INVESTIGATION OF OCCUPATIONAL HAZARDS AND ILLNESSES IN THE SRI LANKAN APPAREL SECTOR

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Degree of Master of Science in Occupational Safety and Health Management

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Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science in Occupational Safety and Health Management

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DECLARATION

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Dr. Nayanthara De Silva Date

Dissertation Supervisor

ABSTRACT

The Sri Lankan apparel industry is one of the major industrial export earners in Sri Lanka. It contributed 40% to GDP in the year 2017. This industry is highly labour intensive and has provided more than 300,000 direct employment opportunities in which the majority is trade workers.

The employees in apparel sector are exposed to various occupational hazards knowingly or unknowingly. As a result, many of them suffer from various occupational illnesses during their employment period or even after a certain period of retirement.

This research is a questionnaire survey which was carried out among the industry workers attached to the production sections from medium and large scale garment factories to identify occupational hazards and illnesses in large and medium scale factories in Sri Lanka. 384 employees were selected randomly for this sample, from 25 factories for this survey. Statistical analysis (t-Test) was carried out to find the significant occupational hazards, illnesses and management practices. Nine expert interviews were carried out to explore strategic preventive measures or mitigate the occupational hazards and occupational illnesses in the apparel sector.

This study reveals that the employees in the apparel sector are exposed to occupational hazards such as, production target pressure, quality demand pressure, excessive work hours, fabric dust, inadequate wages and working for a prolonged time in the same posture. The significant illnesses are leg pains and back pains. To overcome these issues the factories are required to implement workplace oriented improvements such as upgrading the work places considering the ergonomic and human factors, establishing quality management systems, planning the production volume according to the physical and psychological capacities of human capital etc. Finally the industry is required to identify occupational illnesses through medical surveillances audits and steps are to be taken for corrective and preventive measures. The people oriented proposals are skills development, professional carrier growth and enhancing the leadership qualities of employees, in order to increase their performance and quality of life.

Findings of this research provide an insight in to the workplaces of medium scale garment factories. These findings will benefit the industry leaders and policy makers in the industrial upgrading and to enhance the skills and quality of life of employees.

Keywords

Hazard, Health, Illness, People, Workplace

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LIST OF ABBREVIATIONS

ACGIH	-	American Conference of Government Industrial Hygiene
BMI	-	Body Mass Index
CSR	-	Corporate Social Responsibility
EDB	-	Export Development Board
ERI	-	Effort Reward Imbalance
GDP	-	Gross Domestic Product
HIRA	-	Hazards Identification and Risk Assessment
HRM	-	Human Resources Manager
HSE	-	Health and Safety Executive
IEQ	-	Indoor Environment Quality
ILO	-	International Labour Organization
JDC	-	Job Demand Control
MSD	-	Musculoskeletal disorders
OSHAS	-	Occupational Safety and Health Assessment Series
PE	-	Participatory Ergonomics
PPE	-	Personal Protective Equipment
SPSS	-	Statistical Package for Social Science
TLV	-	Threshold Limit Value
USD	-	United State Dollar
WHO	-	World Health Organization

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CHAPTER 01

INTRODUCTION

1.1 Chapter Introduction

Garment industry is a recent phenomenon of industrialization in developing countries during the past few decades. A major contribution of the global apparel demand is fulfilled by the low income countries (The World Bank, 2012). The global apparel industry contributes 7% of the industrial production of the world, engaging 14% of the global labour force (Megeid, Hamdi, Hammadi, & Malek, 2011). In 2014 the apparel industry gripped 2% of the world GDP with 24.8 million employees engaged in the industry (Fashion United, 2016). The apparel industry is highly price competitive and has earned three trillion US dollars of global revenue in 2014.

Sri Lankan apparel industry is highly export oriented, and a purely privately owned industry catering to EU and US markets having four characteristics such as high quality, ethical production, current fashion and competitive prices. The apparel industry is the primary foreign exchange earner, accounting to 40% of the total exports, 52% of the industrial product exports and a revenue of over Rs. 692 billion (USD 4675 million) in 2016 (Export Development Board[EDB], 2017). There are 350 garment factories in Sri Lanka in several locations island wide and 300,000 direct employees and 600,000 indirect employees are employed in the industry (Embuldeniya, 2015). The total industrial workforce is 255,386 in Sri Lanka (Department of Census, 2016). That is 33% of the labour force are in the manufacturing sector (U.S. Department of Commerce, 2017).

Textile and apparel is the second largest industry in Sri Lanka. It contributed to 16% of GDP in 2014 with a value of 4.9 billion USD. According to the Factory Industry Production Index, the apparel industry has taken the first place in the rank (Embuldeniya, 2015).

This research is designed to identify the occupational health hazards, prevailing illnesses among the employees and also to identify the involvement of the management to address the occupational hazards and illness in the Sri Lankan apparel sector. The ultimate objective of this research, is addressing the issues found

in the research for a solution framework to mitigate the issues and to design a sustainable work place for the employees in the industry.

1.2 Research Background

A large number of garment workers suffer from various occupational illnesses even when they are young (Mehta, 2012). She further stated that some workers suffered from diseases such as anemia and dysentery but they continue to work while having these illness conditions that affects the productivity and the working life of employees.

Generally, the apparel industry shows that the workers' health issues are linked to the physical and mental hazards. The outcomes will be cardio vascular diseases, muscular skeletal disease, psychological disease and aggressive behaviour while on the job (Landsbergis, 2003). A study carried out among Australian garment workers showed that muscular skeletal disorders, eye strain, exposure to dust related illness and stress related disorders existed in the industry workers (Mayhew & Quinlan, 1999). Another recent study carried out in a Bangladesh apparel industry came up with different kinds of illnesses among workers such as pruritus, common cold, skin allergies, dermatitis, fungal infections, frequent body aches, asthma etc. When the workers are employed in confined workplaces, they generally suffer from diseases like nausea and vomiting, breathing problems, respiratory problems and fainting at the workplace (Tasnim, Rahman, Rahman, & Islam, 2016). In another research finding recently carried out in the Bangladesh apparel industry, showed fourteen types of occupational illnesses which are prevailing among workers, listed as pain in body muscles, complexities which arise from abortion, food poisoning, pruritus, eye strain, neck pain, hepatitis, frequent headache, injuries from cuts, fatigue, common cold, numbness and tingling of fingers and arms, gastric pain and helminthiasis (Ahmed & Islam, 2015).

Based on recent researches held at the free trade zone in Koggala, Sri Lanka, it was observed that frequent occupational illnesses in the apparel trade employees are muscular skeletal disorders, headaches, respiratory diseases and dermal diseases such as rashes, lesions, infections etc. (De Silva, Lombardo, Lipscomb, Grad, & Ostbye, 2013).

According to the International Labour Organization (ILO, 2010) the factors related to occupational illnesses would be exposure to chemical agents, physical agents, biological and infectious agents and the results would be respiratory diseases, skin diseases, muscular skeletal diseases, mental and behaviour disorders, occupational cancer and other diseases. There is a wide array of data sources to identify occupational illnesses such as, medical diagnostic test reports, questioning of health related issues from employees and surveying of occupational conditions, jobs and health histories (Baker, Melius, & Millar, 1988).

Garment workers are paid the lowest salary in the world. Lack of alternative employment options combined with widespread poverty; drive these women to accept low wage jobs. Therefore, they are poorly paid and employed in workplaces that fail to adhere to the most basic standards of life needs (Khanam,2010). Owners of the industry say that they pay the low wages to their employees due to low profits (Ascloy, Dent, & Haan, 2004). On average, workers are paid approximately Rs 15,000 ($140 US dollars) per month but they have to work long work hours per week, more than 45.5 hours regularly and overtime due to production demand (De Silva et.al., 2013).

Sri Lankan apparel manufacturers practice as ethical manufacturers in order to comply with ethical working conditions, free of child labour, free of forced labour, free of discrimination and free of sweatshop (EDB, 2017). A high compliance level is maintained in the industry to achieve international labour standards and environment standards to meet the buyers and consumers' ethical standard (Kelegama, 2005). Low cost and fast production are the main characteristics of the apparel industry, which relies on cheap labour and low production costs in order to compete with other competitors in the industry (Khanam,2010).

The aim of occupational health study is the promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations (Khan et al., 2015).

1.3 Problem Statement

The apparel and textile industry is the second largest industry in Sri Lanka (Embuldeniya, 2015) the majority of the workforce in this industry are females

(Perry, Wood, & Fernie, 2014).This industry is not only limited to the free trade zone but also has spread over various parts of the country.

The employees in the industry have a higher degree of possibility to get exposed to various hazards such as cotton dust, chemical inhalation, having to use machinery all day long, discomfort due to heat & poor ventilation caused by poor work place design, poor lighting, mismatch of people versus machines and repetitive motion. Similarly, they are exposed to psychological and socio economic hazards because they are being paid a low salary, have to work long hours to complete targets, constant work stress due to demands for quality and hard to achieve production targets (Thatshayini & Rajini, 2018) and (Ahmed & Islam, 2015). Majority of the employees in the industry are in a low level of education status (De Silva, Lombardo, Lipscomb, Grad, & Ostbye, 2013). In addition to that they have a poor living status and a low income level (Hancock, Carastathis, Georgiou, & Oliveira, 2015).

Many researches have been conducted in the apparel industry to address various production related problems and quality issues. However, very few researches could be found related to employees' occupational illnesses in the context of Sri Lankan apparel industry. But other developing countries such as Thailand, India, Pakistan and Bangladesh had conducted many researches for health and safety concerns among the employees in the trade.

This research is focused on identifying the occupational illnesses prevalent in the Sri Lankan apparel industry. It is fruitful and beneficial to conduct such research to help improve the quality of life of the employees in the industry and to improve their economic status as well as the economy of the country in general, because the employees make a significant contribution to the GDP of Sri Lanka.

The research framework helped to identify the root causes of occupational illnesses among the apparel industry workers and how to prevent employees being victims of the causes leading to these illnesses. Therefore, this research is carried out with this objective, using primary data collection and a survey questionnaire procedure. This is convenient to have access to relevant data rather than searching for reports of medical check-ups and medical consultancy judgments.

1.4 Aim and Objectives

1.4.1 Aim

The aim of the study is to investigate occupational illnesses and to prepare a strategic framework to enhance the health environment in the apparel industry by reducing the occupational hazards in the Sri Lankan apparel industry.

1.4.2 Objectives

1) Identify occupational illnesses among workers and related health hazards in the apparel industry in Sri Lanka.
2) Analyze the causes for those occupational illnesses and related health hazards.
3) Develop a strategic framework to reduce occupational illnesses of employees by controlling the hazards in the apparel industry.

1.5 Methodology

This is a survey-based research. In this survey, qualitative type data is converted into quantitative type using Likert scale.

The questionnaire survey comprises of four parts, which are demography information, type of health hazards that the employees are exposed to during employment, type of health issues that the employees are subjected to and the management/ welfare practices that the entrepreneurs have taken to mitigate health and safety issues. Further, interviews of experts were conducted to explore the strategic measures to enhance the health standards of the workers.

Statistical analysis has been used to identify the significant occupational hazards and illnesses. Single sample T-test analysis was carried out using SPSS software. The solution for significant health issues and hazards were taken from interviews of experts to develop a strategic framework to reduce occupational illness.

1.6 Scope of the Study and Dissertation Outline

This research is focused on purely export oriented, medium and large scale garment factories established in various locations island wide. These factories are included in both the industrial zones and outside zones. All factories are state registered as private limited organizations and all are members of the Sri Lanka Apparel Exports Association.

The research was a questionnaire survey to identify the health hazards, the prevailing health issues among workers and the level of the action by the management taken to mitigate the occupational health issues in the respective organizations.

Only the shop floor employees were selected for this research but the involvement of the management did not occur during the sample selection and the answering procedure of the research questionnaire by employees. The last 2 quarters of the year 2018, was the data collection period.

Occupational health issues were determined based on the employees' experience about their body aches and the related exposures to hazards but medical check-up methods to diagnose illness were not followed due to time and cost constraints in this research. During this study, muscular skeletal disorders, respiratory diseases, eye strain and occupational stress were focused on.

1.7 Chapter Organization

Chapter 1: Research Introduction

Chapter one presents the back ground of the apparel industry in global and local levels and types of occupational illnesses prevailing among employees in the industry. The evaluation of the problem statement, aim and objectives this research, briefing of the methodology that have been used for this research and the scope and the limitations of this research have been included in this chapter.

Chapter 2: Literature Review

Chapter two consists of a literature review mainly focusing on the types of health hazards that persist in the apparel industry, types of health issues that the employees are exposed to due to the relevant occupation and the management practices and welfare facilities to promote the employees' health and safety within the organization. Further, the industrial standard to maintain a healthy and safe workplace were discussed.

Chapter 03: Research Methodology

This chapter indicates the method in which the research was carried out to meet the aim and objectives defined. There are ten sections in this chapter which are sample

population, survey sample, survey questionnaire development, test run, survey questionnaire confirmation, data collection, data analysis and solution frame design.

Chapter 04: Data analysis and findings are included in this chapter.

All the data are primary data. There are 2 types of primary data in this research. The research questionnaire is the first set of data that the collection method used to identify the occupational health hazards, occupational Illness and management practices. Single sample t test was conducted to find the significant issues. The significant outcome provides information to meet the 2nd objective of the research. The significant issues were taken for the expert interviews to formulate the solution framework to meet the 3rd objective of this research.

Chapter 05: This chapter consists of 6 sections beginning with the introduction. The other sections are the conclusion, the implications, the recommendations, and the limitations for further research.

