational accidents, diseases, dangerous occurrences and so forth.

(Muchiri, 1992 and ROK, 1990)

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Introduction

The research started with review of the relevant literature, discussing the nature of informal economy, informal construction sector, site safety theory, safety management systems, economics of safety, safety awareness and identifying the possible factors affecting safety performance on construction sites. Secondly, a safety audit checklist for the assessment of compliance with safety requirements on site, and three sets of questionnaires for the workers, the owners and the foremen respectively were developed. Thirdly, data from target sample once returned was subjected to screening to eliminate those that fail to meet the criteria for admissibility and coded before being analyzed. Lastly, on the basis of the findings of the study, conclusions were drawn and recommendations made.

The primary unit of analysis for the study was informal construction sites. The workers, foremen and the owners represents a homogeneous group of respondents who are knowledgeable about the questions, since the issues raised in the questionnaires directly affected their well-being.

3.2 Research Design

It was a multiple-site descriptive study, with a primary goal of investigating safety awareness on informal construction sites with a view to recommending effective ways of improving safety awareness in the informal construction sector.

3.3 Population

The target population for the study was the ongoing informal construction sites (during the foundation, framing and closing-in stages of construction) within Nairobi. According to McDonald and Hrymak (2002), it is usually during these stages of construction when

much of the high-risk activities take place, and concomitantly, a time when concern for workers' safety is highest.

These sites differ from formal sites in that they avoid legal and administrative requirements like formal contracts, licensing, taxation, insurance and registration in accordance with FOPWA and other laws.

3.4 Sample and Sampling Technique

Although convenience-sampling method suffers from lack of both representativeness and control of bias (Leedy, 1993, p. 200), it was employed in this study.

According to Monette, Sullivan and DeJong (1994), convenience sampling is popular and appropriate for research when it is very difficult or impossible to develop a complete sampling frame or too costly to do so. The difficulty in developing a complete sampling frame seemed more real in the informal construction sector in Kenya as pointed out by Wachira (2001), and Mitullah and Wachira (2003). Because the goal of the study was to investigate safety awareness and compliance with safety requirements, this required that the researcher sample a variety of contrasting sites.

Wachira (2001) identifies Kayole, Umoja, Embakasi, Zimmerman and Dandora as some of the low-income residential development areas in Nairobi where informal construction activities are prevalent. From a quick observation and reconnaissance of Kayole, and nearby low-income development areas, Kasarani was conveniently selected for the study. This area had a variety of informal construction sites that were easily accessible and in close geographical proximity with one another, and therefore favourable to the study due to financial and time constraints.

Non-systematic approach was employed in locating specific informal construction sites at site study level. It involved a transect walk across the residential area looking for active construction sites that meet the prescribed qualities. This method was necessitated by the impossibility of developing a complete sampling frame. Mitullah and Wachira (2003) employed a similar method. Carefully scrutinizing available documents on site, for example, site registration, contract documents, insurances and planning approval documents, informal construction sites were distinguished from the formal ones.

3.5 Sample Size

The sample size was 45 ongoing informal construction sites. This was more than the minimum recommended number of cases. According to Cohen and Manion (1985), a sample size of 30 is held by many to be the minimum number of cases if a researcher plans to use some form of statistical analysis on data. Although a larger sample size was preferable, due to time and financial constraints, the researcher opted for one and a half times the minimum recommended sample size.

3.6 Survey Instruments

Survey instruments in use included a safety audit checklist and structured questionnaires. The questionnaires were designed to collect information from workers, owners and foremen. All instruments were pre-tested on a sample site in Kasarani to verify the appropriateness and clarity of the questions and items in the checklist. Safety standards and requirements were determined from an extensive study of safety literature including FOPWA. Several questions were asked about each of these issues. The questionnaires took the workers between 10-20 minutes to complete. The owner and foreman's questionnaires were less involving taking 5-15 minutes to complete.

3.7 Procedure of Data Collection

The researcher and one assistant visited each of the 45 sites and spent approximately two hours on each site. Due to the high mobility in the informal sector, and both time and financial constraints, the workers', the owners' and foremen's survey, and observational survey were conducted at the same time. It was administered at the worksites, with the researcher present to provide assistance if necessary. The questionnaires were designed in such a way as to facilitate self-administration, making it also possible for the respondents to complete them during lunchtime. In exceptional cases where the respondents, for one reason or another, could not complete the questionnaires on site or incase of the absence of the owners at the time of the visit, self addressed stamped envelopes were provided for the respondents in question and requested to post the completed questionnaires within a week's time for those with less than a week's time on site. For the respondents with more

than a week's time of engagement on site, the researcher collected their completed questionnaires during the subsequent site visits.

3.7.1 The Observational Study

Basing on 41-item safety audit checklist developed by Duff et al (1993) and 18-item safety audit checklist developed by McDonald and Hrymak (2002) for assessing safety and health on construction sites, a checklist was developed and piloted on an informal construction site in Kasarani before finally developing a modified 20-item safety audit checklist.

The procedure of observation on each site visited was as follows:

1. A generalized description of the site including name of project, street name, number of employees on site and stage of construction was carried out.
2. The researcher then surveyed the site and recorded all information on a safety audit checklist. The responses were recorded in three possible ways:
    a. Unsafe conditions were recorded as a number of items on site not conforming to the recommended practice.
    b. Safe conditions were recorded as a number of items on site conforming to the recommended practice.
    c. If the situation was not seen or not applicable, a 'NA' was recorded.

Recording the observations in these three possible ways was due to the following reasons:

1. The temporary nature of construction projects and the associated need to perform unique tasks in each project (Harris and Mcaffer, 1992) coupled with the interest of the researcher in surveying a variety of informal construction sites.
2. Multi-skilled nature of construction sites
3. Possibility of getting a mixture of conformity and non-conformity to recommended practice regarding a particular condition, for example, observing both soundly and unsoundly constructed ladders on the same site.

McDonald and Hrymck (2002) employed similar way of recording observations in a safety audit checklist.

3.7.2 The Worker Survey

Each worker was approached and informed of the goals of the study by the researcher before being asked if he was interested in participating in the study. Workers were asked about their knowledge, perceptions and preferred behaviours regarding risk and safety requirements, their experience in construction, skills and training and recruitment details.

3.7.3 The Foreman Survey

Following the same procedure as for the workers, the foremen were approached and asked questions about their experience in construction, skills and training, employment details, their perceptions regarding safety requirements, safety inspections and safety meetings.

3.7.4 The Owner Survey

The owners were asked about their management practices, safety related documentation, knowledge of safety requirements, their risk perception/management and their opinions on how to improve safety in the informal construction sector.

3.8 Variables in the Study

3.8.1 Dependent Variable: Safety Performance

Safety performance of an organization refers to the effectiveness of the organization's system of structures, responsibilities and procedures put in place for safety management (Körvers et al., 2001). To ensure successful evaluation this important variable was measured by workers' descriptions, and observation by the researcher of the site conditions. Near-miss rates were not used in this study due to lack of near miss incident records and too short durations on informal sites by workers that would make this data very subjective and inaccurate, and thus not valid for drawing conclusions. Similarly, the

number of injuries was also not used because on most projects there are usually not enough injuries to draw valid conclusions about safety performance (Jacobs 1970) and there is evidence that many injuries go unreported (McDonald and Hrymak, 2002).

The first measure involved workers being asked to give their opinion of the perceived level of occurrence of eight real work situations in the informal construction sector. Although it was desirable to also get the workers' opinion of the level of occurrence on their current sites, their short durations on one particular site (Wachira, 2001) made it unreliable. For second measure, the researcher made a one-time observation of safety conditions on each site three times (on different days and varied times of the day) to assess compliance with safety requirements for the purposes of ensuring safety and health of all involved in and affected by the construction work. Mwangi (1989) and McDonald and Hrymak (2002) employed similar approaches in their studies.

The checklist in this study was based on FOPWA abstract. It covers site safety situations under the headings of housekeeping, prevention of falls from heights (scaffolding, work platforms and access to heights), PPE, precautionary equipment, mechanical hazard elimination and safety propaganda. The high incidence of falling from heights in construction accident statistics (McDonald and Hrymak, 2002 and Larchers and Sohail, 1999) led the researcher to focus mainly on factors associated with falling from heights. The items in the checklist for observation as indicators of safety performance fall under the technical controls factors. These included:

1. Housekeeping/orderliness of the worksite was measured by the tidiness of the site, for example, the manner of storage of materials and tools, and whether spoil heaps of waste materials was provided and utilized.
2. Physical hazards controlled were measured by the effectiveness of the material controls that exist to protect against falls, falling objects and other hazards of a physical nature.
3. Health hazards controlled were measured by the effectiveness of the material controls that exist to protect against contact with harmful chemical substances and other threats to their health.
4. The availability of PPE was measured by safety equipment provided.

5. Frequency of occurrence of high-risk situations was measured by asking workers to indicate their opinion of perceived frequency of occurrence of a number of high-risk work situations in the informal construction.
6. Informative safety propaganda was measured by the amount of information given on safety in form of posters displayed on site.

3.8.2 Independent Variable: Safety Awareness

Safety awareness is defined as a state of mind where one is constantly aware of the possibility of injury and act accordingly at all times (MCA, 2004, May 30). This implies knowledge and understanding in the area of safety (Mwangi, 1989), and skill and motivation in the use of safe work techniques and practices. In the absence of skill and motivation in safe performance of certain tasks, having knowledge of hazards alone would mean that one is in "a state of mind where he is constantly aware of possibility of injury", but lack the capability to "act appropriately at all times"

Although compliance with safety requirements is an indication of the awareness of safety requirement by those involved with the worksite, non-compliance is not necessarily a measure of lack of awareness. According to Cooper (1999), people have the capacity to ignore safety measures put in place and behave unsafely. Similarly, employers can intentionally avoid implementing safety requirement as way of cutting down on costs and this may mislead one into labeling an employer as safety ignorant. To avoid this problem, workers' characteristics, management commitment, and motivational controls and group processes (as surrogates of) safety performance were measured to give the latter's correct measures as follows:

a) The Worker's Characteristics

The following indicators were used to measure the worker's characteristics:

1. Knowledge of safety requirements was measured by how well workers answered a number of questions on safety requirements.

2. Experience and qualifications was measured by asking workers to indicate the number of years they have worked in the construction industry.
3. Attitude of the workers towards safety was similarly measured by asking workers to indicate whether they thought they were so familiar with their work that they forget to take precautions.
4. Risk perception was measured by asking workers to indicate their perception of the level of risk of a number of real work situations.
5. The preferred behaviour in handling a number of high-risk situations was measured by asking workers to indicate their probable behaviour in the face of the selected real work situations.

b) Management Commitment

The following indicators were considered adequate measures of management commitment to workplace safety:

1. The site owner's safety attitude was measured by workers' perceptions of the site owners' attitude towards safety, in particular, the degree to which safety is valued in comparison with high production, and the site manager's active and consistent involvement with site safety.
2. Safety inspections and reporting was measured by the owner's frequency and thoroughness of safety inspections, and the frequency of safety tours by the site foreman.
3. Safety planning was measured by the degree to which management anticipates hazards in production operations and steps taken to eliminate or mitigate them.
4. Line accountability was measured by the extent to which the safety attitude and performance of supervisor was scrutinized by the owner as demonstrated by the safety reports expected of the supervisor.
5. Owner's interest in safety was be measured by workers' perceptions of the owner's interest in or indifference toward safety conditions on the project.

c) Motivational Controls and Group Processes

Motivational controls are defined as controls that are concerned with the development and maintenance of general safety awareness and management support of technical controls. It has three principal elements of setting a safety tone for the organization, definitions of safety responsibility, and developing mechanisms of accountability for safety performance. The indicators for the motivational controls and group processes included:

1. How well coordinated the workgroups were in performing their work and dealing with safety hazards, for example, joint decisions and support for safe behaviours.
2. Safety training and orientation was measured by the provisions provided for safety instructions at the time of initial employment and the quality of ongoing safety training.
3. Supervisor's safety leadership was measured by how well the supervisor interacts and communicates with the workers about safety.
4. Supervisor's safety attitude, on the other hand, was measured by how important safety is to the supervisor as demonstrated by the frequency of safety inspections.

3.9 Data Analysis

Data was analyzed using simple spreadsheets. Percentages and arithmetic means were used to show both the proportion of the sample that has a particular attribute of the variables being measured. The use of spreadsheets was appropriate because the number of variables under study was easily manageable using this software. The researcher found it appropriate not to test the hypotheses due to the low number of responses and list wise deletion as it would have probably led to inaccurate results.

CHAPTER FOUR

4.0 DATA ANALYSIS

4.1 Introduction

This chapter comprises of three sections containing the analysis of data collected for the study, that is socio-economic background of workers and foremen, safety management practices and documentation, and safety behaviours, perceptions and attitudes.

34 out of 45 sites sampled were accessible to enable full assessment of the factors covered in the checklist and obtain completed questionnaires. This represents a sample response of 77.8%. These comprised of 94.3% new construction projects and 5.7% alterations and extensions of the existing property. A total of 30 owners, 34 foremen and 206 workers completed the questionnaires, making it 66.67, 75.56 and 82.4% response rates respectively.

4.2 Compliance with Safety Requirements

A twenty measure/guards checklist was used to gauge how efficient the integrated site safety system was. The guards and measures included in the checklist, although by no means exhaustive, were selected on the basis of the ability to be assessed on the sites visited with ease and in an objective manner, and association with high risk situations (Mwangi, 1989, McDonald and Hrymak, 2002 and Larchers and Sohail, 1999) under housekeeping, prevention of falls from heights, PPE, precautionary equipment, mechanical hazard elimination and safety propaganda headings.

4.2.1 Housekeeping

There are many accidents due to tripping, slipping or falling over materials and equipment which have been left lying around and stepping on nails that have been left projecting from timber (ILO, 1999, p. 10). Therefore paying attention to site tidiness can make a major contribution to safe working conditions on site.

To establish whether or not the site management paid attention to housekeeping, three variable measures were included in the checklist under this section, that is rubbish on access routes, storage of materials and storage tools in toolboxes.

87.5% of sites surveyed had incidences of rubbish on access with more than 50% non-compliance rating. Only 2.5% of the sample had 100% compliance with safety requirements. Concerning storage of both materials on site and tools in tool boxes, 89.66% and 89.66% of the sites surveyed had more than 50% non-compliance rating respectively and none of the sites had 100% compliance in either of the two aspects.

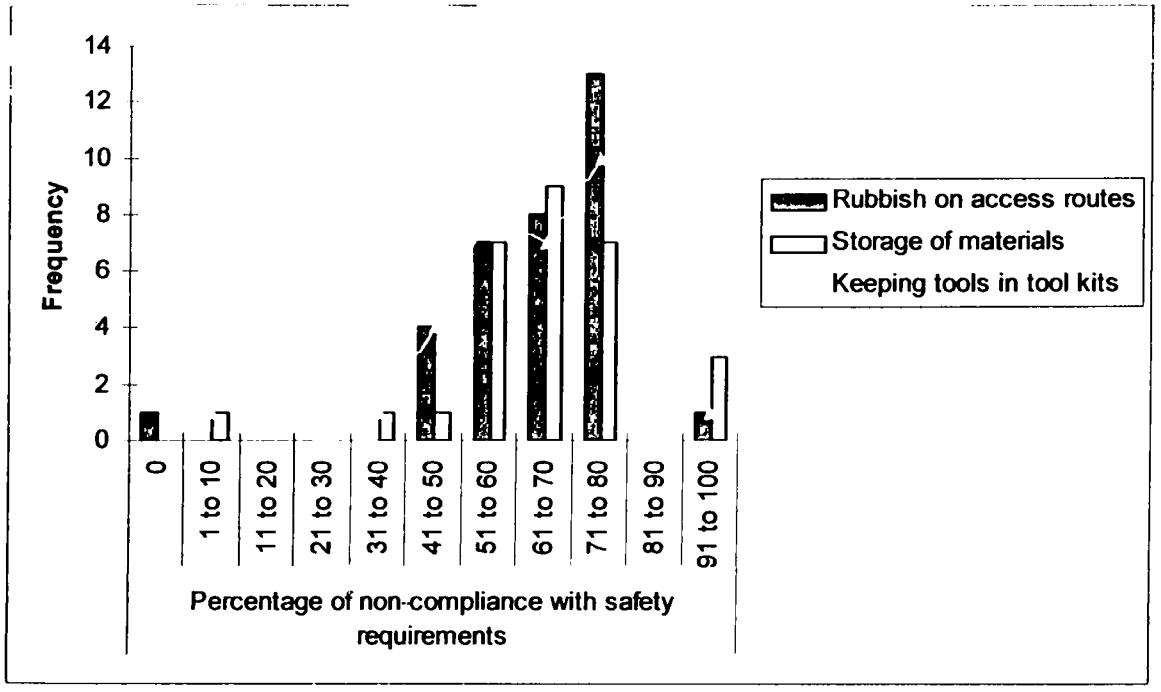

Figure 4.1: Compliance with housekeeping requirements

4.2.2 Prevention of Falls from Heights

Prevention of falls from heights was measured by a variety of items included in the checklist under scaffolding and work platforms section, that is (i) unguarded openings, (ii) missing scaffold and (iii) missing guardrail or edge protection; and access to heights

section comprising of (i) defective ladders, (ii) ladders shorter than 1m above the landing and (iii) ladders incorrectly tied or not secured.

