FOSTERING OSH IN INFORMAL CONSTRUCTION SECTOR OF SRI LANKA: CHALLENGES AND APPROACHES

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Dissertation submitted in partial fulfilment of the requirements for the degree Master of Science in Occupational Safety and Health Management

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Sri Lanka

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DECLARATION

I declare that this is my own work and this dissertation does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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Dr. Nayanthara De Silva

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ABSTRACT

Fostering OSH in Informal Construction Sector of Sri Lanka: Challenges and Approaches

The informal construction sector plays a vital role in Sri Lankan economy by being the second highest informal sector after agriculture. Moreover, there are considerably higher amounts of hazards in informal construction sites when compared with other industries. Simultaneously, several challenges to eliminate those hazards were discovered under five key areas as financial, time, knowledge/skills, misconception and poor attitude, cultural, regulatory and industrial. Thus, this study was conducted with the aim of fostering Occupational Safety and Health in Sri Lankan informal construction sector by recommending the probable approaches to mitigate above identified challenges.

Accordingly, a mixed research approach was adopted with questionnaire survey for 102 respondents while carrying out semi structured interviews with seven professionals. The findings were analyzed with descriptive analysis, one sample T-Test, factor analysis and code-based content analysis techniques. As the most common hazards in Sri Lankan informal construction sector, falling from height and ladder/scaffolding work with slippage and breakage were identified. Twelve critical challenges towards Occupational Safety and Health in Sri Lankan informal construction sector were extracted and they were further categorized under four specific factors as Knowledge and education, Safety attitude and culture, Government support and Nature of informal construction sector.

Consequently, it was recommended to implement mandatory rules for both labours and clients, provide awareness and education, conduct site inspections and accident inquiries, empower relevant regulatory bodies to provide guidance and support, labour gatherings in community level to raise their problems, training and evaluation for individual labours and provide safety equipment for reasonable prices as few major approaches to mitigate the identified challenges and foster Occupational Safety and Health in informal construction sector of Sri Lanka.

Key Words: *Occupational Safety and Health, informal construction sector, hazards, challenges, approaches*

DEDICATION

I dedicate this piece of work to
MY BELOVED FAMILY MEMBERS……
Who encouraged me
Providing emotional and spiritual effort
In this endeavour……
While being my pillars of support
At my hard times……

Let this be a tribute to their aspirations……

ACKNOWLEDGEMENT

This research study embraces much dedication and ready assistance received from many people, who contributed in ample ways to complete this. Consequently, I take this opportunity to convey my sincere gratefulness to every one of them.

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Last, but not least, I express my heartfelt gratitude to my family members, my batch mates and many others, for willingly giving me their utmost support, advice and continuously motivating me to carry out the work successfully.

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LIST OF ABBREVIATIONS

CCOHS	Canadian Centre for Occupational Health & Safety
CIDA	Construction Industry Development Authority
COT	College of Technology
CRC	Cooperative Research Centre
CSCS	Construction Skills Certification Scheme
EFA	Exploratory Factor Analysis
GDP	Gross Domestic Product
GNP	Gross National Product
ICESCR	International Covenant on Economic, Social and Cultural Right
ILO	International Labour Organization
IMF	International Monetary Fund
KMO	Kaiser-Meyer-Olkin
MC	Municipal Council
NAITA	National Apprentice and Industrial Training Authority
NHSL	National Hospital of Sri Lanka
NI	National Insurance
No.	Number
NVQ	National Vocational Qualifications
O/L	Ordinary Level
OSH	Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
PCA	Principle Component Analysis
PPE	Personal Protective Equipment
RPL	Recognition of Prior Learning
SME	Small and Medium sized Enterprises
SPSS	Statistical Package for the Social Sciences
TEC	Technical Colleges
UC	Urban Council
UDA	Urban Development Authority
UDHR	Universal Declaration of Human Rights
UK	United Kingdom
UN	United Nation
UNEP	United Nations Environment Programme
USA	United States of America
VTA	Vocational Training Authority
WHO	World Health Organisation
WIEGO	Women in Informal Employment: Globalizing and Organizing

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CHAPTER 01

1.0 INTRODUCTION

1.1 Background

Occupational Safety and Health (OSH) is an interdisciplinary theme to prevent occupational accidents and ill health which has been created a major occupational issue in worldwide (International Labour Organization [ILO], 2019). The ILO estimates that over one million of occupational fatalities occur annually while millions of global workers suffer from occupational injuries. Among them, the informal sector suffers particularly more due to high risk of exposure and lack of legislative, administrative and technological provisions (World Health Organization [WHO], 2017).

The term 'informal sector' which was introduced nearly four decades ago by the ILO (Senanayake, Wimalaratana & Premaratne, 2016) has created with activities and workers who perform an entirely legal task and get a payment, but are not governed by any labour legislation. Further, most of them have no formal contracts, social service benefits or leave entitlements (Michael, 2018). As per the ILO (2019), more than 2 billion of global employed population which represent over 60% are working in the informal sector. In Sri Lanka, over 4.5 million people representing 60% of Sri Lankan employments are from informal sector and it is more than in the formal private sector, government sector, state-owned enterprises and combined (Department of Census and Statistics, 2017).

Construction industry is one of the largest informal sectors in globe other than agriculture, retail trade and services (Fourie, 2018). Mselle & Sanga (2017) defines the informal construction sector as a set of unregistered, unprotected and unregulated activities and individuals mostly with small enterprises. Similary, Senanayake et al. (2016) describes it as self-employed or small-scale businesses with or without hired workers usually in a low organizational and technological base created with primary objective of generating employment and incomes. Thus, the term "Informal Construction Sector" can be defined as a segment which comprises with construction activities and construction workers mostly in self-employed or small-scale which are

not regulated by any labour legislation. Therefore, it is rare to see the formal contracts, labour benefits and OSH practices in this sector. Further, informal construction workers can be there in both informal and formal sectors if they are hired without any formal contract and unregulated with labour legislations.

When considering the informal sector as a whole, the informal workers in construction industry is rapidly growing globally (Women in Informal Employment Globalizing and Organizing [WIEGO], 2019). As per the data revealed by Wells and Jason (2010), 93% of workers from all construction workers are informal in India while 90% in Egypt, 85% in Philippines, 77% in Republic of Korea, 74% in Malaysia, 72% in China, 70-95% in Tanzania and 66% in Mexico. Thus, it proves that the number of informal construction workers as a proportion of all construction workers is growing worldwide (Wells & Jason, 2010). In Sri Lanka, while the highest contribution for informal sector is still from the agricultural industry with 87.5% of informal workers, the second highest informal contribution is from the construction industry (Department of Census and Statistics, 2017). Thus it is non-arguable that the informal construction sector plays a vital role in the development of Sri Lankan economy.

At the same time, employment injuries are more frequent in informal construction sector (Caponecchia & Sheils, 2011). Vitharana, De Silva and De Silva (2015) declared that construction activities create hazards for people working in industry as well as for public in proximity to sites. According to the ILO (2019), occupational hazards in construction sites are frequently higher than other industries as manufacturing. However, the unstructured nature of informal construction sector unacceptably leads to high risks with heavy losses of life and property (Osei-Boateng & Ampratwum, 2011). Further, the same authors revealed that the informal construction workers seem to ignore the safety issues in their field or they are not affordable to protect themselves from adverse environmental and other hazardous conditions. Thus, the sector faces with various occupational hazards. According to Ametepeh, Adei and Arhin (2013), there are several physical hazards exposed by informal construction sector as vibration, fire, high noise, dirty environment, ergonomic hazards as wrong postures, chemical hazards as dust, smoke and fumes and

psychological hazards as stress and sexual harassments. Besides, the informal construction sector has labelled with characteristics of low income, limited job security, low technology and skills and low social protection (Aurick, Munalula, Mundia, Mwale, & Vincent, 2017; Osei-Boateng & Ampratwum, 2011).

Simultaneously, many researchers have identified several causes for above hazards in informal construction sector. Garnica and Barriga (2018) exposed that small in scale, law income, lack of education and skills, lack of resources for physical investment as premises, equipment and machinery and unawareness about regulations and procedures have disrupted the informal construction sector to follow with an institutional framework. Similarly, Amfo-Out and Agyemang (2017) revealed that most informal construction workers do not consider the OSH as serious. Further, the absence of support from government to enforce an institutional framework among informal construction sector is another reason. Accordingly, these conditions are contributing for the high amounts of hazards within informal construction sector.

1.2 Research Problem

ILO (2019) reports that the informal sector represents more than half of the global labour force while over 60% of Sri Lankan employments are from informal sector in where the construction industry is in the second highest representation (Department of Census and Statistics, 2017). Further, there is a high rate of accidents due to occupational hazards which results for 500,000 annual man day loss in Sri Lanka (Dissanayake, 2016). A survey done by Accident and Orthopaedic Service of National Hospital of Sri Lanka (NHSL, 2015 as cited Darshana, 2017) shows that among 102,321 victims of accidents, 12% are due to occupational hazards and among fatal accidents, 50% are from construction industry. However, only 3.5% of construction employees have reported occupational accidents and most of them are only from the formal sector (Labour Department, 2013 as cited Darshana, 2017). Thus, it proves that the unregulated informal constructions may contribute to a higher occurrence of work-related hazards and the accidents happened due to those hazards are not even reported. Further, there are evidences that the informal construction sector is often tend to ignore the OSH issues in their sector due to various challenges (Kelloway & Cooper, 2011).

Therefore, it creates a necessity to investigate those challenges towards hazard elimination and give recommendations to mitigate them in order to foster OSH in informal construction sector of Sri Lanka.

1. 3 Aim and Objectives

The aim of this research is to foster OSH in Informal Construction Sector of Sri Lanka.

In order to achieve above mentioned aim, the objectives are;

1. To review informal construction sector in the worldwide and Sri Lankan contexts
2. To investigate the hazards in Sri Lankan informal construction sector
3. To examine the challenges to eliminate hazards in Sri Lankan informal constructions
4. To recommend the probable approaches to mitigate above challenges in order to foster OSH in informal construction sector of Sri Lanka

1.4 Methodology

A comprehensive literature survey was carried out by referring journals, books, articles, conference proceeding, government publications, dissertations, previous research investigations and internet to define the informal construction sector and its worldwide and Sri Lankan contexts. Further it was investigated the hazards in Sri Lankan informal construction sector. To complete the fourth and fifth tasks respectively, a questionnaire survey was carried out with skilled/unskilled labours and technical level workforces in Sri Lankan informal construction sector while semi structured interviews were carried out with construction professionals. To analyze the findings from questionnaire and interviews, descriptive analysis, one sample T-Test, factor analysis and code-based content analysis techniques were adopted respectively.

1.5 Scope and Limitations

The scope of this study is to ascertain the probable approaches to mitigate the challenges for fostering OSH in informal construction sector of Sri Lanka. Based on that scope, the participants for the questionnaire survey was limited for Sri Lankan informal construction sector including skilled/unskilled labours and technical level workforces. Formal construction workers were not contributed to the questionnaire

survey. Further, the participants were limited for male construction workers as they were more available than female. For the semi structured interviews, participants were only the professionals based on their designation who involve in both local and foreign constructions and local regulatory bodies as the Labour Department. They were selected on the basis of having awareness and analytical knowledge on the OSH practices in construction industry.

1.6 Chapter Breakdown

Chapter One Introduction	• Give an overview on the dissertation with research background, problem statement, aim and objectives, methodology and scope and limitations.
Chapter Two Literature Review	• Encloses the theoretical background and research issues through comprehensive literature review.
Chapter Three Research Methodology	• Discusses the methods adopted in research approach, research process, data collection and data analysis.
Chapter Four Research findings and Analysis	• Contains survey analysis and findings of the survey.
Chapter Five Conclusions	• Summarizes the survey findings and presents the conclusions and recommendations. And it points out the further research pathways.

Figure 1. 1: Chapter Breakdown

1.7 Chapter Summary

This chapter was focused on providing the background knowledge on research area which based to carry out the study. By forming the research problem as what are the probable approaches to overcome the challenges for fostering OSH in Informal Construction Sector of Sri Lanka, the aim and the objectives of the research were pointed out correspondingly. The methods to be used in carrying out this research were described in research methodology while the boundaries were described in the scope and limitations. Eventually, the chapter breakdown of whole study was discussed.

CHAPTER 02

2.0 LITERATURE REVIEW

2.1 Introduction

As discussed in chapter one, hazards in construction sites are more frequent than other industries and informality of the sector leads to high risks of having hazards. Therefore, it creates a need for identifying the existing challenges to implement OSH practices in informal construction sector while recommending probable approaches to overcome them. With the understanding of research problem, this chapter intends to present detailed literature associated with informal construction sector in worldwide and Sri Lankan contexts while identifying hazards in the sector and existing challenges in order to get an idea on how to foster OSH in informal construction sector.

2.2. Introduction to Informal Sector

Though there is no exhaustive literature on this area, different researchers have identified the term of informal sector in different ways. Sibhat (2014) declared the informal sector in numerous names as Informal economy, Grey market, Black economy, Casual work, Undercover activities, Community of the poor, Family-enterprise sector, Hidden sector, Informal opportunities, Intermediate sector, Invisible segment, Irregular segment, Trade-service segment, Lower-circuit of the urban economy, Non-plan activities, Parallel economy, People's sector, Transient sector, Underground sector, Unobserved sector, One-person enterprise, Petty commodity production, Shadow economy, Unorganized economy, Unrecorded economic activities, Unofficial sector, Unremunerated sector, Unstructured sector and Urban subsistence sector. ILO introduced this term "informal sector" in 1972 (Senanayake et al., 2016) and it considers as a part of the economy due to the contribution for production process of the country. Further, ILO (2019) defined the informal sector as a set of independent enterprises run by households comprising informal self-account enterprises and informal employer base enterprises usually with small and non-registered scale.

Similarly, Benjamin, Beegle, Recanatini and Santini (2014) defines the informal sector as income generation activities which are fully or partially outside of the government regulations, taxations and observations". Senanayake et al. (2016) declared that the informal sector has created with workers who perform an entirely legal task while getting a payment, but are not governed by any labour legislation. Contrary to that, the Organization for Economic Co-operation and Development. (2019) gives a definition for this sector as a group of jobs which are not generating normal income while not paying the taxes. Further, this term sometimes refers only for illegal activities where workers are forced to work without any payment and it can also be identified as legal activities which engage with exchanging goods or services other than money (Sibhat, 2014). Thus, getting one definition for informal sector is slightly difficult as different authors have defined it in different perspectives. However, it has been widely defined as unregulated economic enterprises. Thus, due to non-regulated, there are less formal contracts, labour benefits and OSH practices and the label has created as informal.

Informality has become as a salient feature in most developing countries compared to developed countries while maintaining a significant contribution to the GDP (De Silva, 2013). As per Hassan and Schneider (2016), it contributes nearly a third to half of the total economy in most of emerging economies. Rinehart (2004) exposed that informal economy has spread in bulk mostly within micro and small enterprises with majority of poor workers. A substantial portion of informal workers are involving in traditional agriculture, mining, construction, traditional fishing, retail trade, transport, repair and maintenance, automobile repairing, welding, personal and domestic services, catering, manufacturing as cement block, wood work, batik and colour dye, beauty industry and handicrafts (Senanayake et al., 2016). Thus, the present informal sector is rapidly integrated with global economy.

The informal sector has a number of distinct characteristics in terms of their policies and regulations, capitalization, organization, labour processes and market penetration (Senanayake et al., 2016). The Table 2.1 summarises those key characteristics.

Table 2. 1: Characteristics of Informal Sector

Characteristics
▪ Entry and exit are easier than formal sector ▪ Predominance of self-employment ▪ Usually employ less than ten workers, mostly immediate family members ▪ Paid in kind, money or both, mostly in an irregular manner ▪ Not entitled to pensions and other similar benefits ▪ Low productivity and low income ▪ Little technologies are used ▪ Low levels of organization ▪ Employer-employee relationship is often unwritten and informal ▪ Employees often work totally on trust or family affiliation with no agreements ▪ Uncertainty and limited job security ▪ Less social protection with less or no trade unions ▪ No age or gender restrictions and children, elders, and women work together ▪ Heterogeneous with various fields and industries ▪ High labour intensive with low level skills workers ▪ Workers train on the job rather than pre job training, learn even since childhood ▪ Capital investment is minimum, thus initial investment cost and loss of winding up is low

[Sources: Senanayake et al. (2016), Amfo-Out & Agyemang (2016), Osei-Boateng & Ampratwum (2011), Aurick et al. (2017)]

2.2.1 Informal Sector in Worldwide Context

The informal sector significantly contributes for the production, employment and income generation, livelihoods as well as output of most emerging and developing countries (Rao, 2011). The latest report of ILO; "Women and men in the informal economy: A statistical picture" shows that 2 billion people representing over 60% of global employed population are working in the informal sector (ILO, 2019). Further, according to that report, 85.8% of employments are informal in Africa while 68.6% in Arab States, 68.2% in Asia and Pacific, 40% in Americas and 25.1% in Europe and Central Asia. However, 93% of global informal employments are from developing and emerging countries. Figure 2.1 indicates the contribution of informal economy to the GDP of global countries.

Fourie, (2018) unambiguously emphasized a little different idea as the informal sector is an important source of employment and its growth is necessary for some countries due to the extremely high unemployment rates. The author stated that many researchers have a narrow view about informal sector as participants have no

aspirations or entrepreneurial skills with no meaningful role. Nevertheless, informal enterprises provide livelihoods, work and income for a large numbers of workers and owners with poverty-reducing effect of employment. International Monetary Fund (IMF, 2017) supports for above idea by stating that there are both advantages and disadvantages of informal sector. Advantage is that it acts as a social safety net by providing employment and income opportunities to many people who may otherwise be unemployed in the absence of sufficient chances in the formal sector. Disadvantage is that productivity levels are low, thus if a country has a large informal sector, the rate of economic growth is low.