CHAPTER 02

LITERATURE REVIEW

2.1 Introduction

This chapter discusses the important areas that affect the negative impacts related to the wellbeing of the employees of the apparel industry due to their occupations and ways of managing occupational health in their workplaces. There are three main sections in this chapter which provide information about occupational health hazards, occupational illnesses and management of health and safety in the industry. The literatures were mostly extracted from published journals articles, books and web sites. Some are local research articles, and the majority is research articles of foreign countries and local and foreign corporate websites.

2.2 Occupational Health Hazard

The term occupational hazard can be defined as potential to harm individuals' health due to occupation. Occupational health hazards are linked with work environment which could be in single or multiple sections such as, occupational hygiene, occupational psychology, occupational toxicology etc. (Mehta, 2012). According to International Labour Organization (ILO,2014) the factors for occupational illness occurrences are employees' exposure to single or multiple types of hazards such as physical hazards ,chemicals, poor ergonomic conditions at work places, exposure to electromagnetic radiation, high psychological and mental demands leading to stress. This can be further simplified in to three basic health hazards as below,

1) Man and physical, biological, chemical hazards
2) Man and Machines
3) Man and Man (Khan et al., 2015)

The aim of occupational health is providing a safe working environment to protect the workers and improving industrial production (Khan et al., 2015). Kosala, Vilasini, & Gamage, (2011) has stated that unfavourable workplaces lead to employees' fatigue, lack of concentration, accident and ill health.

2.3 Occupational Health Hazard in Apparel Industry

Occupational health hazards in the apparel industry such as, physical hazards are heat, noise and light. The chemical hazards such as allergies and the ergonomic

hazards are awkward posture and biological hazards connected to lack of nutrition (Thatshayini & Rajini, 2018). Psychological hazards are high quality demand, production targets, long working hours and poor socio economic status (Ahmed & Islam, 2015).

2.3.1 Thermal discomfort

The factors related to thermal comfort at work place are comfortable temperature, good air quality and ventilation, appropriate lighting and humidity (Padmini & Venmathi, 2012). Thermal discomfort gives negative health effects (Lan, Wargocki , Wyon , & Lian, 2011). Overcrowded work places, inappropriate machineries and equipment, poor ventilation, could cause uncomfortable temperatures at the workplace (Silpasuwan, Prayomyong, Sujitrat, & Suwan-ampai, 2015). Insufficient ventilation and humid work environment are the causes for dermal diseases such as rashes, fungal infections and allergies (Ahmed & Raihan,2014). Poor Indoor Environment Quality (IEQ) is related to symptoms of sick building syndrome, resulting in respiratory illnesses, which leads to sick leave and ultimately to low productivity (Seppanen & Fisk, 2011).

According to the American Conference of Government Industrial Hygiene (ACGIH), the Threshold Limit Value (TLV) for heat stress as in below table.

Table 2-1 Heat Stress Standard ACGIH for Permissible Threshold Limit Value

Work Load	**Permissible Heat Exposure** (HEALTH (GENERAL PROVISIONS), 1942) Threshold Limit Value The Maximum WBGT temperature level that, all workers who may be repeatedly exposed to an 8 hour workday and a 40 hour work week, daily, without adverse effects on their health		
Work-Rest Regimen	Light	Moderate	Heavy
Temperature	29.5 ^{0}C	26.7 ^{0}C	25.0 ^{0}C

Source: ACGIH- American Conference of Government Industrial Hygiene

2.3.2 Noise Exposure

Noise is physical and psychological health hazards which can be defined as unwanted sound (Stansfeld & Matheson, 2003) that emerges when numerous numbers of sewing machines are being operated at the same time in the production floor (Mehta, 2012). Other noise emitting sources are, ventilation fans, pneumatic machines and fabric cutting machines. According to the ACGIH the TLV of noise is below 85 dBA for 8 hours per day and 40 hours per week. Stansfeld & Matheson(2003) stated that noise intensity, duration of exposure, meaning of noise, frequency and complexity of sound may be factors to response of noise that would cause for hearing disorders and occupational stress.

2.3.3. Exposure to Fabric Dust at Work Place

Fabric dust is a health hazard (Ahmed & Raihan, 2014) which emerges during the cutting process at the cutting section and during the stitching process in sewing lines in apparel factories (Thatshayini & Rajini, 2018). Fabric dust contains different kinds of chemicals, which are used in order to get the desired properties to fabrics as anti-crease, flame resistant, water repellents etc. It also contains anti-soiling agents, antimicrobials, softening agents and natural contaminates such as organic dust, bacteria, endotoxins and moulds. Fabric dust is present in the air during handling, processing and air flowing at workplaces (Phakthongsuk, Sangsupawanchi, & Musigsigsan, 2007). Inhalation of fabric dust is a risk of negative health effects to employees in the apparel industry (Mayhew & Quinlan, 1999). The impacts in health due to dust exposure are duration (weekly hours) of employment, age, length of employment and factors related to this are, working conditions and the level of dust, quality of breathing air after work, tobacco smoking and Body Mass Index (BMI) (Silpasuwan et al.,2015). The TLV for repairable fabric dust (cotton and synthetic dust) is 0.2mg/m3 as per the ACGIH standards.

2.3.4. Improper Lighting and Fixtures

Improper lighting fixtures or poor placement of lighting arrangements will contribute to neural problems to works in apparel factories (Mehta, 2012). Poor lighting conditions in the work places causes eye strain and headaches that could lead to poor efficiency and accidents due to poor visibility and lack of concentration (Kosala et al., 2011) and (Parimalam, Kamalamma, & Ganguli, 2006). Also too bright lighting causes “Glare effect”, which can lead to headaches and eye strains and is potential to

accidents. Visual comfort could be provided by ensuring uniform and optimum light intensity levels, free from glare, right contrast conditions, right colours in the surrounding area and the absence of stroboscopic effect or intermittent light (ILO, 2011).

Installation of light and fixtures in correct positions will improve the visual comfort as illustrated in figure 2.1 as below, which prevent lighting rays coming directly to human eyes while working.

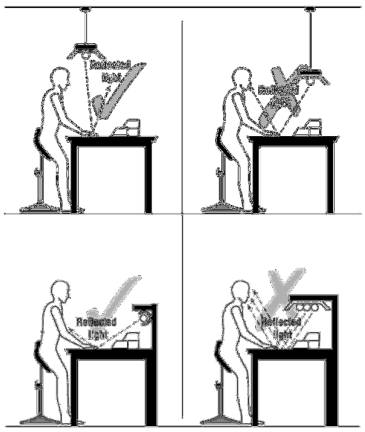

Figure 2.1: Correct Glare Problems

Source: ILO, 2011; Conditions Required for Visual Comfort.

The figure 2.2 shows the recommended lighting intensity with respect to the as per ILO encyclopedia.

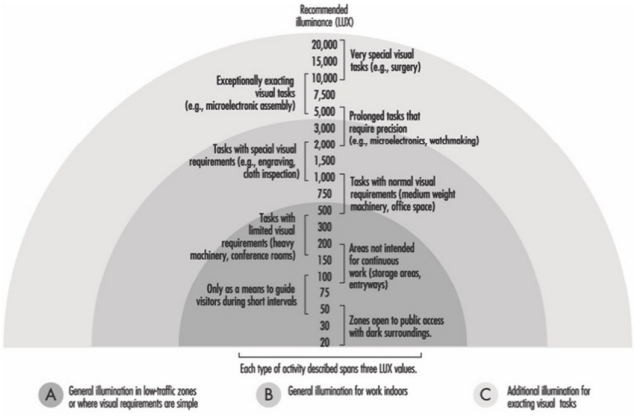

Figure 2.2: Recommended illumination level according to

task- Source ILO Encyclopedia, 2014

2.3.5 Chemical Exposures

Exposure to chemicals is potentially dangerous to health, which has a risk of damaging the organs of the human body. The level of damage depends on several factors such as the chemical type, concentration, quantity, duration of exposure and the media of absorption such as inhalation, dermal contact and ingestion (Tasnim et al., 2016). They further stated that the effects due to chemical exposures are shown after a long time of period from the time of exposure. Sometime effects are shown after 30 to 40 years from prolonged exposure.

Chemicals are added to fabric during the fabric manufacturing process to get desired properties such as anti-crease, water repellent, flame retardant, anti-soiling, softening and antimicrobial (Phakthongsuk et al., 2007). In addition that various types of chemicals are used in the apparel industry for different purposes such as dirt and stain removal from garments during cleaning and the maintenance process of machineries, furniture and buildings.

2.3.6 Ergonomic Hazards

Ergonomics literally means “measurement of work” but this term has a wide subject area. In designing job profiles and equipment, it is important to consider anthropometric measurement of humans to get the best human efficiency (Padmini et al., 2012).Production sections of most of garment factories are not designed to meet ergonomic factors and that could cause back pains of employees (Thatshayini & Rajini, 2018). The below subsections describes the kind of ergonomic hazards which prevail in the apparel industry.

2.3.6.1 Awkward and Steady Posture due to Improper Workplace Design

Workers in the cutting section experience discomfort in the neck, shoulder and back because they have to lean forward over the cutting table to perform their task (Mehta, 2012). She further stated that workers in the sewing section work in awkward postures due to poorly designed furniture, prolonged standing or sitting postures and forward bending, do continuously high repetitive work for long periods of time. Ahmed & Islam,(2015) has stated that improperly designed work places and employees unsafe behaviors are leading factors for awkward postures and such

postures are causes for muscular skeletal illnesses in the apparel sector. Sewing machine operators in the apparel factories are highly exposed to awkward postures and repetitive motions and due to that they suffer from various musculoskeletal disorders (Hoque, Ahmed, Paul, & Parvez, 2015). While cutting, the cutting machine operators hold awkward postures and overreaching postures when cut panels in the middle area of the cutting table Mehta, (2012). Burgel, Lashuay, Israel, & Harrison, (2004) have stated that workers in the apparel industry suffer from muscular skeletal illnesses due to unhealthy postures and movements.

2.3.6.2 Frequent Handling of Heavy Goods

The common production processes in the apparel industry are fabric cutting, stitching and finishing (Kosala et al., 2011). Frequently fabric rolls are manually handled while fabric loading and unloading from stacking pallets or racks, loading and unloading on to the fabric inspection machine and laying the fabric for cutting processes. Fabric roles are heavy and bulky. Heavy fabrics such as denims and twill could not be handled individually. Unloading and stacking are done in a short period of time due to the logistics waiting cost and space constraints. This activity is extremely repetitive and is performed at a high speed.

Mehta,(2012) stated that the repetitive manual work, other heavy work activities in the cutting room are lifting of fabric rolls, layering, bundling and numbering by the employees. These activities cause muscular illnesses among workers.

2.3.6.3 Repetitive and Monotone Tasks

During the sewing process, operators frequently paddle by the right foot and the right knee is used to raise the needle foot and the elbow is elevated for feeding the panels for stitching (Nag, Desai, & Nag, 1992). Ahmed & Islam,(2015) stated that continuous repetitive work are the leading causes for MSDs within the apparel industry. De Silva et al., (2013) stated that the apparel industry employees carryout monotonous jobs for long periods of time that could cause occupational stresses. A study based in India, shows that the workers in the apparel industry were required to undergo standing or sitting in forward bending postures for prolonged periods of time (Mehta, 2012).

2.3.7 Psychological Hazards- Work Stress

The world is fast changing with new technology, economy, social practices and values (Fernando, Selvam, & Bennet, 2010). They further stated that the factors which contribute to job related stress are level of job involvement, job ambiguity, work place culture, inadequate salary and negative work environment. Occupational stress is defined as "the harmful physical and emotional response that occurs when the requirements of the job do not match the capabilities, resources or needs of the worker" (De Silva, Samanmali, & De Silva, 2017). Job related stress leads to work related illnesses in different work places (ILO, 2014). The table below shows the job related stress causing components that are existing in the apparel industry. De Silva et al.(2017) have stated that occupational stress is due to not having job satisfaction, organizational satisfaction, organizational security, organizational commitment, high level of worry and exhaustion. The other connected risk factors for stress are lack of support, lack of recognition, absence of promotions, little or zero job security, less freedom, lack of trust by the management, lack of trust by co-workers and abusive language (Steinisch et al., 2013). The table 2.2 job related stress causing components.

Table 2.2: Job related stress causing components

Work related demand	Interpersonal Resources	Work related values
Physical demand Time pressure Worries about quality failures Exposure to abusive language	Support Recognitions Adequate payment Trust	Job security Promotion prospect Job freedom.

Source: Work stress and hair cortisol levels among workers in a Bangladeshi ready-made garment factory (Steinisch et al., 2014)

2.3.7.1 Production Targets and Quality Demand

Workers in the apparel industry work under negative stress due to high production and quality demand, Fernando et al.(2010) A research carried out in Bangladesh

apparel trade said that the work load and the mental pressure are high among many employees in the industry (Ahmed & Islam, 2015).

Female workers in the apparel industry are exposed to verbal and physical harassment at the workplace (Attanapola, 2004). She further states that the supervisors threaten them even for minor mistakes and for not meeting the production targets. Therefore they have to work even during the rest periods. High workload or demand pressure combined with low control or no decision making power, will increase the risk of psychological strain and physical illnesses (Landsbergis & Janet , 1994). This has been shown in figure 2.3 in below.