To prevent falls from heights, the site management must ensure suitability of scaffolding for the work and the competency of the people handling it. Similarly, ladders used in access to and egress from heights must be soundly constructed, of adequate height in relation to the landing, properly secured and properly used to avoid accidents.

The study revealed that 63.52% of the sites surveyed did not prevent unguarded openings from occurring. They had a non-compliance rate of more than 70.5%. As for the prevention of occurrences of missing scaffolds, the study established that 91.67% of the sample surveyed had a non-compliance rate of more than 50%. All sites surveyed regarding guardrails/edge protection had occurrences of violations of safety requirements. 93.1% of the sites had missing guardrails/edge protection with more than 90% non-compliance rating.

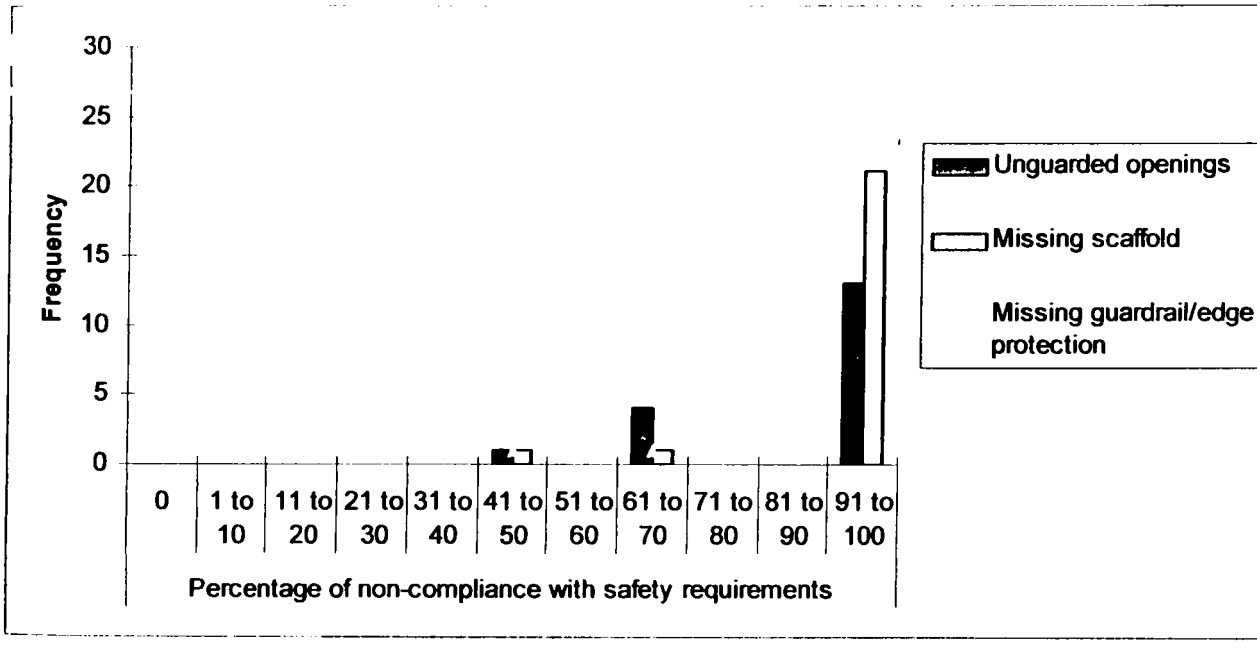

Figure 4.2: Compliance with safety requirements associated with working on scaffolds

Of all the sites surveyed regarding ladders shorter than 1m above the landing, 76.92% had 100% non-compliance while 23.08% had a non-compliance rate of more 60%. On the other hand, all ladders on all sites surveyed were found to be not only defective but also either incorrectly tied or not secured at all.

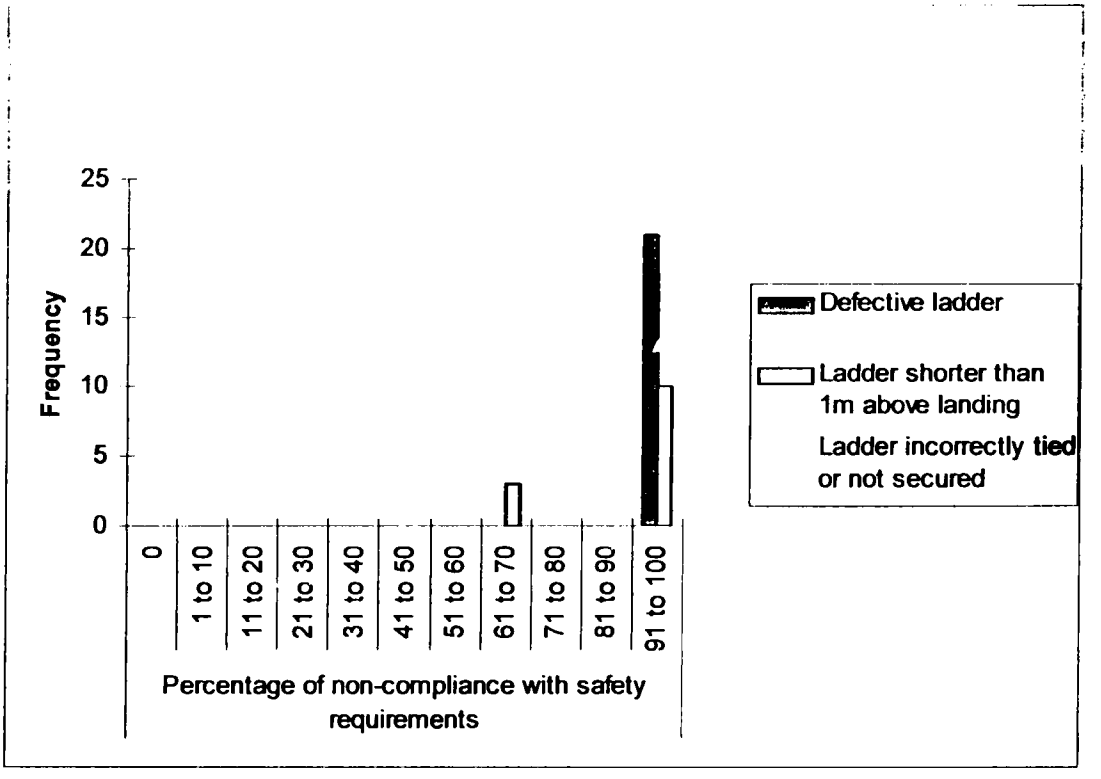

Figure 4.3: Compliance with safety requirements associated with the use of ladders

4.2.3 Personal Protective Equipment Provided

Under this section the items under study included safety helmets in use, hand gloves in use, hard boots worn by workers and dust masks worn. All these are easily identifiable and measurable since they are items worn by workers on their heads, hands, feet and mouth/nose. They also constitute the most commonly used PPE for any safe site (Mwangi, 1989).

There wasn't even a single incidence where a worker was observed wearing a safety helmet, dust mask or hard boots even though their activities called for the use of the

latter. Regarding incidences of workers wearing hand gloves and wearing overalls, the study showed that 97.06% (wearing hand gloves) and 76.47% (wearing overalls) of sites surveyed respectively had 100% non-compliance with appropriate safety requirements.

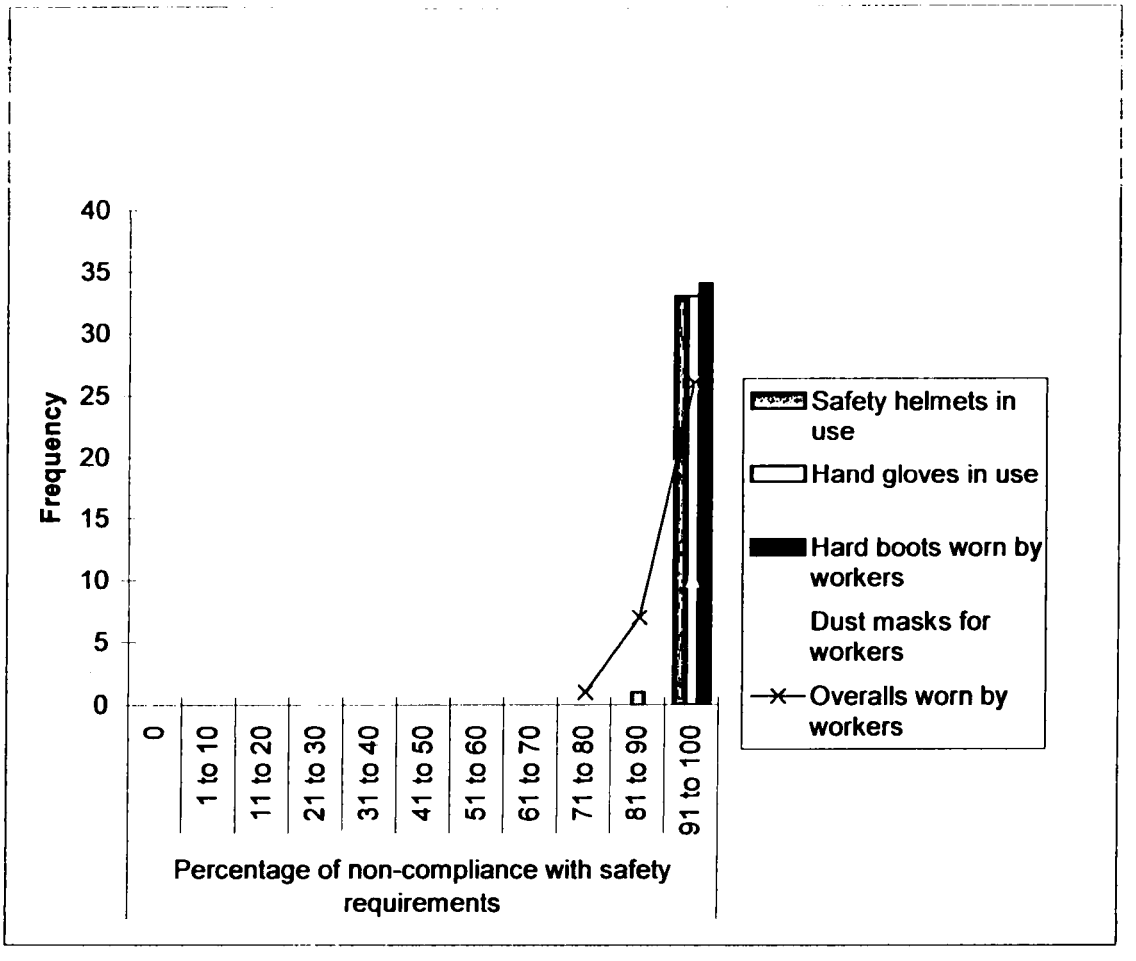

Figure 4.4: Compliance with safety requirements associated with PPE

4.2.4 Precautionary Equipment Provided

Two variables, availability of both first aid kit and fire extinguishers, were measured to establish the preparedness on the part of the site management to handle emergency situations in the event of accidents occurring on site.

With regards to the provision of first aid kits only one out of the thirty-four sites surveyed had an incidence where a first aid kit was provided. It is worth noting that the only site that had a first aid kit was actually the construction of a new hospital block that

was adjacent to the existing dispensary. All sites surveyed had not provided the fire extinguishers as a precautionary measure.

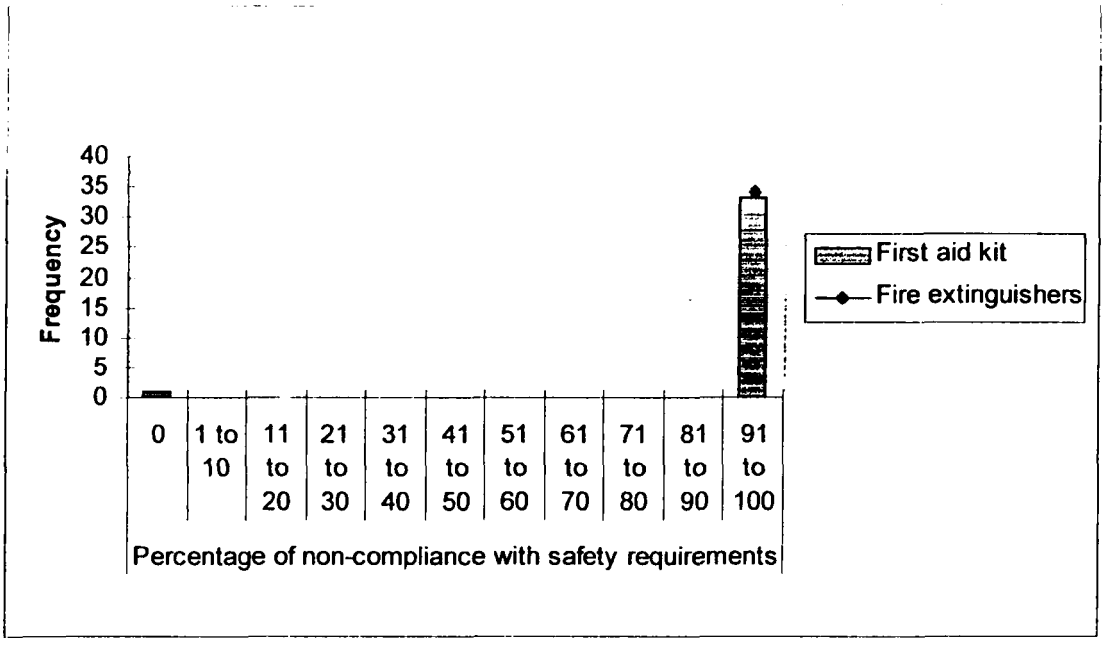

Figure 4.5: Compliance with safety requirements associated with precautionary equipment

4.2.6 Mechanical Hazard Elimination

To establish whether the site management took deliberate steps to eliminate hazards through mechanical means, three measures were included in the checklist. These included means of securing excavations exceeding 1.2m deep, complete hoarding around the site, and barriers around excavations.

None of the eight sites surveyed that had incidences where excavations exceeding 1.2 meters had any means of securing the excavations in place. As for hoarding and barriers around excavations, only five out of the thirty-four sites surveyed had complete hoarding around the site. None of the sites surveyed had incidences where open excavations were observed (nine sites) having barriers around these excavations.

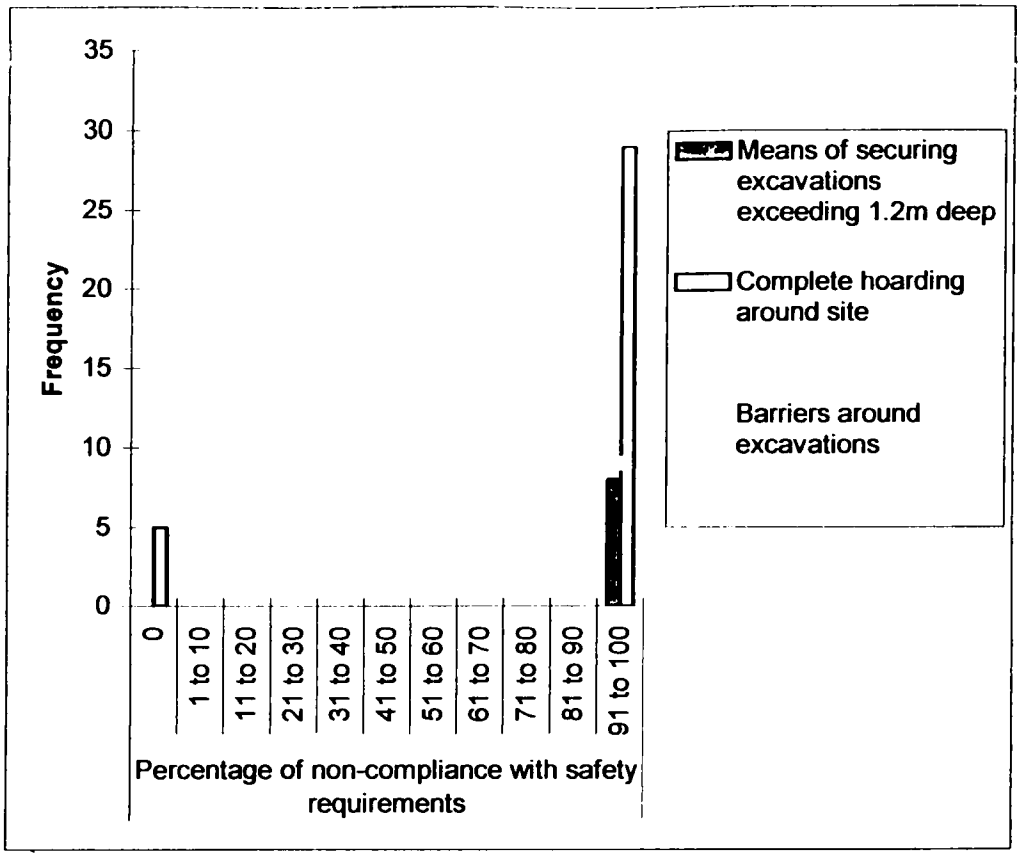

Figure 4.6: Mechanical hazard elimination

4.2.7 Safety Propaganda

This measure was included to establish whether or not the site management took deliberate steps to sensitize workers and the public at large on matters pertinent to safety on site. The variable studied under this section was incidences of safety posters displayed on and around the site. None of all the sites surveyed had posters displayed on site.

