

FUNCTIONS OF STAKEHOLDERS FOR DIFFUSION OF ENERGY EFFICIENCY
TECHNOLOGIES IN SMALL AND MEDIUM SIZED ENTERPRISES: A CASE STUDY
OF THE SRI LANKAN APPAREL INDUSTRY

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ABSTRACT

The apparel manufacturing industry in Sri Lanka is an important driver of the economy, contributing to 40% of the industrial production and is one of the energy intensive industries in the country. In the apparel industry, energy cost is a significant component of the total operational cost and in Sri Lanka the energy cost is higher compared to most of the competitors, which is one reason for the large companies to introduce energy efficient technologies (EET) in their factories considering the highly competitive nature in the industry. However the small and medium sized enterprises (SMEs) are not yet using those technologies due to the lack of knowledge, finance and motivation. Although several studies has been carried out by illustrating the importance of energy efficiency in reducing the cost and providing recommendations about the possible EET in the apparel industry, the studies regarding diffusion of those technologies in the apparel industry is very rare. The study includes interview and questionnaire survey with apparel industry SMEs and organizations including apparel associations and banks in Sri Lanka and it was found that while the higher energy cost is a considerable issue in the garment industry, the awareness among the SMEs regarding the existing EET is still lacking. The implementation of the EET is further restricted by the lack of access to finance for the SMEs. This study provides a framework on how to diffuse EET by identifying the functions of industry associations, funders such as government and banks and knowledge providers such as universities and ESCOs (Energy services companies). The framework illustrates how the industry associations can collaborate with these stakeholders to provide knowledge and information on technologies, access to finance, and incentives for SMEs to introduce EET and how those associations can become a linkage between SMEs and other stakeholders.

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LIST OF ABBREVIATIONS

Abbreviation	Description
ATC	Agreement on Textiles and Clothing
BOI	Board of Investment of Sri Lanka
CBSL	Central Bank Sri Lanka
CITI	Clothing Industry Training Institute
CFL	Compact Fluorescent Light
EE	Energy Efficiency
EET	Energy Efficient Technologies
ESCOs	Energy Services Companies
EA	ESCOs providing Energy Audit Services
EES	ESCOs providing Energy Efficiency Services
EU	European Union
EPZ	Export Processing Zones
GFP	Garment Factory Program
GWG	Garment Without Guilt
GATT	General Agreement of Tariffs and Trade
GSP	Generalized System of Preferences
GSP+	Generalized System of Preferences Plus
GB01	Government Bank 01
GB02	Government Bank 02
ILO	International Labor Organization
JAAF	Joint Apparel Association Forum
LDB	Lankaputhra Development Bank
MFA	Multi Fiber Agreement

NCPC	National Cleaner Production Center Sri Lanka
NPA	Non Performing Advances
PB	Private Bank
SMEs	Small and Medium sized Enterprises
SLASA	Sri Lanka Apparel Sourcing Association
SLCGE	Sri Lanka Chamber of Garment Exporters
SWOT	Strengths, Weaknesses, Opportunities and Threats
UNIDO	United Nations Industrial Development Organization
US	United States
VA	Voluntary Agreement
WTO	World Trade Organization

CHAPTER 1: INTRODUCTION

1.1. Background of the Study

The depletion of fossil fuels, global climate change and CO₂ emission has increased the interest in the renewable energy and energy efficiency in the industrial sector around the world. Apart from the government policies and consumer pressure, the cost reduction from energy consumption contributes heavily for this kind of movement. The apparel industry is one of those industries, which has the potential to use energy efficiency for cost reduction. The highly competitive nature of the apparel industry has led the apparel making countries to compete with each other with various aspects while maintaining the price competitiveness. Higher quality, labour compliance, shorter lead time¹, labour compliance and total service providing² are usually considered as competitive aspects while few countries try to maintain high price competitiveness by lower wages and lower infrastructure costs as, still the price remains as the main factor for the sourcing decision of the buyers.

Higher quality, higher labour compliances and reliability are considered as main competitive advantages for Sri Lankan apparel exporters. Sri Lanka is one of the very few outsourced apparel manufacturing countries in Asia which has ratified 39 conventions of International Labor Organization (ILO). These regulations have made a requirement to increase the working conditions which lead to higher infrastructure cost and increase in wages. In addition to the increase in cost due to the working conditions, Sri Lankan garment factories experience increase in electricity tariff frequently. As per shown in figure 1.1 the unit electricity rate has been increased five times over 2002 to 2013 period while increasing the fixed charges as well.