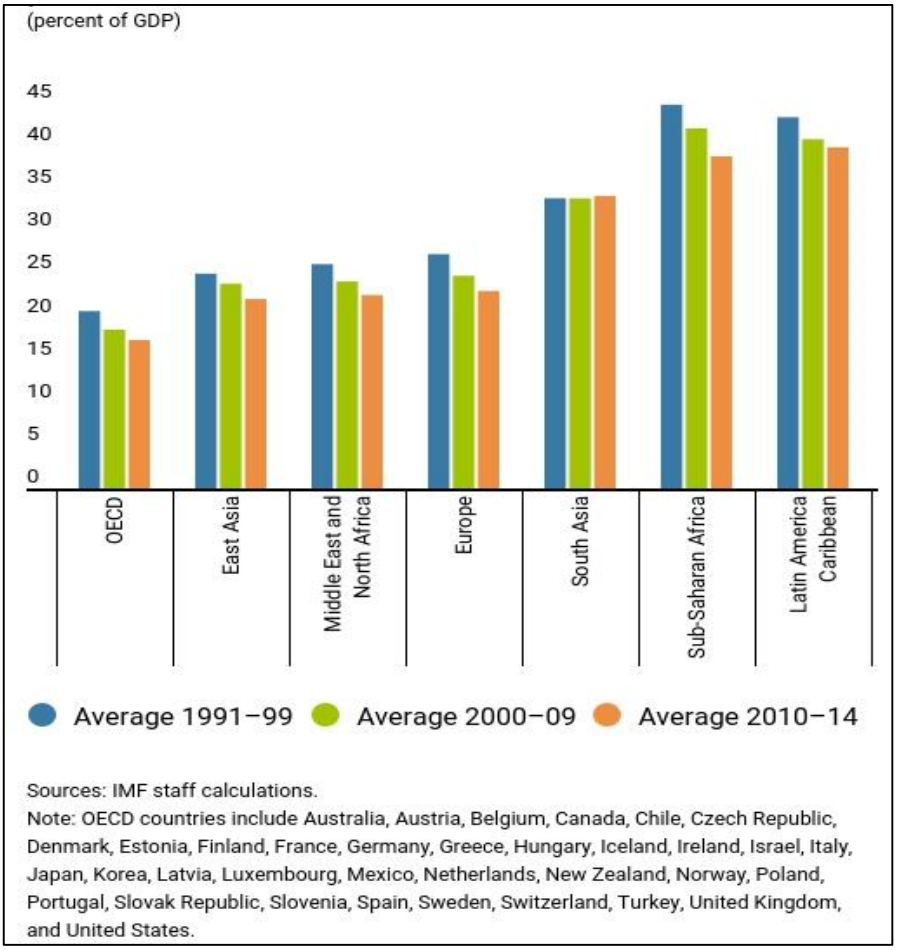

Figure 2. 1: Contribution of informal economy to the GDP globally
[Source: IMF, 2017]

2.2.2 Informal Sector in Sri Lankan Context

Michael (2018) label the Sri Lankan informal sector as a rare gem wait for polishing. Further, there is a large informal sector workforce representing almost 60% of Sri

Lankan employments as in many developing countries. Further the same author presents that over 4.5 million of Sri Lankans are employed in informal sector which is larger than local formal sector with combination of all private and public enterprises. There are two groups of Sri Lankan informal economy as small or individual unregistered enterprises with less than 10 employees and formally registered enterprises who hire additional workers informally (Michael, 2018). As per ILO (2019), nearly two-third of Sri Lankan employments are informal and there are some critical issues as lacking decent work conditions. Gunasekara (2016) emphasized that as the Sri Lankan informal sector contributes for a substantial portion of GDP, adequate social security is required for informal workers. The informal sector is the source of sustaining millions of Sri Lankan employees with their families while generating a major portion of production and income to the country (Michael, 2018). The decent work program should be in place and safety regulations and procedures should be simplified while implementing incentive offers relating to Sri Lankan informal sector (ILO, 2019). Further, the existing knowledge base on informal economy of Sri Lanka should be upgraded with more comprehensive research studies.

2.3 Informal Construction Sector

As per the United Nations Environment Programme [UNEP, 2011], the construction is an important sector of the economy which significantly contributes to GDP by representing nearly one-tenth of the global economy. This industry generates employment and income for a significant portion of the population with a wide variety of technologies and different scales (Odediran, Babalola & Adebiyi, 2013). Further, a high percentage of output from those global constructions is often produced by being informally. At the same time, informal construction sector is high labour intensive compared to other informal sectors (Fourie, 2018). Nevertheless, it is difficult to measure the scope of informal construction sector which is booming both in developed and developing countries. However, it can be said that the informal sector in construction is likely to grow (Wells & Jason, 2010; WIEGO, 2019).

The informal construction sector consists with unregulated and insecure activities and individuals with small enterprises (Mselle & Sanga, 2017). Further it is characterized

with lack of formal employment and unprotected by labour laws (Jason, 2008). Yet, it plays a significant role in construction sector of most developing countries (Mselle & Sanga, 2017).

2.3.1 Informal Construction Sector in Worldwide context

The whole informal sector in the worldwide context is dominated by the agriculture and then by services as trade and transportation. Outside of agriculture and services sectors, the highest informality is there in construction and manufacturing sectors worldwide (WIEGO, 2014). ILO (2019) reports that though the number of informal enterprises are decreasing in almost all sectors in the world, construction sector is still opposite to that pattern. As per the data revealed by Wells and Jason (2010), Figure 2.2 shows the informal construction workers as a percentage of all construction workers in several countries. On the other hand, the informal construction sector is clearly evident for gender segmentation as it is highly male dominated when compared with other informal sectors globally (WIEGO, 2014). Further, the same author highlighted the short-term and seasonal employments with temporary basis as another globally noticed feature in informal construction sector.

Figure 2. 2: Worldwide context of informal construction sector
[Source: Wells & Jason, 2010]

2.3 Informal Construction Sector in Sri Lankan context

Figure 2.3 shows that the percentage of informal sectors in Sri Lanka. According to that, highest informal sectors are agriculture and fishery industry. The second highest informal sector is the construction industry in Sri Lanka. The construction work in Sri Lanka is basically carried out by registered contractors of the Construction Industry Development Authority (CIDA), international contractors, unregistered local contractors and individual labours (Michael, 2018). Further, those unregistered local contractors and individual labours are coming under the informal construction sector. Hence, the informal construction sector plays a vital role in Sri Lankan informal economy.

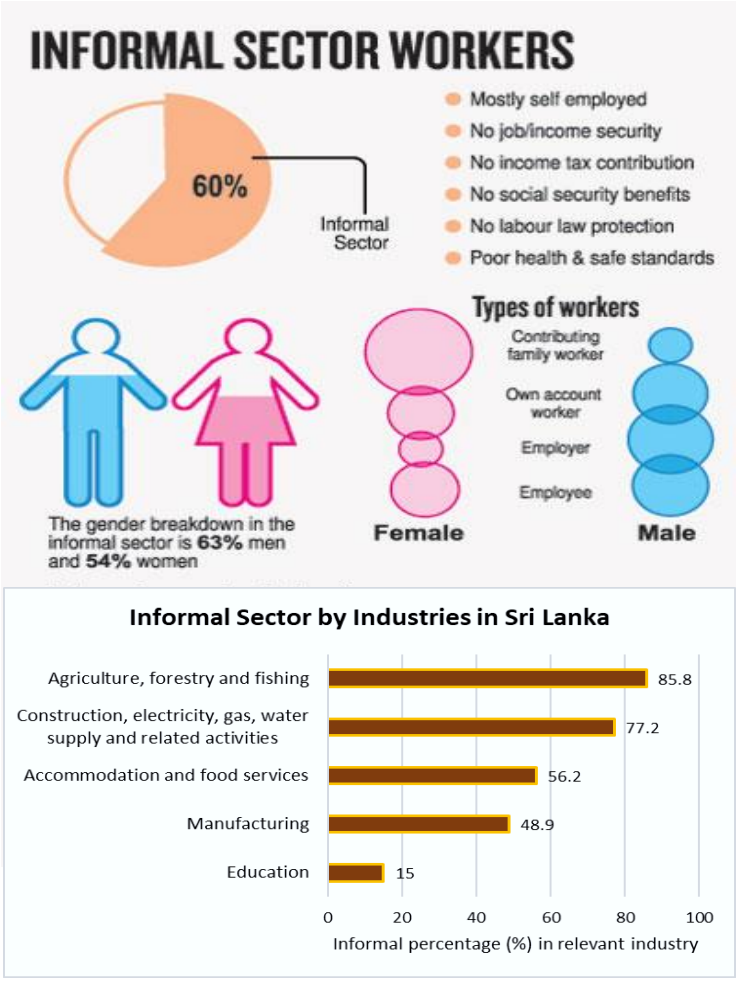

Figure 2. 3: Sri Lankan context of informal construction sector
[Source: Michael, 2018]

However, ILO reports that a majority of informal construction workers are with lack of decent working conditions, social protection and employment rights (ILO, 2019). Further, informal construction workers often work in the most hazardous workplaces and conditions. High exposure to risks involving with low social protection put most informal construction workers in a very vulnerable situation. (ILO, 2019). The World Health Organisation (WHO) recently reported that 60% of employees working in entire informal sector experience the work related accidents. Further, informal sector is difficult to monitor and it is difficult to find real information due to lack of reporting (Daily Mirror, 2018). Thus, hazard identification and eliminating those hazards are necessary for the safe operation and effectiveness of informal construction workers.

2.4 Hazards in Informal Construction Sector

As per the Benjamin et al. (2014), hazard is the potential source to cause a harm. Similarly, a hazard is a source of potential damage, harm or a severe health effect on someone or something (Canadian Centre for Occupational Health & Safety [CCOHS], 2019) Further, the words "Hazard" and "Risk "are interacted with each other. There are five general groups of hazards as shown in Figure 2.4.

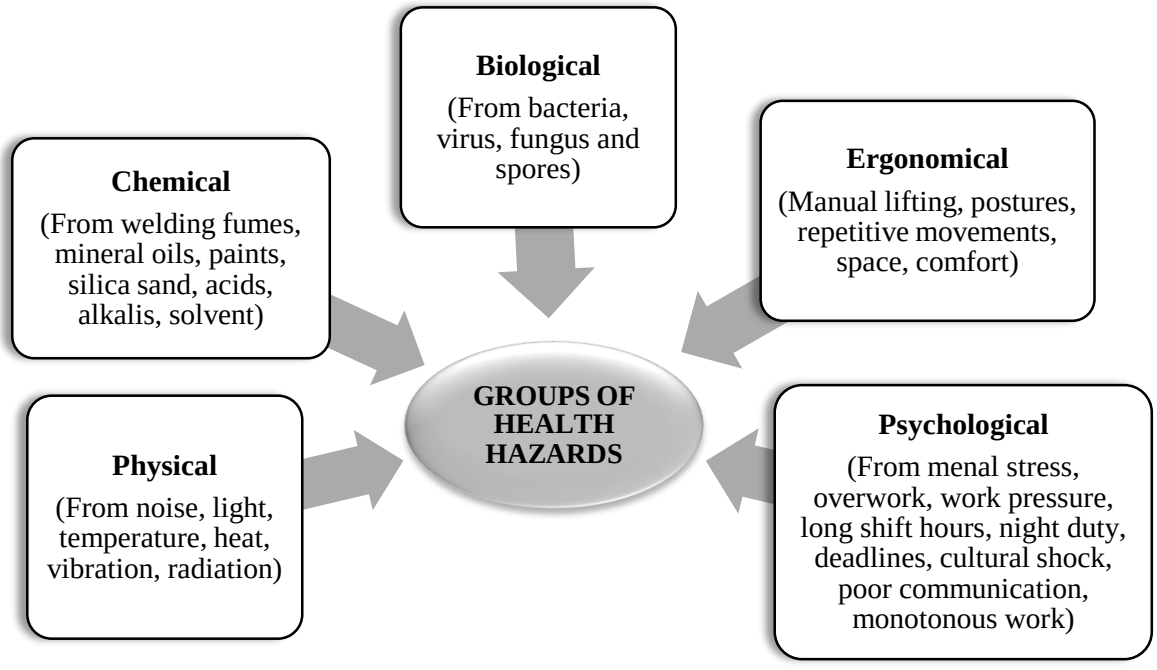

Figure 2. 4: Groups of Health Hazards
[Source: CCOHS, 2019]

In construction industry, as there is a high involvement with a vast range of stakeholders as contractors, manufacturers, suppliers, sub-contractors in design, operation, refurbishment work with various construction materials, products and building services, this complexity has made it as one of the most hazardous industries with high rate of accidents (ILO, 2012). On the other hand, there is a significant number of workers under categories of skilled, semi-skilled and unskilled and generally all of them are at a risk of being injured, death or various illnesses while working at sites (Vitharana et al., 2015). Ametepeh, Adei and Arhin (2013) shows that there is a wide range of physical hazards which are exposed by informal construction sector workers as physical hazards as vibration, noise, dirty environment, fire, chemical hazards as dust, fumes, smoke and gas, ergonomic hazards as poor postures and psychological hazards as working stress and sexual abuse.

As per Abdul-Hamid, Wan-Yusuf and Singh (2003), there are physical hazards at sites from equipment as poor access equipment, plant and machinery for excavation, scaffoldings, ladders, roof work and manual handling which can happened direct injury or even death to site workers. Further, various sources of mechanical energy as vibration, radiation, noise, extreme hot and cold temperature also can create physical hazards. In construction sites, noise is an unavoidable hazard due to the nature of construction activities and it can cause adverse health effects as hearing loss. (Vitharana et al., 2015). There are chemical hazards related to construction work as spray paints, solvents, welding fumes, cutting oil mists, asbestos and hexavalent chromium (Gibb, Brace, Pendlebury & Bust, 2010). Further, dust is considered as a major chemical hazard by construction workers while cement, adhesive, solvent and asbestos can adversely effect on their health.

The effects from above hazards can be acute or chronic as categorised in Figure 2.3. In Acute effects, severe symptoms develop rapidly and lead quickly to a health crisis (Vitharana et al., 2015). Mostly stated acute hazards are falling from height and electrocution at construction sites. Further, roof work, ladder work, lifting, moving or carrying heavy materials or tools, plant machinery and tool usage, harmful chemicals, excavating in deep trenches and fire have been identified as hazards at construction

sites in several previous studies. Mainly, the scaffolds contribute for accident occurrences at the construction sites, thus construction workers consider 'working at height' as the major risk activity (Ismail & Ghani, 2012). Further, long working hours, shift work and night work develop fatigue which result in poor decision making and concentration while increasing the risk of occurring hazards (Haslam, Atkinson, Brown & Haslam, 2005).

Normally, Chronic effects are developing slowly and the death or sickness is occurred after a specific time period due to long and continuous exposure of low concentrate hazardous substance (Vitharana et al., 2015). Mostly reported chronic hazardous are exposure to hazardous substances, skin sanitizers, corrosive materials and irritants. Similarly, the workers who expose to noise, vibration, extreme temperature and radiation face with chronic health effects. As per Gibb et al. (2010), work-related upper limb disorder, work-related back pain, work related dermatitis, hand arm vibration syndrome, radiation diseases, respiratory diseases, ultraviolet radiation, pneumoconiosis Asbestos and Silicosis, mental stress, decompression illness are the common health issues among construction workers. By considering above exposed facts, the hazards in the construction industry can be summarised as in Table 2.2.

Table 2. 2: Summary of hazards in construction industry

Health Hazards	
Health hazards having chronic effects	Physical (high noise, high light, high temperature, high vibration, high radiation)
	Asbestos usage
	Ionizing radiation (welding)
	Chemical (Bitumen, paints, acids, cement, silica sand)
	Contaminated land and materials (old buildings)
	Hazardous substances (dust, fumes, gas work)
	Vibratory tools
	Compressed air environment
	Environment with limited lighting
	Ergonomical (Wrong postures, repetitive movements)
	Psychological (Mental stress, overwork, work pressure, long shift hours, night duty, deadlines, poor communication, repetitive work)
Health hazards having	Poor housekeeping
	Ladder/scaffolding work (slippage and breakages)
	Lifting, moving or carrying heavy tools or materials
	Plant, machinery and tool usage

	Fire and emergency
	Excavating in deep trenches
	Workers falling from height
	Electric shocks
	Biological (Diseases from bacteria, virus, food poisoning)

[Sources: Ismail & Ghani (2012), Haslam, Atkinson, Brown & Haslam (2005), Vitharana et al. (2015), Gibb et al. (2010)]

2.5 Challenges to eliminate hazards and to implement OSH

In response to above hazards identified in section 2.4, the construction industry has been struggling for improving its safety performance (CRC Construction Innovation, 2007; Hon, Chan & Yam, 2012). AS an example, the Hong Kong has implement various initiatives in the form of legislation, law enforcement, safety promotion and training to promote safety and health in the workplace (Choudhry, Fang & Lingard, 2009). Nevertheless, the informal construction sector with Small and Medium sized Enterprises (SMEs) are often tend to ignore the OSH issues in their sector (Kelloway & Cooper, 2011). Further, it is common for subcontractors to face with a high frequency of hazards in where most subcontractors are informal and small scale (Gray & Sadiqi, 2015). As the informal construction sector doesn't manage OSH risks effectively as larger firms, it causes higher risks of having hazards than in formal construction sector (Arocena & Nunez, 2010; Kheni, Gibb & Dainty, 2010).

However, the existing literature on OSH relating to construction industry has mainly focused on formal sector firms and there is only a limited number of studies that have focused on informal sector constructions and their OSH practices. Though there are more literature discussed on the importance and approaches of proper OSH management, adopting such methods by informal sector small construction companies generates practical problems. By considering the existing literature, the probable challenges to eliminate hazards and implement OSH in informal construction sector can be summarised as financial challenges, time challenges, knowledge/skills challenges, misconception and poor attitude challenges, cultural challenges, regulatory challenges and industrial challenges (Table 2.3).