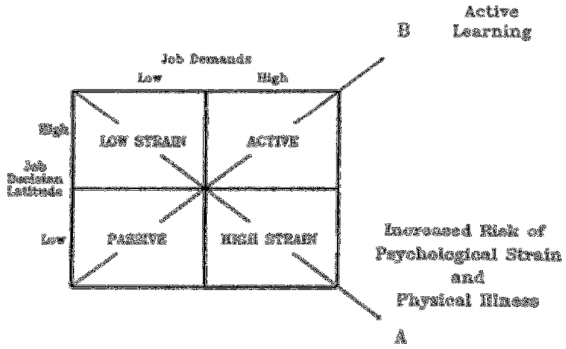

Figure 2.3 Robert Karasek's "job strain" or "job demands-control" model of occupational stress

2.3.8 More Overtime and Inadequate Rest

Workers in the apparel industry work under pressure due to lack of rest breaks, long working hours such as overtime and holiday work, shift work and lack of leave to meet production targets and delivery in time (De Silva et al., 2013). Burgel et al,(2004) stated that workers in the apparel industry work long periods of time during employment in unhealthy postures and movements that causes for muscular skeletal disorders.

2.3.9 Socio Economic Status (SES)

Socio economic status is another factor that would affect the individual health. If the social economic status is in a high level, then the health level will increase proportionately, since they have more spending power for good housing, good meals, medical care, physical activities, good education and access to better work (Wnkleby, Jatulis, Frank, & Fortmann, 1992). The SES measuring parameters are education, income and occupation or a combination of these. Kahn et al,.(2015)

stated that the employees are at a high risk of work related injuries, chronic diseases, occupational stresses due to low education, lack of experience of work processes and inadequate training.

2.3.9.1. Inadequate Salaries

In general, workers in the apparel industry are in lower Socioeconomic Status (SES), because they are paid low salaries which are just enough to maintain only a basic living standard and most of them are in a low educational level (Attanapola, 2004). The average living standard of a country or area is determined as per capita income. The average cost of living of an individual and family is Rs 25100 and Rs.42700 respectively in Sri Lanka (Trade Economics, 2019).

2.4. Occupational Illness in Apparel Sector

Common work related illnesses observed in the apparel industry are respiratory diseases, dermal diseases, muscular skeletal disorders, psychological stress (Tasnim et al., 2016). Ahmed & Islam(2015) stated that common occupational health illness in the apparel indusry are pain in body muscles, food poisoning, pruritus, eye strain, neck pain, hepatitis, frequent headache, fatigue, common cold, numbness and tingling of fingers and arms, gastric pain and helminthiasis. Below subsections of this chapter describes such diseases which are related with the apparel industry.

2.4.1 Respiratory Diseases

Inhalation of either synthetic or natural fiber lint or dust causes respiratory tract disorders, which will affect the work efficiency and affect the productivity negatively (Silpasuwan et al., 2015). Fabric dust that emerges during the cutting process is possible to enter the human body through the respiratory tract and, that may be the cause of byssinosis (Mehta, 2012). Byssinosis is a respiratory disease that is caused by prolonged inhalation of cotton fiber dust (Silpasuwan et al., 2015). They further state that acute exposure to cotton dust can show respiratory symptoms such as chest tightness, bronchoconstriction, and dyspnoea. Ahmed & Islam(2015) stated that respiratory illness such as asthma can be seen among the workers in the apparel industry. The signs and symptoms of respiratory diseases are, cough and phlegm, wheezing, breathlessness, chest colds, and the recurrence of past respiratory illnesses (Tasnim et al., 2016). Seppanen & Fisk, 2011 have stated that the poor indoor air

quality related to respiratory illnesses, which leads to sick leave and ultimately to low productivity.

2.4.2 Skin Diseases

Job-related dermatitis is an irritant reaction to workplace inflammatory material (Ai-Lean & Maibach, 2000). Skin diseases such as rashes and fungus are prevalent among workers in the apparel industry due to dermal contact of irritant substances (Mehta, 2012) and (Silpasuwan et al., 2015). Such substances are physical, chemical or biological material (ILO, 2010). Another research says skin rashes are more prevalent in overcrowded work places in garment factories (Attanapola, 2004). Workers in the apparel industry experience fungal infections and dermatitis due to prolonged exposure to chemicals (Tasnim et al.,2016). Ahmed & Islam,(2015) has stated that skin illness such as skin allergies, dermatitis, fungal infections are significant among apparel trade workers due to poor indoor air quality of factories.

2.4.3 Hearing Disorders

Expose to high noise intensity between 85 to 90 dBA within the life time in industrial settings will cause progressive hearing loss or lift the threshold of hearing sensitivity (ILO, 2010). Mehta (2012) stated that prolonged exposure to high noise will cause hearing impairment issues with workers in the apparel factories.

2.4.4 Visual Discomfort and Headache

High focus on fine work, good quality and production demand are the expectations from the employees in the apparel industry. Hence, employees are required to keep their eyes focused, during cutting, stitching, finishing, matching and checking activities to meet the job demands (Padmini et.al., 2012). Quality checking employees suffer eye related problems such as visual discomfort and headaches due to stress on eyes (Ahmed & Raihan, 2014).

2.4.5 Venous Disorders Related Symptoms

Some of the risk factors for venous disorders are prolonged standing or sitting, obesity and pregnancy and family history (Heller & Evans, 2015). Venous disorders can be observed as minor sicknesses, but it is possible to develop in to a disabled stage with time (Reina, Krijnen, Boer, & Bruynzeel, 1997). Varicose veins are usually diagnosed by a physical examination by a medical doctor. The treatment type depends on the severity of the disorder (Heller et al., 2015).

Sewing machine operators carryout their work in a sitting posture and the rest of the workers in a standing posture for long hours during their work shifts. Prolonged sitting postures, causes strain in the legs and prolonged standing postures causes compression in the legs (Kosala et al., 2011). Hence employees who do their work in prolonged standing postures complained of discomfort or pain in the veins of their legs, sensations such as aching, tightness, burning, itching, or tingling of the legs, and swelling in the leg. These symptoms are related to varicose veins (Heller & Evans, 2015). Another research article contained the symptoms of disorders of varicose veins, such are feeling a sensation of heaviness in the legs and swelling of the legs and calf cramps while sleeping (Reina et al., 1997).

2.4.6 Muscular Illnesses

Sewing machines operators are in sitting posture for long time periods without rest and break, and the body is inclined forward while sewing. Withstanding for long time periods in this postures cause a cumulative load on the muscular-skeletal structure including the vertebral column. Hence, there is a high prevalence of discomfort and pain in different body parts (Nag et al.,1992). Studies based on garment workers in Australian factories revealed that most of the workers suffered from muscular illness due to continuous work and over use of the body before the recovery from the strain or muscular injuries.

The symptoms of muscular illness are back pain, lumber spine pain, knee pain, hand pain etc. (Mayhew et al., 1999). Their study showed that correlation between work arrangement and muscular injuries such as excessive working height linked with wrist and arm pain, forearm and shoulder pains and thoracic spine pain health issues. As per the study of Parimalam et al., 2006 the prevelance muscular illness in the apparel indusry are epicondylitis, carpal tunnel syndrome, bicapital tendinitis, forearm tendinitis, lower back pain, neck pain, shoulder pain and knee pain.

Older employees who work in high physical demand with high repetitive motions in prolonged work periods are high risk to MSD. They suffer from back aches and pain in the large joints such as the knee and shoulder joints (De Silva et al., 2013). The most common impacts on the body muscles, joints, tendons, ligaments, bones and nerves are awkward postures and high repetitive motions. The monotonous work leads to increased worker fatigue due to continuous handling of loads, prolonged

standing, repetitive movement of both hands and wrists and awkward postures (Mehta, 2012). The wages based on the number of pieces scheme, increase the risk of muscular skeletal injuries among female sewing machine operators compared to the fix wage operators (Johansson, Rask & Stenberg, 2010).

High physiological demands were associated with an increased risk for pain in the upper limbs (Johansson et al., 2010). They further stated that the monotonous repetitive motions lead to back pain and hip pain. Compared to the control group study carried out in the apparel industry showed that neck and shoulder syndromes significant among the sewing machine operators. Diagnoses included cervico-brachial fibromyalgia, rotator cuff syndrome, and cervical syndrome (Burgel et al., 2004). Another risk factor of MSD is heavy load lifting, awkward postures, demographic characteristics and psychological factors (Choobineh, Tabatabaei, Makhtarzadeh, & Saleth, 2007). However MSDs are not fully occupational related, sometimes daily life activities such as sports, house work and social work will give rise to such disorders (Punnett & Wegman, 2004).

2.4.7 Psychological Health Issues

Regular exposure to high noise levels could badly affect the physiological and psychological health (ILO, 2010). Stansfeld et al.(2003) stated that exposure to noise for a long period of time in factories will cause psychological ill-health, symptoms of such illnesses are, argumentativeness and changes in mood, anxiety, headache and nausea.

Prolonged stress is a potential danger to adverse health effects such as premature ageing, disabilities, depression and poor quality of life (Wright, Hickman, & Laudenslager, 2014). They further stated that stress gives negative health impact to older people. Prolonged job related stress causes negative effects on the physical health which increases the risk of cardiovascular diseases and two types of diabetes (Hirokawa et al., 2016)

2.5 Managing Occupational Health in Apparel Sector

According to the World Health Organization(WHO,2017) conducive work environment can provide employee development occasions, social protection and protection from physical and metal hazards. The objective of an occupational health

and safety management system is to maintain a safe work environment while protecting and maintaining good health of the workers (Zeng, Shi, & Lou, 2006).

Concepts of Occupational Health and Safety Management system have been standardized over the past twenty years and the verity of standards, guidelines and audits have been developed by recognized institutes such as British Standard Institution, Health and Safety Executive, ILO etc. (Robson et al., 2007).

Multinational brands are sourcing their products to factories who comply with their own code of conduct and compliance with legislative respective sourcing countries. Therefore sourcing factories are audited by respective bands or independent parties for social compliance requirements to ensure products are being manufactured ethically (Lindholm, Egels, & Ruden, 2016). Reputed apparel brands carry out audits to make sure whether the relevant supply chains, adhere to the contractual regulation in order to protect the intellectual property assets within the brand name (Nossar, Johnstone, & Quinlan, 2003). Due to that, the international brands have added an ethical compliance as a part of sourcing principles. The rest of sourcing factors are price, quality, delivering on time (Rahman & Hossain, 2010), they further state that ethical compliance improves the compliance status of sourcing factories. Good treatment to employees is a part of Corporate Social Responsibility (CSR) in ethical trading in the western world (Krueger, 2008). Occupational Safety and Health policy, Hazards Identification and Risk Assessment (HIRA), Internal audits, employee training for occupational safety requirements, establishing safety cultures and providing appropriate safety equipment are salient features of social compliance requirements of brands (ILO, 2015). Perry et al., (2014) stated that the aim of ethical compliance is adhering to minimum legal requirements for health and safety, no harassment, fair or legal wages and benefits, legal working hours, prohibition of forced labour and child labour. To establish the ethical compliance, the manufacturers require adequate human and financial resources for its monitoring; employee training and awareness, and communication; operational control measures and monitoring, mechanisms for corrective action (Krueger, 2008). Large buyers provide their safety, health and welfare guidelines to manufactures to follow prior to engaging with their business and to continue business with them (De Silva et.al., 2013)and (Ahmed & Hossain, 2010).

2.5.1 Work Environment

Legislative requirements of workplace safety, health and welfare are consisted in Factories Ordinance No.45 of 1942-Sri Lanka. The welfare facility under ordinance are, provide clean drinking water, provide resting facilities, provided clean and hygienic washing and toilets facilities and provide clean meal rooms. In addition, if a person is standing on anti-fatigue mats, wear comfortable footwear and change the posture intermittently, provide resting facilities to get short breaks, and these actions are possible to prevent or mitigate venous disorders (Dodd, 1964).

2.5.2 Provide Training

Lindholm et al., (2016) stated that ILO has identified that employees are required to undergo training in the correct uses of PPE, safe handling and storage of chemicals and handling under decent work place creation programmes of the apparel industry. According to a research based on apparel industry ,that the awareness of work place safety and health encourage employees to use personal protective equipment, that would help in achieving a safe and healthy workplace environment. (Padmini and Venmathi,2012).

2.5.3 Personal Protective Equipment (PPE)

Respiratory protective equipment prevent the entering of tiny dust particle into the respiratory system (Silpasuwan et al., 2015). To prevent the physical ill health issues such as hearing losses, workers who are exposed to high noise are provided with ear guards to wear during their working hours (Parimalam et al., 2006).

2.5.4 Medical Checkups

Carrying out medical investigations at workplaces can identify work related illness (WHO,2017). Two activities have to be conducted in occupational surveillance: identifying the causes of illnesses or injuries and monitoring the trend of illness or injuries (Baker et al., 1988). Physician reports, medical examiner findings and laboratory reports are incorporated in health surveillances (Baker et al., 1988). They further stated that central processing is required to determine whether the inputs are of sufficient quality to merit reporting and analysis results.

2.5.3.1 Identification of Respiratory Disease

Structured interviews focused on respiratory disorders and occupational health assessments, workflow process observations, lung function screening tests, and workplace dust density assessments, can be considered when searching for causal factors of occupational respiratory disorders (Silpasuwan et al.,2015).

2.5.3.2. Identification of Occupational Stress

There are two other methods for stress measurement as Job Demand Control (JDC) and ERI (Steinisch et al., 2014). They said both the methods are interviewing methods but the purposes are different. The JDC method is used for jobs with low control with high job demands and ERI method is used to measure stress, when working under pressure, inadequate salary, low job security and no recognition between colleagues.