4.3 Socio-Economic Background of Workers and Foremen

4.3.1 Duration of Work in Construction Sector

The study found that a total of 54.84% of the workers surveyed had worked in sector for between one and five years, 32.26% for more than 5 years and 12.9% for less than one year.

4.3.2 Education, Skills and Training

A total of 76.44% of the workers surveyed had attained secondary level of education, 23.04% of the sample primary education level and 0.52% of the sample university level of education.

50.49% of the workers surveyed indicated their skill status as skilled, 43.69% semi-skilled and 5.82% unskilled. A total of 59.18% of the workers surveyed had acquired their skills through on-job training, 11.22% through family business, 10.21% through informal apprenticeship and 19.39% through the formal training institutions (4.08% through national polytechnics and 15.31% through the village polytechnics respectively).

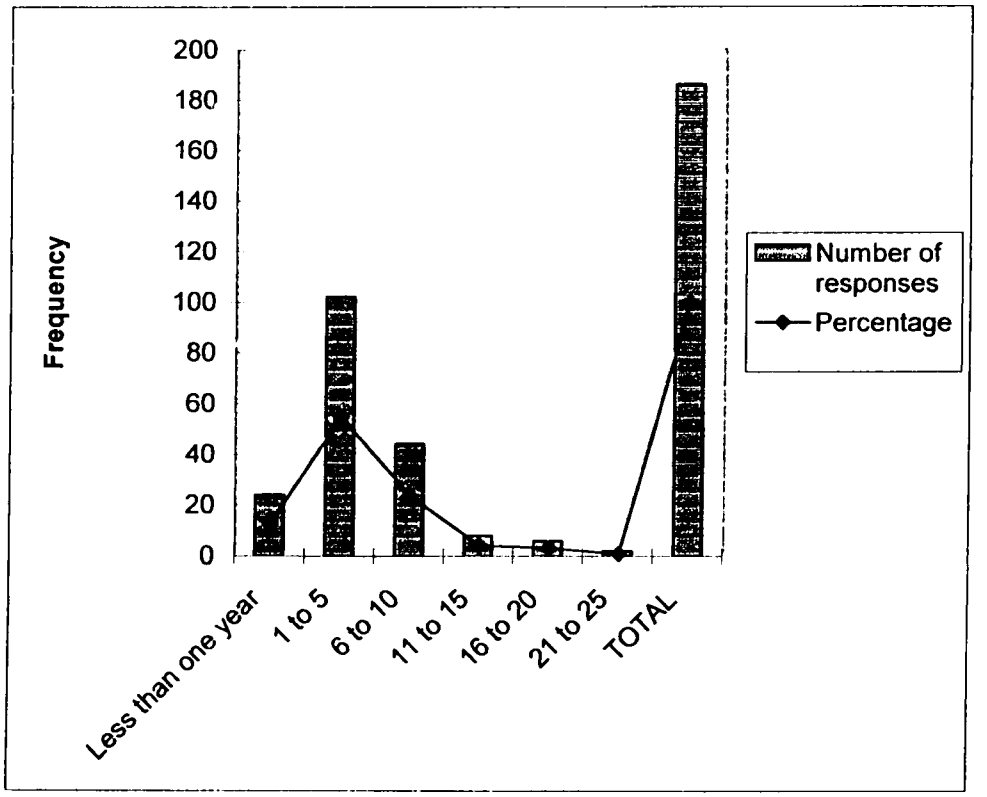

Figure 4.7: Duration of work in construction

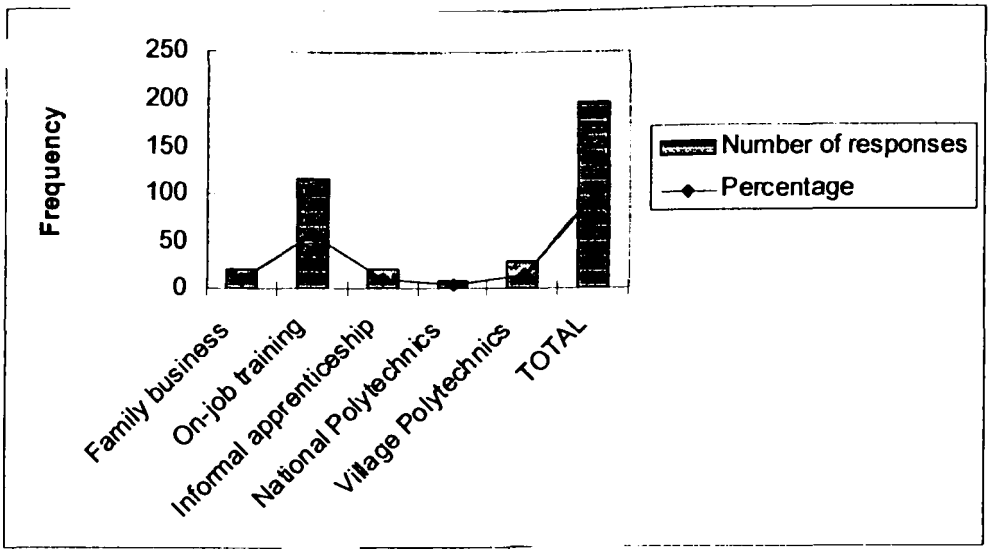

Figure 4.8: Institution of training

4.3.3 Workers' Recruitment, Work Agreement and Method of Payment

71.19% of the workers surveyed acquired their jobs through personal search, 27.12% through their family and friends and 1.69% through apprenticeship. As for employment requirements, 87.26% of the workers surveyed indicated work experience/visits to previous jobs as a criterion for their selection, 8.82% used their trade certificates and 3.92% indicated that reputation was the basis for their selection.

Most workers (80.61% of the sample) had verbal agreements with their employers while 19.39% had non-standard written contracts. 62% of the sample was paid on weekly basis, 29% on daily basis and 9 percent on piecework. Only 21.74% of the workers worked for more than eight hours per day.

1.3.4 Duration of Work in Construction Sector

Although work in the construction sector is considered tedious and tiresome (Mitullah and Wachira, 2003), majority of the foremen surveyed had been working in construction sector for more than 5 years. A total of 70.59% of the foremen surveyed had worked within the sector for more than 5 years and 17.65% for more than 25 years.

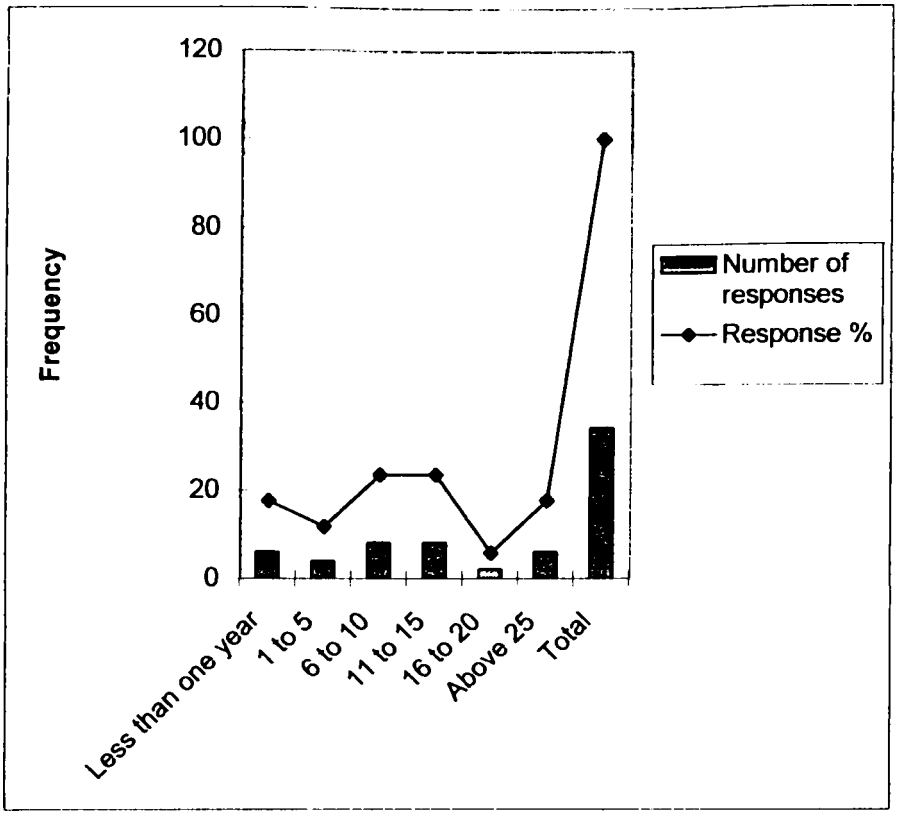

Figure 4.9: Duration of work in construction

4.3.5 Education Level, Skills and Training

A total of 76.47% of the foremen surveyed had attained secondary level of education and 23.53% primary education level. Regarding skills, a total of 88.24% of the foremen surveyed indicated their skill status as skilled while, interestingly, 11.76% of the foremen surveyed indicated their status as semi-skilled.

Most of the foremen (62.5% of the sample) had acquired their skills through on-job training, 25% through formal training and 6.67% through both informal apprenticeship and family business. A total of 82.35% of the sampled foremen, including some of the semi-skilled, indicated training apprentices.

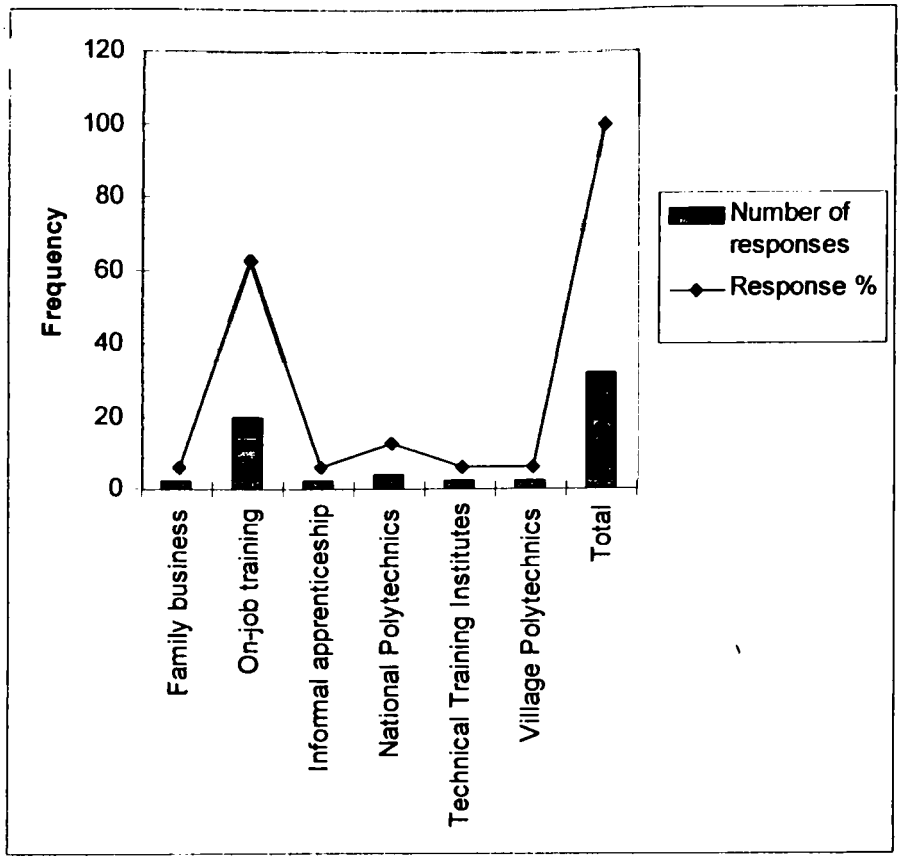

Figure 4.10: Institutions of training

4.3.6 Foremen Recruitment, Work Agreement and Method of Payment

Most of the foremen (52.94% of the sample) acquired their jobs through personal search and 47.06% through their family and friends. Regarding their employment requirements, 52.95% of sample indicated work experience as a criterion for their selection, 35.29% indicated visitation to their previous job sites by potential developers while 11.76% indicated that their trade certificates were the basis for their employment.

A total of 52.94% of sampled foremen had verbal agreements with the owners and 47.06% had written contracts (not standard type). 52.94% of the sample was paid on weekly basis, 29.41% through the labour only contract method, 11.76% paid daily and 5.88% of the sample was paid on piecework basis.

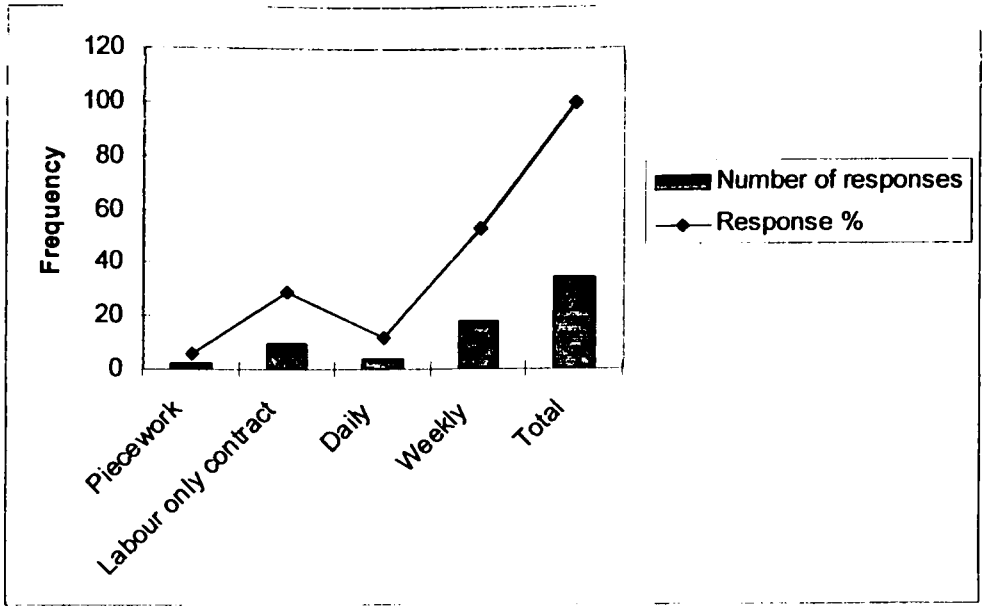

Figure 4.11: Payment methods

4.4 Safety Management Practices and Documentation

Safety management has three main objectives of making the work environment safe, making the job safe, and making workers safety conscious. In the informal construction sector, the owner plays the role of the top management/employer while the foreman provides site supervision and therefore deals with the management aspects of construction safety.

The variables analyzed here below are meant to help determine the management practices and documentation associated with safety in the informal construction sector and their impact on the achievement of the goals of safety management. The findings of the survey are utilized in making inferences about the appropriateness of the management practices and documentation associated with safety in use in the informal construction sector.

4.4.1 Safety in Construction Planning

Before work begins on site, serious thought need to be given to the order in which work will be done, especially hazardous operations, site access and egress, storage of materials

and equipment, arrangement to keep site tidy, training needs of both workers and supervisor, site security, location of other facilities among other issues (ILO, 1999).

The site owners were asked to indicate matters taken into consideration during the planning stage of the project before the commencement of work on site. A total of 72.22% of the surveyed site owners indicated considering labour and material availability and only 5.56% indicated taking workplace safety into consideration.