Table 2. 3: Summary of challenges to eliminate hazards in construction industry

Type of Challenge	Reference
Financial Challenges	
- Non affordable to purchase Personal Protective Equipment (PPE)	(Kelloway & Cooper, 2011; Amfo-Out & Agyemang, 2017)
- Instability nature of informal sector	(Kelloway & Cooper, 2011)
- Most informal construction companies are small scale	(Amfo-Out & Agyemang, 2017)
- Struggle only to the business survival	(Hon et al., 2012)
Time Challenges	
- Benefits from safety can't be noticeable in short term	(Champoux & Brun, 2003)
- Tight project deadlines	(Silva & Wimalaratne, 2012)
Knowledge/skill Challenges	
- Lack of OSH training for labours	(Hasle, Bager & Granerud, 2010; Kelloway & Cooper, 2011; Wadick, 2010)
- Lack of safety education from schools and colleges	(Jorgensen, Duijm & Troen, 2011)
- Lack of safety guidelines at construction sites	(Masi & Cagno, 2015)
- Lack of awareness on safety related activities	(Masi & Cagno 2015)
- Little knowledge on OSH legislation	(Gomes, Arezes & Vasconcellos, 2016; Garnica & Barriga, 2018)
- Lack of idea on why safety is important	(Masi & Cagno, 2015)
Misconceptions and poor attitude Challenges	
- Underestimate the safety risk	(Champoux & Brun, 2003)
- Think as safety is the responsibility of one individual person	(Lin & Mills, 2001)
- Perception as Safety regulations are too complex, heavy and unrealistic	(Hasle & Limborg, 2006)
- Misconceptions as cost of safety is too high compared to supposed benefits	(Okoye & Okolie, 2014)
- Overconfident of workers	(Hung et al., 2013)
- Believe in luck as workers are not in danger	(Pingqing, Fang & Chunjing, 2006)
Cultural Challenges	
- No audits for detection of non-conformities on safety	(Garnica & Barriga, 2018)
- Safety consider as employees' responsibility and promote OSH management by workers themselves	(Floyde, Lawson, Shalloe, Eastgate & D'Cruz, 2013; Gomes et al., 2016)

- Poor social status of workers	(Kheni et al., 2010)
Regulatory Challenges	
- Inadequate OSH policy within the business	(Gomes et al., 2016)
- lack of OSH legislative enforcement by the government	(Charles et al., 2007)
- Neglecting the informal construction sector by relevant government bodies	(Osei- Boateng & Ampratwum, 2011)
- Lack of uniformity in construction related OSH regulations	(CRC Construction Innovation, 2007)
- Difficulties to comply with strict and complex legislation	(Gomes et al., 2016)
- Lacking technical support by control authorities	(Masi & Cagno, 2015)
Industrial Challenges	
- Competitive tendering and selecting the lowest bidder	(Choi, Chan & Chan, 2012)
- Cost cutting practices by client	(Hung et al., 2013; Chiang, 2009)
- Lack of accident reporting system in informal construction sector	(Ahmed, Shaukat, Usman, Nawaz and Nazir, 2018)
- Clients are more focused on getting the job done than safety	(Wadick, 2010)
- Difficulty in prior planning of OSH activities	(Masi & Cagno, 2015)
- A large number of labour force involvement	(Garnicaa & Barrigaa, 2018)
- High number of small scale sub-contractors involvement	(Gray & Sadiqi 2015)
- Workers are daily or contract basis and not permanent	(Garnicaa & Barrigaa, 2018)
- Insufficient availability of skilled labourers	(Ahmed et al., 2018)
- Lack of effective cooperation between informal construction workers	(Ahmed et al., 2018)

As categorized in above, it is necessary to identify the critical challenges towards the OHS performance in informal construction sector.

Financial Challenges

A significant issue that mostly effect on effective OSH practices is the cost. It will incur an additional project cost to purchase Personal Protective Equipment (PPE) and employ safety staff (Kelloway & Coorper, 2011). The financial fragility and instability of most informal and business enterprises can hinder the level of OSH practices that can be adopted (Pinto, Nunes & Ribeiro, 2011). Amfo-Out and Agyemang (2017)

revealed that informal and small businesses simply are non-affordable to purchase safety equipment to protect their workers from adverse hazardous and environmental conditions. Additionally, the weight on safety is proportionate to the size of informal enterprise or the scale of construction project (Kartam, Flood & Koushki, 2000). The highest priority of most such companies is the business survival rather than concerning on safety and health due to limited resources (Hon et al., 2012).

Time Challenges

As the benefits from safety investments cannot be noticeable in short term, it has made the informal construction sector to be less attractive on OSH (Champoux & Brun, 2003). Besides, additional barrier for effective OSH management is having tight project deadlines and thus the industry is struggling to complete projects on time while neglecting safety (Silva & Wimalaratne, 2012). This challenge of time pressure is getting worse with poor design details, insufficient project planning, missing instructions, errors in delivery dates and suspension of work due to extreme weather conditions (Conchie, Moon & Duncan, 2013).

Knowledge/Skills Challenges

Conversely, Kelloway and Cooper (2011) highlighted the lack of OSH training and education for construction labourers as a reason for significant increase in occupational risks. These training programs help workers to follow several preventive actions and create positive attitude on safety (Zhou, Fang & Mohamed, 2011). The organizations with poorly structured training and induction procedures are often experiencing poor safety performance (Wadick, 2010). Hasle et al. (2010) declared that most informal sector constructions are not giving priority for safety trainings by thinking it as expensive and not much necessary to develop workers' positive safety attitudes. Further, owners of such businesses do not have adequate knowledge to implement safety practices while appreciating the importance of it (Jorgensen et al., 2011). Lack of safety awareness of informal construction workers is also a challenge towards OSH performance (Zhou et al., 2011). Small businesses and informal contractors are not feeling the necessity of focusing on safety by themselves (Lin & Mills, 2001).

Misconception and Poor Attitude Challenges

Informal construction owners and workers underestimate the safety risks by believing it as a part of the job (Champoux & Brun, 2003). Further, their belief is that controlling the risk is merely a responsibility of employees (Lin & Mills, 2001). Additionally, there is a negative perception on safety by small scale informal organisations as safety regulations are too complex and financial burdens which are too heavy and unrealistic (Hasle & Limborg, 2006). Although they understand that there are negative impacts on financial performance due to poor safety measures at their organisations, still their opinion is that the cost of compliance with safety is too high compared to supposed benefits (Okoye, & Okolie, 2014). Hung et al. (2013) disclosed that experienced informal construction workers are mostly overconfident on their past experience or safety records while believing that safety trainings are not needed by them. Thus, misconception or underestimation of risk can be a cause for unsafe environments and reluctant to follow advices may reduce the safety performance of the sector. Some workers believe that luckily they may not face with any significant danger as problems are occurred very rarely (Pingqing et al., 2006). Thus, to fostering the OSH in informal construction sector, the perception on risk by both employers and employees should be changes as it vastly effects on the probability of having hazards (Caponecchia & Sheils, 2011).

A study conducted in Tanzania on the exposure to occupation and health issues in informal construction workers shows that the use of personal protective equipment is less although the workers expose to high levels of various health hazards (Rongo, Barten, Msamange, Heederik & Dolmans, 2004). Similarly, Gebrezgiabher, Tetemke, and Yetum (2019) reported that though there is a high awareness on work related hazards and accidents, low usage of protective measures against those hazards. The type and duration of training, years of experience and awareness level on using protective devices are the major factors of eliminating occupational hazards (Amfo-Otu & Agyemang, 2017). Thus, it is proved that the informal construction workers tend to ignore about safety concerns while working in their field.

Cultural Challenges

Poor safety culture is another challenge towards the safety at informal construction companies (Sunindijoa, 2015). Most informal sector contractors are not considering the safety as a priority as they have more 'urgent' issues mandatory by clients. They predict that establishing high safety standards is not much necessary for this sector due to the requirement of additional cost and resources (Cagno, Micheli & Jacinto, 2013). They promote to manage the safety risks by the workers themselves while blaming to workers when accidents happened (Floyde et al., 2013). Thus, due to lack of management commitment, the existing poor safety culture at informal organisations getting worst (Ozmec, Karlsen, Kines, Andersen & Nielsen, 2014). On the other hand, Kheni et al. (2010) declared that in most developing countries, many informal sector workers are having low socio-economic status and their wages/salaries cannot fulfil the cost of their basic needs. Thus, such workers don't like to complain on poor working conditions and willingly accept the risk when their wages are paid promptly with risk allowances. On these grounds, many informal construction workers are vulnerable in respect to OSH. These findings contribute to the fact that there is a low level of concern on OSH in informal construction sector of developing countries.

Regulatory Challenges

As per Charles et al. (2007), the lack of legislative enforcement and OSH jurisdiction within the informal construction sector can impede the efficiency of OSH practices. However, Osei-Boateng and Ampratwum (2011) argued that this sector suffers with policy and regulatory neglecting due to the unstructured nature of it. This challenge is further increased by lack of uniformity in construction related safety regulations while causing confusion and controversy with different regulatory influences (CRC Construction Innovation, 2007). Gomes et al. (2016) identified the major OSH challenges in construction sector as lack of knowledge on OSH legislation, difficulties to comply with complex and strict legislations, lack of OSH policies safety conditions considered as employees' responsibility.

Industrial Challenges

In the competitive nature of construction industry, winning more contracts and economic survival have got prioritized than safety consideration (Sunindijoa, 2015). Besides, the clients are giving more attention on job success over workers' safety (Wadick, 2010). The small scale informal contractors have low bargaining powers as they also compete in the same market with more players (Sunindijoa, 2015). Further, as clients consider small contractors as disposable and replaceable at any time, such contractors try to maintain good relations with their clients over safety (Ozmec et al., 2014). Thus, competitive tendering and selecting the lowest bidder induce the contractors to keep their prices as low as possible while reducing costs for additional requirements as health and safety (Choi et al., 2012). This cost cutting pressures is usually passed down to subcontractors by creating several quality and safety issues (Hung et al., 2013; Chiang, 2009). Occasionally, the characteristics by the nature of small enterprises as informal and personal management by owners, high resource restraints, limited market share, independence, financial risk, high initial cost with low profitability, short life cycle and high potential to failure create the challenges to implement OSH within the sector (Garnica & Barriga, 2018).

2.6 Current approaches to foster OSH in informal construction sector

While the challenges towards OSH in informal construction sector is as above, many countries have already initiated several approaches to mitigate those challenges and foster OSH. The Universal Declaration of Human Rights (UDHR) protects the rights of workers which contains health and safety at work while UN International Covenant on Economic, Social and Cultural Rights (ICESCR) declares the safety and health as a component of positive working condition (Bamu-Chipunza, 2018). Thus, ILO adopted Decent Work Agenda to encourage a safe working environment in all sectors including informal constructions (ILO, 2009).

By following the guidance of above organizations, countries as USA, UK, Germany and Ireland promotes the coordination and cooperation with relevant bodies for enhancing OSH in informal construction sector (ILO, 2015). Further, the same author

explored that several strategies have been taken by those countries to support labour inspections of informal construction sites and safety awareness campaigns are conducted to cover informal construction sector. National Academies of Sciences, Engineering, and Medicine (2016) disclosed the approaches obtained by several countries to enhance OSH in their informal sector. Accordingly, there are workers' health state centres in all states of Brazil which provides OSH services with clinical assistance, treatments, safety inspections, identification of hazards and educational workshops for both formal and informal sectors. Further, the Thailand has focused on the safety and health of informal workers by ensuring to have health insurance for almost all informal workers.

As per the *Occupational Safety and Health Law No. 84/2015/QH13* (VIE), Vietnam OSH law system has been developed to cover informal sector of the country. In Indonesia, the law has been passed to cover the informal sector and 50% of annual budget for OSH program is allocated for informal sector (National Academies of Sciences, Engineering, and Medicine, 2016). Further, the Indonesian provincial health offices provide OSH information, education and communication with trainings and technical assistance for informal workers. The UK individual workers are covered by a national license system which evaluate the workers' skills and health and safety practices (ILO, 2015).

2.7 Chapter Summary

The chapter 02 has introduced the informal sector concept as a whole with its worldwide and Sri Lankan contexts. Then it moved to informal construction sector in order to achieve the first objective of the research. With the identification of worldwide and Sri Lankan contexts of informal construction sectors, it could be noticed that the informal construction sector is emerging and vulnerable to high hazardous conditions. With that concern, the hazards in informal construction sector was identified as a partial fulfilment of second objective. Eventually, the challenges to eliminate those hazards were tabulated under 7 categories and current approaches initiated in globally for fostering OSH in this sector were discovered while partially achieving the third and fourth objectives of the research.

CHAPTER 03

3.0 RESEARCH METHODOLOGY

3.1 Introduction

Research methodology can be identified as the path which is needed by researchers in order to develop their research by formulating the research problem, objectives and presenting the final results which were collected throughout study period (Sileyew, 2019). This chapter contains the concepts and processes which were adopted in this research in order to achieve the aim and objectives of the study. Further, it is described the research approach, research design and the research technique that were used for data collection and data analysis.

3.2 Research Approach

Research approaches can be categorized into three types as qualitative, quantitative and mixed method which are the plans and procedures of a research including data collection, analysis and interpretation (Creswell, 2014). In most scenarios, qualitative approach is subjective and quantitative approach is objective (Naoum, 2012). However, the most suitable approach can be selected based on the nature of research problem (Noor, 2008).

As this research was undertaken to investigate the hazards in Sri Lankan informal construction sector while examine the challenges towards OSH in the sector and finally recommend the probable approaches to overcome those challenges, both numerical data and different opinions with in-depth understanding is required. When the research involved with more numbers and statistical analysis, it can be used the quantitative approach (Apuke, 2017) and when it is required detail and in-depth information, qualitative approach is most suitable (Yin, 2015). According to Cresswell (2014), mixed research approach is involving with both quantitative and qualitative approaches which gives a more complete understanding about the research problem rather than approach alone. Therefore, according to above justifications, the mixed research approach can be suggested as the best option for this study.

3.3 Research Design

Polonsky & Waller (2010) observed that creating an appropriate research process is very essential for commencing a research. With that view, the research process of this study was designed under three main phases as illustrated in Figure 3.1.

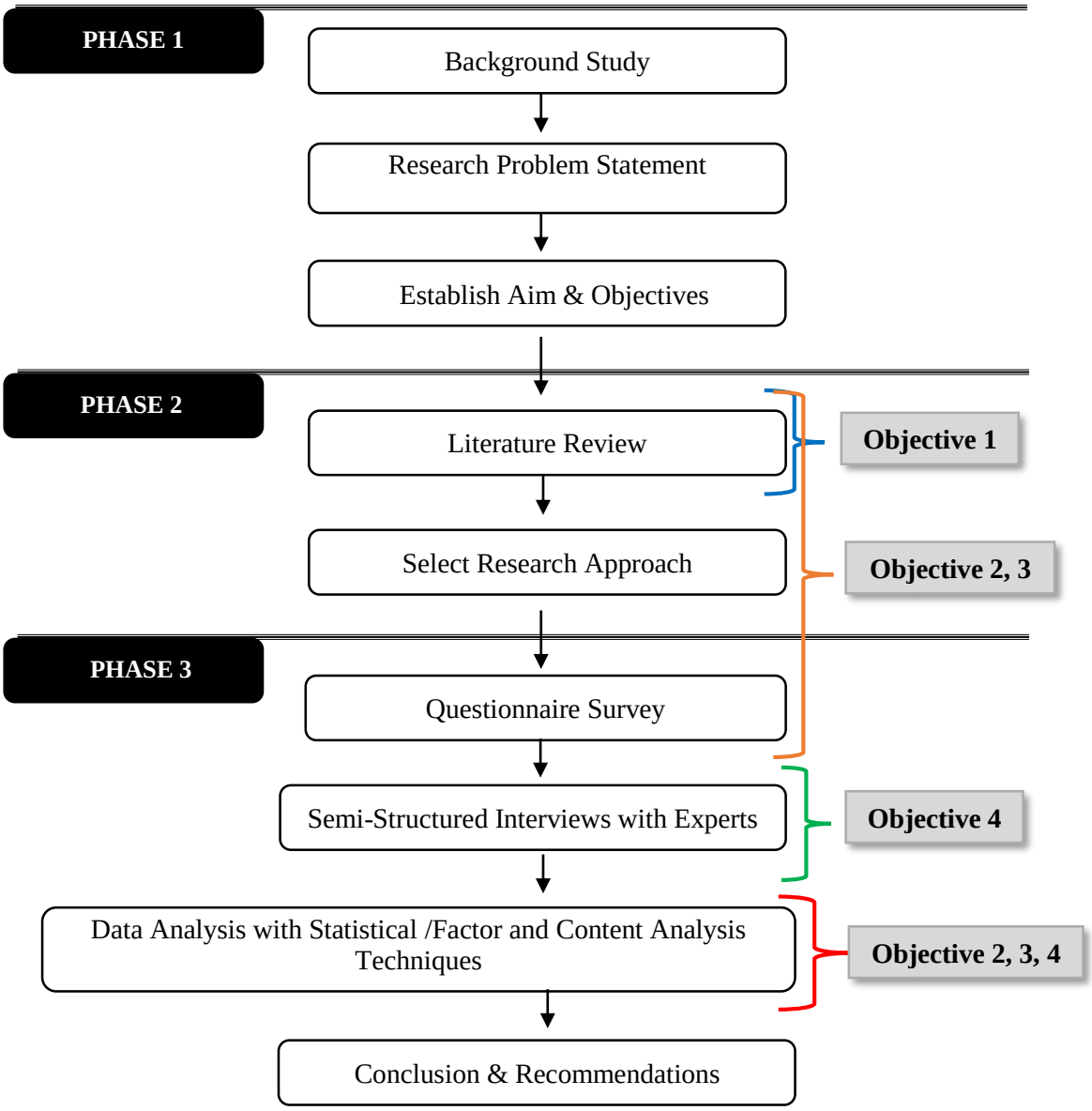

Figure 3. 1: Research Process Design

3.4 Research Technique

3.4.1 Data Collection

Numerous data collection methods are available for conducting researches and the adequacy of such data collection methods is depending on the nature of research problem (Sileyew, 2019). With identification of research approach as mixed method, both quantitative and qualitative data collection techniques have to be adopted for this study.