A Cross sectional study was carried out to identify the occupational stress among Bangladesh apparel trade workers. There were two steps taken in this study as interviewing the sample and then obtaining data from medical checkups. They have used psychometrical evaluation using interviews with seven-item version of the Effort Reward Imbalance (ERI) questionnaire and hair cortisol analysis to measure the stress (Steinisch et al., 2013).

Cortisol is a body hormone that responds to stress which is regulated by the hypothalamic pituitary gland (Wright, Hickman, & Laudenslager, 2014). They further stated that it is commonly contained in saliva, urine, blood and hair. The level of cortisol can be measured in medical laboratories. The level of stress is proportionate to the amount of cortisol. Hair cortisol test is used to measure prolonged stress and rest of the tests are used to measure acute stress measurement (Steinisch et al., 2014).

2.5.4 Stress Management

Personal coping techniques are not adequate to manage stress (Fernando et al., 2010). There are many stress management techniques used worldwide. Changing the work environment is the best method to address the issue of stress (Nag et al.,1992). For that evaluating occupational stress causing factors and improving the work environment to address such emerging factors (Saksvik, Ro, Rgensen, & Aslaug, 2002). Commonly used stress management techniques are squeezing a ball, vacation,

changing the carrier, watching movies of your choice, leisure activities, physical exercise, picnics, yoga activities and meditation (Fernando et al., 2010). Apart from that some of the stress management activities are engaging in hobbies, socializing, having various forms of entertainment and seeking support from colleagues (De Silva et al., 2017). Occupational counseling is a mental therapy for stress management (Whitcher & Tse, 2004). The table 2.3 contains the summary of stress management techniques with a short description.

2.3 Table: Stress Management Technique

No.	Stress Management Technique	Method
1	Physical activity and Exercising	Brisk walk and aerobic exercise
2	Healthy Eating Habits	Foods rich in Vitamin C and Omega-3 fatty acids
3	Adequate Sleep	7 to 8 hours of sleep
4	Relaxation	Diaphragmatic breathing or deep breathing is a type kind of traditional yoga exercise expansion of the abdomen rather than the chest when breathing. Deep breathing exercise reduces the anxiety and asthma and resets the autonomic nervous system.
5	Transcendental Meditation	In this meditation person is required to sit with eyes closed and repeating a 'mantra', a meaningless sequence of sounds specific to each individual, 20 minute per day.
6	Laughter	Laughter positively affects physiological and psychological changes in the body. That increases the oxygen level in the body and stimulates various muscles and organs including the heart and lungs. Further, laughter reduces blood pressure and blood sugar levels, increases blood flow, and improves energy levels.
7	Progressive muscle relaxation,	Relaxing and tensing of muscle groups in the body in a sequential pattern with eyes closed for certain period of time. Such relaxation muscles are those in the legs, abdomen, chest, arms and face.
8	Autogenic Training	Autogenic training is a self-relaxation activity developed by Heinrich Schultz, that help the body relax and control breathing, blood pressure, heartbeat, and body temperature.

Source: Stress Management Techniques (Varvogli & Darviri, 2011) and (Broman-Fulks & Kelso, 2012).

2.6 Chapter Summary

This chapter consists of six sections with 20 sub sections. Section two of this chapter consists of occupational hazards and types of occupational illness in brief in the

apparel industry. These health hazards are thermal discomfort, exposure to noise and fabric dust, exposure to chemicals and improper ergonomics. The psychological health hazards are frequent overtime employment, target pressure and high quality demand. The forth section discuss about occupational illness that prevail in the industry. These potential illnesses are respiratory disease, skin disease, hearing disorders, visual discomfort, venous disorders, muscular skeletal disorders and occupational stress. The fifth section which is discussed is about managing of health hazards and illnesses in the apparel industry. The level of influences to manage health and safety implementation in the apparel industry and criteria of safe work place design, employee training, and personal protective equipment (PPE), medical checkups and stress management is discussed here.

CHAPTER 03

RESEARCH METHODOLOGY

3.1 Introduction

Research methodology is a guidance to achieve objectives that are defined (Kumar, 2011) and the literature provides a wide range of information that may lead to more information to identify the research problem. This information was highly useful when developing the research questionnaire.

This chapter consists of 10 sections such as research design, research process flow chart, data collection methodology, sample size determination technique and sample selection from the target population, data analyzing method, which have been followed in this research. Last section of this chapter comprises of the method that was carried out in designing the solution frame work.

3.2 Research Design

This research is designed as a questionnaire based survey which has two phases as questionnaire survey for shop floor employees and expert interviews with industrial experts who are currently engaged in the apparel trade. All the sources are primary sources of information and the data collecting techniques were questionnaire surveys (Kumar, 2011) and expert interviews. They were designed by means of information collected from literature reviews and significant findings of employee questionnaire survey results were discussed with experts to find solutions to meet the third objective of this research.

Both types of data in this survey were qualitative, but the employee interview data was converted into quantitative type for the purpose of statistical analysis. The expert interview data and literature were incorporated during the stage of designing the solution framework. The outcome of this data meets both the second and third objectives of this research.

3.3. Research Process Flow Chart

The research process flow chart is shown in figure 3.1 as in below. The research design, sample selection, questionnaire development, test run, data collection phase 1 and phase 2, method of data analysis, finding and propose solutions are described in this chapter in detail.

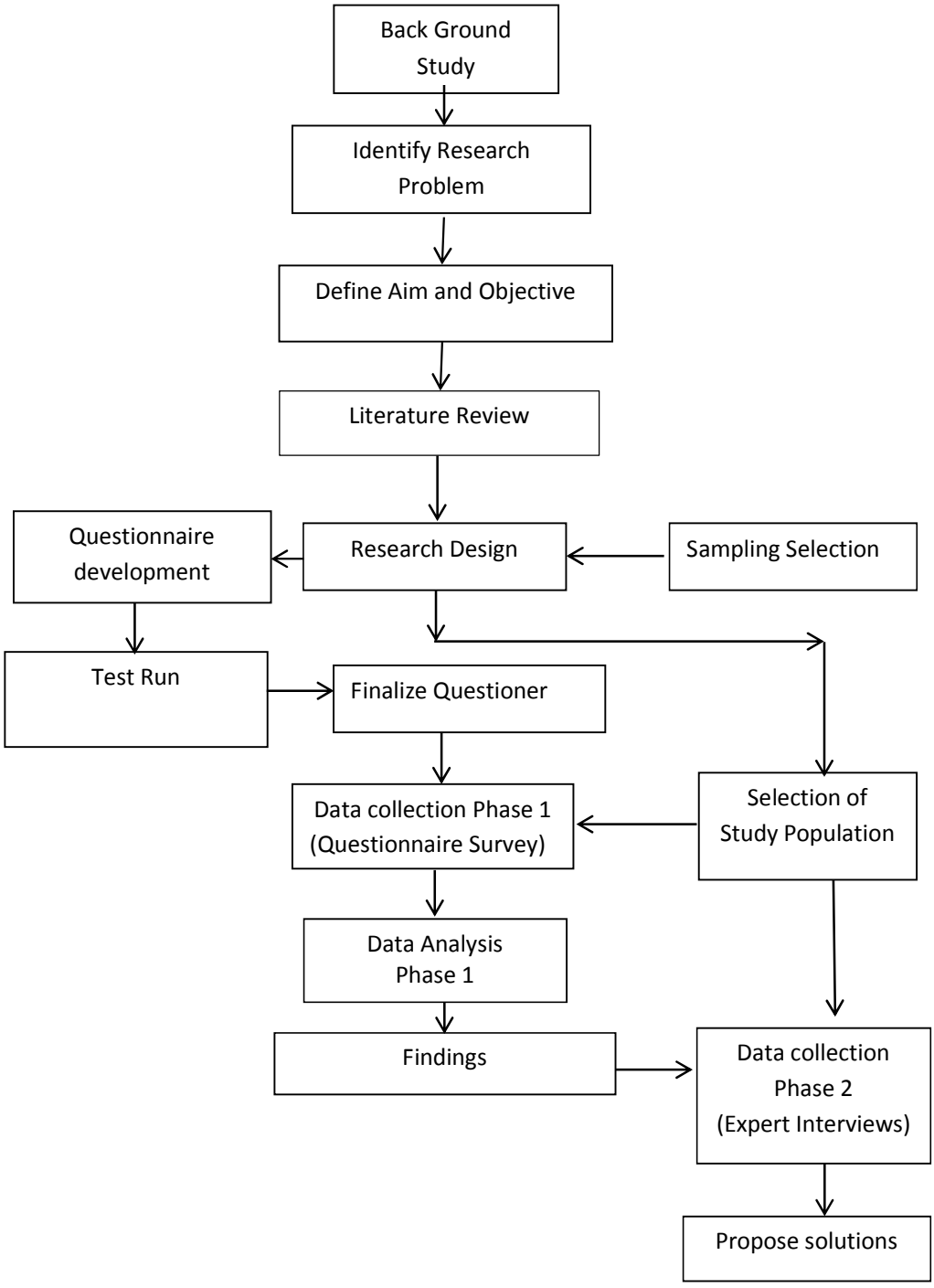

Figure: 3.1 Research Process

3.4 Development of the Questionnaire for Employees' Survey

The questionnaire supports the evidence collected in the survey (Saksvik, Ro, Rgensen, & Aslaug, 2002). Answering the survey questionnaire in a Likert scale is the best method with reference to attitudes in a qualitative research.

The research questionnaire in this study was designed by means of the outcomes of the literature review. The survey questionnaire consists of 2 sections such as A and B. The section A of the questionnaire contains the demographic information, which is also called the responder profile information, which include gender, civil status, age, job category, income, level of experience and weekly average working hours.

Section B has 3 parts in collecting the information using a psychometric scale called the Likert scale. This scale is used to convert the qualitative data into the quantitative type. Part 1 of section B comprises of 19 questions, which the Likert scale depicts as 1 for strong disagreement, 2 for disagreement, 3 for in between, 4 for agreement and 5 for strong agreement. The part 2 comprises of 15 questions about the prevailing health issues among the workers. The Likert scale never occurs as 1, rarely occurs as 2, once in a while as 3, sometimes as 3 and almost always occur as 5. The part 3 of section B comprises of 13 questions, in the Likert scale as 1 for strong disagreement, 2 for disagreement, 3 for in between, 4 for agreement and 5 for strong agreement.

3.5 Test Run

Initially, the developed questionnaire was distributed among the focused group, to find out the respondents' comprehension in completing the questionnaire (Qureshi & Rowlands, 2012). Sample questionnaires were distributed among 5 shop floor workers to assess the level of understanding of the survey questionnaire. Unclear areas or the ambiguity in questions were amended to get a common understandable level after discussing with the relevant employees who participated in this test run. Afterwards, the survey questionnaire was finalized for the data collection process in this study.

3.6 Study Population

The sample population was selected for this research from a casual wear apparel manufacturer, specializing in jersey tops, dresses, pants, shirts etc. They export readymade garments to western countries such as the United Kingdom, the United States, Germany and France. The general manufacturing processes in the apparel industry are followed by them, such as using fabric warehouses, fabric inspections, cutting, sewing, quality checking, ironing, packing and storage. The sewing operations follow the conventional production method. All the factories are registered under the government and are members of the Sri Lanka Apparel Export

Association. All the factories operate in a day shift with accordance to the factories ordinance of Sri Lanka.

There are 79 apparel manufacturers, registered under the Sri Lanka Apparel Exports Association. The table 3.1 below shows the information of medium and large scale manufacturers according to the Sri Lankan Apparel Exporters.

Table 3.1: Number of medium and large scale factories.

Population Type	**No of factories**	**No employees**
Large scale (employees above 1000)	39	138256
Medium Scale (employees above 300)	40	14014

Source : Annual report -Sri Lanka Apparel Exports Association-2017

3.7 Survey Sample

The survey sample size was determined according to the report of annual census published by the Sri Lanka Apparel Exporters Association in the year 2017. The survey sample was drawn from 24 factories out of the 79 factories, which are in the list of factories published in the Sri Lanka Apparel Exports Association - 2017. Four large scale and 21 medium scale factories were selected for this research and it is shown in the table 3.1.

Prior to selecting of the sample from the known population, the Daniel formula was used to calculate the sample size required for this survey (Naing, Winn, & Rusli, 2006). According to the population, the minimum sample size should be 384, with a 95% confidence level and 5% of margin of error according to the Danial formula as shown below. A sample of this size was considered for the phase - 1 of data collection.

$$n = \frac{Z^2 P(1-P)}{d^2}$$

n= Sample size
Z= Z statistic for a level of confidence
d= Precision / accuracy
P= Expected prevalence or proportion

Source: Practical Issues in Calculating the Sample Size for Prevalence Studies

3.8 Data Collection

There were 2 phases of data collection methods that were taken for this survey as phase 1 and phase 2. The Phase 1 data collection was done initially, afterwards this data was statistically analyzed and phase 2 data collection was carried out as described in sections below.

3.8.1 Data Collection Phase 1- Questionnaire Surveys

Factories were selected for this survey by taking in to consideration the convenience and the accessibility for the survey. The respondents were selected randomly by the researcher from the production floor without any influence by the management; the number of employees selected for the sample is shown in table 3.2.