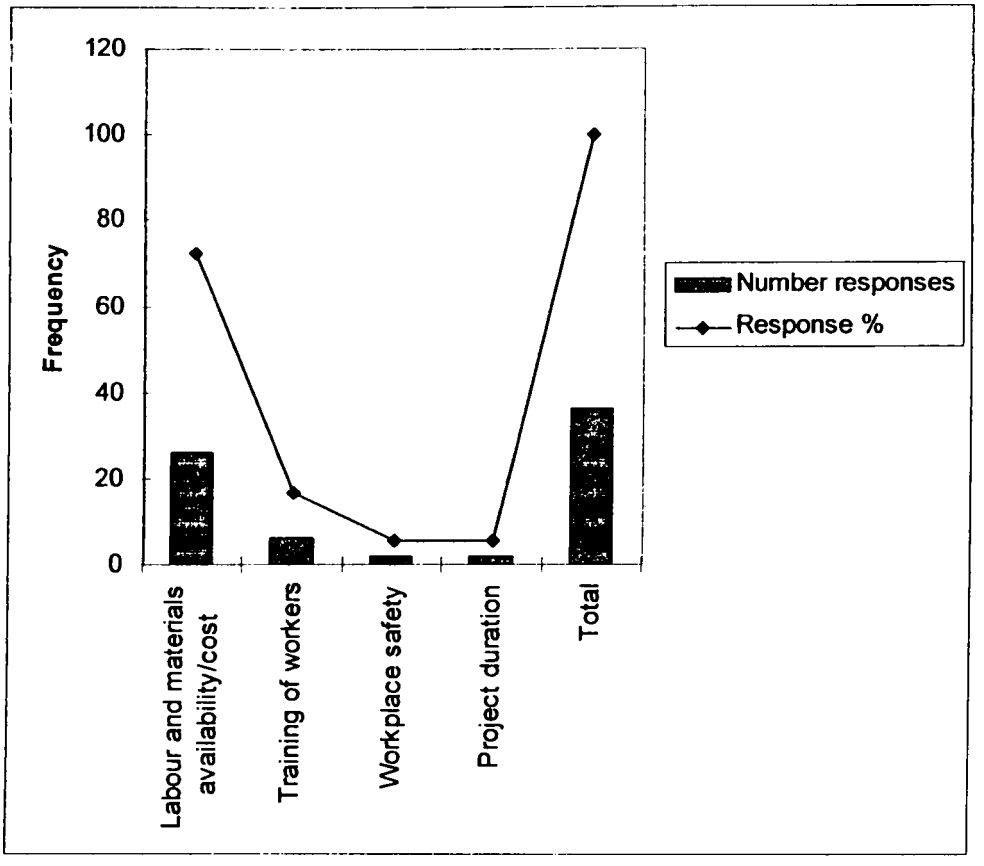

Figure 4.12: Matters Taken into Consideration during the Planning Stage of the Project Before Commencement of Site Operations

4.4.2 Safety Meetings

Planned meetings or briefings between the top management (owner) and the site manager/supervisor in which safety issues are included in the agenda for discussion helps to show the manager's commitment to safety. To establish whether the top management

held periodic site meetings with the supervisor to review workplace safety, a structured question was included in the questionnaire requiring owners to indicate whether held periodic site meetings or not.

A total of 85.71% of the sample indicated holding periodic site meetings. However, only 10.29% of the sample surveyed indicated including workplace safety among issues for discussion in their meetings.

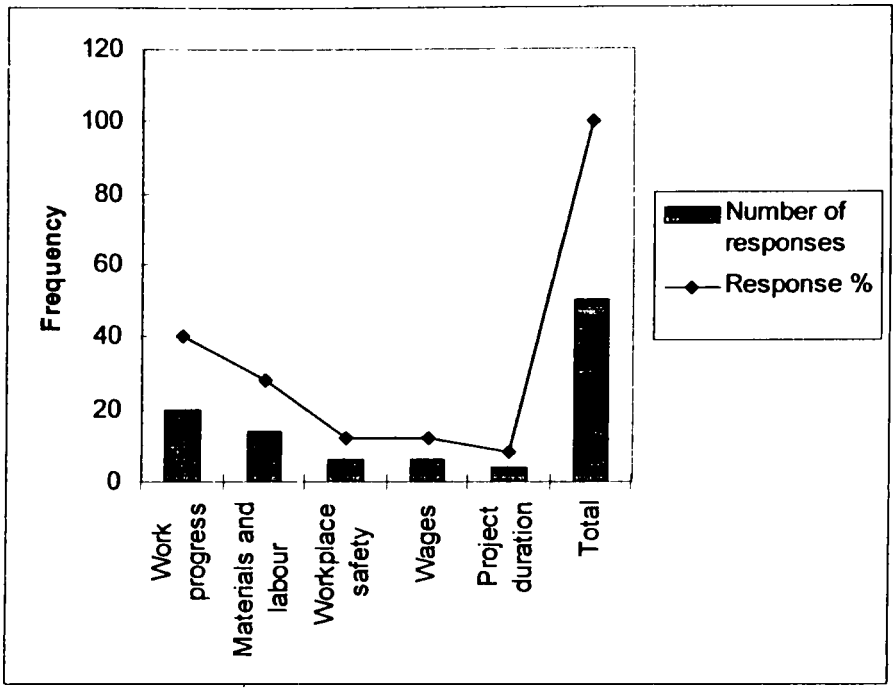

Figure 4.13: Issues discussed in the meetings

4.4.3 Safety Inspections by Owner

Joint site safety inspection by the owner and the site supervisor shows the owner's commitment to safety and raises the general level of safety consciousness at site (ILO, 1999). To evaluate the owners' commitment to site safety, the questionnaire examined whether site inspections were being carried out or not, the frequency of such site visits by the owner and in particular, whether safety aspects of the project were among those inspected during such visits.

The study found that 85.71% of the owners surveyed indicated inspecting their sites periodically while 14.29% acknowledged not inspecting their sites at all. However, despite the high percentage of owners carrying out periodic site inspections, only 8.3% of the sample indicated including workplace safety among issues for inspection. Whereas 30.41% of the owners in the sample inspected work progress, 24.88% of the sample inspected materials/component stock and security, and 22.12% of the sample inspected work quality.

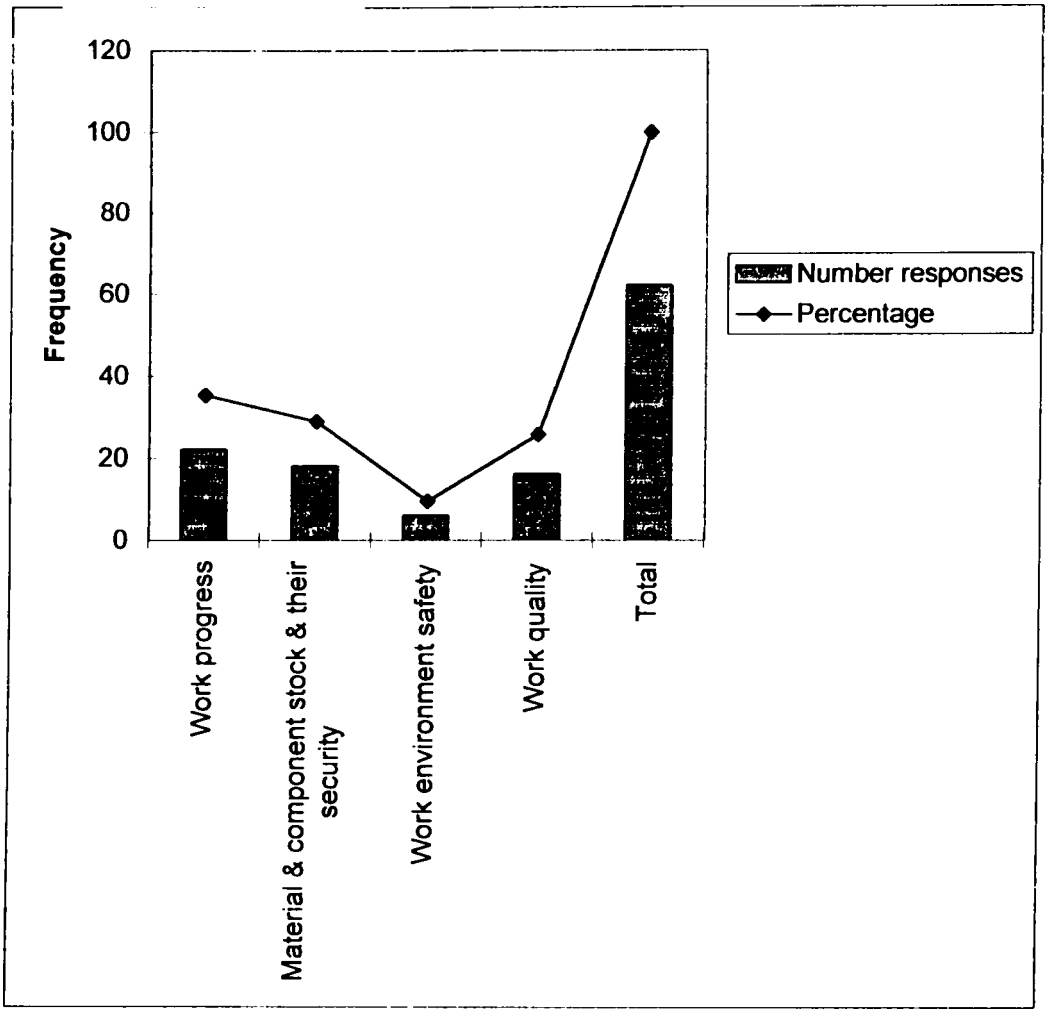

Figure 4.14: Aspects of the project inspected during site inspections

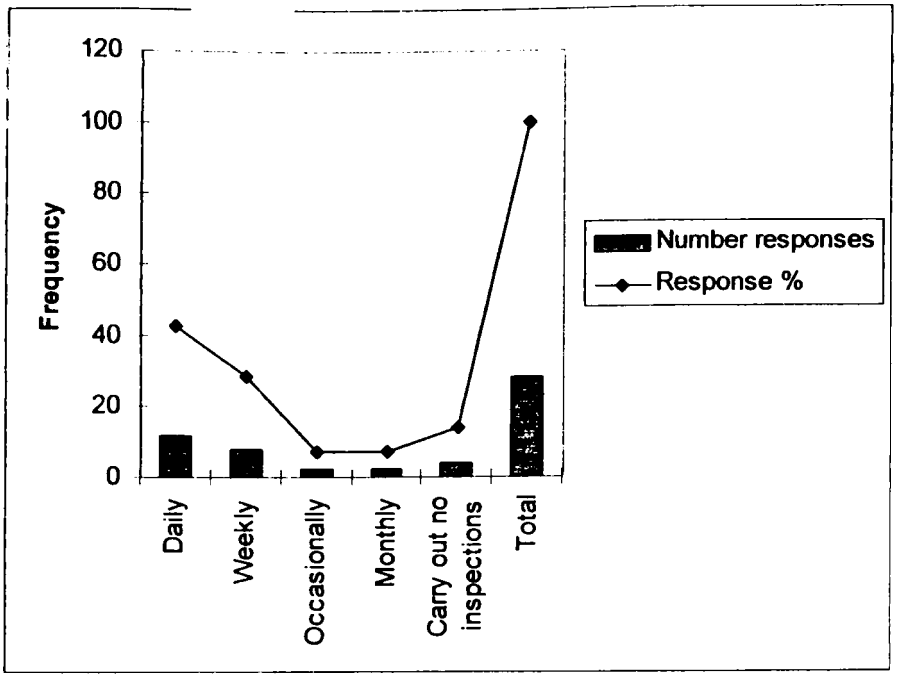

Figure 4.15: Frequency of site inspections

4.4.4 Safety Reporting and Documentation

Investigation was carried out to establish whether informal construction sites had any form of safety reporting and documentation system. The existence of an elaborate safety reporting and documentation system, in addition to helping in the facilitation of identification and resolution of OHS problems (ILO, 1999), demonstrates the seriousness with which safety line accountability is taken by the management, that is how the owners scrutinize the safety attitude and performance of supervisors.

The owners were asked to indicate whether or not there was any form of project reports they expected from the foremen on their sites. Secondly those who indicated expecting reports from their foremen were asked to specify the type of reports expected of the foremen. A total of 96% of the surveyed owners expected their foremen to report about the various project aspects while 3.96% expected no reports to be made at all. As to the type of reports, the study found that 36% of the owners surveyed expected reports on materials and component stock and their security, 32% on work progress, 20% on payroll and only 8% expected reports on workplace safety.

The owners were also asked to indicate if at all they kept any project related documents, and if they did, their type. 93.75% of the sample surveyed indicated keeping project related documents (62.75% kept material receipts and delivery notes, 31.25% kept payrolls and 6.26% kept no project related documents at all). Most interestingly, the survey found that none of the owners kept any safety related document regarding their projects.

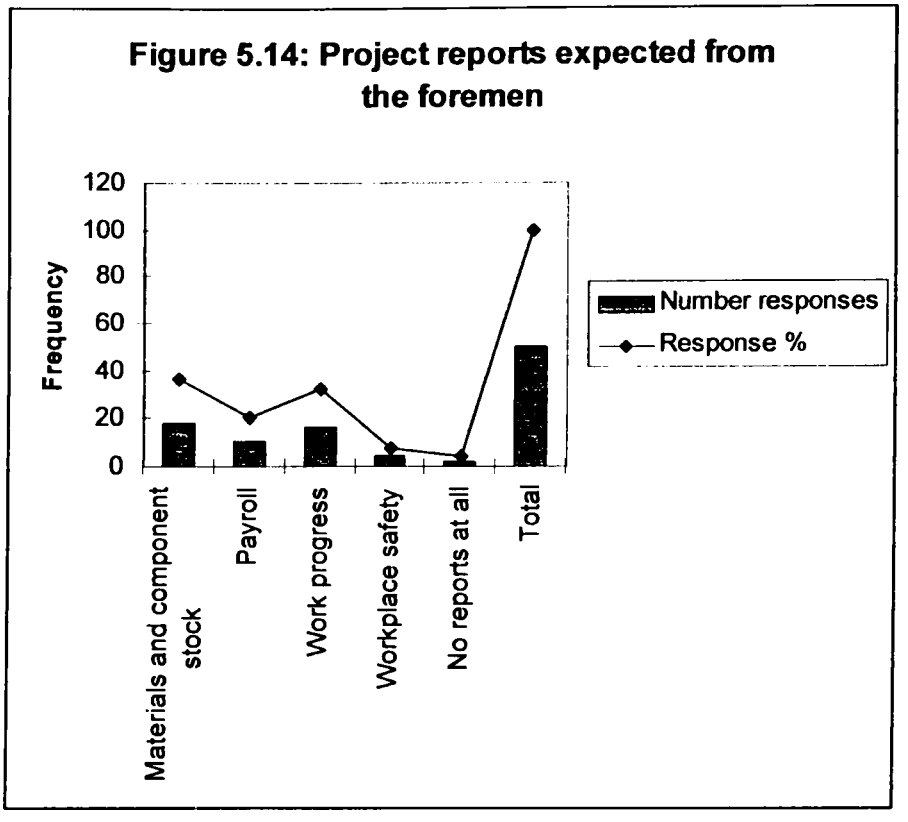

Figure 4.16: Project reports expected from the foremen

4.4.5 Safety Orientation and Training

Asked whether the foremen offered any form of training to the workers on their sites or not, 56.25% of those surveyed indicated not having offered any form of training to workers at all. 18.75% of the surveyed sample equally indicated that they offered training to skilled; a similar percentage trained unskilled workers while 6.25% of the sample offered training to all new employees. The study also found that 30.88% of the foremen

surveyed trained workers in competence in their specialized skills while, interestingly, only 12.87% of the foremen sampled indicated training workers in the area of workplace safety.

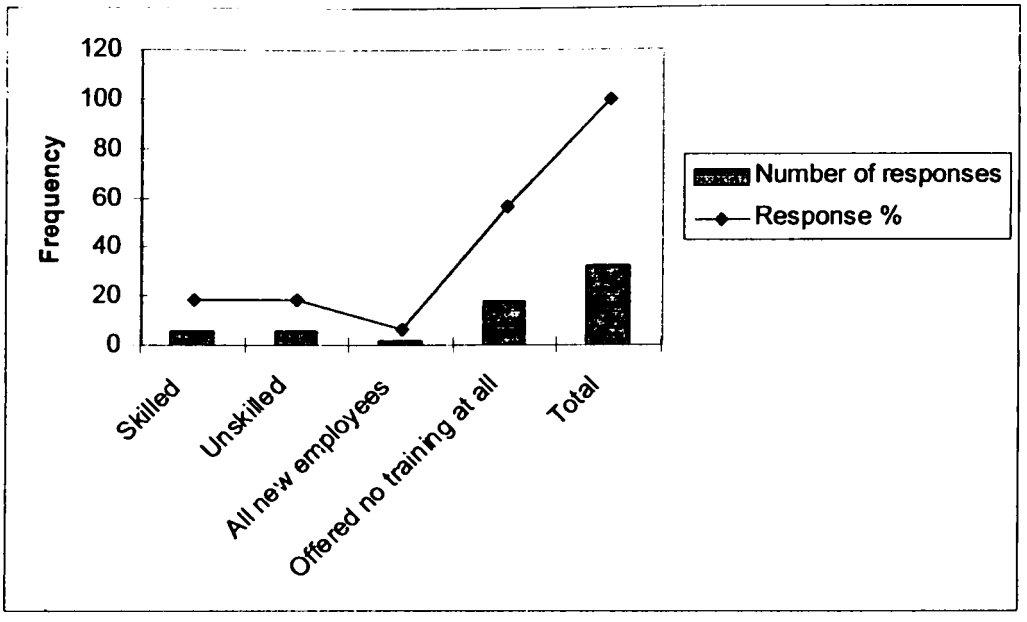

Figure 4.17: Categories of workers trained on site

4.4.6 Safety Meeting

Safety meetings provide an opportunity to talk about safety problems likely to be encountered and potential solutions to identified problems (ILO, 1999). It helps to show the supervisor' commitment to safety, promotes positive safety attitudes among the workers (HSL, 2002) and encourages the workers to carry out "safety checks".