3.4.1.1 Questionnaire Survey

Cresswell (2014) revealed that quantitative studies generally contain with close-ended responses as questionnaires. As quantitative data was required to achieve third and fourth objectives of this study, the questionnaire was selected as the data collection technique to gather information relating to those objectives.

3.4.1.2 Semi structured interview

Many qualitative studies are conducted with semi-structured interviews with small sample of population (Yin, 2015). Further, the researcher can get non-verbal hints from the respondent over face to face interviews (Seale, 2012). Thus, face to face interviews were selected as the most suitable technique for collecting data under the final objective. Further, semi-structured interviews were conducted as it can approach the respondents with adequate flexibility than structured interviews (Noor, 2008),

3.4.1.3 Questionnaire design and Interview guideline

The questionnaire (Refer Appendix A) was prepared with two sections and section1 was to obtain general information while section 2 was to identify hazards and challenges in Sri Lankan informal construction sector. Close ended questions and 5 point Likert scale questions were used to design the questionnaire. The interview guideline (Refer Appendix B) was prepared with open ended questions as to find the approaches to overcome the identified challenges. Questions were developed based on the findings of literature review.

3.4.1.4 Data collection process

The questionnaires were distributed among participants through hand delivery or email. In hand delivering, the responses were collected at the same time in both verbal and written answers. Therefore, it could be obtained a noticeable high response rate from questionnaire survey which was administered to 125 participants and received responses from 102. Voice recording technique was adopted while interviewing the experts (with permission of the interviewee) for avoiding missing of the data. Eventually, the interview transcripts were prepared based on collected data. However, the actual names of respondents or interviewees were not exposed in this report or any other document relating to this study in order to maintain the confidentiality.

3.4.1.5 Selection of participants

Apuke (2017) disclosed that quantitative data collection methods as questionnaire survey are mostly selected on randomly by giving the equal chance while qualitative methods as interviews are most commonly selected non- randomly. On the other hand, Etikan, Musa and Alkassim (2016) revealed that convenience sampling method is used in quantitative researches, when the population is too large and unreported. Accordingly, the participants for questionnaire survey was selected by convenience sampling but as much as randomly due to the total number of informal construction workers in Sri Lanka is unreported and the purposive sampling technique was used to select experts for the interviews. Usually, the number of participants for qualitative data collection methods as interviews is smaller than the quantitative methods as questionnaire Apuke (2017). Generally, the number of participants for data collection is decided on the basis of theoretical saturation in where the new data adds no longer additional insight to the research problem (Sofaer, 2002) which was adopted for this study.

3.4.1.6 Sampling Frame

As this survey was based on both convenience and purposive sampling methods, the sampling frame was as follows.

- Questionnaire Survey;

I. Skilled or Unskilled Labours who are directly working in informal construction sector.

II. Technical staff who have obtained National Vocational Qualification (NVQ) qualification and now working in small scale construction companies

- Expert Interview

III. Professionals with Degree qualification and over 8 years working experience in the construction industry or labour related regulatory bodies

Accordingly, the details of selected sample have been presented in Table 3.1.

Table 3. 1: Details of the sample

Questionnaire Survey	
Skilled Labour (Mason, Carpenter, Painter, Welder, Plumber, Electrician, Landscaper)	
Unskilled Labour (Helper)	
Others (NVQ qualified Draftsmen, Quantity Surveyor and Site Supervisor)	
Total	**102**
Expert Interview (over 8 years working experience)	
E1 – Specialist Factory Inspecting Engineer (Construction) Department of Labour, Industrial Safety Division	
E2 – Deputy Chief Factory Inspecting Engineer Department of Labour	
E3 – Contract Administrator/Health, Safety and Environmental Manager Local and UK Constructions	
E4 – Safety and Environmental Engineer Local and Foreign Constructions	
E5 – Health and Safety Officer Local Constructions	
E6 – Civil Engineer/ NVQ Assessor/ Visiting Lecturer on OSH	
E7 – Environmental and Civil Engineer/ NVQ Assessor/ Visiting Lecturer on OSH	
Total	**07**

3.4.2 Data analysis

Sileyew (2019) stated that the analysis of a research includes a comparison between collected data under each inquired topics and then builds a summary of them with their diversity. Based on the research approach and the nature of collected data, the data analysis method can be decided (Creswell, 2014). Further, the same author indicated that in a quantitative survey approach, it is used an appropriate statistical analysis method and in a qualitative survey approach, it is used text and image analysis methods such as content analysis. Consequently, the analysis of this study was done with both quantitative and qualitative data analysis techniques as it was used the mixed approach through the survey.

3.4.2.1 Descriptive, T-Test, Factor and Content analysis

There is a wide range of statistical analysis available to analyze quantitative data and descriptive statistical analysis is one of them (Akboga & Baradan, 2015). Further, quantitative analysis is the process of collecting and evaluating numerical and measurable data with the aim of interpreting objects statistically with numbers (Akboga & Baradan, 2015). Thus, descriptive statistical analysis and one sample T-Test was initially adopted to recognize the significant findings from questionnaire survey of this study. The findings extracted from one sample T-Test were further analyzed through exploratory factor analysis which can be used to categorize the variables under a small number of factors by considering the correlation among them (Hadi, Abdullah & Sentosa, 2016). When focusing on the qualitative data gathered through interviews, code-based content analysis was adopted which is a flexible method for analyzing the written, verbal or visually communicated data by linking the key concepts under a particular topic (Elo & Kyngas, 2008). Among numerous data analysis softwares, the IBM SPSS developed by IBM Corporation is a software package for statistical analysis while NVivo is a set of tools developed by Qualitative Solutions and Research (QSR) International (Pvt) Ltd to assist qualitative analysis (Chan, Javed, Lyu, Hon, & Wong, 2016). Thus, a combination of IBM SPSS-version 16 and QSR.NVivo-version 12 was used to support for the descriptive statistical analysis, T-Test, factor analysis and content analysis of the findings.

3.5 Conclusion Drawing

This is the finalizing phase of the study. Rajasekar, Philominathan and Chinnathambi (2006) viewed that the ultimate goals of a research are predictions, results and the conclusions. Thus, after analysing the data, the conclusions were drawn on the results from study and about their interrelationships with existing literature. Further, new research directions emerging from this research study were pointed out in the conclusions.

3.6 Chapter Summary

This chapter presented the research design and research process including research approach and research technique with data collection and data analysis. The mixed research approach was selected as the best approach as quantitative approach had been adopted for identifying the hazards and challenges to eliminate those hazards in Sri Lankan informal construction sector while qualitative approach was adopted for investigating the probable approaches to overcome identified challenges. The questionnaire sample was created with skilled, unskilled labours and technical staff while semi-structured interviews were conducted with experts in construction industry and labour related local regulatory bodies. Descriptive statistical analysis, one sample T-Test, exploratory factor analysis and code-based content analysis techniques were used to draw conclusions by analyzing the findings.

CHAPTER 04

4.0 RESEARCH ANALYSIS AND FINDINGS

4.1 Introduction

This chapter conducts a comprehensive discussion on the research findings by presenting both quantitative and qualitative analysis. Accordingly, under section 4.3 and 4.4, it analyses the findings on most significant hazards and challenges toward OSH in informal construction sector of Sri Lanka. Further, section 4.5 presents the code-based content analysis of probable approaches to overcome above challenges in order to foster OSH in informal construction sector of Sri Lanka.

4.2 Results of Respondents

Table 4.1 shows the response rates as a percentage of received responses from total distribution.

Table 4. 1: Response Rate

Data collection method	Respondent Type	Total number of distribution	Total number of responses	Response rate as a %
Questionnaire	Skilled/unskilled Labours/NVQ staff	125	102	81.6%
Interview Guideline	Experts related to OSH field	07	07	100%

Figure 4.1 presents the distribution of the type of respondents in questionnaire sample. It is observed that 48 respondents are skilled labours which presents 47% of total sample. 44 (43% of total sample) are unskilled labours and 10 (10% of total sample) are from other category with NVQ qualified workers. Figure 4.2 presents the distribution of the age and experience of respondents in the questionnaire sample. It is observed that there is a higher representation of respondents who exceed the age more than 40, working in Sri Lankan informal construction sector. Distribution of working experience has been depended on the type of respondent in where the unskilled labours are mostly in the range of 4 year or less than experience while skilled labours and NVQ staff are mostly in more than 10 year or 20 year working experience. The range of 5-9 years represents both skilled and unskilled labours with NVQ staff.

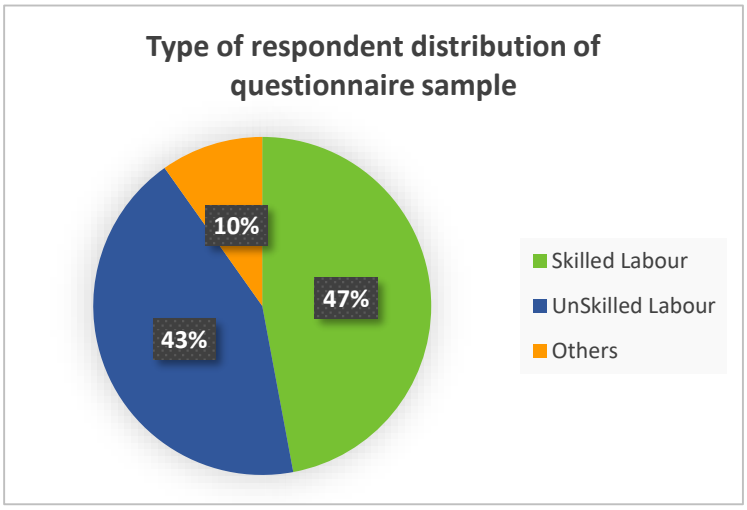

Figure 4. 1: Type of respondent distribution of questionnaire sample

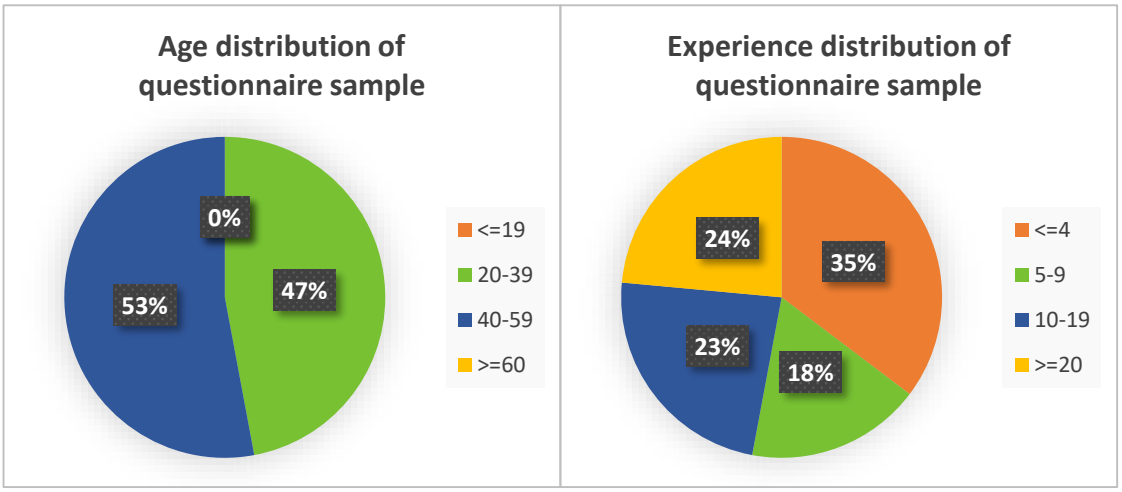

Figure 4. 2: Age and experience distribution of questionnaire sample

4.3 Hazards in informal construction sector of Sri Lanka

This section presents the analysis of hazards in informal construction sector which was identified in literature review and ranking according to their significance in Sri Lankan context. The importance of adapting ranking method is disc losing the highest available hazard and it creates an ability to compare the risk in Sri Lankan informal construction sector with Sri Lankan formal construction sector. Figure 4.2 shows the results of hazard analysis while Figure 4.3 clearly presents the most common hazards in Sri Lankan informal construction sector by rearranging the results in descending order.

According to the Figure 4.2, the most common hazards in informal construction sector of Sri Lanka is falling from height and ladder/scaffolding work. Several respondents mentioned that falling from height are mostly happened due to working at high positions without safe edge protections and accidents from ladder or scaffolding work are mostly happened due to slipping or breaking the ladder or scaffolding.

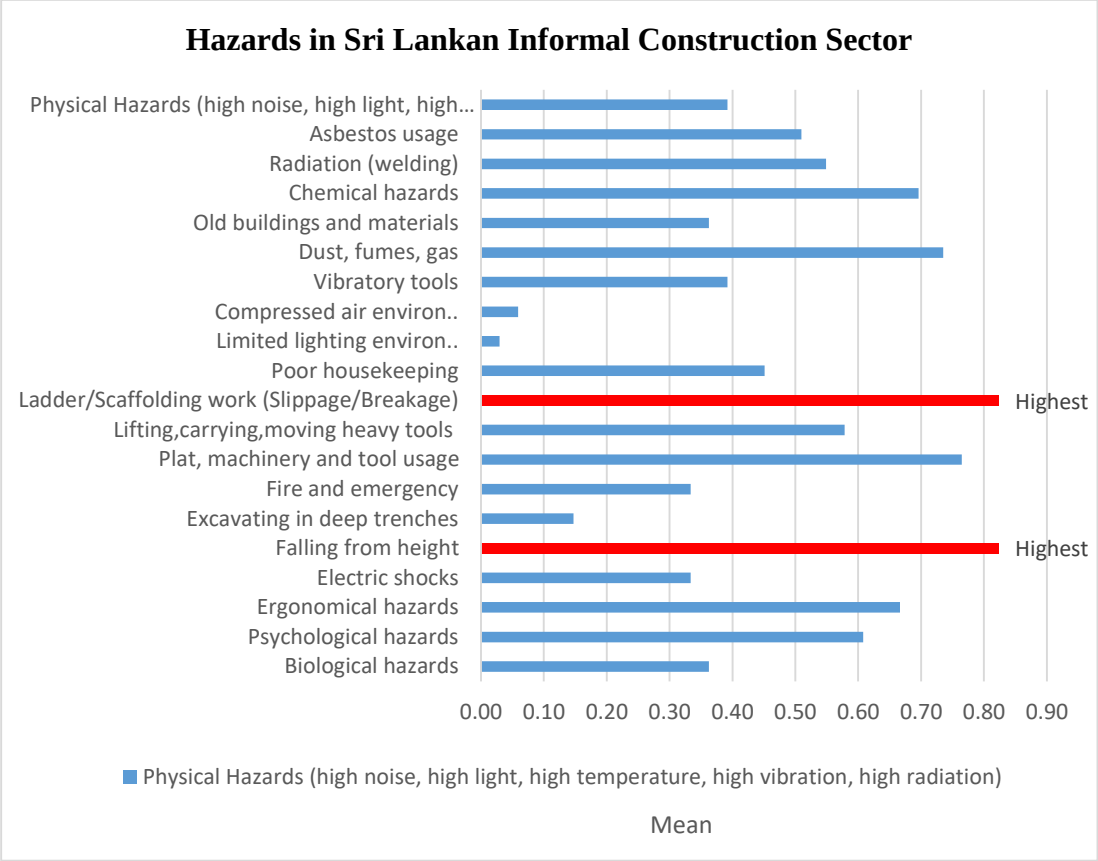

Figure 4.3: Available hazards in Sri Lankan informal construction sector

Third highest hazard is plant, machinery and tool usage in where the most Masons and Carpenters highlighted that cutting and drilling the fingers are commonly happened and falling machines on legs, hands and head are common as well. Next highest available hazards are dust, fumes, gas and chemical hazards. These were mainly emphasized by Painters and Welders as they are mostly suffered when dust or small particles go through their eyes, nose or mouth. Further, they are suffering with inhaling or touching hazardous chemical substances. Ergonomical hazards and psychological hazards are the next common hazards identified in Sri Lankan informal construction

sector. Most respondents disclosed that they are suffering with back pain, shoulder pain and leg pain after shutting down the work. Psychological hazards are due to mental stress, high work load, night work and physical fatigues. Some respondents highlighted that falling objects and loose clothes as additional hazards in their sites.