¹ Lead time is the time from receiving the order to delivering the finished products.

² Total service providing is handling all the operations from designing stage to final product stage of the garment by the manufacturer.

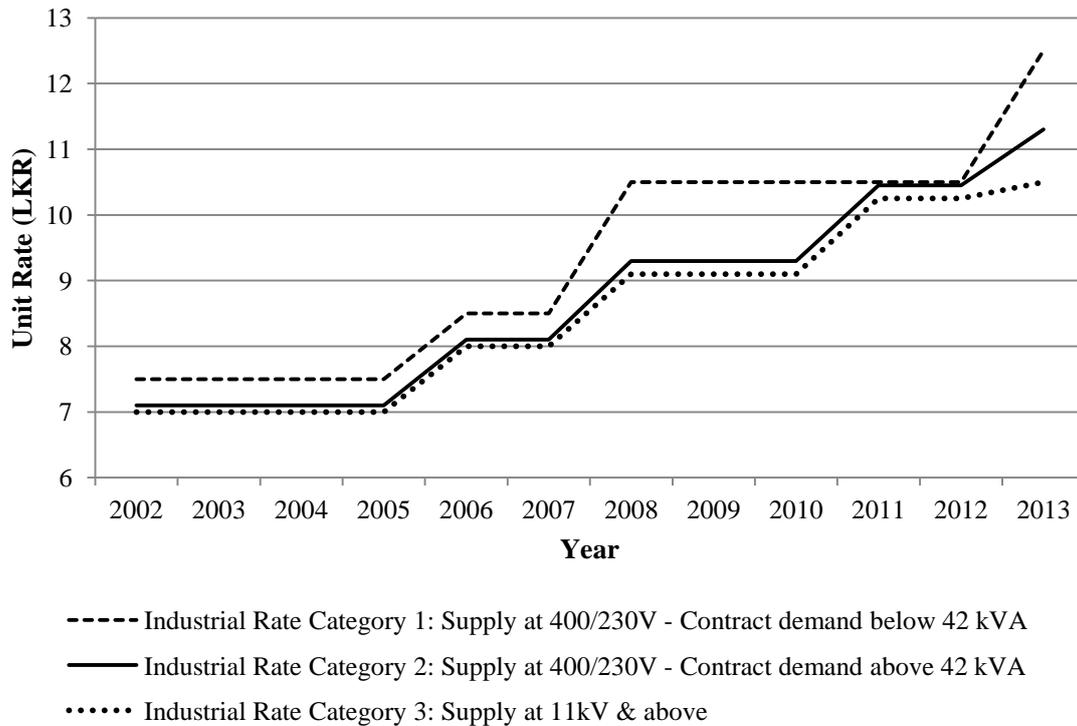


Figure 1.1: Change in electricity tariff in Sri Lanka from 2002 to 2013

Source: Ceylon Electricity Board statistical digest reports from 2002 to 2013

This frequent hike of electricity tariffs and increase in wages due to higher labor standards and labor shortage have resulted Sri Lankan garment companies less price competitive. This issue has led the large apparel manufacturing companies to move towards green manufacturing, where they can obtain a competitive advantage by both cost reduction and product differentiation.

The apparel industry in Sri Lanka is an important driver of the economy in terms of its contribution to industrial production, foreign exchange earnings and employment generation and is one of the energy intensive industries in the country, where energy cost is 6.1% of the total production cost (Central Bank, 2011). The energy cost is higher compared to most of the competitors, which is another reason for the large companies to introduce energy efficient

technologies (EET) in their factories. However these EET are not yet spread among Small and Medium sized Enterprises (SMEs) and the application is still limited to large companies or the SMEs who have higher financial capabilities due to several barriers such as lack of knowledge, finance and motivation. Although several studies has been carried out by illustrating the importance of energy efficiency in reducing the cost and providing recommendations about possible EET in the apparel industry, the studies regarding diffusion of those technologies is very rare.