To establish whether the site supervisors undertake this important aspect of safety management, a question requiring the foremen to indicate whether or not they held site meetings with the workers on their sites was included in the questionnaire. A total of 82.35% of the foremen surveyed indicated that they held site meetings with workers while 17.65% indicated not having held any meetings with workers on site. Secondly those who indicated that they had held site meetings were asked to indicate the issues discussed during such meetings. Of all the foremen surveyed, 47.05% indicated that they

had discussed work progress while 35.3% discussed wage payment. Interestingly, none of the foremen surveyed held site meetings in which workplace safety was discussed.

4.4.7 Safety Inspections by the Supervisor

A supervisor carrying out periodic safety inspections together with the workers raises the level of safety consciousness at the site (ILO, 1999). To establish how seriously the foremen took workplace safety, questions requiring the latter to indicate whether or not they carried out site inspections, the frequency of their inspections if they indicated carrying out site inspections, and the aspects of the project inspected were included in the questionnaire. A total of 80% of the surveyed sample indicated carrying out site inspections at varied frequencies while 20% indicated not having held any inspections at all.

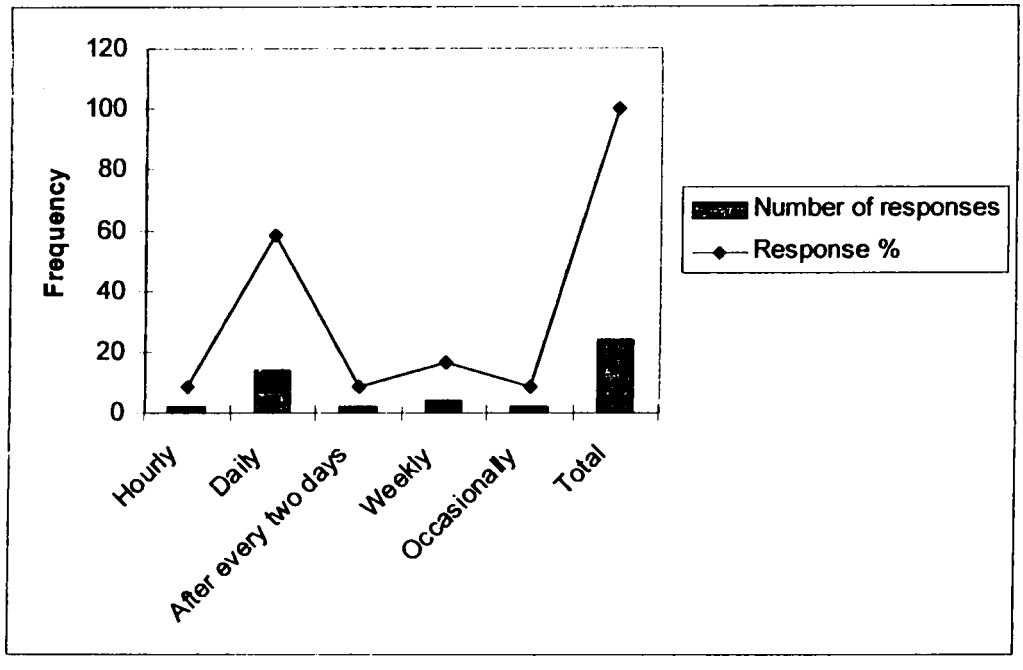

Figure 4.18: Frequency of periodic site inspections by the foremen

The frequency of site inspections was 46.67% on daily basis, 13.33% on weekly basis and 6.67% for each of hourly, every two-hourly and occasional basis respectively. The

survey also revealed that 58.64% of the surveyed foremen carried out inspections on work quality, 16% on work progress and only 5.36% of the sample inspected workplace safety.

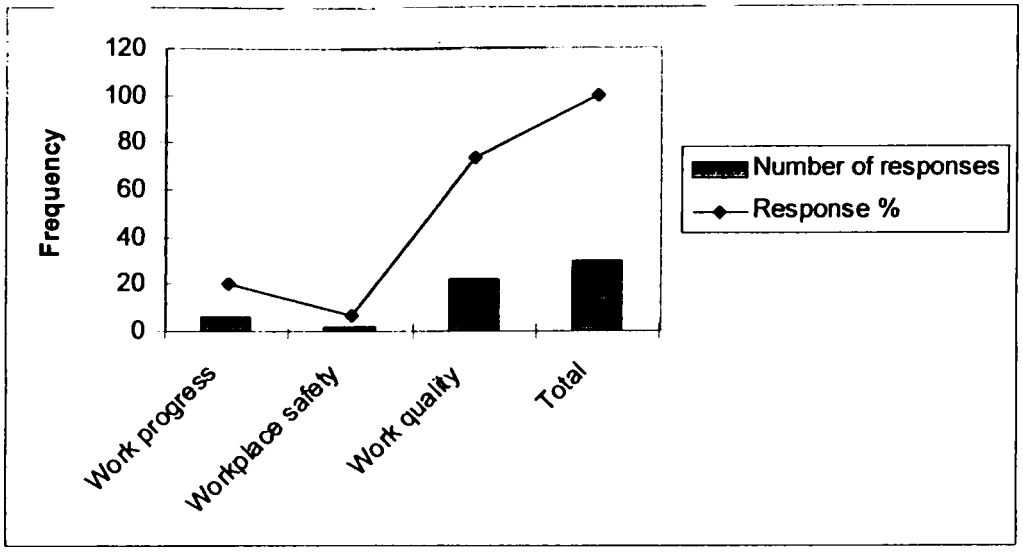

Figure 4.19: Project aspects inspected by the foremen during periodic site inspections

4.5.0 Safety Behaviours, Perceptions and Attitudes

4.5.1 Awareness of Safety Regulations

To investigate the foreman's knowledge of safety regulations, questions requiring the latter to first, indicate if they were or not aware of any safety/health regulations for construction sites and secondly, if they acknowledge awareness of safety regulations, to list them, were included in the questionnaire.

Although most of the foremen (53.33% of the sample) indicated awareness of safety regulations, only 26.67% of the sample correctly lists a few of FOPWA regulations. Only 13.33% of the sample surveyed listed the use of PPE among the regulations while each of the rest of the suggestions (figure 4.20) was mentioned by 6.67% of the sample. Out of the 46 FOPWA abstract regulations, the most commonly known regulation was known by only 13.33% of the sample surveyed.

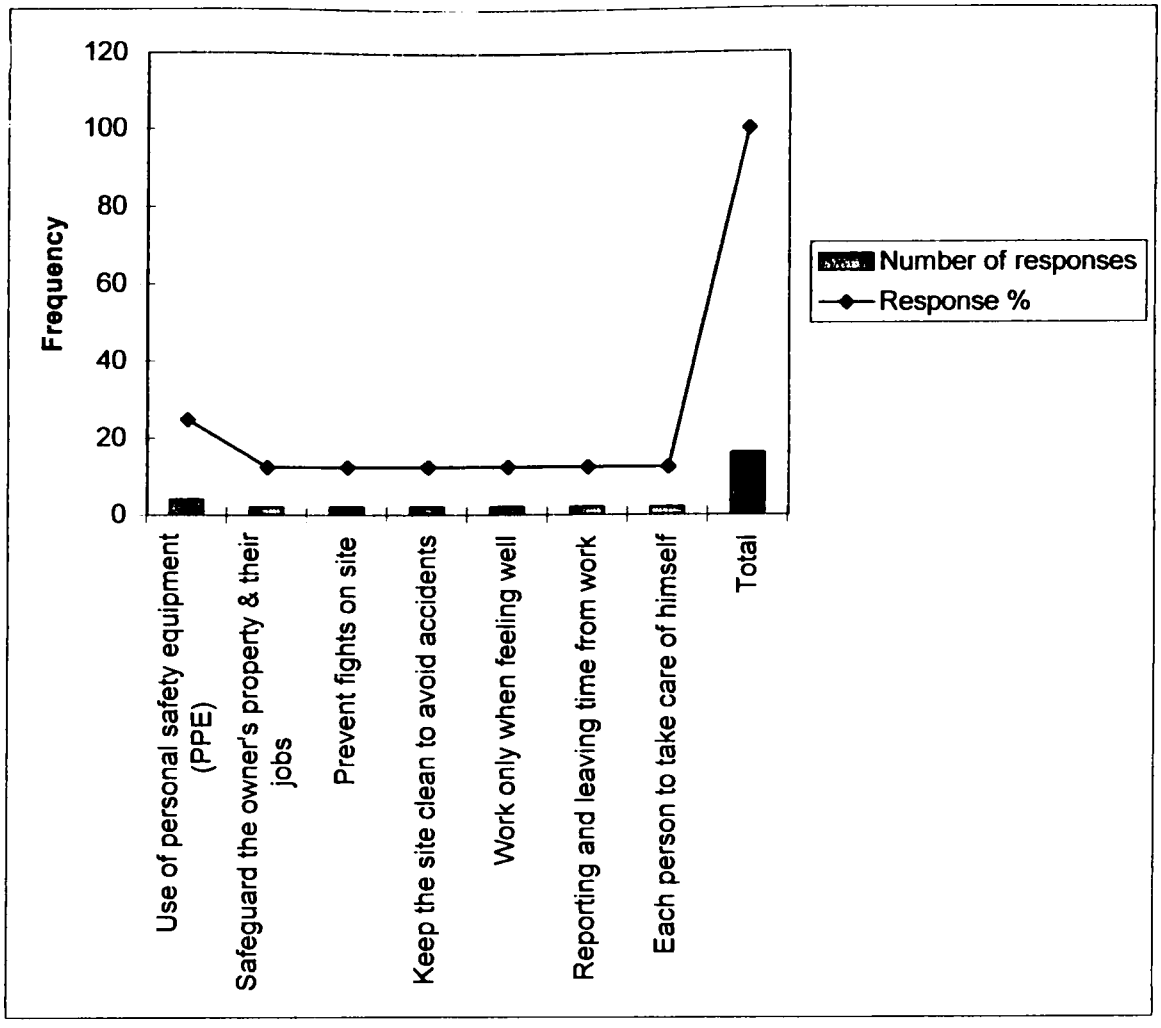

Figure 4.20: Safety regulations as known to foremen on informal construction sites

Asked to give suggestions on how workplace safety in informal construction could be improved, the surveyed foremen gave a variety of suggestions as shown in figure 4.21. The most suggested (by 29.63% of foremen the sampled) as a way of improving safety in informal construction was provision of PPE, followed by the equipping the workers with safety skills (14.81% of the sample). This implies that no single suggestion was known to more than 29.63% of the sample even though the same are clearly stated in the FOPWA abstract.

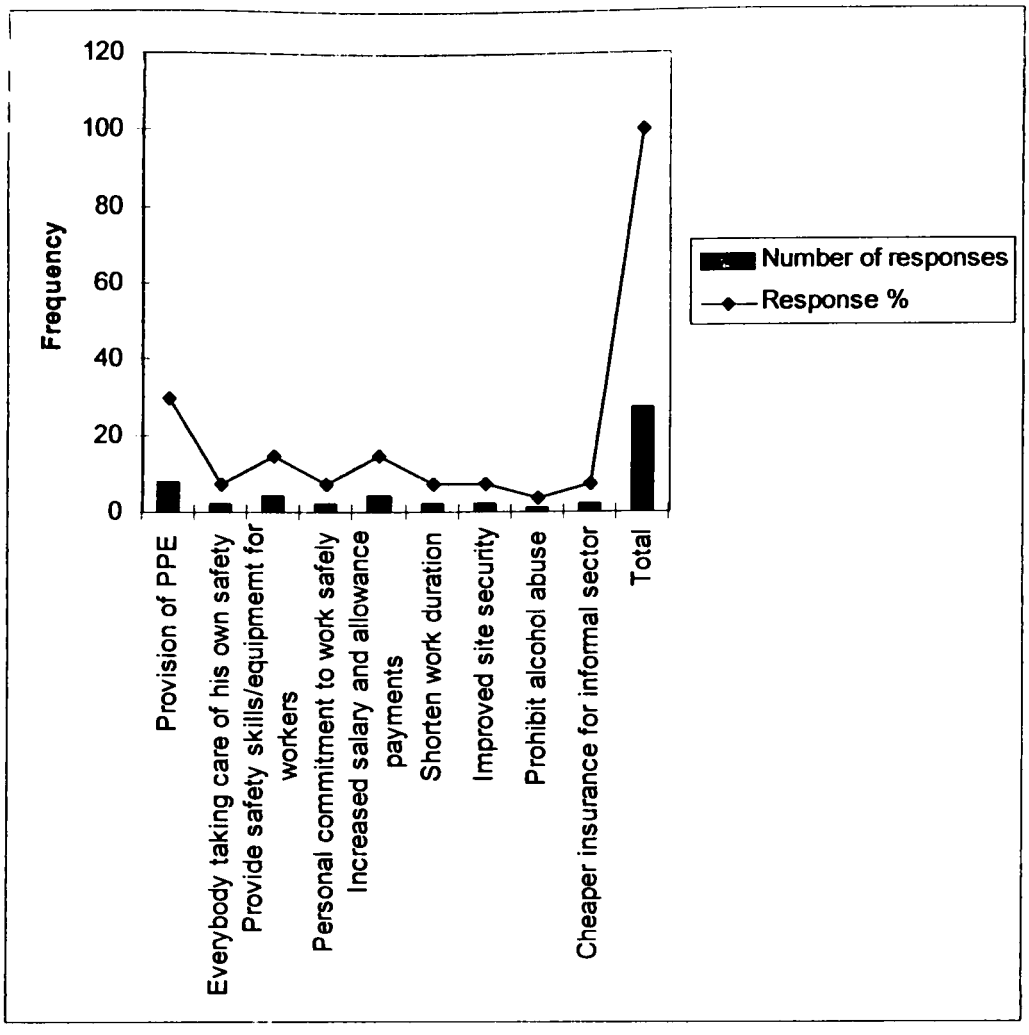

Figure 4.21: Foremen's suggestions on how safety could be improved in informal construction

4.5.2 Workers' Awareness of Safety Regulations

To establish whether or not the workers knew the party responsible for the provision for the safe working environment as per FOPWA, a question requiring the workers to indicate the person charged with this responsibility from the choices given was included in the questionnaire. 47.52% of the workers interviewed indicated that the foremen were responsible for the provision for the safe work environment, 32.68% indicated that they themselves were responsible while 19.8% indicated that the employer/owner was responsible.

4.5.3 Safety Climate

To investigate safety climate on sites, a question inquiring into the workers' perception of the management commitment to safety was included in the questionnaire. The workers were asked to indicate issues that were, in their opinion, of greatest concern to the site owner from the provided choices. A total of 47.47% of the workers surveyed indicated high production and work quality as the greatest concern to owners, 44.44% indicated material utilization and only 8.09% indicated workplace safety as the greatest concern to the owners.

4.5.4 Workers' Risk Perception

To investigate the workers' safety risk perception, eight high–risk situations were selected for inclusion in the questionnaire. Each worker was asked to give his opinion about perceived level of risk, frequency of occurrences and preferred behaviour in the face of risk for each of the situations selected. Falls from heights was chosen for exploration mainly because, according to McDonald and Hrymak (2002), the literature and statistics highlight that three aspects, that is working on scaffolds, using ladders and working on roofs, account for the most frequent and severe accidents in construction sector. The eight real work situations included the following:

Situation 1: Working on scaffolds not totally boarded

Situation 2: Working on scaffolds missing guardrails

Situation 3: Climbing up and down the scaffold without a ladder

Situation 4: Using a ladder incorrectly tied or not secured

Situation 5: Using a broken or somehow defective ladder

Situation 6: Using a ladder shorter than one meter above the landing

Situation 7: Working on fragile roofs without crawling boards

Situation 8: Working on roofs without edge protection/harness

The workers responses to the two questions about these eight situations – how risky the situation was and how frequently they would be found in informal construction in general, are summarized in figure 5.45.