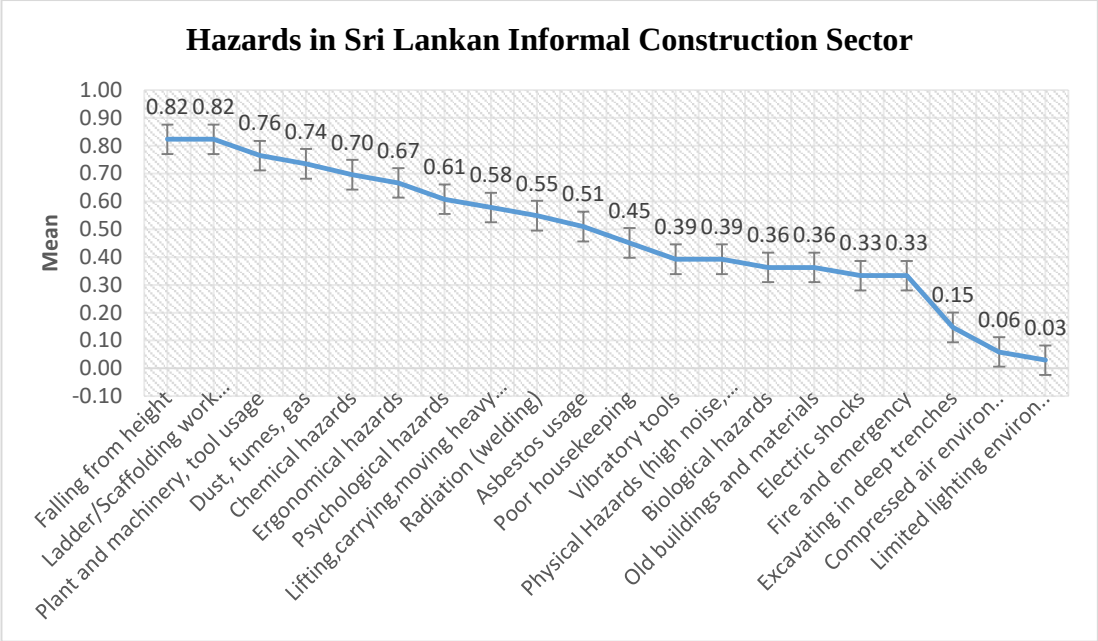

Figure 4. 4: Most common hazards in Sri Lankan informal construction sector

While the ranking of hazards in Sri Lankan informal construction sector is as above, it creates a path to build up a comparison with Sri Lankan formal construction sector. Several studies have explored the highest reported hazards in formal construction sites of Sri Lanka and at the same time it depends on the nature of construction project. Vitharana et al. (2015) disclosed that workers falling from height, electrocution and exposure to hazardous substances as mostly reported health hazards in Sri Lankan formal construction sites. Additionally, heavy vehicles (Darshana, 2017), large equipment, dangerous tools and hazardous materials (Rathnayake, De Silva and Nawarathna, 2014) were identified as major hazards in Sri Lankan formal construction sector. Perera, Somachandra and Samarasiri (2017) identified the slipping and stripping as the most available hazards.

Accordingly, it is undisputable that there are similar types of hazards highly available in both formal and informal construction sectors of Sri Lanka as falling from height,

slippage and breakage of ladders and scaffoldings. At the same time, there are additional most common hazards in formal sector as electrocution, hazardous substances, heavy vehicles, large and dangerous equipment and tools.

4.4 Challenges towards OSH in informal construction sector of Sri Lanka

This section presents the analysis of challenges towards OSH which were identified in literature review under seven main categories as financial challenges, time challenges, knowledge/skills challenges, misconception and poor attitude challenges, cultural challenges, regulatory challenges and industrial challenges. As the questionnaire was developed with likert scale under above headings, they were ranked based on the average mean value in order to identify the most affected challenges.

4.5.1 Financial challenges

Table 4.2 shows the descriptive analysis of financial challenges with calculations of statistical data resulting mean and standard deviation while ranking the challenges for better understanding of results. The ranking was determined by the highest value of the mean found through SPSS analysis. Struggle only to the business survival with an aim of finding money for daily consumption and non-affordable to purchase PPE has contributed as highest ranked financial challenges. However, several respondents didn't agree with the fact that labours don't have money to purchase PPE by stating that some labourers don't use though they already have PPE with them. Thus, they did not highlight it as a major challenge. Further, most of them stated that the sector is not much unstable as they have work at all the time. Besides, though the informal companies are small scale, it is not affected to promote OSH. Thus, that factor was considered as not applicable as a challenge.

Table 4. 2: Ranking descriptive Statistics of financial challenges

	N	Sum	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
Struggle only to the business survival	102	407	3.99	.078	.790	.624
Can't purchase PPE	102	306	3.00	.072	.731	.535
Instability nature of informal sector	102	270	2.65	.097	.981	.963
Most informal companies are small scale	102	232	2.27	.101	1.016	1.033

4.5.2 Time challenges

As shown Table 4.3, not having shot term noticeable benefits from safety is the highest time challenge for OSH in Sri Lankan informal construction sector. Nevertheless, respondents highlighted that there are several short term benefits as well. On the other hand, 'tight project deadlines' was not agreed by most of them by mentioning that though the clients are giving deadlines, they are not much tight as in formal industry. When delay happens, client is all the time comes to negotiation method and no liquidated damages or any other claims granted by the client. Thus, both of these challenges are not much significant in promoting the OSH in Sri Lankan informal construction sector.

Table 4. 3: Ranking descriptive Statistics of time challenges

	N	Sum	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
Benefits from safety can't be noticeable in short term	102	300	2.94	.088	.888	.789
Tight project deadlines	102	224	2.20	.092	.934	.872

4.5.3 Knowledge/skills challenges

Table 4.4 presents the results of analysis on knowledge/skills challenges and lack of OSH training for labours is the highest ranked. Many labourers highlighted this is one of the major barrier for them to follow safety methods at site. Most of them have never got such a training on safety practices relating to their job and even have left the school after O/L or before that. Lack of safety education from school and colleges were ranked as the second one. Lack of safety guidelines at work site is the next challenge as labourers have never seen any safety notice in their informal construction sites. Most respondents marked the 'little knowledge on OSH legislations' as 'not applicable' by stating that there are no OSH legislations in Sri Lanka for informal construction sector. Respondents did not mostly agree with the facts that lacking awareness and lack of idea on safety related activities as they have the idea on why it is important and how to work safely by practice and experience. But the challenge was they have not get any proper training or education on correct safety practices.

Table 4. 4: Ranking descriptive Statistics of knowledge/skill challenges

	N	Sum	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
Lack of OSH training for labours	102	424	4.16	.066	.671	.450
Lack of safety education from schools and colleges	102	391	3.83	.076	.772	.596
Lack of safety guidelines at construction sites	102	321	3.15	.096	.969	.939
Little knowledge on OSH legislation	102	315	3.09	.091	.924	.854
Lack of awareness on safety related activities	102	281	2.75	.086	.872	.761
Lack of idea on why safety is important	102	255	2.50	.092	.931	.866

4.5.4 Misconception and poor attitude challenges

As per the results presented in Table 4.5, underestimating safety risk is the highest ranked challenge. Most respondents directly agree with that by mentioning most labourers are careless on safety and face with accidents. Overconfident of workers was secondly ranked and it is mainly with experienced labours. Some respondents believed on their luck to happen accidents while some were rejecting it. Safety cost is too high compared to benefits was not ranked as a major challenge since though there are high cost safety precautions, there are several simple and cheap safety measures they can take. Most respondents did not have the opinion that safety is the responsibility of one individual person. Safety regulations are complex and unrealistic was the last ranked one as there are no safety regulations for informal construction sector of Sri Lanka.

Table 4. 5: Ranking descriptive Statistics of misconception/poor attitude challenges

	N	Sum	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
Underestimate the safety risk	102	454	4.45	.080	.804	.646
Overconfident of workers	102	432	4.24	.083	.835	.697
Believe in luck as I am not in danger	102	312	3.06	.075	.755	.571
Safety cost is too high compared to benefits	102	296	2.90	.088	.885	.782
Safety is the responsibility of one individual person	102	244	2.39	.108	1.091	1.191
Safety regulations are too complex and unrealistic	102	107	1.05	.079	.801	.641

4.5.5. Cultural challenges

Under the cultural challenges, no audits for safety was the first challenge (refer Table 4.6). Labourers disclosed that there are no authorized person or government officer coming for inspections of informal construction sites and safety issues of those constructions except from National Dengue Control Units. Thus, labourers tend to careless on safety as there are no checking or actions. Besides, some respondents had an idea as poor social status of workers in this sector is not majorly affected on safety practices on them. Less number of respondents agreed with the fact that safety is the responsibility of only labours and they have to fulfil their safety by themselves.

Table 4. 6: Ranking descriptive Statistics of cultural challenges

	N	Sum	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
No audits for safety	102	373	3.66	.084	.850	.723
Poor social status of workers	102	317	3.11	.096	.974	.949
Safety is employees' responsibility by workers themselves	102	315	3.09	.084	.846	.715

4.5.6 Regulatory challenges

Referring to the Table 4.7, highest regulatory challenge is neglecting informal construction sector by relevant government bodies. Under that, respondents highlighted it is majorly on informal construction sector as other informal sectors as agricultural and fishing industry are getting much attention from Sri Lankan government. Further, respondents highly ranked for the challenge of lacking OSH related legislations in Sri Lankan construction industry. Some respondents working at hotel projects and maintenance, compared Sri Lankan situation with foreign countries by mentioning that foreigners highly concern on safety. They emphasized that they follow safety as they have used to it by their country's OSH regulations. Besides, technical support by control authorities is very low when compared to the agricultural sector. Inadequate OSH policy within company or worker is identified as the fourth challenge. Last two ranked regulatory challenges were not applicable as per the respondents due to not having construction related OSH regulations in Sri Lanka.

Table 4. 7: Ranking descriptive Statistics of regulatory challenges

	N	Sum	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
Neglecting informal construction sector by relevant government bodies	102	411	4.03	.069	.696	.484
Lack of OSH legislations by the government	102	400	3.92	.094	.951	.905
Lacking technical support by control authorities	102	365	3.58	.079	.801	.642
Inadequate OSH policy	102	312	3.06	.091	.921	.848
Difficulties to follow strict, complex legislation	102	138	1.35	.104	1.050	1.102
Lack of uniformity in construction OSH regulations	102	124	1.22	.093	.940	.884

4.5.7 Industrial challenges

Table 4.8 presents the results of survey analysis on industrial challenges. Most labours responded that not like foreign clients, many local clients are more focused on getting the job done than safety. The labours work for foreign clients emphasized that they will even not getting the work from foreigners if they are not following safety practices during construction or maintenance at foreigners' properties. Lack of accident reporting in informal construction sector was ranked as the second challenge as labours don't have any place to report when there is an accident. Thus, it is not formally reported any information regarding safety of informal construction sector in Sri Lanka. Besides, skilled labours are insufficient in this field and as available workers also are daily, contract basis and not permanent, they do not tend learn the correct safety practices at industry. Due to Cost cutting practices by local clients, they are not spending any additional money for the safety of workers and themselves as well. Competitive tendering and high number of small scale sub-contractor involvement were ranked as the last two industrial challenges as they are not much applicable to informal construction sector but only in formal constructions.

Table 4. 8: Ranking descriptive Statistics of industrial challenges

	N	Sum	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
Clients are more focused on getting job done than safety	102	441	4.32	.085	.858	.736
Lack of accident reporting system in informal construction sector	102	391	3.83	.068	.691	.477
Insufficient availability of skilled labourers	102	358	3.51	.072	.728	.530
Workers are daily, contract basis and not permanent	102	321	3.15	.085	.861	.741
Cost cutting practices by clients	102	317	3.11	.080	.807	.652
Lack of effective cooperation between informal construction workers	102	306	3.00	.093	.944	.891
Difficulty in prior planning OSH activities	102	254	2.49	.095	.962	.926
Large number of labour force involvement	102	254	2.49	.091	.920	.846
Competitive tendering and select lowest bidder	102	202	1.98	.091	.923	.851
High number of small scale sub-contractors involvement	102	188	1.84	.093	.941	.886

4.5.8 Critical challenges for OSH in Sri Lankan informal construction sector

While the challenges under each category are as above, the critical challenges for OSH in this sector were extracted by One Sample T-Test. The mean value of Likert scale (1-5), 3 was used for that as the test value to compare the mean values of sample and the critical T Value was 1.960 for 101 (n-1) degree of freedom with 95% confidence level. Accordingly, twelve challenges were extracted with high significant level of low p-value (< 0.05) as highlighted in Table 4.9.

When considering Table 4.9, the most critical challenge that affected for OSH in informal construction sector of Sri Lanka is ‘Underestimate the safety risk’ which was categorized under the misconception and poor attitude challenges. The second highest challenge is ‘Lack of OSH training for labours’ which is a knowledge/skill challenges challenge. ‘Clients more focus on getting job done than safety’ under industrial challenges is the third critical while ‘Overconfident of workers’ and ‘Neglecting informal construction sector by relevant government bodies' are fourth and fifth critical challenges categorized under misconception/poor attitude challenges and regulatory challenges respectively.

Table 4. 9: T-Test results of challenges for OSH in Informal Construction Sector

One-Sample Test

	Test Value = 3		
	t	Sig. (2-tailed)	Mean Difference
Can't purchase PPE	.000	1.000	.000
Instability nature of informal sector	-3.632	.000	-.353
Most informal companies are small scale	-7.210	.000	-.725
Struggle only to the business survival	12.663	.000	.990
Benefits from safety can't be noticeable in short term	-.669	.505	-.059
Tight project deadlines	-8.694	.000	-.804
Lack of OSH training for labours	17.409	.000	1.157
Lack of safety education from schools and colleges	10.904	.000	.833
Lack of safety guidelines at construction sites	1.533	.128	.147
Lack of awareness on safety related activities	-2.837	.005	-.245
Little knowledge on OSH legislation	.965	.337	.088
Lack of idea on why safety is important	-5.425	.000	-.500
Underestimate the safety risk	18.231	.000	1.451
Safety is the responsibility of one individual person	-5.625	.000	-.608
Safety regulations are too complex and unrealistic	-24.608	.000	-1.951
Safety cost is too high compared to benefits	-1.119	.266	-.098
Overconfident of workers	14.948	.000	1.235
Believe in luck as I am not in danger	.786	.433	.059
No audits for safety	7.804	.000	.657
Safety is employees' responsibility by workers themselves	1.054	.294	.088
Poor social status of workers	1.118	.266	.108
Inadequate OSH policy	.645	.520	.059
Lack of OSH legislations by the government	9.785	.000	.922
Neglecting informal construction sector by relevant government bodies	14.940	.000	1.029
Lack of uniformity in construction OSH regulations	-19.170	.000	-1.784
Difficulties to follow strict, complex legislation	-15.847	.000	-1.647

Lacking technical support by control authorities	7.289	.000	.578
Competitive tendering and select lowest bidder	-11.162	.000	-1.020
Cost cutting practices by client	1.349	.180	.108
Lack of accident reporting system in informal construction sector	12.187	.000	.833
Clients are more focused on getting job done than safety	15.582	.000	1.324
Difficulty in prior planning OSH activities	-5.352	.000	-.510
Large number of labour force involvement	-5.596	.000	-.510
High number of small scale sub-contractors involvement	-12.412	.000	-1.157
Workers are daily, contract basis and not permanent	1.726	.087	.147
Insufficient availability of skilled labourers	7.075	.000	.510
Lack of effective cooperation between informal construction workers	.000	1.000	.000

Other critical challenges in Table 4.9 are Struggle only to the business survival (financial challenges), Lack of accident report system in informal construction sector (industrial challenges), Lack of safety education from schools and colleges (knowledge/skill challenges), Lack of OSH legislations by government (regulatory challenges), No audits for safety (cultural challenges). Lack of technical support by control authorities (regulatory challenges) and Insufficient availability of skilled labours (industrial challenges).

Subsequently, the most critical twelve challenges extracted from T-Test were forwarded for a factor analysis in order to categorize the variables under appropriate factors for finding more effective approaches to overcome existing challenges.

4.5.9 Exploratory Factor Analysis (EFA)

EFA is a statistical technique used to categorize a large number of identified variables into small number of components or factors by considering the correlation among observed variables (Hadi et al., 2016). Thus, EFA was adopted as a tool to investigate the relations among highest ranked twelve challenges while clustering them under

several underlying factors. At first Kaiser-Meyer-Olkin (KMO) and Bartlett's Test was conducted to check the suitability and sample adequacy of data (Table 4.10). As per the Kaiser (1974 as cited Hadi et al., 2016), KMO in SPSS is a statistical tool used to measure adequacy of sample and if KMO value is larger than 0.5, the sample is sufficient for a factor analysis. In here, the KMO Measure of Sample Adequacy is 0.583 and hence, the sample is sufficient to proceed with factor analysis to categorize the most affecting challenges.

Table 4. 10: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.583
Bartlett's Test of Sphericity	Approx. Chi-Square	172.200
	Df	66
	Sig.	.000

Communalities indicates the proportion of common variance within given variables. Further, larger communalities indicate that the variable fits well with another variable in its factor and low value as 0.3 indicates that variables are not fit well (Danish & Chakraborty, 2019). In here, all the challenges have communalities greater than 0.3 for better measurement of factor analysis (Table 4.11). Principle Component Analysis (PCA) with Varimax rotation matrix of factor analysis was used as extraction and rotation methods to analyse twelve identified challenges.

Table 4. 11: Communalities of Variables

Challenges	Initial	Extraction
Struggle only to the business survival	1.000	.663
Lack of OSH training for labours	1.000	.666
Lack of safety education from schools and colleges	1.000	.428
Underestimate the safety risk	1.000	.454
Overconfident of workers	1.000	.774
No audits for safety	1.000	.636
Lack of OSH legislations by the government	1.000	.777
Neglecting informal cons. sector by relevant govern. bodies	1.000	.590
Lacking technical support by control authorities	1.000	.431
Lack of accident reporting system in informal cons. sector	1.000	.308
Clients are more focused on getting job done than safety	1.000	.530
Insufficient availability of skilled labourers	1.000	.390

Extraction Method: Principal Component Analysis.

Table 4.12 presents that there are four factors that exceeding the Eigen value more than one. The total variance of 55.39% has been achieved by all four factors. The first Eigen value is 2.547 which explain 21.229% of variance in the original data. The second Eigen value is 1.581 and explain 13.175% of variance. The third Eigen value is 1.309 while explaining 10.908% of variance and the fourth Eigen value is 1.209 which explain 10.079% of variance. The Scree plot in Figure 4.4 gives more understanding of these four factors which exceed the Eigen Value than one. Its horizontal axis displays the number of factors with vertical axis of corresponding Eigen value. There are four factors above the red line which represents the Eigen value equal to one.

Table 4. 12: Total Variance Explained

Compo-nent	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.547	21.229	21.229	2.547	21.229	21.229	2.059	17.160	17.160
2	1.581	13.175	34.404	1.581	13.175	34.404	1.697	14.145	31.305
3	1.309	10.908	45.312	1.309	10.908	45.312	1.481	12.339	43.644
4	1.209	10.079	55.390	1.209	10.079	55.390	1.410	11.746	55.390
5	.945	7.876	63.266						
6	.906	7.551	70.817						
7	.769	6.410	77.227						
8	.716	5.964	83.191						
9	.707	5.891	89.083						
10	.561	4.672	93.754						
11	.394	3.283	97.037						
12	.356	2.963	100.000						

Extraction Method: Principal Component Analysis.