Table 3.2: List of factories taken for the research

Factory No	No of employees	Sample Size	Administrative District
F1	1083	18	Kandy
F2	532	20	Gampaha
F3	670	20	Badulla
F4	826	15	Kaluthara
F5	651	20	Mathale
F6	500	19	Kandy
F7	878	18	Gampaha
F8	696	12	Polonnaruwa
F9	220	12	Colombo
F10	790	18	Kaluthara
F11	670	15	Anuradhapura
F12	350	13	Kaluthara
F13	409	7	Colombo
F14	1194	10	Galle
F15	1661	20	Galle
F16	508	16	Polonnaruwa
F17	438	12	Kaluthara
F18	810	18	Colombo
F19	672	10	Trincomalee
F20	890	15	Kurunegala
F21	610	18	Kandy
F22	750	18	Rathnapura
F23	380	20	Puttalam
F24	1982	20	Hambantota

Total	18170	384	

The respondents in the survey sample were selected from the shop floor department containing sections such as raw material storages, cutting section, sewing section, ironing, packing and finish goods warehouse. Both skilled and unskilled workers were included into this research sample.

Prior to answering the research questions, the respondents were informed about the objectives, the importance of this research and the confidentiality of the research data. This questionnaire was in the Sinhala language; however, Tamil employees were also included in data collection with the help from colleagues of the respective employees who were versed in both Sinhala and Tamil languages.

3.8.2 Phase 2 of the Data collection – Expert Interviews

The second phase of the data collection was carried out after processing the data which was collected previously, in order to find solutions for the significant health hazards, occupational illnesses and management practices to control hazards and illness in the apparel sector. This second phase of data collection was the interview type, either telephone conversations or face to face interviews. Known experts related to the target population were selected to collect the required information (Kumar, 2011) about the causes of problems and to seek solutions to develop the solution frame. The types of data of the respondents were qualitative and such answers of the verbatim form were integrated in this research. The survey sample for the expert interviews were selected according to the credibility and leadership of the apparel industry. The designation, experience, and the experts those who came from different factories are given in Table 3.3. But expert 7 and 8 were not directly responsible to the respective factories, expert 7 provides consultation to the industry and expert 8 is appointed as a medical officer attached to the Health Ministry and whose designation was, Environment and Occupational Health-Medical Officer.

Table 3.3.Designations of the experts and their experience

No	Designation	Years of experience
Expert 1	Chairman, from F22	30+
Expert 2	General Manager , from F24	20
Expert 3	Senior Human Resource Manager(HRM), from F11	25
Expert 4	Ethical Compliance Manager, from F4	22
Expert 5	Group HRM and Ethical Compliance Manager, from F7	18
Expert 6	Group Ethical Compliance and System Manager, From F11	21
Expert 7	Senior Manager –Information Technology, Trainer Apparel industry for leadership/ Ergonomics	20
Expert 8	Environment and Occupational Health Medical Officer-Health Ministry	20

3.9 Data Analysis

The data collected in the demographic survey of the questionnaire, was analysed for grouping the information, which were used to understand the demographic characteristics of the sample. Charts, figures and tables were used to present the information in the survey sample.

The Statistical Package for Social Science (SPSS) software was used for data analysis of this survey to identity the significance of health hazards, occupational illnesses and improper management practices. Single sample t-test was conducted with a 95% confidence level and the test value is 3 for all questions in section B of the survey. Conbrach alpha test was incorporated to test the reliability of the sample.

This demographic data of the survey and the details of health hazards, health issues and ineffective management practices after t-test were discussed with the industrial experts to formulate the solution framework.

3.10 Designing of the solution framework

The base of the solution frame work was designed considering the significant occupational health hazards in connection with respective occupational health issues by means of literature. The Expert interview information was analyzed to mitigate the exposure to hazards at the work place and alternative solutions for issues related to occupation illnesses. This information was included into the process of the solution frame work. The solutions for occupational health issues were extracted from literature.

CHAPTER 04

DATA ANALYSIS AND RESULTS

4.1 Introduction

This chapter provides vital information of data analysis of this research. All the data in this survey are primary data. These are employees' perceptions regarding the workplace hazardous exposures, effects or results due exposure as occupational illnesses and the existing management practices and welfare facilities provided for the employees. Using Statistical Package for Social Science (SPSS) software, this data was processed to find the significant level of occupational hazardous exposure, the occupational illnesses and the management practices that the industry follow to mitigate illnesses. The analysis was a single sample T-test to find the significance of these factors. The output of these findings meets the second objective of this research. Next, the significant findings were taken from expert interviews to find the causes and practical solutions according to their capacity. According to that, the solution framework was designed to meet the third objective of this research.

4.2 Respondent Profile

The respondent profile comprises of gender, civil status, age, working section, monthly income, level of educational qualifications and experience in this survey. The survey response status are shown in table 4.1

Table 4.1: Statistics of the respondents' profiles

Variable	Number of responses for question
Gender	383
Civil Status	378
Age	340
Section	362
Income	375
Education	376
Experience	381
Total sample size	385
Total number of missing answers	91

The survey sample was 385; most of the respondents had answered all the questions under their respondent profiles section. But a few of them had not answered some questions, may be due to their personal reasons or they may have missed out some questions. The following subsections provide details of the demographic information of this survey.

4.2.1 Gender Distribution of the Sample

The gender distribution of this survey is sample is shown in the figure 4.1 in below.

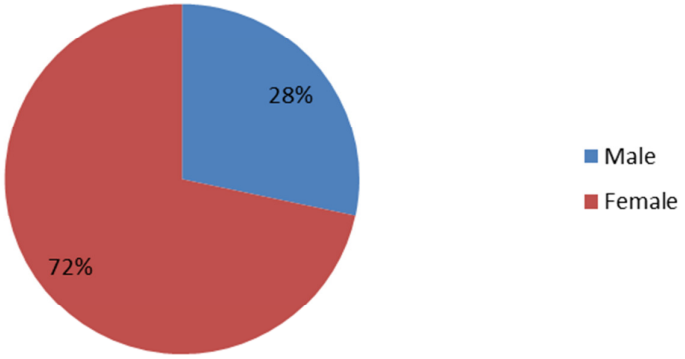

Figure 4.1: Gender distribution of survey

The figure above shows the gender based classification of the respondents of this survey. The majority was female as 72% and male representation was 28%. Many researches have stated that the apparel industry is a female oriented industry; hence the results of this survey show the same. Therefore this was a reasonable sample distribution in terms of gender in apparel sector.

4.2.2 Distribution of the sample in different sections of the factory

The research sample was randomly chosen from different working sections in the factories. According to the general factory set up of the apparel industry, there are seven different manufacturing departments that carry out the production process. The figure 4.2 shows the department wise representation of this survey sample.

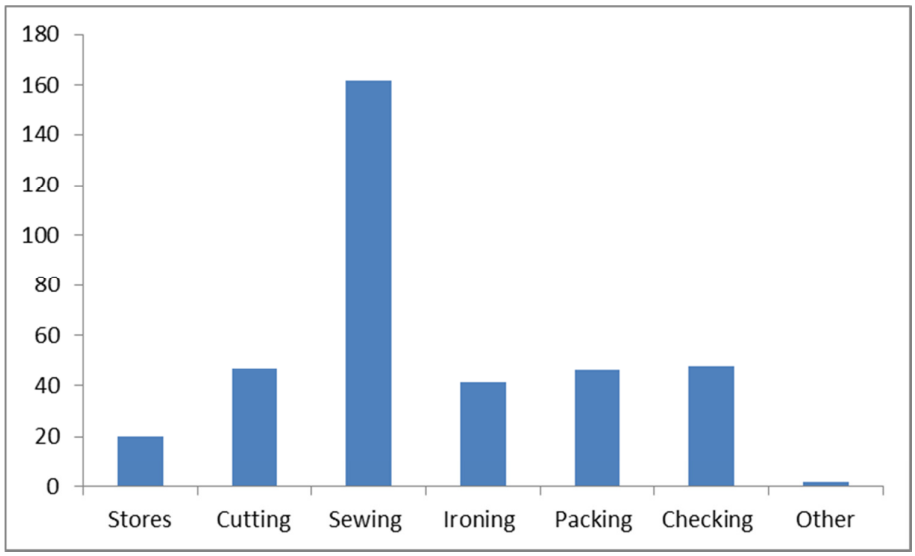

Figure 4.2: Working sections of respondents

The figure 4.2 shows the sample distribution of different working sections of factories. There were 162 respondents in the sewing section which was 42.1% out of the total sample. The rest of the respondents who belonged to 6 other sections were, 5.2% from storage sections, 12.2% from cutting sections, 10.6% from ironing sections, 11.9% from packing sections, and 12.5% from quality checking sections, and 0.5% from the other groups of employees such as sweepers, electricians, mechanics etc.

4.2.3 Monthly income

The monthly income of individuals is a key indicator of their living status. Therefore it is very important to check the income level of the employees in the apparel industry to understand their financial strengths and purchasing strengths. The table 4.2 shown below depicts the monthly income level of the employees of this survey sample. The column named as Frequency, refers to the number of respondents in a particular income level. The last column shows the percentage of a particular salary scale in the survey sample. One out of the 385 employees had not marked his/her monthly income in this survey.

Table 4.2: Monthly Income

Monthly Income in Rs	Frequency	Percentage
13,500	14	3.6
15,000	70	18.2
20,000	176	45.7
25,000	111	28.8
40,000	11	2.9
Over 40,000	2	.5
Total	384	99.7
Absent	1	0.3
Total	385	100.0

The information in the table above shows that the majority of the respondents are in an income level between Rs.13500 – 20,000 per month, which is 67.5%. The income level between Rs 20,000 – 25,000 is 28.8%. It was noted that 96.3% of the sample is less than or equal to Rs 25,000 per month. Hence the majority of the respondents were low income earners. This income level was not adequate to maintain a family as per the cost of living in Sri Lanka. This also indicates that, in case of health, nutrition and good housing, they might struggle to find sufficient money to manage the situation.

4.2.4 Level of education

The table 4.3 shown below describes the education level of the employees who were selected for this survey.

Table 4.3: Level of Education

Level of Education	Frequency	Percentage
Below Grade 8	33	8.6
Below O/L	92	23.9
O/L	146	37.9
AL	96	24.9
Graduate	10	2.6
Total	377	97.9
Absent	8	2.1
Total	385	100.0

The level of education had been marked for only 377 out of 385 employees in this research sample. Out of the 377 employees, 10 had completed the graduate level qualification. The majority of the sample which is 65.1% of the employees had completed up to the GCE O/L examination. However, it is also noteworthy that nearly 25% of the participants had completed the Advance Level qualification. The lowest percentage in this sample was 8.8% and the education level for this value was below grade 8.

In general, the employees who took part in the survey have a low education level. With reference to the literature survey, most of the employees in the apparel sector are from low socio economic back grounds and the majority is not able to continue their education to achieve professional qualifications.

4.2.5 Experience of the employees in the survey sample

Working experience is a vital factor when considering the employees' ability to understand the skills and the retention period in the industry. The Figure 4.3 shows the working experience of the respondents of this survey.

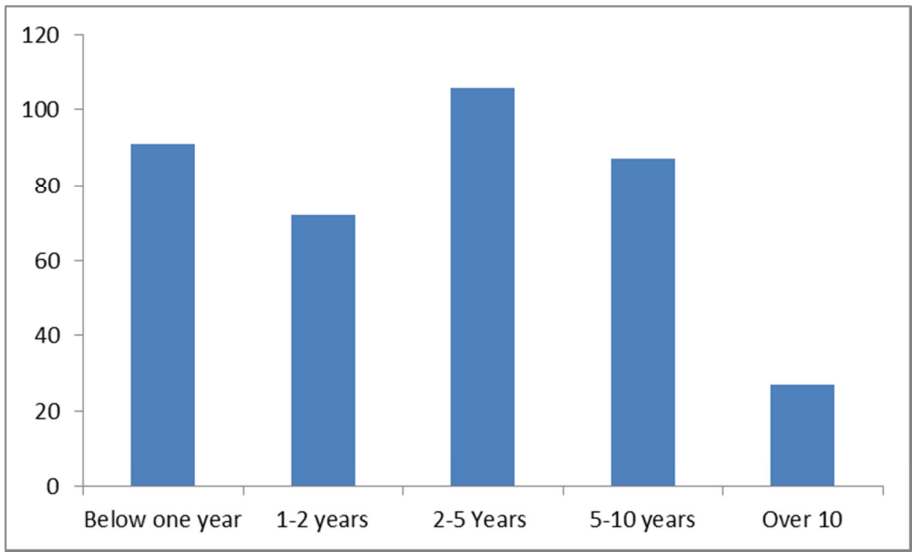

Figure 4.3: Working experience in the apparel sector

According to the survey sample, 30% of the participants have more than 5 years of experience. Only 23.8% have less than one year's experience. When considering the overall experience of this sample, the respondents have a fair representation in terms of experience which helps to indicate the reality in terms of the survey objectives.

4.2.6 Age groups analysis

The figure 4.4 shown the age group distribution among the research sample.

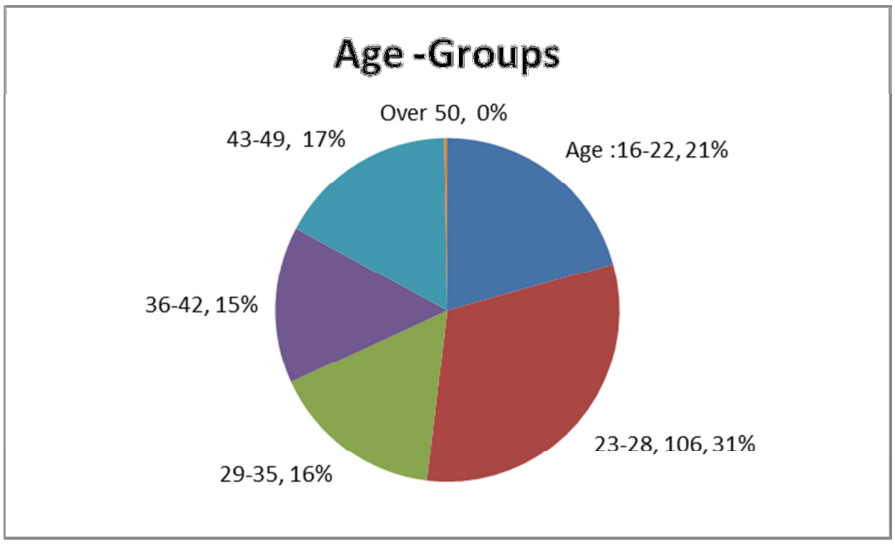

Figure 4.4: Age group distribution of the respondents.