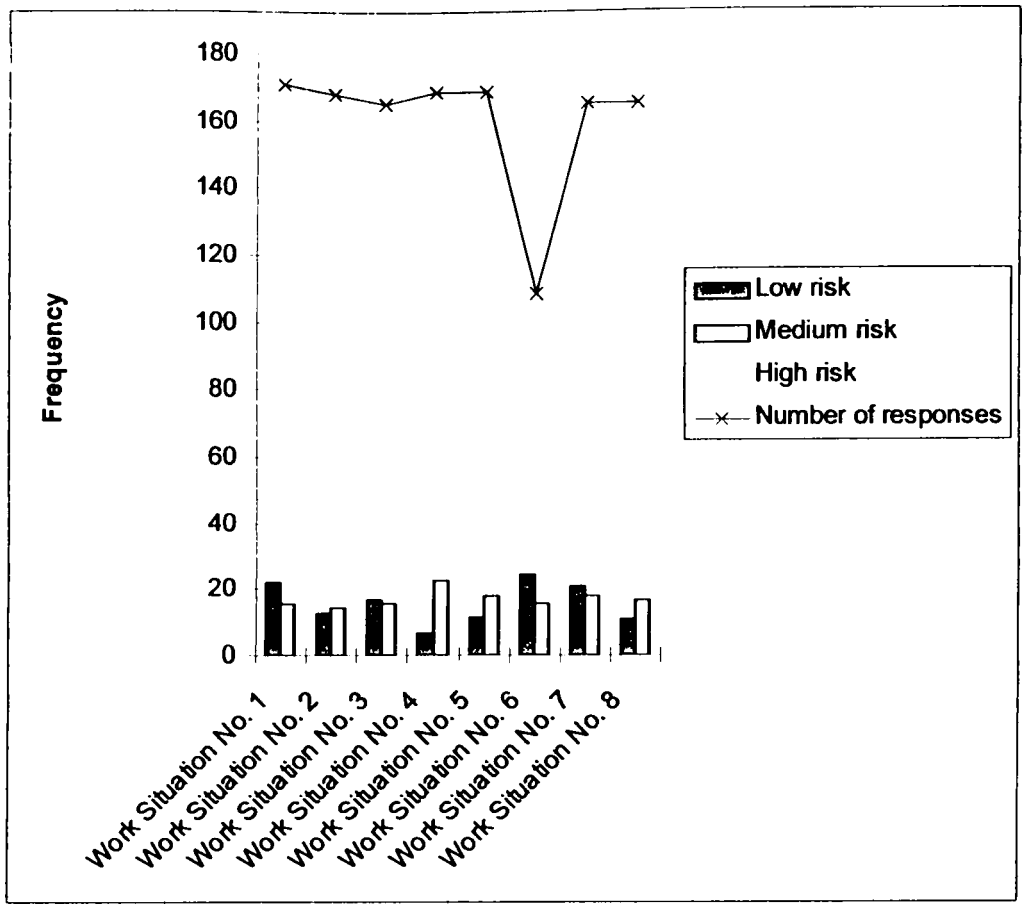

Figure 4.22: Workers' risk perception

The study found that 66.1% of the workers surveyed perceived the eight high-risk situations as high risk. However a small proportion of the workers (18.4% of the sample) perceived the situations as medium risk and 15.5% of the sample as low risk.

66.11% of the sample surveyed rated the frequency of occurrence of the eight high-risk situations in informal construction as frequent, 19.81% of the sample indicated the occurrence as usual while 14.09% of the sample indicated the situation as rare.

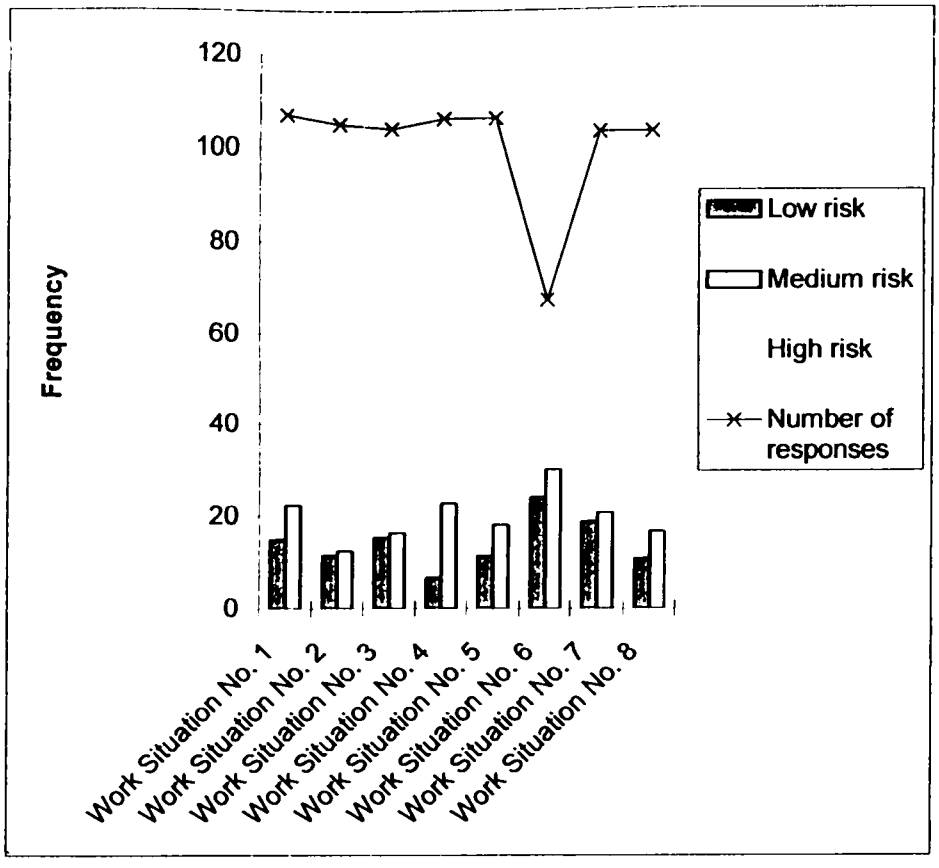

Figure 4.23: Frequency of occurrence of high-risk situations in informal construction

4.5.5 Preferred Behaviour for Handling High-Risk Situations

The surveyed workers' answers to the question of how they would behave in relation to these situations are varied. 46.17% of the sample indicated that they would continue working or using the items, 26.7% of the sample would fix the situation themselves, 20.65% would report the situation to the supervisor and 6.49% of the sample would stop working or using the item in question.

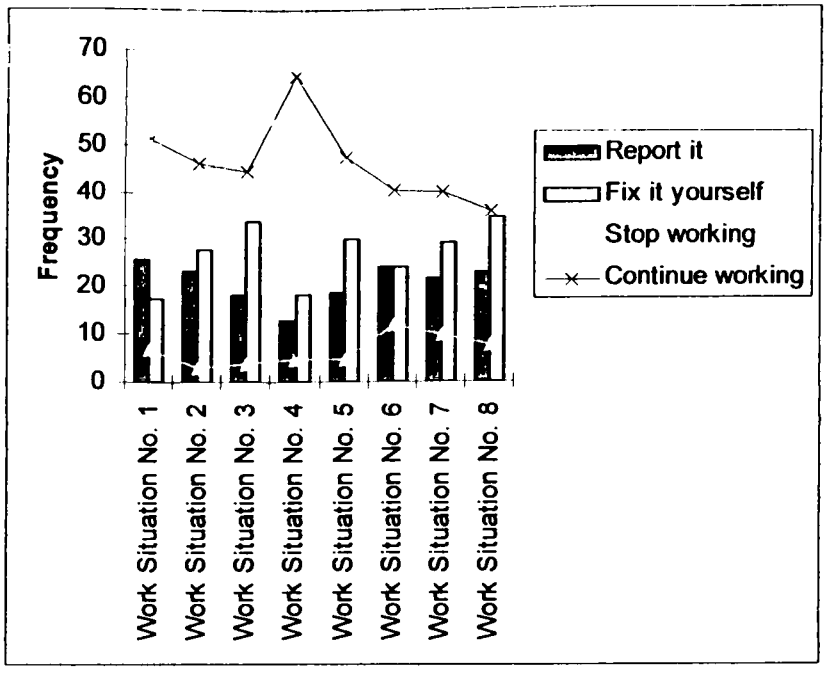

Figure 4.24: Preferred behaviour to handle high-risk situations

4.5.6 Safety Attitude

To evaluate the safety attitudes of the workers, a question requiring them to indicate whether familiarity with their work made them forget to take precautions was included in the questionnaire. The study found that 65.86% of the workers surveyed never forgot to take precautions due to their familiarity with work while 34.14% of the sample indicated being made to forget to take safety precautions.

Asked to indicate the expected reactions of their co-workers if they acted carelessly, never pointed out risky situations or never took safety precautions, 50.52% of the sample expected their co-workers to caution them, 42.27% of the sample expected to be reported to the foremen.

The workers were also first asked to indicate whether or not they made joint decisions on site concerning the project. Secondly, those who indicated taking joint decisions were asked to indicate the project aspects upon which they made joint decisions. 81.44% of the workers surveyed indicated taking joint decisions on various project issues while 18.56% indicated not taking any joint decisions about the project.

Regarding the work issues jointly agreed upon, the study revealed that 32.41% of the sample made joint decisions about work procedures, 20.78% about work quality, 18.28% about salary, 8.31% about safety rules and 1.66% about hours of work.

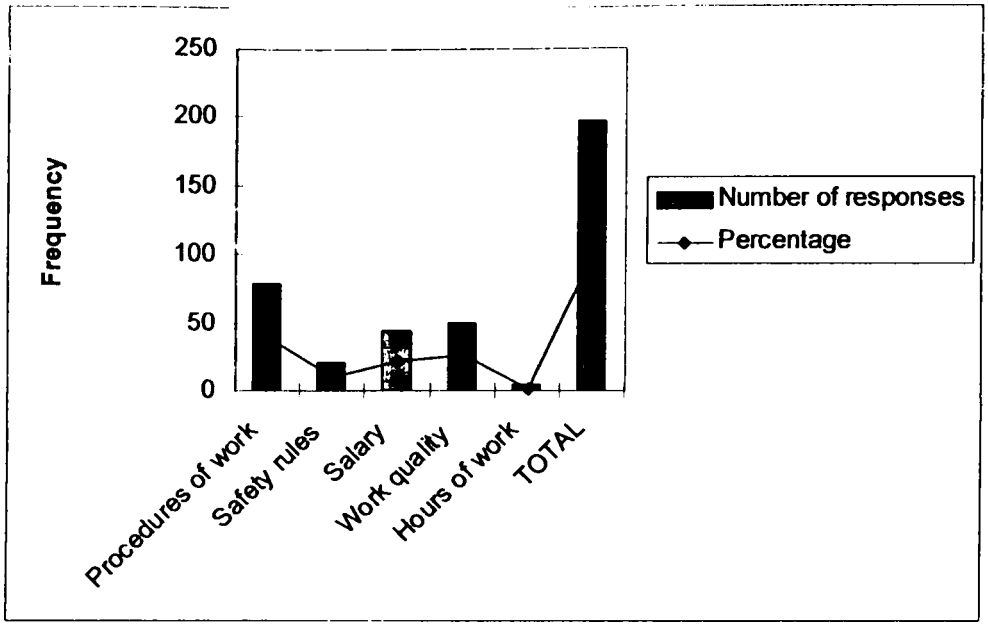

Figure 4.25: Project issues on which workers made joint decisions

4.5.7 Owners' Awareness of Safety Requirements

To establish whether the owners knew the safety regulations as spelt out in FOPWA, a number of questions were included in the questionnaire. First, the owners were asked to indicate the person charged with the responsibility of the provision for safe working environment on site.

A total of 56.35% of the owners surveyed indicated that it was the responsibility of the foremen, 25% indicated that it was the workers' while 18.75% indicated that it was the duty of the owners to provide for safe work environment. FOPWA Section 66 prohibits employers from making any deduction from the employees' wage in respect of anything they have to do or provide in pursuance of the Act.

Asked to indicate if there were any safety regulations for governing construction sites, a total of 54.55% of the owners surveyed acknowledged the existence of regulations for

site operations. It is worth noting that 19.84% of the sample lists the use of PPE as a regulation (the most known regulation to owners) and a total of 45.45% of sample surveyed are totally not aware of any such regulations. Other mentioned regulations were mentioned by 4.96% of the sample each (figure 4.26).

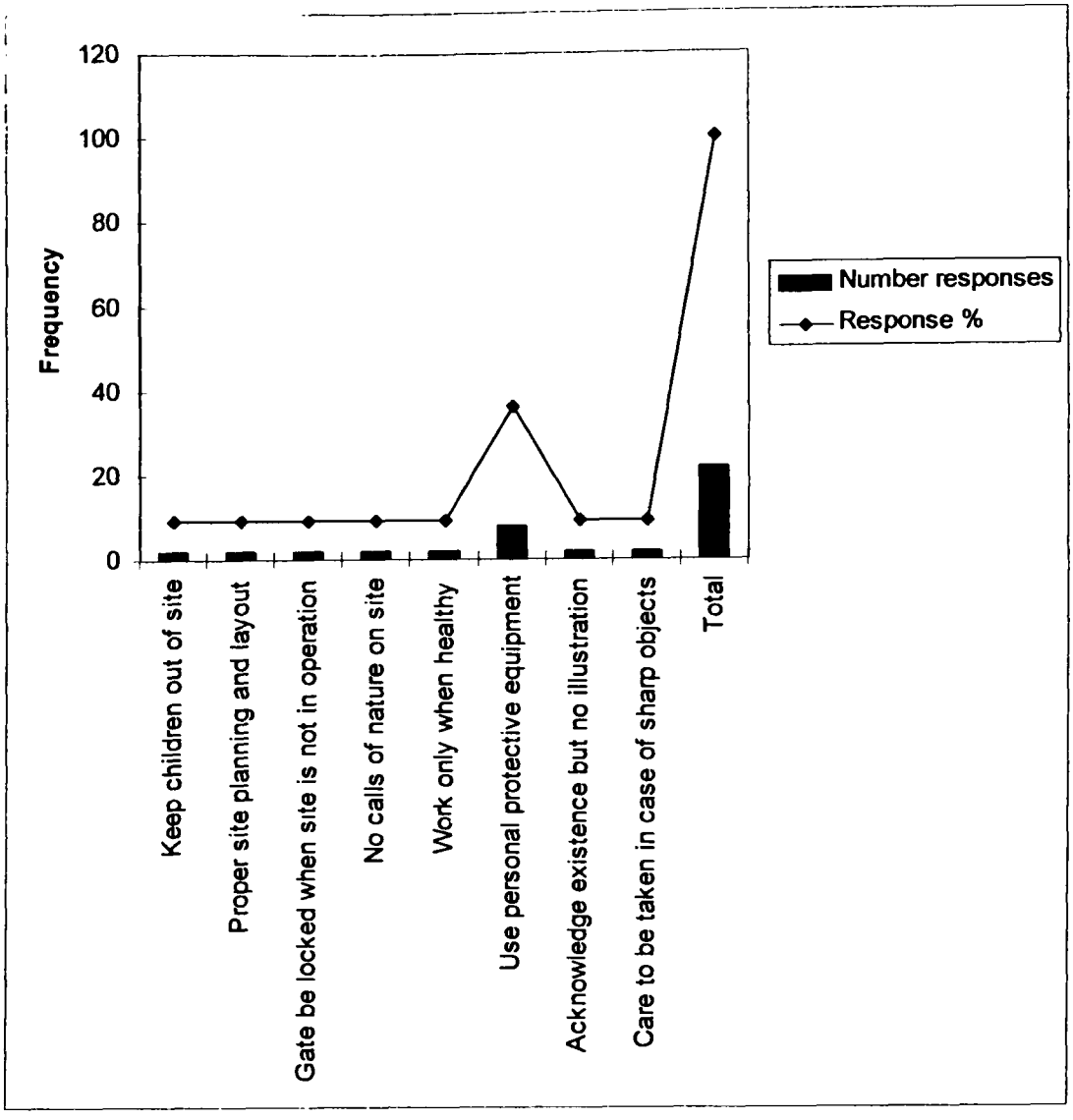

Figure 4.26: Safety regulations governing construction as known to owners

4.5.8 The Owners' Risk Perception

Identification of the risks involved in the total working of each site, affecting men and property, both own and others', is an essential step in risk management (Joy, 1991). To establish whether the owners had identified the risks they were exposed to in their capacities as owners of the projects or not, a question requiring the owners to indicate whether they were exposed to any safety related risks or not was included in the questionnaire. Secondly, those who indicated being exposed to safety related risks were asked to list them.

52.17% of the owners sampled indicated that they were not exposed to any risks in their capacity as project owners. The study also found that 27.69% of the owners surveyed indicated being exposed to accidents (like falling, being hit by falling objects and dust from site activities) in their personal capacities (as individuals) during their site visits, 5.04% indicated exposure to legal liability for personal injury of owner's workers and 5.04% acknowledge exposure but are not aware of any specific risk.