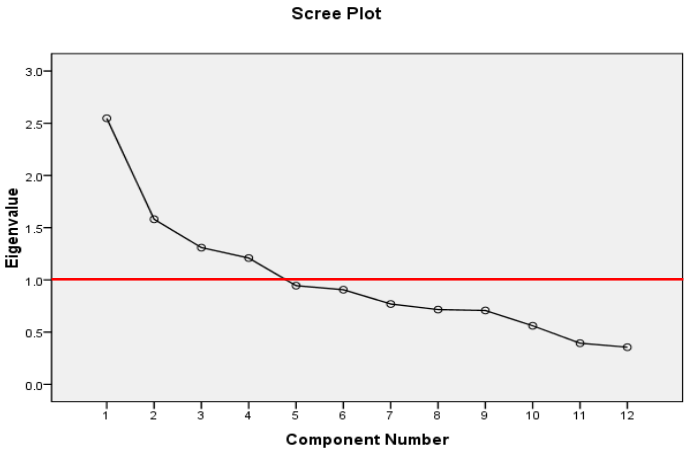

Figure 4. 5: Scree Plot of factors

The factor loading was conducted through a standardized process of PCA with Varimax rotation matrix and only the values exceed 0.5 were considered when categorizing the variables under each factor. Thus, nine challenges were extracted under four factors and three challenges were removed due to low factor loading values (< 0.5) including Lacking technical support by control authorities, Lack of accident reporting system in informal construction sector and Insufficient availability of skilled labourers. The results of factor loadings have been shown in Table 4.13.

Table 4. 13: Factor Analysis of factors affecting to OSH in Sri Lankan informal construction sector

Challenges	Factor Loadings					Initial Eigenvalues		
						Total	% of Variance	Cumulative %
Clients are more focused on getting job done than safety	.708	Factor 1				2.547	21.229	21.229
Lack of safety education from schools and colleges	.646							
Underestimate the safety risk	.551							
Overconfident of workers		.821	Factor 2			1.581	13.175	34.404
No audits for safety		.761						
Lack of OSH legislations by the government			.845	Factor 3		1.309	10.908	45.312
Neglecting informal cons. sector by relevant govern. Bodies			.538					
Lack of OSH training for labours				.755	Factor 4	1.209	10.079	55.390
Struggle only to the business survival				.621				

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 6 iterations.

The four factors explored under Exploratory Factor Analysis can be named as;

- Factor 1: Knowledge and education
- Factor 2: Safety attitude and culture
- Factor 3: Government support
- Factor 4: Nature of informal construction sector

Factor 1: Knowledge and education

Factor 1 contains three challenges explaining 21.229% of variance and Eigen value of 2.547. The challenges under here are Clients more focus on getting job done than safety, Lack of safety education from schools and colleges and Underestimate the safety risk. Poor safety knowledge and education is affected to both labour and client sides. Not like foreign clients, many Sri Lankan clients more focus on getting the job done without considering safety. It is mainly due to not having a proper knowledge and OSH education in Sri Lankan education system. On the other hand, the workers engaged in informal construction activates shows low education level and also no proper training course followed. Experience is the only mode that they have gained awareness on safety and thus it results to underestimate the safety risk by both labours and clients.

Factor 2: Safety attitude and culture

There are two challenges under the Factor 2 with 13.175% of variance and Eigen value of 1.581. The challenges are Overconfident of workers and No audits for safety. Overconfidence of workers is mainly created with their experience and it tends to neglect the occupational safety while increasing the accidents. It is a major weakness of the attitude of Sri Lankan informal construction workers. Further, a safety culture has not still developed within the country as to audit the informal construction sites by safety inspectors.

Factor 3: Government support

Factor 3 contains two challenges explaining 10.908% of variance and Eigen value of 1.309. The challenges coming under here are Lack of OSH legislations by government and Neglecting informal construction sector by relevant government bodies. When comparing with some other countries, Sri Lankan government support is not sufficient to foster OSH in informal construction sector and more attention should be given for this sector when compared with agricultural and fishing sectors in the country. No direct OSH regulation to cover the informal construction sector and it results to

disappear this sector for relevant government bodies. At the same time, they have neglected this sector without giving proper technical support.

Factor 4: Nature of informal construction sector

Moreover, factor 4 consists with two challenges explaining 10.079% of variance and Eigen value of 1.209. They are Lack of OSH training for labours and Struggle only to the business survival. Nature of informal construction sector is quite unstable and thus long term labours can't be expected in this sector. Most of the labours are daily basis and not permanent. Therefore, they don't tend to have a proper vocational training and it is one of the major challenge for them to follow safety methods at site. Instead of learning and practicing correct methods, informal construction workers struggle only to the business survival with the aim of finding money for daily consumption.

With extracting above factors, it created the path to fulfil final objective of this study and thus the expert interviews were conducted for getting expert opinions on how to overcome the explored challenges under four factors in order to foster OSH in informal construction sector of Sri Lanka.

4.5 Probable approaches to overcome challenges for fostering OSH in informal construction sector of Sri Lanka

This section presents the analysis of probable approaches to overcome challenges for fostering OSH in informal construction sector of Sri Lanka. The interview guideline was basically focused on how to overcome the challenges which were identified under four key factors as shown in Figure 4.5.

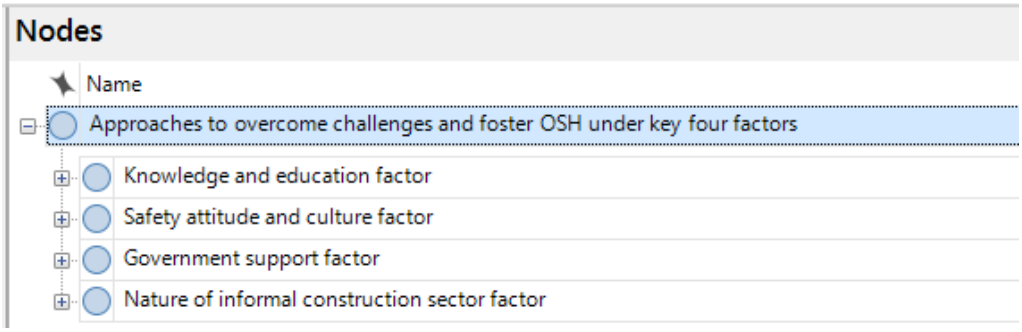

Figure 4.6: Coding Structure of Key Challenging Factors

4.6.1 Approaches to foster knowledge and education

As presented in Figure 4.6, the experts have highlighted 11 key approaches in order to foster knowledge and education on OSH in informal construction sector. Under this factor, three variables were identified by factor analysis as Clients more focus on getting job done than safety, Lack of safety education from schools and colleges and Underestimate the safety risk. Many experts agreed with that knowledge and educational factor is the major challenge for implementing OSH in informal construction sector of Sri Lanka. Further, they revealed that there is no big challenge as financial problem for informal construction workers and lacking awareness and education is the main problem.

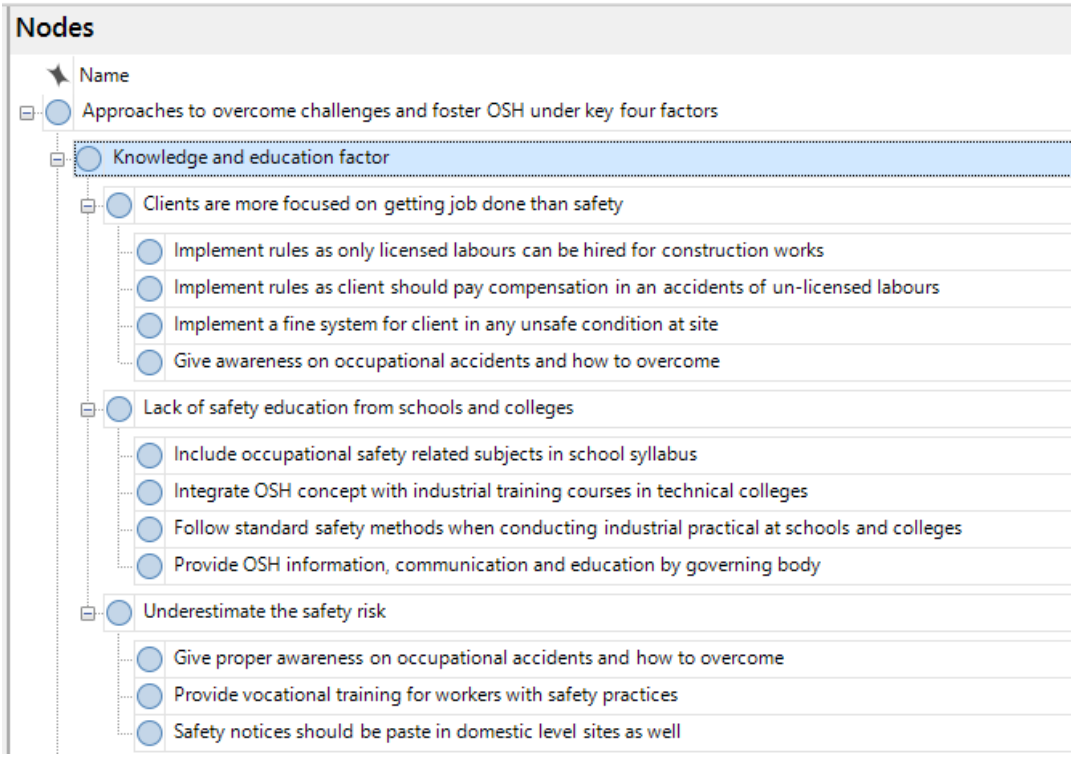

Figure 4. 7: Coding structure of approaches to enhance knowledge and education

4.6.1.1 Clients are more focused on getting job done than safety

E3 suggested that "*it is needed to implement rules as only licensed labours can be hired by clients for their construction work. Then, clients are checking the labours' occupational and safety license before assuming any work for them. It will be a necessity to labours as well to get license as much as quick*". E4 emphasized that there

should be mandatory rules as client is responsible if any accident happened at their site and should pay compensation to the injured un-licensed labour. E6 and E7 gave similar fact that "*most foreign clients do not let labours to work at their home or sites if labours do not follow standard safety methods. That may be because they are used to be afraid on any accident happened to the labour based on the strict rules implemented by their countries*". Further E3 suggested to have regular visits by safety inspectors and implement a fine system for client if safety inspectors found any safety faults at site. Then clients tend to assure the safety of labours at their construction sites.

E2's view was that "*client reluctant to provide safety due to poor safety education*". Thus, it needs to educate clients regarding benefit of safety as well as global recognition for safety. Similarly, E1 and E7 revealed that clients also should get the awareness on the importance of this OSH concept. Besides, E5 stated that "*media should give the awareness on occupational accidents and how to overcome them. It can be done through advertisement by CIDA or any authorized body similar to the advertisements already created for health diseases from tobacco, alcohol or heart diseases by health department. Further there can be media discussions with professionals to give awareness on this concept. Other than the road accidents, more occupational accidents can be published by newspapers or media news to emphasize the idea that occupational safety is very important*".

4.6.1.2 Lack of safety education from schools and colleges

E1 and E6 suggested to have more occupational safety related subjects in school and technical college syllabus. Further the knowledge should be giving by their mother language to the informal workers.

E4 emphasized that if the schools and colleges are following standard safety methods at all the time of conducting industrial practical, students learn on how to properly wear PPE and always used to follow it at their occupation as well. E2 stated that "*it needs to provide implementation tool and supervision during academic activity as well as non-academic activity in school level as train to use hand glove, mask, goggles, safety harness and etc. during laboratory work and housekeeping*". E7 add some

points as "*OSH is not just a theoretical subject and it should learn with a practical idea. As we all know, Sri Lankan education system should be more job oriented even since school level. Actually, even some engineering related degree and vocational courses have not focused on occupational safety concerns in Sri Lanka*". Thus, Sri Lankan education system should more focus on OSH.

4.6.1.3 Underestimate the safety risk

E1, E5 and E7 viewed that proper awareness should be given to the informal workers on what are the occupational accidents can be happened and how to overcome them. E5 stated that "*social media has the main responsibility to give that awareness and relevant authorities as CIDA or construction approval issuing bodies as UDA, MC or UC should give this awareness through social media or workshops at village level. It is the method that can be avoided an accident before it happens*". E7 gave an opinion as Ministry of Skills Development and Vocational Training can get the responsibility to give awareness through community officers at village level.

E4 had an opinion as by giving a proper vocational training with safety precautions for the workers, they used to practice it. His idea was that "*if the workers are not well trained and they learn their occupation by observation or from family background, then they are not much worry about accidents and safety precautions. But if they trained with proper safety equipment, then they don't tend to work without safety at any time*". E2 mentioned that training should be given with real accident case study videos. E3 and E6 stated that vocational training with safety practices should be a mandatory requirement for issuing the working license for labours.

E4 proposed that if there are safety notices relevant to the constructions going on even domestic level sites, when workers always see that, they tend to follow those safety methods. Further, it is the responsibility of clients to paste such safety notices in order to ensure the safety at work.

4.6.2 Approaches to foster Safety Attitude and Culture

Under Safety Attitude and Cultural factor, two variables were identified as Overconfidence of workers and No audits for safety. Many experts disclosed that when compared with many foreign countries, Sri Lanka has not built up with a good safety culture and peoples' attitude should be more developed on occupational safety. The findings show 4 key approaches to enhance safety attitude and culture as presented in Figure 4.7.

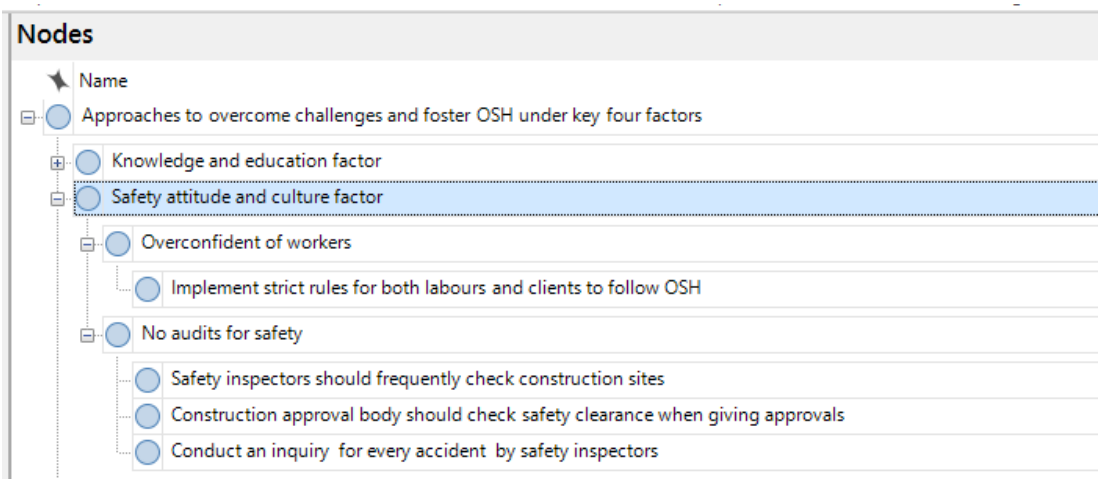

Figure 4. 8: Coding structure of approaches to enhance safety attitude and culture

4.6.2.1 Overconfident of workers

E6 stated that overconfidence of workers can't be avoided and the only thing that can be done to follow safety precautions by them is implementing mandatory rules. E3 suggested that an occupational and safety related license system can be introduced by the government and all workers who are involving with construction activities must get that license. Further he revealed that "*there is a certification and license system in UK as CSCS and NI number for all construction workers in even individual or domestic level. Further the labours will give a payment bill to the client after finishing their work. Thus, though they are informal workers, they do their occupation in professional level*". E7 also expressed the idea of having NI number and License system for labours. Similarly, E6 disclosed that if labours should compulsorily follow safety methods and if clients also are mandatory to supervise labours on whether they

follow safety methods and if not avoid giving work for such unsafe workers, all informal workers will follow safety methods.

4.6.2.2 No audits for safety

E3 stated that there should be safety inspectors appointed by government to check the safety precautions at construction sites. As per his views "*in Sri Lanka, there are Dengue inspectors to check the cleanliness of lands and even construction sites are inspected by them and order some fine to the owner of land if there is issue. At same, safety practices of construction work at domestic level can be inspected by safety inspectors and it is already practicing some foreign countries in where safety inspectors frequently check the construction work nearly twice per week*". E1 disclosed that "*already there are ten District Factory Engineer Offices in Sri Lanka and they conduct accident investigations and inspections in formally registered construction companies*". He suggested to develop that system to informal construction sector as well.

E5 further added for that point as "*in Sri Lanka, construction activities are inspected by relevant approval authorities before construction and after construction only. But, there should be inspections during construction as well. Further, they should consider on safety precautions at construction sites as well*". E4 emphasized that "*there should be an enquiry for every accident reported to the relevant authority. The officers should inspect the relevant site and conduct inquiry with both labour, client and from 3rd part if any*".

4.6.3 Approaches to foster Government Support

Experts emphasized that the Sri Lankan government support and legal enforcement is very low to improve OSH in informal construction sector. Thus, there are 8 key approaches proposed by the experts in order to foster the government support which have been presented under two variables as Lack of OSH legislations by government and Neglecting informal construction sector by relevant government bodies (Figure 4.8).