The majority which is 31% of the employees in the sample are in the age group between 23 to 28 years. The second highest age group is between 16 to 22 years which was 21% out of the sample. 17% of the sample is age between 43- 49 years, 16% of the sample is age group between 29 to 35 years and 15% of the sample is in the age group between 36 to 42 years respectively. However the above 50 years of age group was negligible.

4.2.7 Marital Status Analysis

The figure 4.5 shows the marital status of the survey sample of this research.

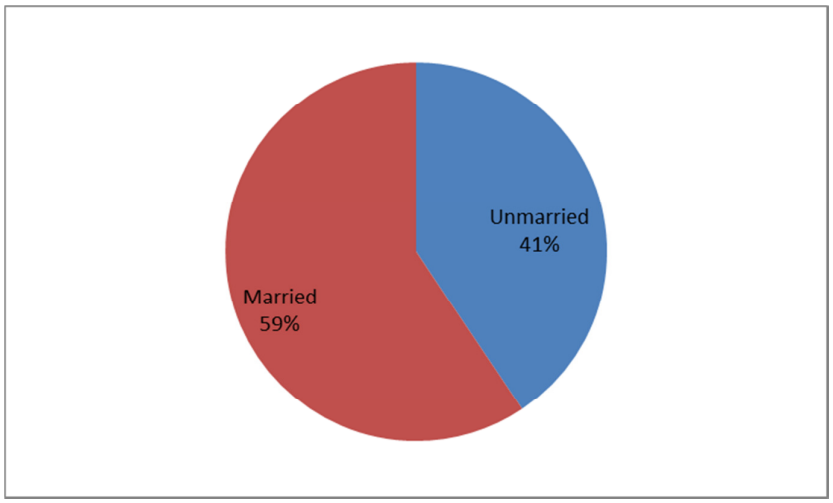

Figure 4.5: Marital status distribution of the respondents.

Referring to the analysis 59 % of the survey sample was married employees and 41% of them were unmarried.

4.3 Data analysis for significant occupational hazards.

In this section it was tested what the employees' perception was regarding the health hazards and how employees responded during questionnaire survey. There are 19 questions under this section.

4.3.1 Reliability tests for the data sample section B-Question 1

The reliability of this section survey was measured using Crombach's Alpha. The survey result is shown in table 4.4 below.

Table 4.4 – Reliability Statistics: Section B – question 01

Cronbach's Alpha	Number of questions
0.863	19

Under the reliability test Cronbach's Alpha has been used; the resulting value is 0.863. This is greater than 0.7 which is the standard value. Hence, this data can be categorized as reliable data according to the Cronbach's Alpha test.

4.3.2 Analysis of occupational hazards

This data was analyzed for one sample t-test with a 95% level of confidence. The relevant critical t-value is 1.646 according to the sample size selected. The test value was 3 for this analysis. According to the literature, nineteen questions were included to this questionnaire survey. Referring to the data analysis six significant issues were highlighted as in the table 4.5 shown below.

Table 4.5 Significant occupational health hazards for illnesses.

Health hazards	**Test Value=3**			
	T-value	**SD**	**Sig. (2-tailed)**	**Rank**
Production targets pressure	11.22	1.1	0	1
High quality demand and pressure for quality failures	5.97	1.33	0	2
Exposure to fabric dust frequently	3.06	1.31	0.002	3
Inadequate wages	2.87	1.38	0.004	4
Working in a prolonged period of time in the same posture	2.7	1.4	0.007	5
Overtime employment on a daily basis	2.05	1.37	0.041	6

The most significant occupational health hazards are production targets pressure, and the demand for high quality and less quality failures. These are risk factors for occupational stress. The third significant health hazard is exposure to fabric dust frequently. The exposure to dust is a risk of respiratory disorders and dermal

diseases. The hazard in the fourth rank is inadequate wages. This is a risk factor for psychological health and physical health (malnutrition) of employees. The fifth rank is working for a prolonged period of time in the same posture which is a physical health risk connected to muscular skeletal disorder. The sixth health hazard is overtime employment on a daily basis which is related to physical and psychological health hazards.

The following sections describe the results from the expert interviews which were conducted according to the six questions that guided the analysis as in table 4.5. The expert interview guidance form is in page 70, attached in appendix B.

- **Production targets pressure**

Firstly experts were asked about the production targets pressure. Four experts stated that, the employees are having difficulties in meeting production targets due to the lack of training. Two experts stated that working in a chain process, where one person's performance affects the whole team, which will affect the individual performance incentives. Also failure to meet delivery on time will directly affect to maintain consistency on orders. The ultimate result causes air freight delivery, which is costly. Expert 6 stated that *lack of support within the team cause target pressure among employees.* Four experts stated that streamling the process, providing required training to develop skills, proper planning and organizing the work flow are solutions to reduce the target pressure. Two experts stated that applying practical industrial engineering methods by understanding employee's physical and mental capacity will be a solution to mitigate the target pressure. There Experts also stated that supportive culture in the industry will reduce the target pressure. Summary of expert interviews to minimize target pressure is shown in the table 4.6

Table 4.6: Experts suggestions to reduce target pressure

Suggestion to overcome target pressure
Streamline the process to balance the production flow
Provide required training to develop skills of people
Man power planning to meet delivery
Industrial engineering to match with the competency of employees

- **High quality demand and pressure for quality failures**

Expert 5 stated that *difficult operations and unsmooth chain processes are causing quality failure. One or more of these factors would badly affect to the cost of production.* Expert 4 stated that *management pressure cascades to the supervisor level and ends at worker level when an item is rejected or orders are canceled. Quality failures will delay on time delivery as a rework time. The final result will be air freight delivery which is costly compared to sea freight.* Three experts stated that the reasons for the quality failure are, indefinite quality demands, poor planning, high labour turnover, no proper support and guidance by the supervisors, unnecessary work pressure and lack of competency of the supervisors and lack of skills of the employees. Expert 7 stated that the *reaction of the management for quality failure is highly unethical and unprofessional, and that would be another reason for the fear about quality.* Expert 2 stated that *targets and quality pressure are matters of psychological stress.* Three experts stated that establishing quality management systems are a good solution for reduction of quality demand pressure. Expert 3 stated that the *employees with a low performance are required to retrain to meet an acceptable level of skill. Then the process gets streamlined. Long term actions are creating a quality culture, establishing and maintaining quality management policies and procedures, hiring competent managers, building the competency level of managers and supervisors, providing technical and soft skill trainings for supervisors. This mechanism should be focused on for the continuous improvement for quality management systems.* Summary of these expert interviews to minimize the high quality demand and pressure for les quality failures are shown in table 4.7.

Table 4.7: Experts suggestions to reduce high quality demand and pressure for quality failure

High quality demand and pressure for quality failures
Establishing quality management policy and procedures
Creating a quality culture
Hiring competent managers
Building the competency level of managers and supervisors
Providing technical and soft skill trainings for supervisors

Reduce employee turnover rate
Skill development of employees
Support and guidance of supervisors

- **Exposure to fabric dust frequently**

All the experts have agreed that the main sources of the emergence of fabric dust are due to fabric cutting and sewing processes. The reason is wearing masks throughout the day was uncomfortable, even if the factory provide free masks. Two experts stated that the low quality of the fabric increases the rate of dust generating while processing. All the experts stated that providing proper respiratory masks is the solution for this issue. Here the experts pointed out that, installing dust suction devices in the high dust areas is a better solution to mitigate exposure to dust at work places. The Expert 7 stated that the *best option to mitigate or control the fabric dust spreading over into the environment is an engineering control rather than providing dust masks to relevant employees. For that purpose, the best solution is providing pneumatic suction devices for the relevant machines such as over lock machines. But the cutting machines do not have dust suction devices. This will be a new opportunity for machinery manufactures in the future*. Expert 4 stated that *segregating the cutting department with dust exhausting devices will be another solution to mitigate the exposure to dust. In addition, establishing a safety culture is good to contribute towards this mitigation of exposure to hazard.* Summary of expert interviews to minimize the exposure to fabric dust is shown in table 4.8.

Table 4.8: Experts suggestions to reduce fabric dust exposure

Suggestions for reducing exposure to fabric dust frequently
Provide proper respiratory masks (PPE)
Installing dust suction devices to machines as engineering control mechanism
Segregating the cutting department with dust exhaust fans
Establishing safety culture in factory

- **Inadequate wages**

Majority of experts in the sample stated that inadequate wages is a common grievance among the employees. There are many reasons for this, such as poor financial management, poor work performance, lack of skills of individuals etc. Expert 3 stated that *high cost of living in the country and the social status are the reasons for inadequate wages.* Expert 1 stated that *according to the export led economic culture; the majority of the workforce does not have long-term objectives in life. Therefore, most of the employees are reluctant to develop their skills. This mentality is a big challenge to enhance the financial status of the employees and the country.* Expert 1 and 5 have similar solutions to resolve this issue. They stated that the employees who left the industry are young and most of them are in a low educational level. Therefore, these employees should be empowered with professional/ vocational qualifications, then that will affect their future success and they will be an asset to the human capital of the country. Therefore, the employees can be oriented towards vocational educational institutes such as Technical Colleges and higher education institutes such as Open Universities in the country. Then, they can boost their earning capacities and opportunities such as job upgrading, promotions and another earning systems.

Expert 7 stated *that most employees are not managing their income and expenditure. They spend the money what they earn but they are not fully aware of the expenditures. This too is a critical factor where people are trapped within a low quality of life. If workers can learn how to budget and understand their earnings and expenses better, then they will be inspired as to how they can upgrade their economic status. Therefore, when they plan their budget, they need to pay good attention to the amount they can invest into their health, both cure and prevention activities. For empowering workers it is required to upgrade the leadership skills of the workers. For this purpose, training should be provided to develop leadership qualities and entrepreneurship. The term leadership is not about being a supervisor, or a manager. In this concept everyone is a leader and there is an opportunity for every worker to see themselves as a leader. This leadership thinking will diminish the low estimate that they have of themselves.* The summary of expert interviews regarding increasing the financial stability of the employees are shown in table 4.9 below.

Table 4.9: Experts suggestions to enhance the income

Suggestions for inadequate wages
Empowered the employees with professional/ vocational qualifications
Provide training for budget to understand earnings and expenses
Empowering workers uplift the leadership skills

- **Working for a prolonged period of time in the same posture**

Six experts stated that, according to the nature of the industry, the employees who carry out processes such as cut panel numbering, sewing, line helping and quality checking have to hold the same posture, either standing or sitting. Expert 2 stated that *this posture is unhealthy and leads to muscular illness of employees.* 4 experts stated that that providing anti fatigue mats and seating facilities are a solution to mitigate the hazardous exposures due to prolonged steady postures. 4 experts stated that providing shorts breaks and stretching exercising are beneficial to resolve these issues. Expert 7 *stated that stretching exercises can reduce bad heath effects due to steady postures.* The summary of expert interviews that can mitigate the hazardous exposure of steady posture is shown in table 4.10 below.

Table 4.10: Experts suggestions to reduce steady posture work

Suggestions for reduce steady posture work
Proving anti fatigue mats
Provide seating facilities to sit when feel fatigue
Providing shorts breaks for rest
Stretching exercising

- **Overtime employment on a daily basis**

As per the expert interviews, there are 2 scenarios for overtime employment, within the organization and outside the organization. The reasons for overtime work are shown in the table 4.11 below.

Table 4.11: Reasons for overtime work

Within the organization	Outside the organization
Poor planning	Style confirmation
High absenteeism	Supply chain issues
Labour turnover	Social and cultural issues
Lack of skilled laborers	
Lack of human resources	
Over booking	

According to the expert interview, 3 experts stated that overtime employment can be reduced by proper planning, considering the capacity and over booking. Expert 1 stated that *skills development will be a solution for preventive measures for overtime employment*. The Expert 8 *stated that increasing the number of shifts is a solution for overtime work reduction.*

Expert 7 stated that the *physical and mental capacity and capability analysis should be conducted prior to ordering, booking and planning and then, updating the crucial process to meet the on-time delivery of goods with the right quality. According to the frequent monitoring and actions from person to person, absenteeism can be minimized and also by having a contingency plan for unforeseen situations, keeping backups with a worker pool and continuous training to improve skill inventory, avoiding overnight work and working beyond 12 hours a day and limiting the overtime for a reasonable amount of time and keeping only volunteers for overtime work.*

Expert 5 stated that *applying practical Industrial Engineering (IE) prior to the commencement of production with the support of the technical staff and with an understanding of employee's physical and mental capacity can be carried out initially, as a short term solution in reducing overtime employment. Hence, it is required to define the correct methods, identify the correct work cycle, to establish the proper workplace arrangements. As a long term solution, proper leadership, strategic management, proper planning, organizing, training, development, assessment and continuous improvement are required to be established.* Summary of

expert interviews that are possible solutions to reduce overtime employment is shown in table 4.12.