4.5.9 Indemnity against Losses

Insurance is guarantee of indemnity against the actual financial losses resulting from the impact of risks when they culminate in loss-producing events (Joy, 1991, p. 184). Any indemnity against potential safety-related losses would not only show prudence on the part of the owner but will also show some level of awareness of the safety risks involved in construction activities on site and preparedness in the event of occurrence of accidents.

Owners were asked to indicate whether they had taken any insurance for the works or not. The study found that all the owners surveyed had not taken any form of insurance cover for their works except for one who indicated having taken a general personal accident cover, not specifically as a result of the project.

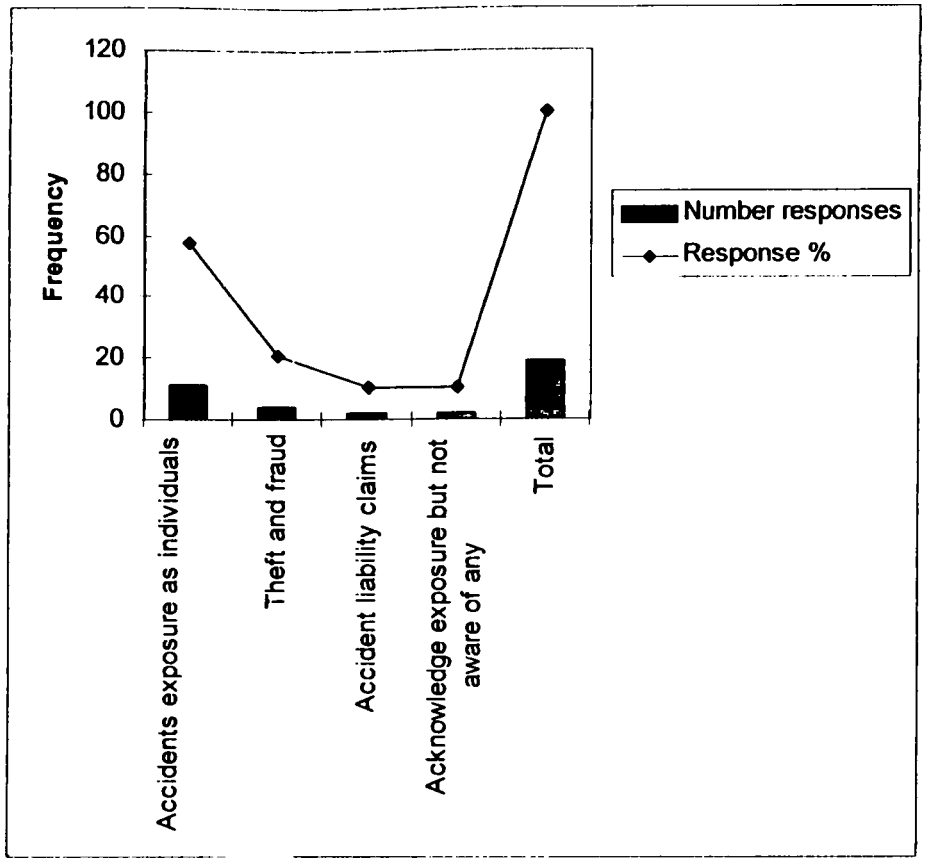

Figure 4.27: Project risk exposure

4.5.10 Owners' Suggestions on how Safety could be improved in Informal Construction

The owners were also asked to give their opinions on how safety could be improved in the informal construction sector. They gave various suggestions as summarized in the figure 4.28. The highest suggested means of improvement (by 14.29% of the sample) was mandatory safety rules and their enforcement by relevant authorities. Education of stakeholders on the importance of workplace safety and the provision of safety equipment were each suggested by 4.76% of the sample surveyed. These are issues recommended or clearly implied by FOPWA that owners versed with the Act should able to know.

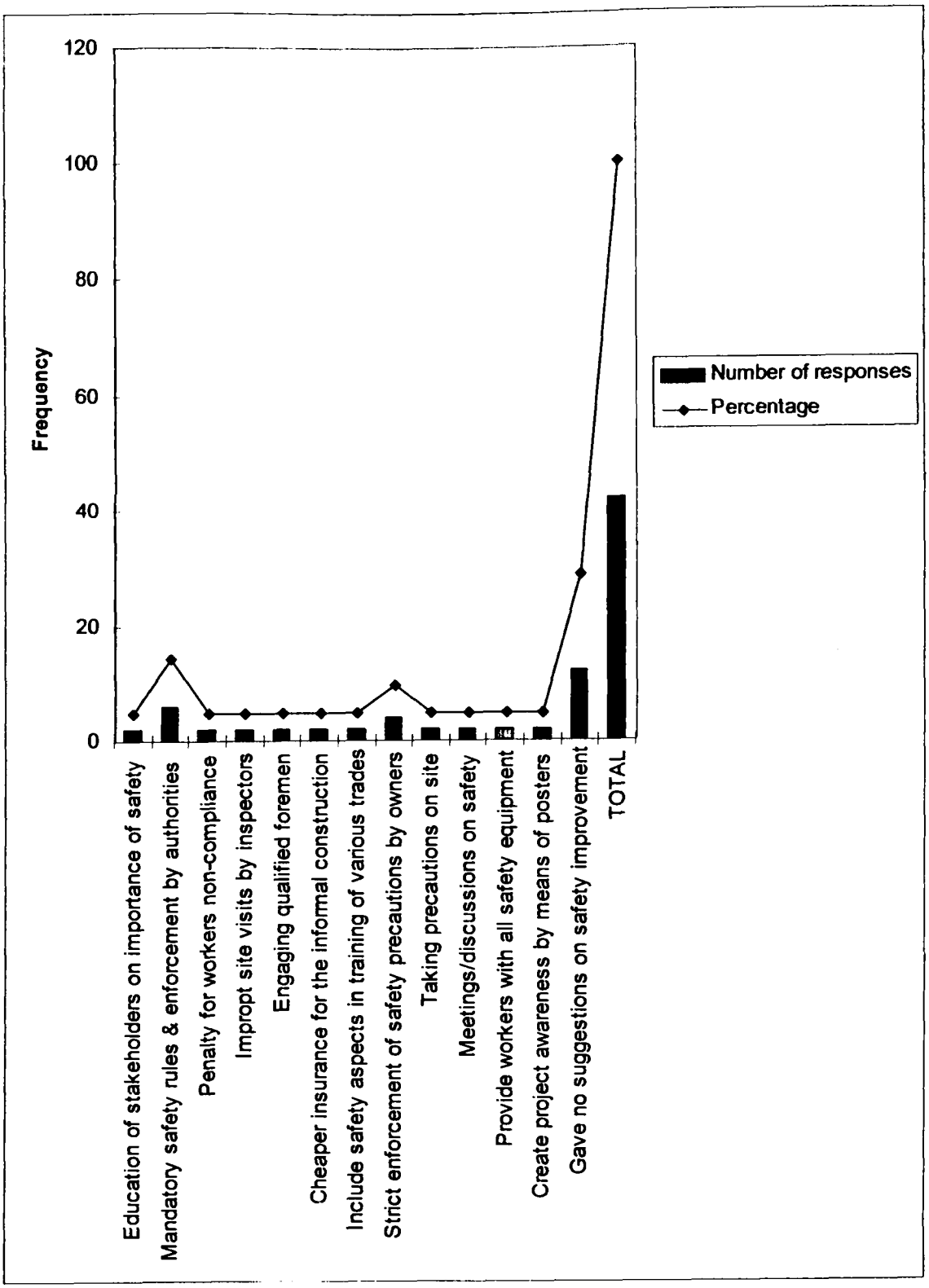

Figure 4.28: Owners' suggestions of how safety in the informal construction could be improved

CHAPTER FIVE

5.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

Although the informal sector is characterized by high exposures to OHS hazards (Loewenson, 1995), most employers surveyed still ignorantly treat OHS issues as luxuries to be avoided even in the face of increased accident rates.

5.2.0 Summary of the Findings

5.2.1 Summary: Compliance with Safety Requirements

Generally, all the sites surveyed had more than 80% non-compliance with safety requirements. This implies that the working conditions on informal construction sites surveyed are ignored, exposing the informal construction workers to OHS hazards.

5.2.2 Summary: Socio-Economic Background of the Workers and Foremen

Majority of the workers did not have very long experience working in construction industry. 67.74% of the sample had worked in construction industry for not more than five years implying that most of them did not have sufficient experience in workplace safety, especially having acquired their skills through informal means on sites (80.61% of the sample). Most of the foremen sampled (82.35%), interestingly, including some of the semi-skilled foremen, offered training to workers through apprenticeship, implying poor quality training. In contrast to workers, most foremen (70.59% of the sample) had a good deal of experience having worked in construction industry for more than five years.

The findings of the study also show that most of the workers and foremen (76.44 and 76.47% of the sample respectively) had attained secondary level of education while the skill status of majority of them (50.49 and 88.24% of the sample respectively) was skilled. The majority of the foremen (75% of the sample) acquired their skills informally, casting doubt on the training quality.

Most of the workers and foremen sampled (71.19 and 52.94% respectively) got their jobs through personal search. As for the criterion used for employment, the majority of the workers and foremen surveyed (87.26 and 88.24% of the sample respectively) were employed on the basis of work experience/visits to previous jobs. This implies that safety performance was never a consideration in the selection of workers and foremen surveyed. Although visits to projects after completion may show the quality of works, it may not show safety performance aspects of construction activities and their impact on those who carried it out, especially, since there are no safety documentations to be used as a reference during recruitment.

Regarding work agreement, majority of workers and foremen (80.61 and 52.94% of the sample respectively) had verbal agreements with the project owners, and weekly mode of payment (62 and 52.94% of the sample respectively) implying that the employment was very temporary and insecure. This also implies a high turn over rate amongst the workers and foremen and thus lack of stability and reliability in workplace safety, issues with potentially grave consequences on safety performance.

The findings of the study also showed that most of the workers (78.26% of the sample) worked for not more than eight hours per day on sites, implying that a small proportion of the workers (21.74% of the sample) work for long hours.

5.2.3 Summary: Safety Management Practices and related Documentation

The findings of the study show that most owners (94.44% of the sample) did not carry out safety planning. This implies that most of the project owners lacked anticipation of hazards in production operations, and thus lack of appropriate steps for mitigating them.

A total of 85.71% of the owners in sample held no safety meetings with the foremen to discuss workplace safety implying indifference towards safety conditions on site. This was reaffirmed by findings that most of the owners (91.7% of the sample) did not carry out safety inspections.

Regarding safety reporting, a total of 92% of the owners in the sample did not require safety reports from the foremen. Interestingly, all the owners in the sample did not keep any project safety related documents, implying that the owners do not value workplace

safety. Even the 8% of the sample that required safety reports, it was in verbal form suggesting poor attitude towards safety.

The study revealed that the majority of the foremen (87.13% of the sample) offered no safety orientation and training to workers, (100% of the sample) held no safety meetings with workers and (94.66% of the sample) carried out no safety inspections. This suggests that the sampled foremen did not value workplace safety and most of workers in the informal construction sector surveyed are safety ignorant (to some extend) as a result of lack of safety communication between the supervisors and the workers on sites.

Only 26.67% of the foremen sampled stated the regulations correctly as per FOPWA correctly. This suggests that most foremen surveyed are ignorant of the provisions of FOPWA. Out of 46 regulations spelt out in FOPWA abstract, only 8 were mentioned and of these, the most mentioned regulation (use of PPE) was only mentioned by 13.33% of the foremen sampled.

5.2.4 Summary: Safety Behaviours, Perceptions and Attitudes

Most of the workers (91.69% of the sample) did not take joint decisions on project safety related issues, (65.86% of the sample) never forgot to take precautions due to work demand, and (92.79% of the sample) believed their co-workers are likely to take action to encourage and support safe behaviour, respectively suggesting very little safety communication and therefore poor group performance in dealing with safety hazards on sites, individual worker positive attitude towards workplace safety, and interestingly, positive safety peer pressure, that if coordinated and encouraged could impact safety performance positively.

Majority of the workers (91.91% of the sample) believe that most of the owners are not actively and constantly involved in workplace safety, (67.67% of the sample) perceived the risks associated with falling from heights as high, and (66.11% of the sample) perceived the frequency of occurrence of the eight high-risk situations associated with falling to be frequent. These suggest that the majority of the owners in the sample lack management commitment towards workplace safety as demonstrated by the deplorable non-compliance with safety requirements on sampled sites, high exposure to a number of

hazards associated with falling from heights, and that the workers have an appropriate perception of risk associated falling from heights.

Most of the workers' (72.87% of the sample) preferred behaviours in the face of the eight high-risk situations are unconstructive implying that workers' behaviours are inappropriate for enhancement of workplace safety on sites. With a high number of inexperienced semi-skilled and unskilled workers in informal construction, allowing workers to fix faulty safety items themselves without reporting and therefore without supervision may be even more risky.

Most of the workers (47.52% of the sample) believe the foremen are responsible for the provision for the safe working environment on informal construction sites. On the other hand, the most commonly known safety regulation by the owners as spelt out by FOPWA was by 19.84% of the sample implying that most of the owners were not aware of the 46 regulations in FOPWA abstract. Similarly, most of the owners (60.33% of the sample) were not aware of any specific safety risks they are exposed to in their capacities as project owners, implying serious inadequate level of risk and hazard awareness amongst the project owners. Not surprisingly, the study also revealed that all the owners did not insure their projects.

The suggestions by most owners (78.57% of the sample) on how safety could be improved in informal construction interestingly imply, in part, ignorance of FOPWA. Most of the suggested "new improvements" are not new: they actually exist in FOPWA and what lacks is their enforcement.

5.3 Conclusions

All activities, whether at work or at play, involve risk, which can result in injury, illness or even death (NZBR, 2002, p. 8). However, though accidents may continue occurring in construction due to its unique characteristics, it is upon all those concerned to reduce the occurrence rate to the lowest possible minimum by doing all that is reasonably practicable to prevent them (Mwangi, 1989, p. 198).

This study concludes that the level of safety awareness on the informal construction sites surveyed was very low, that is safety systems in informal construction sites are not working and hence the deplorable safety record. Most of the sites do not comply with almost all of the safety requirements leaving workers exposed to a variety of hazards some of which could easily have been controlled or eliminated if all those concerned had done their parts well.

Most of the workers surveyed do not have a great deal of experience in construction industry having worked in the sector for not more than five years. Most of them join construction without any skill and take a number of years learning craft skills on job through informal modes of training.

It is the conclusion of the study that most of the foremen surveyed had a great deal of experience in craft skill. However, they do not have adequate experience and appropriate qualification to be effective in identification and mitigation against safety hazards on site having (themselves) received craft skills informally. The ill-equipped on-job trainers do not sufficiently include safety in their training programmes, and some of the unskilled foremen were also involved in the training of others implying serious inadequacy in the training in terms of quality and content. Direct and vicarious experience of hazards may be the main way of gaining knowledge of risks of construction and how to manage them. This is a reactive and dangerous way of learning (McDonald, and Hyman, 2002, p. 77). Without sufficient experience, and with a good percentage of both unskilled and semi-skilled workers (49.51% of the sample) and foremen, informal construction workers are more prone to accidents as they are not prepared well enough in hazard identification and means of handling these hazards.

The study concludes that although most of informal construction workers and foremen surveyed have attained secondary level of education, this was not used as a criterion for admission into informal construction sector. This high number of secondary education leavers in informal construction may be due to lack of employment in the modern sector occasioned by poor economic performance, retrenchment a moratorium on public service employment (Mitullah and Wachira, 2003) and the high number of people now completing secondary education that are unable to join training institutions for professional qualification.

Employment of most of the informal construction workers/foremen surveyed was based upon the criteria of work experience/visit to previous jobs and social networks. Social networks play an important role in sustaining workers employed within the informal urban economy. The networks are a form of social capital and act as insurance for the comparatively poor urban workers who do not have any form of formal insurance (Mitullah and Wachira, 2003, p. 21). The study concludes that safety performance and trade certificates were not a basis for employment in the sector. Employment within the sector is largely based on the relationship between the worker and the owner of the development or the foreman in charge of the site (Mitullah and Wachira, 2003, p. 21).

Most of the workers and foremen interviewed had verbal agreements with the owners and were paid on weekly basis demonstrating the informality and casualty in the sector that leaves the workers/foremen exposed to risks of depravation of legal redress incase of disagreement over terms of engagement, payment or injury at work. The workers and foremen may be constrained from registering their displeasure or dissatisfactions with bad terms of employment due to a "verbal contract between willing worker and willing employer" (Mitullah and Wachira, 2003) contrary to ILO's (1999) safety and health in construction recommendation, 1988 (No. 175). The study concludes that informal construction workers/foremen surveyed lack stability and reliability necessary to enhance safety consciousness on sites due to the high turnover rate.