Considering the above and the inadequacy of the studies regarding EET diffusion in apparel industry and there is a requirement to conduct a proper study to create a framework for efficient diffusion of EET in the apparel industry SMEs. In view of the above considerations, the study is focused on, identifying the current functions of the stakeholders of SMEs in the apparel industry in Sri Lanka, while examining SME's perceptions and situation of current energy consumption. Further this research aims to develop a framework that improves the diffusion of EET in SMEs by identifying the required functions of the stakeholders.

1.2.Thesis Structure

Chapter 1 represents an overview of the thesis, justifying the research problem under investigation. Chapter 2 provides information about the historical and current situation of the Sri Lankan apparel industry and its competitive situation. Chapter 3 explains about the current researches on the EET in the apparel industry and chapter 4 explains the barriers for diffuse on of EET in SMEs and existing studies regarding the diffusion of EET in industries both in general and in SMEs. Chapter 5 presents the methodology of the research. The types

of data collection methods and the description about the sample section are discussed here. Chapter 6 includes the results from the questionnaire surveys and interviews conducted at SMEs and organizations. These results are discussed in Chapter 7 while analyzing the current framework of stakeholders and giving a new proposal for more effective framework for diffusion of EET in SMEs. Chapter 8 presents the conclusion of the research. Also it contains limitations of the research and further research areas.

CHAPTER 2: APPAREL MANUFACTURING INDUSTRY IN SRI LANKA

2.1. History of the Sri Lankan Apparel Industry

The apparel manufacturing industry in Sri Lanka emerged from a modest beginning and experienced a phenomenal growth after 1977, when free trade was introduced. The market friendly environment created by free trade and the implementation of export processing zones (EPZ) encouraged export led industries to start their apparel business in Sri Lanka (Dheerasinghe, 2003). The first EPZ was initiated in Katunayake in 1978 and then followed Biyagama (1986), Koggala (1991), Mihintale (1993) and Kandy (1994).

This liberal trade regime coupled with the low cost of production and availability of highly skilled and trainable workforce attracted quota-hopping East Asian garment exporters to relocate their garment factories in Sri Lanka. This encouraged the local entrepreneurs to venture into this sector to exploit the markets guaranteed by quotas (Wijayasiri and Dissanayake, 2008). At that time majority of the garment production was located near Colombo and from 1993 all the garment companies who are under the Board of Investment of Sri Lanka (BOI) are subjected to same privileges as the companies in EPZs (Knutsen, 2003). Some of the advantages being in BOI or EPZ are duty free imports of machinery and raw materials, low interest on credit, lower corporate taxes and tax holidays, etc. (Kelegama and Epaarchichi, 2002)

The other important factor responsible for the rapid expansion of the Sri Lankan apparel industry is the Multi Fiber Agreement (MFA) which provided opportunities to enter the world markets under the quota system. MFA is a quota agreement that was introduced in 1974, to regulate international trade in textiles and apparel, and was managed under General Agreement of Tariffs and Trade (GATT). Although most efficient garment manufacturers experienced export tightening, Sri Lanka benefited from MFA due to the assured market due

to quota in a very competitive environment. This helped Sri Lanka to protect the industry from competitors from major apparel producers. In addition, BOI came into operation in 1992 and started 200 Garment Factory Program (GFP) in order to encourage the garment manufacturers to move to rural areas. For those factories higher quota and tax exemption were granted with the objectives of reducing the rural unemployment and achieving higher growth of the industry (Kelegama & Epaarachchi, 2002). After the establishment of World Trade Organization (WTO) a new Agreement on Textiles and Clothing (ATC) was implemented to phase out the MFA within ten year period (January 1995 to December 2004) (Wijayasiri and Dissanayake, 2008).

In order to prepare the apparel industry for post MFA era, all the associations in the apparel industry collaborated with the government to establish the Joint Apparel Association Forum (JAAF) in 2002. The members JAAF are Sri Lanka apparel exporters association (SLAEA), National apparel exporters association, Sri Lanka garment buying office association, Sri Lanka Chamber of Garment Exporters (SLCGE) and free trade zone manufacturers association (Arai, 2006; Kelegama, 2005). A five year plan was developed by JAAF after identifying the weaknesses of the industry and came up with a five year strategy report. This report consists of an analysis of strengths, weaknesses, opportunities and threats (SWOT) and a strategy to eliminate the weaknesses, consolidating strengths, use opportunities and minimize threats (Kelegama, 2005). Nine committees were appointed which comprise of representatives from industry and government to implement the strategy (Kelegama, 2009). However the JAAF coordinated the strategy management and hired experts to support the work.