Table 4.12: Experts suggestions to reduce overtime employment

Suggestions for reduce overtime employment
Planning considering physical and mental capacity of factories prior to ordering booking
Skills development training, continuous assessment and maintain a skill inventory
Keeping backups, worker pool and volunteers for overtime work
Contingency plan to meet deliveries
Increase the number of shifts is a solution for overtime

4.4 Data analysis for significant occupational illness

In this section it was tested what the employees' perception is regarding the occupational illnesses in the way the employees responded during the questionnaire survey. There are thirteen questions under this section.

4.4.1 Reliability tests for the data sample section B-Question 2

The reliability of this section survey was measured using Crombach's Alpha. The reliability test result is shown in table 4.13

Table 4.13: Reliability test for section B- question 2

Cronbach's Alpha	Number of questions
0.86	13

4.4.2 Analysis of occupational illnesses.

To determine the significant occupational illnesses in the survey sample, one sample T-test was conducted with a 95% level of confidence. The relevant critical t-value is 1.646. The test value taken for this analysis is 3. Referring to the data analysis two significant issues were highlighted as in the table 4.14 shown below.

Table 4.14: Significant Occupational Illness

Occupational illness in apparel sector	Test Value=3			
	T value	**SD**	**Significant**	**Rank**
Leg pain	2.22	1.49	0.027	1
Back pain	2.12	1.52	0.035	2

The results above show that the significant illnesses are in this study sample were leg pains and upper back pains. Both are related to muscular skeletal disorders. The reasons for these issues would be carrying out their activities in steady posture as standing or sitting postures in prolonged period and excessive working hours. The rest of the issues were not significant according, because the t value is less than the critical t value on the level of significance which is more than 0.05.

- **Leg pains and back pains**

Four experts stated that leg pains and upper back pains can be resolved if the workplace is designed ergonomically, by providing job rotation and by providing adequate rest. Two experts stated that providing anti-fatigue carpets and comfortable footwear, providing training for correct postures and manual handling techniques, providing seating facilities between and after the prolonged standing postures could mitigate leg pains.

Expert 8 stated that *leg pain and back pain occur due to poor ergonomic work setup in the workplace, excessive working hours, unsafe postures and lack of rest time. This can be resolved with consultation of ergonomic experts in work place design and employees are required to undergo training for safe postures and methods. Increase the number of work shifts and providing rest periods is another administrative action to resolve these health issues. Also, carryingout internal medical surveillances in factories to identify issues and managing the issues as per the medical expert guidance could be a solution. This will be medical treatment in curing the illnesses in this issue.*

Expert 7 stated that *arranging seating facilities to get short breaks and providing anti fatigue carpets for employees who are standing in the same posture for prolonged periods of time and subsequent relaxation and stretching for seated employees is the best solution for muscular pains and issues in the apparel industry.* Three experts stated that the management staff is required to train, especially in the department of industrial engineering having knowledge of ergonomics and human factors and proper planning. Next, the process is required to be validated by a competent person prior to starting mass production.

Table 4.15: Experts suggestions to reduce leg pain and back pain

Suggestions for reducing leg pain and back pain
Design the workplace to meet ergonomic requirement
Provide job rotation and adequate rest
Provide training for stretching exercises for seated employees
Provide anti-fatigue carpets and comfortable footwear
providing training for correct postures and manual handling techniques
providing seating facilities
Increase the number of work shift
Carryout medical surveillance and treatments for illness

But other health issues taken for this survey were not significant. Even such issues were not significant as per the journal articles in literatures that have been conducted in Bangladesh and Thailand. They found shop floor workers in the apparel industry suffer many other issues, such as lower back pain, hand pain, shoulder pain, cough, heaviness in the leg even after work, headache, nausea, neck pain, leg cramping, burning pain in the leg, elbow pain, skin diseases, wrist pain, leg trouble and varicose veins in the legs were also tested for this study.

According to this survey results, the majority of the workers have no serious health issues such as skin diseases, venous illnesses and respiratory diseases. This is a positive factor that shows the workforce is not in the major level of health issues in general as yet.

4.5. Data Analysis for managing occupational health in apparel sector

In this section it was tested what the employees' perception regarding the welfare facilities and the existing health and safety management system that the factories currently follow. There are thirteen questions under this section.

4.5.1 Reliability tests for the data sample section B-Question 3

The Cronbach's Alpha reliability test was carried out for the questions under this section. The test results are shown in the table 4.16 as in below.

Table 4.16: Reliability Statistics: Section B – question 03

Cronbach's Alpha	Number of questions
0.922	13

The test results of Cronbach's Alpha values was 0.922 which is greater than the standard value of 0.7 hence this data is acceptable.

4.5.2 Analysis of managing occupational health in apparel sector

To determine the significance of the welfare facilities and the existing health and safety management systems, one sample T-test was carried out with a 95% level of confidence. The relevant critical t-value is 1.646. With reference to the following table 4.17, the majority has given favourable answers to all the questions for managing hazard and health concerns in workplaces

Table 4.17: Significant best practices to mitigate hazards

Management practices for health management at places.	**Test Value=3**			
	T value	**SD**	**Significant**	**Rank**
Training given regarding Health and Safety/ PPE/ warning signs of hazards	26.79	0.82	0	1
Factory provides clean drinking water	24.92	0.82	0	2
Factory takes remediation when health issues arise to employees	24.88	0.84	0	3
Factory has appointed capable person to manage Health and Safety concerns in the factory	24.87	0.85	0	4

Canteen is kept clean and hygienic	19.53	0.89	0	5
Factory provides free medical facilities	18.17	0.98	0	6
Factory provides recreational facilities for the employees.	16.95	1.02	0	7
Factory provides correct personal protective equipment.	16.58	0.96	0	8
Factory maintains clean toilets	14.2	1.04	0	9
Employees are given promotions based on their skills	12.96	1.06	0	10
Factory does occupational health promotion programmes	11.14	1.08	0	11
Factory provides adequate rest time to employees	7.5	1.16	0	12
Factory does annual medical examinations for employees	3.29	1.24	0.001	13

According to the results of the table shown above, the respondents provided a positive perception on the level for existing health & safety management systems and the facilities that have been provided by their employers. Hence, the statistical t-values given are positive, for all the points that were tested. This is clear evidence that the management in the industry has identified the important factors relate to safe workplace requirement. But the least priority has been given for employee' rest periods and annual medical checkups according to this analysis.

According to the interview 5 experts stated that the Sri Lankan apparel industry has gradually grown in terms of value and volume when considering the past years. The infrastructure of the Sri Lankan apparel industry is being gradually upgraded currently. The major apparel brands and retailers, consider the apparel industry in Sri Lanka as a bench mark with respect to those in other countries. Expert 1 *stated that the industry leaders are more passionate to be compliance with the social standards developed by reputed apparel brands and accredited organizations to sustain their business. These social standards are highly health and safety oriented.*

4.6 Strategic framework to reduce health hazards and occupational illnesses in apparel sector.

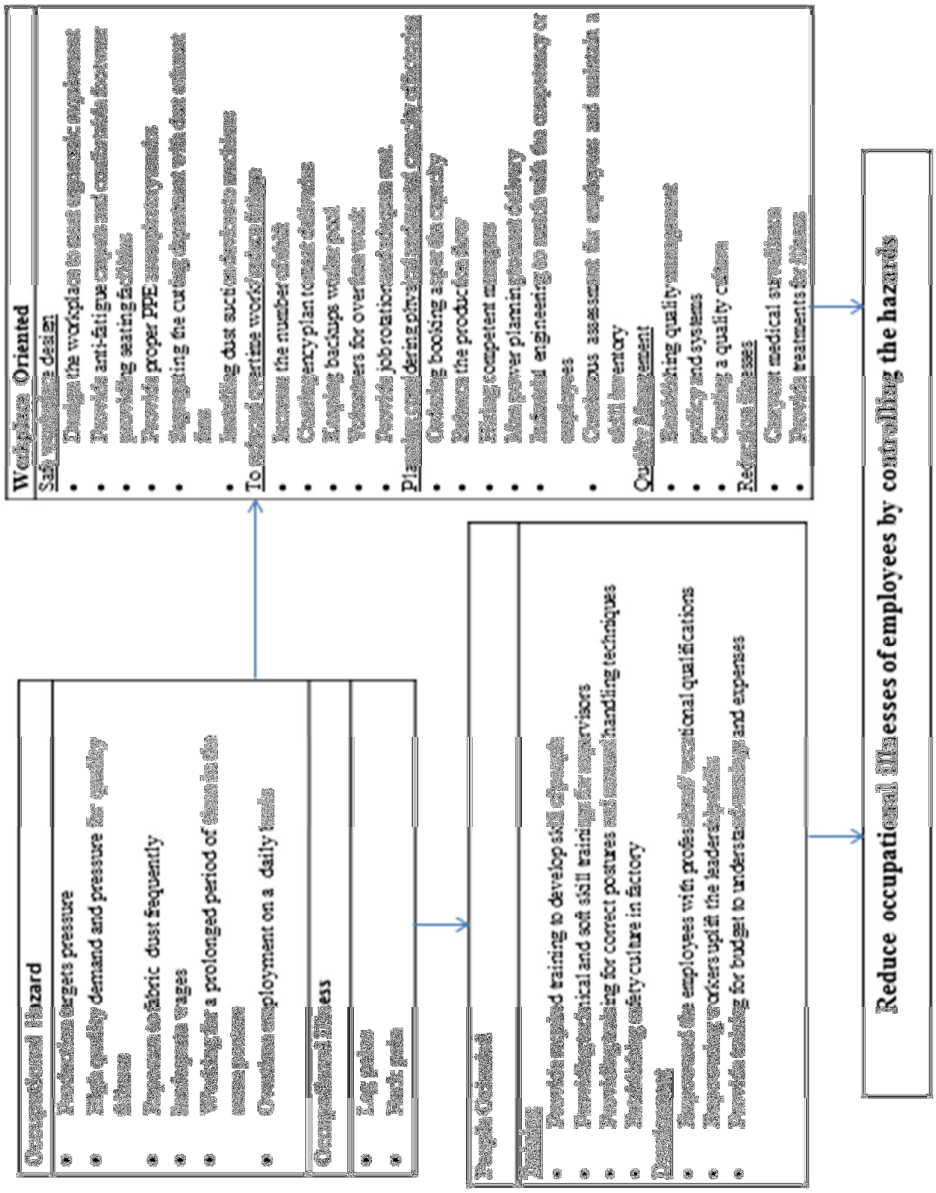

Figure 4.6: Strategic framework to reduce occupational hazard and illness in apparel sector.

The strategic framework as in figure 4.6 was designed considering people oriented and work place oriented aspects of factories. The work places oriented factors that reduce the hazards and illnesses are aspects

According to the questionnaire survey, six significant occupational hazards are highlighted in this research. These are production target pressure, high quality demand and pressure for less quality failures, exposure to fabric dust frequently, inadequate wages, overtime employment on a daily basis and working at prolonged periods of time in the same posture. Two significant occupational illnesses were identified in this survey. These are leg pains and back pains.

The strategic framework was designed according to the expert interview as in figure 4.6. There are two main blocks for solution frame work. These are people oriented and work place oriented aspects that are required to implement to reduce occupational hazards and illnesses in the apparel sector. The work place oriented factors to reduce the hazards and illnesses are designing a safe workplace, reducing overtime and fatigue, planning taking in to consideration the physical and mental capacity of employees, implementation of quality management systems and reduction of illnesses.

The workplace oriented actions are described as follows: here the safe workplace should be designed considering the ergonomic requirements. In addition to that employees should be provided anti-fatigue carpets, proper PPE (respirator masks), comfortable footwear and seating facilities. If the employees feel fatigue, the factory should allow employees to get short breaks to recover from fatigue. Segregating the cutting department with dust exhaust fans and installing dust suction devices to machines to remove fabric dust while processing are proposed for safe work place designing.

The strategies to reduced overtime work are increase the number of shifts, prepare a contingency plan to meet deliveries, keeping backups, worker pool and a volunteer team for overtime work. Reduction of employees fatigue can be done providing job rotation and adequate rest.

Capacity planning should be in accordance with physical and mental capacity of the workforce of the factory, at the order booking stage. To achieve this, a competent management should be appointed. Then manpower can be planned to meet the delivery. Industrial engineering department should facilitate to make a correct layout planning according to the capacities of the employee. Achieving all of these criteria will help to smoothen the production flow in the factory. The management should

provide continuous training to employees to enhance their skills. Also the management should carry out continuous assessment for employees' skills and which should be recorded in a skills inventory to refer in the order booking and planning stage.

Implementation of quality management systems will strengthen the level of product quality and factory performances. Ongoing quality management systems crate quality culture in factories.

Reduction of occupational illnesses such as leg pains/ back pains can be identified through qualified doctors in medical surveillance audits. The doctors could provide medical treatment and physiotherapy for managing the situation. Employees who recover from ill health would promote the occupational health in the company. The management should provide training about correct postures and manual handling techniques to employees to mitigate muscular skeletal disorders.

The people oriented factors for reduction of hazard exposure and illnesses should be providing training, establishing safety culture, empowering employees with professional qualifications and uplifting the leadership skills of employees. People oriented actions are providing required training to employees to develop their skills. The objective of the development of the people is upgrading skills and earning capacities of the employees, because that will increase organizational productivity and spending power of the employees.

Also majority of the employees in the industry are young, have a low education level and exit from their job in a short period of time. Skills development programs will be beneficial for them even after leaving their job. The people development programmers can be carried out either in-house or in external institutes. The best way of in-house programme is mentoring employees and for external training employees should connect with government institutes such as technical colleges, higher education institutes. Empowering the employees to uplift the leadership skills will benefit in finding solutions within the group. Then employees will be encouraged to achieve their objectives. The management can provide training to employees on how to budget the expenses. Then they can understand earnings and the meaning of expenses. These will be beneficial in money saving and will be an initiative for poverty reduction of employees.