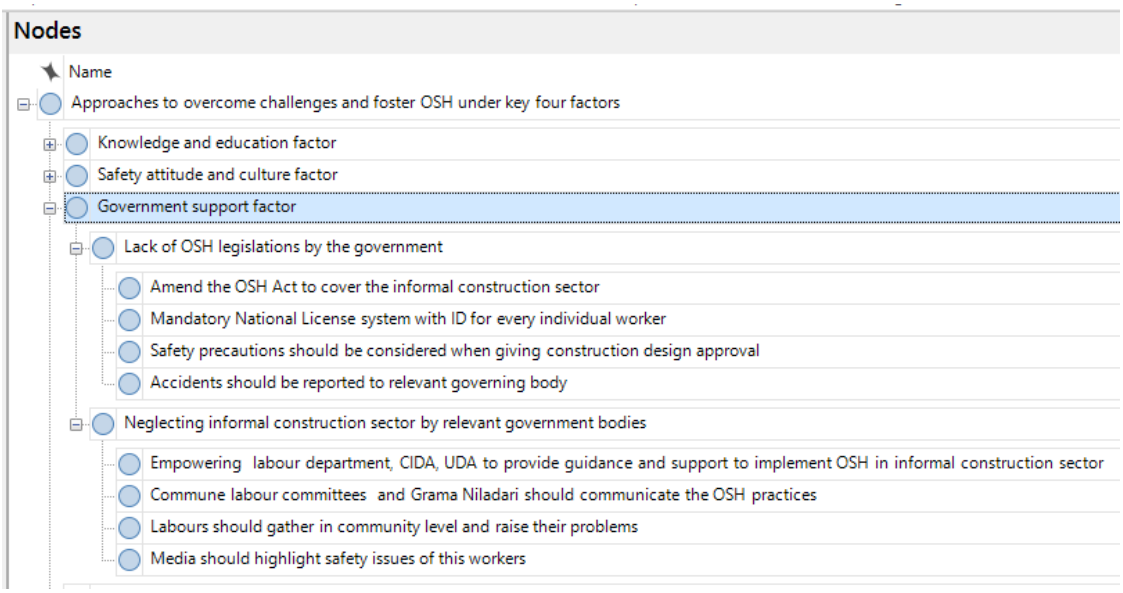

Figure 4. 9: Coding structure of approaches to enhance government support

4.6.3.1 Lack of OSH legislations by the government

E1 and E2 disclosed that the existing Act should be amended as to cover the informal sector as well. E6 stated that there should be a mandatory license system for every worker involving with construction activities similar to the driving license system. E4 also agreed with that by stating "*there are license systems for several work as garage operation, boiler operation and etc. So, construction workers also can have such a license system*". E3 explored that "*there is a license system in UK as CSCS which gives to individual construction workers based on their vocational and safety qualification and all construction workers are mandatory to have it*".

E5 disclosed that "*even for small construction work in Sri Lanka, the approval should be taken from relevant authority as UDA, UC or MC. So, when giving that approval, safety precautions that will be taken by the client also should be considered*".

E1 and E2 agreed with the fact that there is no accident report system for Sri Lankan informal construction sector. E3 suggested to have a mandatory rule as "*every worker or 3rd party who faced with an injury or accident during construction should report to relevant commune authority in order to get the compensation*". E1 and E5 proposed that hospital can record the occupational accident and how it's happened at admitting time and then hospital should report to the relevant authority.

4.6.3.2 Neglecting informal construction sector by relevant government bodies

E2 emphasized that "*it is not neglected by the relevant bodies, but not enough coverage due to lack human resources to supervise up to expected depth and also due to lack of regulations*". E1 and E2 suggested to amend the laws by empowering relevant government bodies as labour department, CIDA, UDA to implement OSH in informal construction sector as well. E1 further suggested that commune labour committees or safety and health committees with Grama Niladari can bring this OSH message to the village level labours.

E1 and E5 stated that there should be a corporation among informal construction workers and they should gather as unions or groups and raise their problems to relevant government bodies. E6 explored that "*there are three major informal industries in Sri Lanka as agriculture, fishery and construction. If we consider on agriculture and fishery industries, they have several vocational committees and even government officers have been appointed to solve and bring their problems to higher authorities. In many time we have seen in media that government is talking on them. But informal construction sector has become hidden because nobody talks about them. So, construction labours should raise their problems as a group*". E5 expressed that "*if there is an influence from workers' and institutional sides, definitely media will highlight this issue and safety problems of workers*".

4.6.4 Approaches to foster Nature of Informal Construction Sector

Under this factor, 8 key approaches were proposed under two variables as Lack of OSH training for labours and Struggle only to the business survival as presented in Figure 4.9. Many experts highlighted the weakness of informal construction workers as they are not stable at the same construction occupation as farmers or fishermen and there is no much cooperation among construction workers to raise their problems as unions or groups. Thus, the informal construction sector creates some barriers by its nature to implement the OSH.

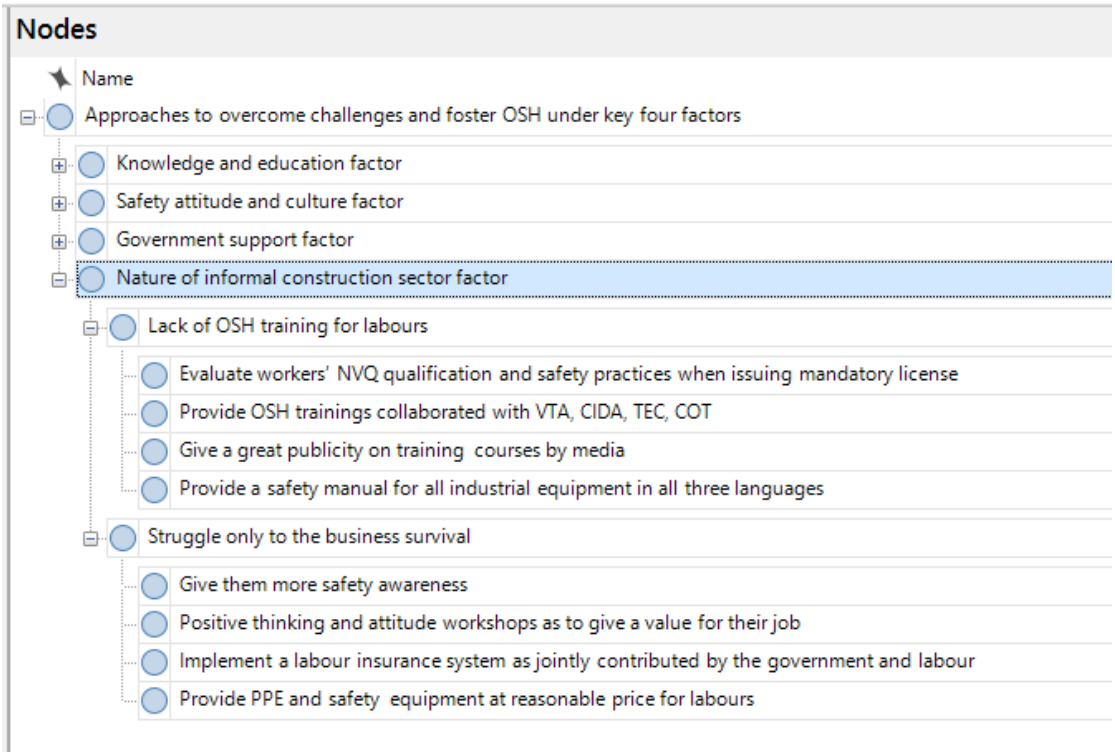

Figure 4. 10: Coding structure of approaches to enhance nature of informal construction sector

4.6.4.1 Lack of OSH training for labours

E6 disclosed that the local workers who apply for any foreign construction jobs as carpenter, mason, plumber, electrician and etc. must minimally get NVQ level 4 certificate with safety related vocational practical. E6 emphasized that "*if foreign countries follow that mandatory policies, Sri Lankan government also can and should implement such compulsory policies in local levels*". Similarly, E3 stated that "*if a mandatory license system is introduced, workers' vocational qualification and safety practices can be evaluated in there*".

E2 suggested that vocational training institutes should be more developed for more focusing on OSH related modules and practical with safety professionals. As per E3's view, "*OSH related vocational courses should be more introduced in full-time and part-time basis for both school leavers and industry workers. The courses should be free of charge or on condition to pay after finishing the course with job salary".*

E1 viewed that though there are considerable amount of vocational training courses with safety aspects, the society has not still get the clear understanding of their

importance. E6 disclosed that "*now NAITA is issuing RPL certificates which offered to the applicants by testing and evaluating their vocational skill with safety concerns. Then, if applicants have skills, they don't need to follow a vocational course and can directly apply for evaluation of RPL test. It is same as getting driving licenses only with a written exam and practical trial without participating to leaners' sessions*". E3 and E6 revealed that there are some vocational training courses in Sri Lanka which gives even some small payments with meals to the trainee and some courses even freely provide the tool kit related to safe practices in trainee's field. As per their views, "*but, still there is a lack of trainees in such courses. That may be because there is no mandatory rule to follow a training course and people are not much aware about these courses*". Therefore, media publicity should be given about these courses by relevant institutes. E2 stated that a safety manual should be provided with all industrial equipment and tools in all three languages as Sinhala, Tamil and English.

4.6.4.2 Struggle only to the business survival

E1, E2 and E3 stated that informal construction workers do not have much awareness on why safety is important in their occupation. E4 expressed that "*if the workers have no proper training and start the job due to family background or their poor social status, they have never practiced or even not aware on safety precautions to follow up during construction work*". Thus, a huge awareness should be given regarding what is OSH and what are the safety methods they can follow. E5 suggested that "*there should be village level workshops on construction related safety practices by focusing on positive thinking and attitudes of workers as to give a value for their job. Workers should feel their valuable requirement to the country and that's why they should follow safety precautions at work*". E4 emphasized that the relevant construction related authorities in national level, provincial level or municipal level should take the responsibility of giving awareness to informal construction workers.

E3 suggested to implement an insurance system for individual labours as the premium is jointly paid by the government and the labour. E2 disclosed that "*it needs to introduce some discount facility for safety equipment*". E3 discovered that "*there are no much safety equipment available in local shops and their prices also are high at*

least more than Rs. 5,000". Thus, E3 suggested that Labour Department, CIDA or UDA can involve with this and provide safety equipment for reasonable prices and they should be in good quality as well. Further, such authorities can carry the idea of implementing OSH in Sri Lankan informal construction sector with their proposals.

4.6 Discussion

As per the findings gathered through expert interviews, the probable approaches to foster OSH in Sri Lankan informal construction sector was recommended under 9 variables of 4 key factors extracted through the analysis. A summary of key recommendations has been indicated in Figure 4.10. Accordingly, the Sri Lankan government should play the key role by providing guidance and support to implement OSH in informal construction sector and the authority should be delegated to relevant government bodies as Department of Labour, CIDA and UDA. The key obligations of each government body has been highlighted in the figure. On the other hand, there are key obligations fulfilled by individual labours and clients in informal construction sector. Thus, this is not a single party's responsibility and everyone has to play a significant role to foster OSH in Sri Lankan informal construction sector.

Focusing on above approaches and fostering OSH in informal construction sector is vital for Sri Lanka as many countries have already initiated those approaches in globally as discovered in section 2.6. Accordingly, Sri Lanka should more focus on Decent Work Agenda adopted by the ILO (ILO, 2009) to encourage the safety of informal construction sector. As explored by the ILO (2015), the countries as USA, UK, Germany and Ireland have followed several strategies to support labour inspections and safety awareness campaigns covering informal construction sector. The UK has implemented a national license system to cover individual workers in informal sector (ILO, 2015). The Brazil and Thailand try to enhance OSH in their informal sector with clinical assistance, safety inspections and health insurance (National Academies of Sciences, Engineering, and Medicine, 2016). Further, Vietnam and Indonesia have developed their law system as to cover informal sector of the country. Thus, when compared with these countries, Sri Lanka is lagging behind

and directing to foster OSH is urgent in order to upgrade the informal construction sector of Sri Lanka.

4.7 Chapter Summary

Based on the findings of questionnaire survey, major hazards in Sri Lankan informal construction sector were investigated. Subsequently, twelve challenges could be extracted as the most critical challenges to eliminate above hazards and they were further categorized under four key factors as Knowledge and education, Safety attitude and culture, Government support and Nature of informal construction sector. The recommendations of probable approaches to enhance OSH by mitigating the identified challenges were obtained through expert survey and analysed under above four factors. Ultimately, the summary of key recommendations to foster OSH in informal construction sector of Sri Lanka were presented in Figure 4.10.

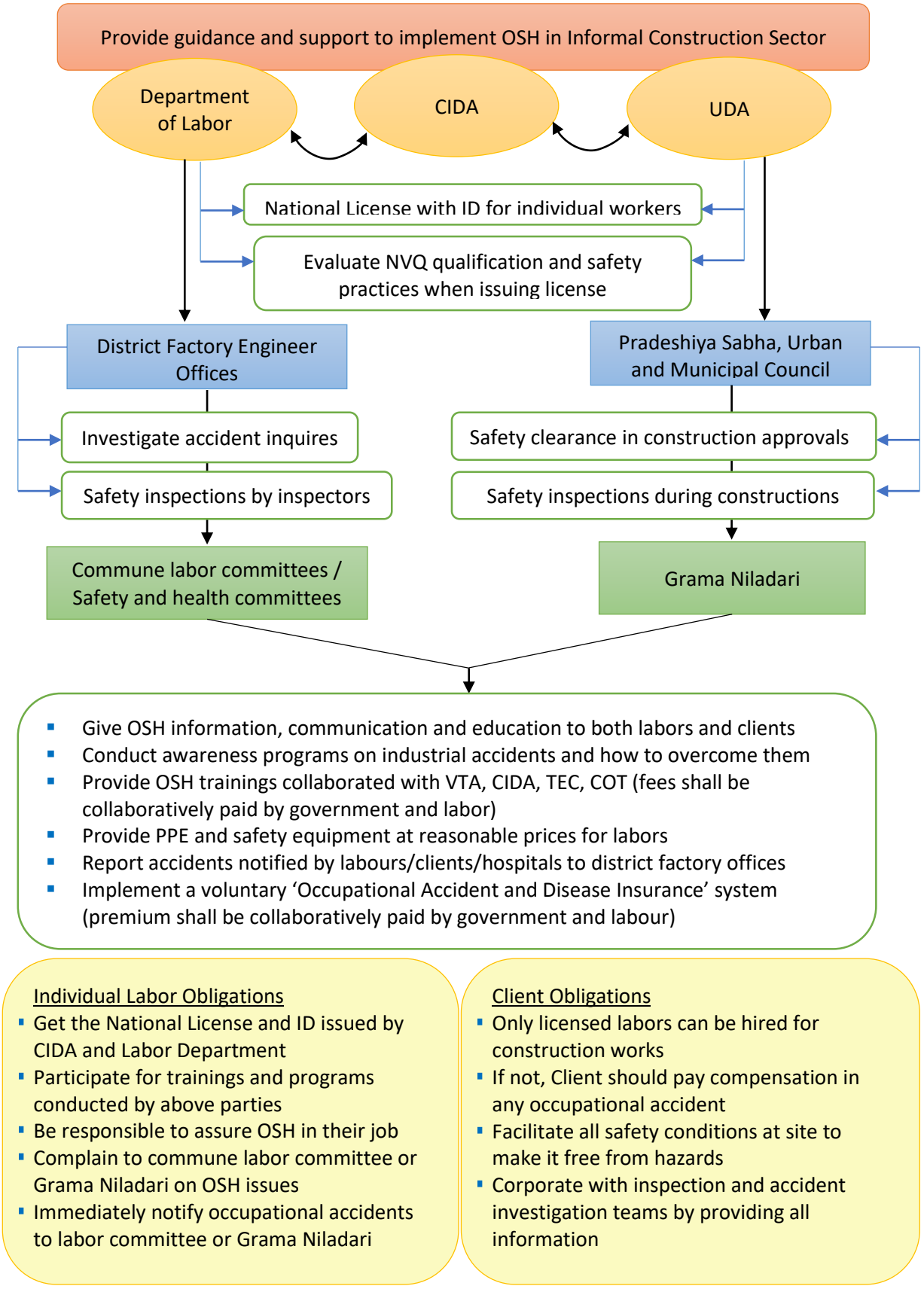

Figure 4.11: Recommendations to foster OSH in informal construction sector of Sri Lanka

CHAPTER 5

5.0 CONCLUSION AND RECOMMENDATION

5.1 Introduction

While the previous chapter analysed the findings from the study, this chapter discusses the conclusions that were drawn for the whole research. In order to provide a clear understanding about the research, the key findings in each phases are summarized for drawing conclusions which assisted to achieve the research aim. Eventually, the contribution of the research for knowledge and for construction industry is discussed with further research avenues.

5.2 Conclusions

Based on the research problem, this study was aimed to foster OSH in informal construction sector of Sri Lanka. In order to achieve the aim, studying informal construction sector in worldwide and Sri Lankan contexts was identified as the first objective while investigating the hazards in Sri Lankan informal construction sector as the second objective. Then, as the third objective, it was examined the challenges to eliminate above hazards in Sri Lankan informal construction sector. With fulfilment of fourth objective, it was directed for the final objective in where it was recommended the probable approaches to mitigate existing challenges in order to foster OSH in informal construction sector of Sri Lanka. A mixed method research approach was adopted with both questionnaire survey and semi structured interview. The questionnaire was distributed among 125 skilled/unskilled labours and technical staff with NVQ qualification from which returned 102 responses. The interviews were conducted with seven professionals in local/foreign construction industry and local regulatory bodies. The findings were analysed by using descriptive analysis, one sample T-Test, factor analysis and code-based content analysis techniques.

5.2.1 Summery of Key Findings

Objective 1: Identify informal construction sector in worldwide and Sri Lankan contexts

Though there were lack of literature regarding informal sector in Sri Lankan level, there were considerable literature published internationally. Based on them, informal workers perform entirely legal tasks while getting payments, but not governed by any labour legislation. Besides, most of them have no formal contracts, social service benefits and leave entitlements. Among all informal sectors, informal construction sector plays a vital role in countries' economy afterward the agriculture sector. The informal construction sector can be defined as a segment which comprises with informal enterprises and informal workers mostly in self-employed or small-scale who perform construction activities with no formal contracts and labour legislations.