Although most of the workers interviewed worked for not more eight hours, most work groups surveyed were not well coordinated in performing their work and dealing with safety hazards. It is the conclusion of the study that safety communication on most sites surveyed is almost non-existent.

The study concludes that the workers interviewed experience positive peer pressure regarding workplace safety, although they lack an appropriate system to coordinate and enhance the exchange of safety ideas on site. The majority also have individual positive attitude towards safety that could be nurtured to promote safety responsiveness on sites.

Most of the workers surveyed are not aware of safety regulations as demonstrated by the belief by most them that they themselves and the foremen were responsible for the provision for workplace safety and this may explain why they continue to work in high-risk situations even when they perceive the level of risk associated with falling from heights correctly as high.

It is the conclusion of the study that most of the workers surveyed are exposed to a variety of hazards especially those associated with falling from heights as demonstrated by the perceived high frequency of occurrences of these high-risk situations in the informal construction sites. This confirms the findings on compliance with safety requirements on sites that showed that safety measures and guards on site are inadequate.

The study concludes that most of the interviewed workers' safety related behaviours in handling high-risk situations associated with falling from heights are inappropriate. This is demonstrated by the informal workers' high risk-taking tendency. For example, using an unsafe item gives others the incentive to engage in unsafe behaviour. As noted by Cooper (1998), people often behave unsafely because they have never been hurt before while doing their job in an unsafe way. On the other hand, although fixing the faulty item may seem reasonable, scaffolds, ladders and other items associated with working from heights must be constructed by qualified persons or under the supervision. Almost half of workers interviewed were found to be semi-skilled/unskilled and therefore not wholly competent to fix the faulty safety items on their own. For example, scaffolds should be erected, altered or dismantled only by competent persons under supervision (ILO, 1999).

Most of the foremen interviewed were not adequately aware of the safety regulations as spelt out in FOPWA and therefore ill-equipped to effectively carry out the duty of maintenance of general safety awareness and technical controls. They also had poor attitude towards safety as reflected in the workers' continued working even in clearly very dangerous situations.

The study concludes that most of the owners surveyed lack commitment to safety as demonstrated by lack of safety planning or desire to acquaint themselves with the safety conditions on site and take appropriate steps to improve.

Most of the surveyed owners' awareness of safety regulations and safety related a risks/ hazard was very low. This is also supported by most of the owners who believed they were not responsible for the provision for the safe work environment in their capacities as employers/owners.

5.4.0 Recommendations

5.4.1 Introduction

Some, but not necessarily all, risk can be reduced or avoided to save lives and prevent accidents (NZBR 2002, p. 8) through good OHS practices. Good OHS practices can contribute significantly to improved productivity. They should therefore be strengthened through meaningful development and maintenance of general safety awareness in the informal sector. The key should be encouraging the sector to be committed to providing and maintaining a healthy and safe working environment for all its employees and any other people who may be affected by its activities.

To achieve this it is appropriate to make some recommendations arising from the findings of the study. However, it must be noted that these recommendations are limited by the prevailing poor economic conditions including poverty and unemployment in the country that has pushed many including informal construction workers into desperation.

5.4.2 Awareness Campaign and Information Dissemination

It is recommended that a massive education campaign to create awareness among all those who directly or indirectly affect or are affected by accident occurrence and their prevention in the informal construction.

5.4.3 Training and Certification

It is also recommended that informal construction workers and foremen be trained or retrained in workplace safety and issued with certificates that could be used for recruitment, especially for the foremen who are responsible for supervision/training of the highly prevalent semi-skilled and unskilled workers in the sector.

5.4.4 Workers' Associations

The study recommends that the government through the Ministry of Labour, trade unions and other non-governmental organizations promote the formation of associations by the informal construction workers to lobby for better working conditions.

5.4.5 Enforcement and Supervision

The study recommends that:

1. Foremen be charged with responsibilities traditionally handled by the safety officers/supervisors and these should be clearly communicated to them on their employment in terms of what is expected of them.
2. Foremen be hired some time before commencement of construction activities on site so as to enable them (having received appropriate safety training) to assess the safety requirements of the project and assist the owner in safety planning
3. Occasional random inspections of informal construction sites be carried out by the relevant agencies primarily to find opportunities for improvement.

5.4.6 Incident and Injury Reporting

It is recommended that workers/foremen be trained in reporting accidents and near-miss incidents. Through their associations, this information can be passed on to the relevant authorities for compilation, analysis and subsequently be used in strategy development.

5.5 Areas for Further Research

Although several factors including increasingly high levels of literacy amongst the informal construction workers are conducive to the implementation of safety strategies in the sector, further research is necessary on the following:

1. Effectiveness of different training methods and other means of reducing accidents on informal construction sites
2. Appropriate informal construction procurement

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APPENDIX I

INTRODUCTION LETTER TO THE SITE OWNERS

Department of Building Economics &
Management, University of Nairobi
P.O. Box 30197, 00100 Nairobi.

Dear Sir,

I am a postgraduate student in the department of Building Economics and Management at the University of Nairobi, carrying out a study on **SAFETY AWARENESS IN INFORMAL CONSTRUCTION SECTOR: A CASE STUDY OF NAIROBI CITY.**

This is for the purpose of part fulfillment of the requirements of a Master of Arts Degree in Construction Management.

Your site has been selected to be included in the study. As a result I kindly ask you to assist me by completing the attached questionnaire to make a useful contribution to the study which is vital to the provision of safety in the informal construction sector.

To enable me complete the research in time, I am requesting you to return the questionnaire within one week by which I hope you shall have found time to complete filling it.

Your assistance is highly appreciated in making this research a success.

Yours truly,

Signed: _____

R.O. NDEGE

(M.A. STUDENT)

All information will be treated confidentially

APPENDIX II

INTRODUCTION LETTER TO THE SITE FOREMEN AND WORKERS

Department of Building Economics &
Management, University of Nairobi
P.O. Box 30197, 00100 Nairobi.

Dear Sir,

I am a postgraduate student in the department of Building Economics and Management at the University of Nairobi, carrying out a research on **SAFETY AWARENESS IN INFORMAL CONSTRUCTION SECTOR: A CASE STUDY OF NAIROBI CITY.**

This is for the purpose of part fulfillment of the requirements of a Master of Arts Degree in Construction Management.

You have been selected to be included in the study. As a result I kindly ask you to assist me by completing the attached questionnaire to make a useful contribution to the study which is vital to the provision of safety in the informal construction sector.

To enable me complete the research in time, I am requesting you to return the questionnaire within one week by which I hope you shall have found time to complete filling it.

Your assistance is highly appreciated in making this study a success.

Yours truly,

Signed: _____

R.O. NDEGE

(M.A. STUDENT)

All information will be treated confidentially

APPENDIX III

QUESTIONNAIRE FOR THE SITE OWNER

1.0 SECTION A

1.1 During the planning stage of the project before the commencement work on site, which ones among the following matters are taken into consideration?

1. Labour and material availability
2. Training for workers
3. Workplace safety
4. Other (please specify) _____

1.2 Do you hold periodic site meetings with the foreman to discuss various matters regarding the project?

1. Yes
2. No

1.3 If yes, which ones among the following aspects of the project are discussed in the meetings?

1. Work progress
2. Material and labour requirements
3. Workplace safety
4. Wages
5. Other (please specify) _____

1.4 Do you carry out periodic site inspections?

1. Yes
2. No

1.5 If yes, how often?

1. Daily
2. Weekly
3. Monthly
4. Occasionally
5. Other (please specify) _____

1.6 Which ones among the following project aspects do you inspect during such visits?

1. Progress of work
2. Materials and component stock and their security on site
3. Workplace safety
4. Quality of the work
5. Other (please specify) _____

2.0 SECTION B

2.1 Are there any project reports you expect your site foreman to make to you?

1. Yes
2. No

2.2 If yes which ones among the following do you expect?

1. Materials and component stock
2. Workers' pay
3. Work progress
4. Workplace safety
5. Other (please specify) _____

2.3 Do you keep any project records/documents?

1. Yes
2. No

2.4 If yes, please indicate the types of records/documents kept

1. Payroll
2. Safety plan
3. Receipts and delivery notes
4. Accident log
5. Other (please specify) _____

3.0 SECTION C

3.1 Are there any risks that you are exposed to in your capacity as the project owner?

1. Yes
2. No

3.2 If yes, please list them down _____

_____

3.3 Have you taken any insurance cover regarding the project?

1. Yes
2. No

3.4 If yes please specify the type of cover taken_____

4.0 SECTION D

4.1 Are there any safety/health regulations for governing construction sites?

2. Yes
3. No

4.2 If yes, please outline these regulations_____

_____

_____

4.3 Who is responsible for the provision for safe working environment on construction sites?

1. Owner/employer
2. Foreman
3. Workers
4. Other (please specify) _____

4.4 In your opinion, how can safety on informal construction sites be improved?

_____

_____

APPENDIX IV

QUESTIONNAIRE FOR CONSTRUCTION SITE FOREMAN

1.0 SECTION A

1.1 How many years have you been working in construction? _____

1.2 Please indicate the highest level of education you attained

1. Primary
2. Secondary
3. Other (please specify) _____

1.3 Please specify your skill status

1. Skilled
2. Semi skilled
3. Unskilled
4. Other (please specify) _____

1.4 Skill acquisition through

1. Family business
2. On-the-job training
3. Informal apprenticeship
4. National polytechnic
5. Technical training institute
6. Village polytechnic
7. Other (please specify) _____

1.5 Specify the type work agreement

1. Written
2. Verbal
3. Other (please specify) _____

1.6 Specify nature of payment

1. Piecework
2. Daily
3. Weekly
4. Other (specify) _____

2.0 SECTION B

2.1 How did you get your current job on this site?

1. Through relatives or friends
2. Apprentice
3. Personal search

4. Other (please specify) _____

2.2 What were the requirements for your employment?

1. Trade certificate
2. Reputation
3. Work experience
4. Visit to previous jobs
5. Other (please specify) _____

2.3 Specify the type of work agreement

1. Standard written
2. Written
3. Verbal
4. Other (please specify) _____

2.4 Specify the nature of payment

1. Piecework
2. Labour only contract
3. Daily
4. Weekly
5. Other (specify) _____

3.0 SECTION C

3.1 Do you offer any training to workers either on job or otherwise?

1. Yes
2. No

3.2 If yes, which categories of workers are covered?

1. Skilled
2. Unskilled
3. Semi-skilled
4. All new employees
5. New unskilled employees only
6. Other (please specify) _____

3.3 Which ones among the following issues are included in the training programme?

1. Competence in the worker's specialized area
2. Workplace safety
3. Financial matters
4. Other (specify) _____

3.4 Do you hold periodic site meetings with the workers to discuss various matters regarding the project?

1. Yes
2. No

3.5 If yes, which ones among the following project aspects are discussed in the meetings?

1. Work progress
2. Workplace safety
3. Payment
4. Other (please specify) _____

3.6 Do you carry out periodic site inspections?

1. Yes
2. No

3.7 If yes, how often?

1. Daily
2. Weekly
3. Occasionally
4. Other (please specify) _____

3.8 Which ones among the following project aspects do you inspect during such inspections?

1. Progress of work
2. Workplace safety
3. Quality of the work
4. Other (please specify) _____

4.0 SECTION D

4.1 Are there any safety and health regulations for governing work on construction sites?

1. Yes
2. No

4.2 If yes outline these regulations _____

_____

4.3 In your opinion, how can safety on informal construction sites be improved?

_____

_____

APPENDIX V

QUESTIONNAIRE FOR THE INFORMAL CONSTRUCTION WORKER

1.0 SECTION A

1.1 How many years have you been working in construction? _____

1.2 Highest level of education attained

1. Primary
2. Secondary
3. Other (please specify) _____

1.3 Specify your skill status

1. Skilled
2. Semi skilled
3. Unskilled

1.4 Skill acquisition through

1. Family business
2. On-the-job training
3. Informal apprenticeship
4. National polytechnics
5. Village polytechnic
6. Technical training institute

2.0 SECTION B

2.1 How did you get your current job on this site?

1. Through relatives or friends
2. Apprentice
3. Personal search
4. Other (please specify) _____

2.2 Requirements for employment

1. Trade certificates
2. Reputation
3. Work experience/visit to previous jobs
4. Other (please specify) _____

2.3 Specify the type work agreement

1. Written
2. Verbal
3. Other (please specify) _____

2.4 Specify nature of payment

1. Piecework
2. Daily
3. Weekly
4. Other (specify) _____

3.0 SECTION C

3.1 Who is responsible for the provision for safe working environment on construction sites?

1. Employer/owner
2. Contractor
3. Foreman
4. Self
5. Other (please specify) _____

3.2 Does your group jointly decide on work issues on site?

1. Yes
2. No

3.3 If yes, which ones among the following are included in joint decisions?

1. Procedures of work
2. Safety rules
3. Salary
4. Quality of work
5. Other (please specify) _____

4.0 SECTION D

4.1 Which ones of the following issues is the site management/owner actively and constantly involved in on site?

1. High production and quality of work
2. Material usage
3. Workplace safety
4. Other (please specify) _____

4.2 What reactions do you expect from your co-workers when you don't use provided safety equipment, don't use extra care, or don't point out unsafe conditions?

1. Caution
2. Report you to the foreman
3. Do nothing
4. Other (please specify) _____

5.0 SECTION E

5.1 For each of the following real work situations give your opinion of the perceived level of risk either as low risk (**L**), medium risk (**M**) or high risk (**H**).

Situation 1: Working on scaffolds not totally boarded _____

Situation 2: Working on scaffolds missing guardrails _____

Situation 3: Climbing up and down the scaffold without ladder _____

Situation 4: Using a ladder not tied or secured _____

Situation 5: Using a broken or somehow defective ladder _____

Situation 6: Using a ladder shorter than 1 metre above the landing _____

Situation 7: Working on fragile roofs without crawling boards _____

Situation 8: Working on roofs without edge protection/harness _____

5.2 For each of the following real work situations predict your probable behaviour if this situation occurred on site today as (**A**) report it, (**B**) fix it yourself, (**C**) stop working/not use the material or (**D**) use it /continue working.

Situation 1: Working on scaffolds not totally boarded _____

Situation 2: Working on scaffolds missing guardrails _____

Situation 3: Climbing up and down the scaffold without ladder _____

Situation 4: Using a ladder not tied or secured _____

Situation 5: Using a broken or somehow defective ladder _____

Situation 6: Using a ladder shorter than 1 metre above the landing _____

Situation 7: Working on fragile roofs without crawling boards _____

Situation 8: Working on roofs without edge protection/harness _____

5.3 For each of the following real work situations give your opinion of the perceived frequency of occurrence in the informal construction sector as rare (**R**), usual (**U**) or frequent (**F**).

Situation 1: Working on scaffolds not totally boarded _____

Situation 2: Working on scaffolds missing guardrails _____

Situation 3: Climbing up and down the scaffold without ladder _____

Situation 4: Using a ladder not tied or secured _____

Situation 5: Using a broken or somehow defective ladder _____

Situation 6: Using a ladder shorter than 1 metre above the landing _____

Situation 7: Working on fragile roofs without crawling boards _____

Situation 8: Working on roofs without edge protection/harness _____

APPENDIX VI

SAFETY PERFORMANCE AUDIT CHECKLIST

SECTION A

General Information

1. Name of project/site:
2. Plot name
3. Street name
4. Nature of works: New works: Alterations/extensions
5. Stage of construction reached at the time of visit:

SECTION B

Instructions

1. Record unsafe conditions or behaviours as a number of items or workers not conforming to the recommended practice
2. Record safe conditions or behaviours as a number of items or workers conforming to the recommended practice
3. Record conditions or behaviours not seen or not applicable as N/A

No.	Item Description	No. items or conditions conforming to recommended practice	No. of items or conditions not conforming to recommended practice	Total No. of items observed
I	**Housekeeping**			
1	Rubbish on access routes			
2	Storage of materials on site			
3	Tools kept in tool kits			
II	**Prevention of falls from heights**			
I	Scaffolds and work platforms			
4	Unguarded openings			
5	Missing scaffold			
6	Missing guardrail/edge protection			

No.	Item Description	No. Items or conditions conforming to recommended practice	No. of items or conditions not conforming to recommended practice	Total No. of item observed
III	**Access to heights**			
7	Defective ladder			
8	Ladder shorter by one metre Above the landing			
9	Ladder incorrectly tied or not secured			
IV	**Safety propaganda**			
10	Posters around the site			
V	**Personal protective equipment**			
11	Safety helmet in use			
12	Hand gloves in use			
13	Hard boots worn by workers			
14	Dust masks for workers			
15	Overalls worn by workers			
VI	**Precautionary equipment**			
16	First aid kits			
17	Fire extinguishers			
VII	**Mechanical hazard elimination**			
18	Means of securing excavation			
19	Complete hoarding around site			
20	Barriers around excavations			