4.7 Chapter summary

This chapter provideded vital information of demography information, types of significant occupational hazards, significant occupational illnesses and work environment information in the Sri Lankan apparel sector. The other sections are the reliability of the survey questionnaire, statistical data analysis, information of survey questionnaire, expert interview information for remediation of significant health hazards and health illnesses. The last section contained the solutions for existing issues and a process chart to from solution framework to meet the third objective of this research.

CHAPTER 05

CONCLUSION, RECOMMENDATIONS AND FURTHER RESEARCH AREAS

5.1. Conclusion

The Sri Lankan apparel industry has gradually matured during the past 30 years. It is not only financially strong but it also has high social/ethical values. This industry strengthens the economy of the county. Currently it has earned the first place in export revenue. A huge number of people are engaged with the industry, and most of them are females and this is the industry for the young citizens of the country, who have a low level of education and low-income.

According to the research finding, the employees are frequently exposed to occupational hazards as high target pressure, quality demand/ high concern for quality failures, exposure to fabric dust, working at prolonged periods in a steady posture and excessive working hours daily. The most prevalence illnesses are back pain and leg pains. These two illnesses can be categorized as muscular skeletal disorders.

According to this research the apparel sector in Sri Lankan has taken adequate measures to create a safe and healthy work place for their employees. Continuous monitoring and pressure from the reputed brands help them to keep up the ethical standard in factories. The positive attitude of leadership is another factor that achieves these standards.

These standards directly affect the physical environment of the industry. Therefore tangible issues have been addressed and rectified by the management of the industry. But the response is low for the intangible areas related to the health hazards and illnesses. The reasons may be that the people in some social standards are reluctant to discuss matters such as occupational stress and low earning power.

The scope of health and safety management system is mostly oriented towards physical health and safety. It is necessary to broaden the scope to include the psychological issues to find solutions for stress generating matters. For that purpose, investigation of the root cause is very important.

5.2 Implications

With reference to the research outcome most of the employees in the apparel sector are in the low income level and their income is not adequate to maintain a good life standard. In addition, most of them are in a low educational level.

According to the research outcome under the health hazards in this research, the respondents are satisfied with the infrastructures that have been provided, such as the conducive work environment factors such as thermal comfort, seating, lighting, noise and work place design. The reason for their satisfaction may be that the work environment matches the living standard of the employees. This implies that the physical industrial standard level is in higher position than the majority of homes of the employees.

But exposure to dust is a significant factor according to the research. In order to control these hazards, the management is required to take action such as controlling the engineering section, controlling the administration or by providing a correct type of personal protective equipment for them.

In addition to that employees in the apparel industry are exposed to occupational stress related hazards such as deep concern about production target pressure, high quality demand and pressure for less quality failures and inadequate wages. These facts cause occupational stress and a poor life standard. Therefore it is very important to address such intangible issues by the higher management.

The majority of employees in the apparel industry remain in the industry a short period of time (less than 5 years) and they leave their jobs while they are still in a young age. Therefore, the symptoms related to ill heath would not be presence in them at this stage. That would be the reason, that the results of the survey are favorable towards the employees' health.

The research outcome also highlights that many workers are suffering from various forms of muscular pains. Continuous exposure to muscular pains can lead to long term health issues. The best way to eliminate muscular pains is to provide a work place with ergonomic and human factors and to provide adequate rest for them when they feel fatigue.

5.3 Recommendations

Two kinds of recommendations have been proposed according to the solution framework to mitigate the existing occupational health hazard and illness in the Sri Lankan apparel sector. One method is mitigating the hazards with controlling the engineering and administrative sectors. The other method is managing the occupational illnesses after identification. Illness can be identified through medical surveillance audits. Surveillance audit results can be taken to find the causes and treatments according to medical experts. Infrastructure development in factories should be carried out to reach safe workplaces using engineering control and ergonomic requirements. To achieve this condition, it is recommended to get consultation from experts in workplace designing and modification. The experts are engineers, architects, ergonomists, health and safety experts and industry experts. In this stage not only the physical factors of the work environment but also the human factors and ergonomics are required to be taken in to account.

Capacities of the low skilled employees are required to be upgraded by giving them training to carry out their duties with confidence. Then the workers demonstrate better productivity and characteristics that can be associated with their ability manage smooth production and to uplift the income status.

As a long term strategy, the author proposes that the factories should constantly monitor the employee skills status as indicators of the workers and keep on carrying out the uplifting programs to ensure that the objectives are met. For this purpose, the management needs to identify a set of key performance indicators (KPIs) and have mechanisms to collect data in association with these indicators at regular intervals and have a model to analyze this data. These are the enhancements that we can make to the proposed solution framework that will ensure the successful implementation of long term strategies to achieve better health for the workers in a sustainable manner.

Implementation of management systems such as the quality management system will streamline the process which will be a solution to mitigate the causes related to stress as the deep concern about quality failure and production target pressure.

5.4 Limitations

The survey results of this research were subjective because the level of understanding of the questionnaire and the judgment in answering depended on the

employees' social standards. In order to get better results, the methodology of the survey should be changed to diminish this effect. Due to the lack of financial availability, limited access of data collection and unavailability of competent persons, the method mentioned below was not carried out.

Diagnosing health issues to provide a wide range of understanding of the situation in the industry, should be carried out by professional health experts. Their functions would be health examinations, reviewing of medical reports and employee interviews. These data should be processed statistically to identify the health issues in the apparel sector.

During this research data was collected for occupational stress occurring factors, but the amount of psychological stress was not measured due to the lack of resources such as the time availability and unviability of resource persons.

5.5 Further research

It was highlighted in the research outcomes and the analysis results that the majority of the workers in the apparel industry are in the lower social and economic levels. There was a clear mismatch between the realities of mental and physical ill health symptoms and the workers perception on health and safety practices implemented by the factories. It is required to carry out further research, referring to this area to understand the causes of the results obtained.

The majority of employees have stated that they are satisfied with the existing level of health and safety practices and welfare at their work places. Given the fact that the employees are facing severe stress factors and muscular health problems but at the same time they think that factories have a good level of health and safety management practices, and implementations. There seems to be a mismatch between the current management practices and the hazards that the employees are actually facing, when it comes to health matters. Hence, it confirms that better models are required to measure the employees' health and wellbeing.

In future studies, it is suggested to involve health experts such as industrial hygienists, ergonomists, and psychological experts to gain greater insights into the reported health issues to further enhance the solution framework and it is required to

consider conducting health checks to further understand the exact health situation of the workers and the potential risks that they might run into in the future.

Referring to the section above and data analysis, many significant issues existed which are associated with psychological stress emerging causes due to occupations. Such points are inadequate wages, overtime work, high target pressure and deep concern about quality, but the amount of stress was not measured. The research suggests carrying out a stress measuring survey for the apparel industry workers future.

5.6 Chapter Summary

This Chapter consists of five main sections. Section one presents a brief introduction of health hazards and the existing health issues found in this research. Section two contains the conclusion part, which consists of the effect of health and safety with the maturation of the industry, the role of the apparel industry in the economic development of the country and its stake holders. This section gives a further description of the research outcomes such the prevailing health hazards, health issues and the management practices that the industry currently follows.

Section three presents the implication of this research. Such implications are, how the employees' wages affect their expenditure to maintain a good living standard, the types of hazard control and the general infrastructures provided by the industry. Both physical and psychological health issues are prevailing in the industry.

Section four presents the recommendations to overcome these issues. There are three recommendations such as implementing the controlling of hazards by the management, empowering the people, and conducting a surveillance to find issues, in order to take remedial action afterwards.

Section five is allocated to the limitations and further research areas. The main limitation of the outcome of the survey questionnaire was subjective, that depended on the persons' understanding of the social cultural environment. The other limitation was lack of financial and time availability to complete this in a short period.

Medical diagnosis method to identify the work related health issues would be more accurate than the survey questionnaire method. Therefore it is recommended to

conduct a medical checkup method in future researches to identify the health issues among workers in the apparel trade to understand the situation in a broad manner.

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Appendices

Appendix A- Sample Questionnaire

This survey is used conducting as a partial fulfillment of the requirements of the Masters Degree in Occupational Safety and Health, University of Moratuwa. This survey is completely anonymous and confidential. Your responses are a more critical to carry out part of my research. Therefore, please be kind enough to answer all the questions as candidly and completely as possible given below.

Thank you very much for your time valuable contribution.

Employee survey

Please supply the following information by making an 'X' in the appropriate circle where the options are provided.

Section A: Respondent Profile

1.Gender ◯ Male ◯ Female

2. Civil status ◯ Single ◯ Married

3. Age : _____

4. Working Section: ◯ Stores ◯ Cutting ◯ Sewing ◯ Ironing ◯ Packing ◯ Quality

5. Monthly income ◯ 13500 ◯ 15000 ◯ 20000 ◯ 25000 ◯ 40000 ◯ over 40
Rupees?

6. Level of education ◯ Below grade 8 ◯ O/L below ◯ O/L ◯ A/L ◯ Graduate

7. Experience ◯ Below one year ◯ 1-2 ◯ 2-5 ◯ 5-10 ◯ above 10

8. Average working ◯ less than 8 hrs ◯ 8 ◯8-10 ◯10-12 ◯ more than 12
Hours Per day

Section B

Question 1.

Please mark the appropriate response to indicate your own personal feeling by marking **X** based on the following scale for below statements.

Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5

Question 1

#	Indicate what extend you are exposed to following health hazards.	Scale				
		1	2	3	4	5
1	My work place temperature is high and not comfortable to me.					
2	My work place is overcrowded.					
3	My work place is noisy.					
4	I am frequently exposed to fabric dust in my workplace.					
5	My workplace does not have proper lighting to carry out work well.					
6	I frequently exposed chemicals during in the factory.					
Ergonomic hazard exposures at workplaces						
7	My work place is not designed according to me and my job.					
8	I have to work in awkward postures.					
9	I have to work in steady posture for prolong period.					
10	Monotonic repetitive motions are high in my job.					
11	I have to handle heavy goods frequently.					
12	I have not been provided adequate time to rest.					
13	My chair doesn't have a proper backrest for lumber support.					
Psychological health hazards						
14	Supervisors pressurized me for production targets.					
15	I am fear about quality failures.					
16	I have consistent time pressure due to a high work load.					
17	I have many interruption and disturbances while performing my job.					
Other factors						
18	I have to work overtime daily					
19	My wage is not adequate to spend health living life to me.					

Question 2.

Please mark the appropriate response to indicate your own personal feeling by marking **X** based on the following scale for below statements.

Never	Rarely	Every once in while	Some times	Almost always
1	2	3	4	5

#	**Indicate to what extend you are suffering from following health issues due to your occupation.**	**Scale**				
		1	**2**	**3**	**4**	**5**
1	I am suffering from respiratory disease (cough and phlegm, wheezing) due to inhalation of fabric dust.					
2	I have experience skin disease because of fabric dust or chemical usage in the factory or both.					
3	I have hearing problem due to noise exposure.					
4	I am frequently suffering from headache and visual discomfort due to work.					
Venous related illness and symptoms.						
5	I feel heaviness of the legs even after duty finish.					
6	My legs are Aching.					
7	I feel burning in my legs.					
8	I am suffering from calf cramps while working or during rest/sleep.					
9	I have varicose vein illness.					
Muscular illness related symptoms – These pains are occur during after work						
10	I am suffering from neck pain.					
11	I am suffering from shoulder pain.					
12	I am suffering from elbow pain.					
13	I am suffering from hand pain.					
14	I am suffering from upper back pain.					
15	I am suffering from lower back pain.					

Question 3:

Please mark the appropriate response to indicate your own personal feeling by marking **X** based on the following scale for below statements.

Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5

#	Managing Occupational Health in your factory	Scale				
		1	2	3	4	5
Managing health and safety						
1	Factory has appointed capable person to manage Health and Safety concerns in the factory.					
2	Factory takes remediation when health issues arise for us.					
3	I am satisfied about Personal Protective Equipment that the factory has provided. Eg Mask, Ear protectors.					
4	Factory provide annual medical examinations for us.					
5	We are given training and awareness, and communication about warning signs/ PPE and health and safety requirement at work place.					
6	Providing free medical treatment facilities.					
Work environment						
7	Hygienic meal rooms are provided for us.					
8	Clean drinking water is provided for us.					
9	Clean toiles are provided for us					
10	Factory provided adequate rest time for us.					
Occupational stress						
11	Factory provide leisure and entrainment activities periodically.					
12	Factory provides recreation facility.					
13	Job enhancements or promotions are given based on skills of employees.					

Thanks for taking a moment to answer the above questions.

Appendix B - Expert Interview Guidance Form

Note : Confidential and Only the academic purpose -

Date:

Designation:

Experience:

Shop floor employee of apparel industry says the below issues are significant in apparel industry.

Question	Issue	Reason	Solution
1	Why employees work under production targets pressure?		
2	Why employees work under high quality demand and pressure for quality failures?		
3	Why employee are expose to fabric dust frequently at their work place?		
4	Why more employees commented that they do not get enough wages?		
5	Why more employees work at prolong steady posture?		
6	Why more employees commented that they work excessive overtime in daily?		
7	Why employees commented they suffer from leg pain due to work?		
8	Why employees commented they suffer upper back pain due to work?		
9	Does the industry committed to compliance with international and local regulations?		