However, the highest number of informal workers are from developing and emerging countries. In Sri Lankan context, over 60% of employments are engaging in informal sector which exceeding whole formal sector. When considering the worldwide and Sri Lankan contexts of informal construction sectors, it was explored that the percentage of informal construction workers is increasing worldwide. While the agriculture and fishery are the highest informal sectors in Sri Lanka, the second highest is the construction industry.

Objective 2: Investigate the hazards in Sri Lankan informal construction sector

The literature found a list of hazards in informal construction sector (refer Table 2.2) and the highest available hazards in Sri Lankan context were extracted through analysing the results from questionnaire. Falling from height and ladder/scaffolding work with slippage and breakage were identified as the most common hazards in Sri Lankan informal construction sector. Plant, machinery and tool usage, dust, fumes, gas, chemical hazards, ergonomic hazards and psychological hazards were identified as other most common hazards.

Objective 3: Examine the challenges to eliminate hazards in Sri Lankan informal constructions

Literature explored the existing challenges under seven main headings as financial challenges, time challenges, knowledge/skills challenges, misconception and poor attitude challenges, cultural challenges, regulatory challenges and industrial challenges. The one sample T-Test of questionnaire survey was extracted twelve critical challenges which exceeded critical T Value of 1.96 with high significant level of low p-value (< 0.05) (refer Table 4.9). Those twelve challenges were further analysed with exploratory factor analysis to categorize them under specific factors. As the output, four factors were explored as Knowledge and education, Safety attitude and culture, Government support and Nature of informal construction sector.

Objective 4: Recommend probable approaches to mitigate challenges in order to foster OSH in informal construction sector of Sri Lanka

This objective was achieved through the expert opinion survey. Accordingly, it could be identified the severity of each challenge in practical context and the various approaches to mitigate them under extracted factors.

- When considering the findings under knowledge and educational factor, most of the experts viewed it as the major challenge for implementing OSH in Sri Lankan informal construction sector. Further, they revealed that financial problem is not a huge challenge for informal construction workers as many people think and lacking awareness and education is the main problem. As the key approaches to mitigate this challenge, it was recommended to implement strict rules for both labour and client sides, provide OSH information, communication, awareness and education in village level, include occupational safety related subjects in school and college syllabus, aware the labours and clients on occupational accidents and how to overcome and provide OSH training for individual labours.

- Under the safety attitude and cultural factor, many experts' opinion was that Sri Lanka has still not built up with a good safety culture and peoples' attitude should be more developed on occupational safety when compared with many foreign

countries. Further, they viewed that while giving awareness and education under previous factor, the major thing to be done to develop a safety culture is implementing mandatory rules. The recommendations to mitigate this challenge were implementing strict rules for both labour and client sides, inspecting the sites by safety inspectors, checking safety clearance when giving construction approval by the relevant body and conducting inquiry for every reported accident.

- Most of experts identified the government support factor as another major challenge as the legal enforcement is very low to improve OSH in informal construction sector of Sri Lanka. It was recommended to amend the OSH Act to cover the informal sector, introduce a mandatory national license system with ID for every individual labour, empower Labour Department, CIDA and UDA to provide guidance and support, implement commune labour committees and Grama Niladari to communicate the OSH practices in village level and report accidents to relevant government body. Further, the labours should gather in community level and raise their problems while Media should highlight them.

- Nature of informal construction sector is another identified factor and many experts emphasized the weakness of informal construction workers as there is no much cooperation among them to raise their problems as unions or groups and they are not stable at the same construction occupation as farmers or fishermen. The recommendations were given to give more OSH trainings collaborated with VTA, CIDA, TEC and COT while giving a great publicity, evaluate workers' NVQ qualification and safety practices when issuing mandatory license, give more safety awareness to individual labours with positive thinking workshops to give a value for their job and implement a labour insurance system partially contributed by the government. Further, PPE and safety equipment can be provided for reasonable prices and a safety manual should be there for all industrial equipment in all three languages.

Accordingly, the probable approaches for identified challenges were recommended by fulfilling the final objective of the research. Further, the experts emphasized that everyone as the government, labour and client have a significant role in the OSH

movement of Sri Lankan informal construction sector. Ultimately all these findings were illustrated indicating the recommended approaches in order to accomplish the final aim of the research (Refer Figure 4.10).

5.3 Contribution for knowledge and implications to Construction Industry

This research contributes to the knowledge by recommending probable approaches to foster OSH in informal construction sector of Sri Lanka by overcoming the existing challenges. Further, this research expanded the scope of OSH in Sri Lankan informal construction sector and created new research directions.

Informal construction sector plays a vital role in the development of Sri Lankan economy by representing over 60% of Sri Lankan labour force. On the other hand, hazards are frequently higher due to the unstructured nature of informal construction sector and it unacceptably leads to high risks with heavy losses of life and property. Thus, fostering OSH in informal construction sector of Sri Lanka is a significant necessity to ensure the wellbeing of people and the country. Therefore, this research contributes to the construction industry and the Sri Lankan economy by suggesting approaches to follow for the stakeholders including local Government, individual labours and clients in order to enhance OSH practices while reducing occupational accidents in Sri Lankan informal construction sector.

5.4 Further Research

This research can be forwarded for following directions as further research.

- The recommended approaches to overcome the existing challenges in order to foster OSH in Sri Lankan informal construction sector can be practically validated with a case study approach and can be conducted a detailed study on the applicability of those proposed approaches.
- A study can be conducted on the role of the government in fostering OSH in Sri Lankan informal sector by proposing an amended Act by comparing with other countries who have focused on this sector.
- The same study can be developed for the agricultural sector and fishery industry which are the other main informal sectors in Sri Lanka.

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APPENDIX A: QUESTIONNAIRE

Fostering OSH in Informal Construction Sector of Sri Lanka:

Challenges and Approaches

I am a postgraduate student of University of Moratuwa and the sole purpose of this Questionnaire is to collect data for my final year research. By this, it focusses on identifying the accidents in informal construction sites of Sri Lanka while examine the major challenges towards OSH in local Informal Construction Sector. It is assured that, all the respondents will be kept confidential and their actual names will not be revealed in this report or any other document relating to this study.

Thank you in advance for participating in this study.

Researcher:

R. Thalpage,
M.Sc in Occupational Safety and Health Management (reading),
Department of Building Economics
University of Moratuwa

Section 1: General Information

1.1 Type of the Participant

Skilled Labour ☐

UnSkilled Labour ☐

Other - Mention ----------

1.2 Services provided by you:

1.3 How much of experience you have in above designation (Age):

Section 2: Identifying hazards

2.1 Please tick the hazards in your construction site ($\surd$)

Physical (Hazards from high noise, high light, high temperature, high vibration, high radiation)	
Asbestos usage	
Ionizing radiation (Hazards from welding)	
Chemical (Hazards from Bitumen, paints, acids, cement, silica sand)	
Contaminated land and materials (Hazards from old buildings)	
Hazardous substances (Hazards from dust, fumes, gas work)	
Hazards from Vibratory tools	
Compressed air environment	
Environmental with limited lighting	
Hazards due to Poor housekeeping	
Hazards due to Ladder/scaffolding work (slippage and breakages)	
Hazards from Lifting, carrying or moving heavy tools or materials	
Hazards from Plant and machinery, tool usage	
Hazards from Fire and emergency	
Hazards due to Excavating in deep trenches	
Hazards due to Workers falling from height	
Hazards due to Electric shocks	
Ergonomical (Hazards from Wrong postures, repetitive movements)	
Psychological (Hazards from mental stress, overwork, work pressure, long shift hours, night duty, deadlines, poor communication, repetitive work)	
Biological (Hazards from Diseases from bacteria, virus, food poisoning)	

2.1 Please mention if any additional hazards in your construction site that listed above.

Section 3: Identifying Challenges towards OSH

2.1 Please Circle the correct numeric response for the challenges towards OSH in your sector

Barrier	Survey Scale: 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5-Strongly Agree				
Financial Challenges					
Can't purchase Personal Protective Equipment (PPE)	1	2	3	4	5
Instability nature of informal sector	1	2	3	4	5
Most informal construction companies are small scale	1	2	3	4	5
Struggle only to the business survival	1	2	3	4	5
Time Challenges					
Benefits from safety can't be noticeable in short term	1	2	3	4	5
Tight project deadlines	1	2	3	4	5
Knowledge/Skill Challenges					
lack of OSH training for labours	1	2	3	4	5
Lack of safety education from schools and colleges	1	2	3	4	5
Lack of safety guidelines at construction sites	1	2	3	4	5
Lack of awareness on safety related activities	1	2	3	4	5
Little knowledge on OSH legislation	1	2	3	4	5
Lack of idea on why safety is important	1	2	3	4	5
Misconceptions and poor attitude Challenges					
Underestimate the safety risk	1	2	3	4	5
Safety is the responsibility of one individual person	1	2	3	4	5
Safety regulations are too complex and unrealistic	1	2	3	4	5
Safety cost is too high compared to benefits	1	2	3	4	5
Overconfident of workers	1	2	3	4	5

Believe in luck and I am not in danger	1	2	3	4	5
Cultural Challenges					
No audits for safety	1	2	3	4	5
Safety is employees' responsibility workers themselves	1	2	3	4	5
Poor social status of workers	1	2	3	4	5
Regulatory Challenges					
Inadequate OSH policy	1	2	3	4	5
Lack of OSH legislations by the government	1	2	3	4	5
Neglecting informal sector by relevant government bodies	1	2	3	4	5
Lack of uniformity in construction OSH regulations	1	2	3	4	5
Difficulties to follow strict and complex legislation	1	2	3	4	5
Lack of technical support by control authorities	1	2	3	4	5
Industrial Challenges					
Competitive tendering and selecting the lowest bidder	1	2	3	4	5
Cost cutting practices by client	1	2	3	4	5
Lack of accident reporting system in informal sector	1	2	3	4	5
Clients more focus on getting the job done than safety	1	2	3	4	5
Difficulty in prior planning of OSH activities	1	2	3	4	5
Large number of labour force involvement	1	2	3	4	5
High number of small scale sub-contractors involvement	1	2	3	4	5
Workers are daily or contract basis and not permanent	1	2	3	4	5
Insufficient availability of skilled labourers	1	2	3	4	5
Lack of effective cooperation between informal workers	1	2	3	4	5

2.2 Mention if any additional challenges for the OSH in your Sector that you have identified.

APPENDIX B: INTERVIEW GUIDELINE

Fostering OSH in Informal Construction Sector of Sri Lanka:

Challenges and Approaches

I am a postgraduate student of University of Moratuwa and the sole purpose of this Interview is to collect data for my final year research. By this, it focusses on identifying the probable approaches to overcome the challenges for fostering OSH in informal construction sector of Sri Lanka. It is assured that, all the respondents will be kept confidential and their actual names will not be revealed in this report or any other document relating to this study.

Thank you in advance for participating in this study.

Researcher:

R. Thalpage,
M.Sc in Occupational Safety and Health Management (reading),
Department of Building Economics
University of Moratuwa

Section 1: Details about the interviewee

Date:	Time:	Duration:
Name of the Organization : Designation :		
Contact Information Telephone :	Email :	

Section 2: Proposals for fostering OSH in informal construction sector of Sri Lanka by mitigating the existing challenges

Knowledge and educational challenges

In here, Clients more focus on getting job done than safety, Lack of safety education from schools and colleges and Underestimate the safety risk were identified.

1. When compared with other countries, the local clients are not much concern on safety and what they want is to getting job done as much as quickly. How can we overcome this attitude of local clients?

---

2. What are your proposals to give more occupational safety related education from schools and colleges?

---

3. How to avoid the underestimating of safety risk by informal workers?

Poor attitude and cultural challenges

In here, Overconfidence of workers and No audits for safety were identified.

4. How can we minimize the overconfident of informal construction workers on safety?

---

5. How to implement a safety audit system for local informal construction sector?

Lacking government support challenges

In here, Lack of OSH legislations by government and Neglecting informal sector by relevant government bodies

6. Do you think that OSH legislations for local informal construction sector is sufficient? If not how to overcome this challenge?

---

7. It seems like the informal construction sector has been neglected by relevant government bodies. How to overcome this?

Nature of informal sector challenges

In here, Lack of OSH training for labours and Struggle only to the business survival were identified.

8. What are your proposals to give more OSH training for informal labours?

---

9. Though there are vocational training courses in Sri Lanka, still the availability of skilled labours are not sufficient. How to overcome this?

---

10. Most informal workers are struggling only to the business survival in their day today lives. How to give them a feeling to more concern on their safety?

APPENDIX C: SAMPLE INTERVIEW TRANSCRIPT

Fostering OSH in Informal Construction Sector of Sri Lanka:

Challenges and Approaches

I am a postgraduate student of University of Moratuwa and the sole purpose of this Interview is to collect data for my final year research. By this, it focusses on identifying the probable approaches to overcome the challenges for fostering OSH in informal construction sector of Sri Lanka. It is assured that, all the respondents will be kept confidential and their actual names will not be revealed in this report or any other document relating to this study.

Thank you in advance for participating in this study.

Researcher:

R. Thalpage,
M.Sc in Occupational Safety and Health Management (reading),
Department of Building Economics
University of Moratuwa

Section 1: Details about the interviewee

Date:	Time:	Duration:
Specialized field : Local and UK Constructions Designation : Contract Administrator/Health, Safety and Environmental Manager		
Contact Information Telephone :		Email :

Section 2: Proposals for fostering OSH in informal construction sector of Sri Lanka by mitigating the existing challenges

Knowledge and educational challenges

In here, Clients more focus on getting job done than safety, Lack of safety education from schools and colleges and Underestimate the safety risk were identified.

1. When compared with other countries, the local clients are not much concern on safety and what they want is to getting job done as much as quickly. How can we overcome this attitude of local clients?

   It is needed to implement rules as only licensed labours can be hired by clients for their construction work. Then, clients are checking the labours' occupational and safety license before assuming any work for them. It will be a necessity to labours as well to get license as much as quick. Further there should have regular visits by safety inspectors and implement a fine system for client if safety inspectors found any safety faults at site. Then clients tend to assure the safety of labours at their construction sites.

2. What are your proposals to give more occupational safety related education from schools and colleges?

   Several safety-related components have already included to the first few grades of the school curriculum. I*t is appropriate to include* OSH *related sections* f*or all grades up to Advanced Level*. *Further it is very important to include relevant OSH sections to all higher education curriculums such as Technical CollegeS and Higher national education institutes.*

3. How to avoid the underestimating of safety risk by informal workers?

   The knowledge should be periodically updated in relevant field. Induction training with practical examples should be provided and vocational training with safety practices should be a mandatory requirement for issuing the working license for labours. Additionally, it is necessary to implement and maintain a good communication system among informal construction works regarding frequent accidents in the construction sector sue to underestimating the safety.

Poor attitude and cultural challenges

In here, Overconfidence of workers and No audits for safety were identified.

4. How can we minimize the overconfident of informal construction workers on safety?

   An occupational and safety related license system can be introduced by the government and all workers who are involving with construction activities must get that license. There is a certification and license system in UK as CSCS and NI number for all construction workers in even individual or domestic level. Further the labours will give a payment bill to the client after finishing their work. Thus, though they are informal workers, they do their occupation in professional level.

5. How to implement a safety audit system for local informal construction sector?

   There should be safety inspectors appointed by government to check the safety precautions at construction sites. In Sri Lanka, there are Dengue inspectors to check the cleanliness of lands and even construction sites are inspected by them and order some fine to the owner of land if there is issue. At same, safety practices of construction work at domestic level can be inspected by safety inspectors and it is already practicing some foreign countries in where safety inspectors frequently check the construction work nearly twice per week.

Lacking government support challenges

In here, Lack of OSH legislations by government and Neglecting informal sector by relevant government bodies

6. Do you think that OSH legislations for local informal construction sector is sufficient? If not how to overcome this challenge?

   When compared with other most countries, Sri Lankan government support and legal enforcement is very low to improve OSH in informal construction sector. Existing OSH Legislations are not properly covered the informal construction sector and they can be amended to comply the requirements. There is a license system in UK as CSCS which gives to individual construction workers based on their vocational and safety qualification and all construction workers are mandatory to have it. It is better to have a mandatory rule as every worker or 3rd

party who faced with an injury or accident during construction should report to relevant commune authority in order to get the compensation.

7. It seems like the informal construction sector has been neglected by relevant government bodies. How to overcome this?

   Relevant local government bodies as CIDA, UDA and Labour Department should be empowered to support and guide the informal construction sector. There should be enough human resources in those government bodies to supervise and monitor the informal construction sites. Further, it needs to full fill the regulations and amendments of law to comply with the requirement.

Nature of informal sector challenges

In here, Lack of OSH training for labours and Struggle only to the business survival were identified.

8. What are your proposals to give more OSH training for informal labours?

   OSH related vocational courses should be more introduced in full-time and part-time basis for both school leavers and industry workers. More training facilities can be provided by government institutes as VTA, NAITA, CIDA, COT and TEC. The courses should be free of charge or on condition to pay after finishing the course with job salary.

9. Though there are vocational training courses in Sri Lanka, still the availability of skilled labours are not sufficient. How to overcome this?

   I agree with that because there are some vocational training courses in Sri Lanka which gives even some small payments with meals to the trainee and some courses even freely provide the tool kit related to safe practices in trainee's field. But, still there is a lack of trainees in such courses. That may be because there is no mandatory rule to follow a training course and people are not much aware about these courses. So, regulations and communication should be more developed.

10. Most informal workers are struggling only to the business survival in their day today lives. How to give them a feeling to more concern on their safety?

    Informal construction workers do not have much awareness on why safety is important in their occupation. I suggest to implement an insurance system and National Insurance (NI) number for individual labours as the premium is jointly paid by the government and the labour. There are no much safety equipment available in local shops and their prices also are high at least more than Rs. 5,000. So, Labour Department, CIDA or UDA can provide safety equipment for reasonable prices and they should be in good quality as well. Further, such authorities can carry the idea of implementing OSH in Sri Lankan informal construction sector with their proposals.