The Sri Lankan apparel exports have been largely governed by MFA until it was totally phased out in 1st January 2005. Although there was serious concern about the fate of

the industry after removal of the MFA, there was an increase in apparel exports due to the introduction of Generalized System of Preferences Plus (GSP+) scheme in 2005. The Generalized System of Preferences (GSP) was introduced in 2003, to assist low and middle income countries to mitigate the impact of MFA removal. In 2005 a new GSP+ was introduced which removed the tariff totally for low and middle income countries which ratify and implement international conventions relating to human and labor rights, environment and good governance. After August 2010, GSP+ was not renewed and this created a great threat for the industry as it was losing the price competitiveness

2.2. Current Performance of Apparel Manufacturing Industry in Sri Lanka

Currently the textile and apparel industry is an important driver of the Sri Lankan economy being the country's largest single industry contributing to 25% of industrial production (Central Bank of Sri Lanka, 2012). By 1992, the apparel industry had become the largest foreign exchange earner overtaking the tea industry (Kelegama, 2005). In 2012 the total value of export earnings in the sector was US\$ 3823 million (JAAF, 2013) accounting for 42.2% of the total export earnings (Figure 2.1).

There was a significant change in the exports to the United States (US) after phasing out of MFA. However as shown in figure 2.2, the exports to European Union (EU) countries increased as a result of GSP+ introduction. This scheme provided a good opportunity for Sri Lanka to supply the garments to EU countries at a lesser price and the total export value increased even after the MFA removal. This situation created a major difference in the Sri Lankan apparel industry by changing the main buyer from US to EU.

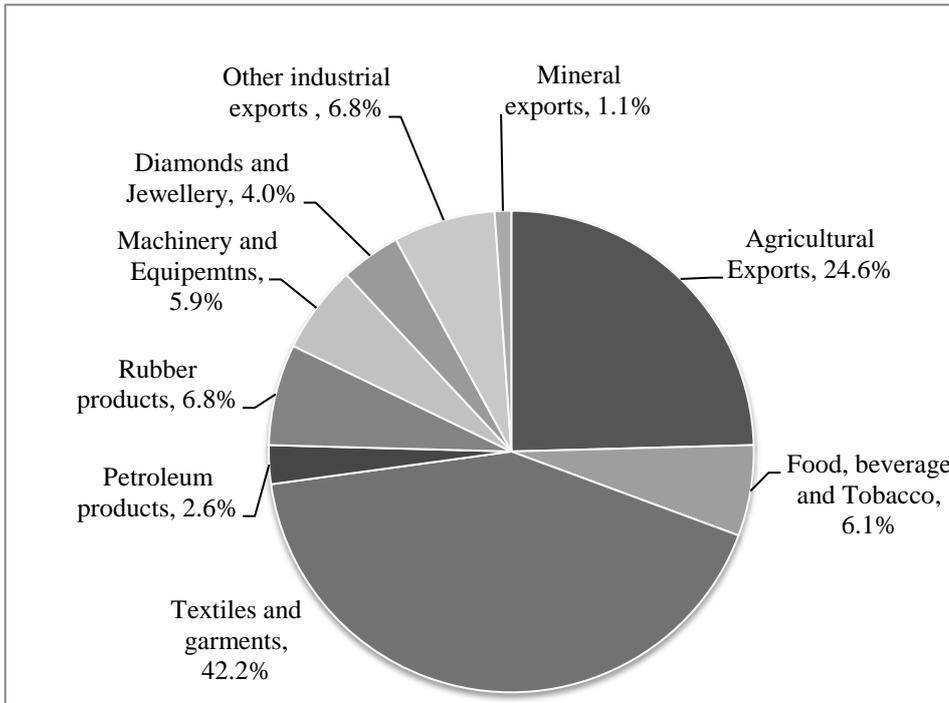


Figure 2.1: Exports by commodity in 2010

Source: (SLAEA, 2012)

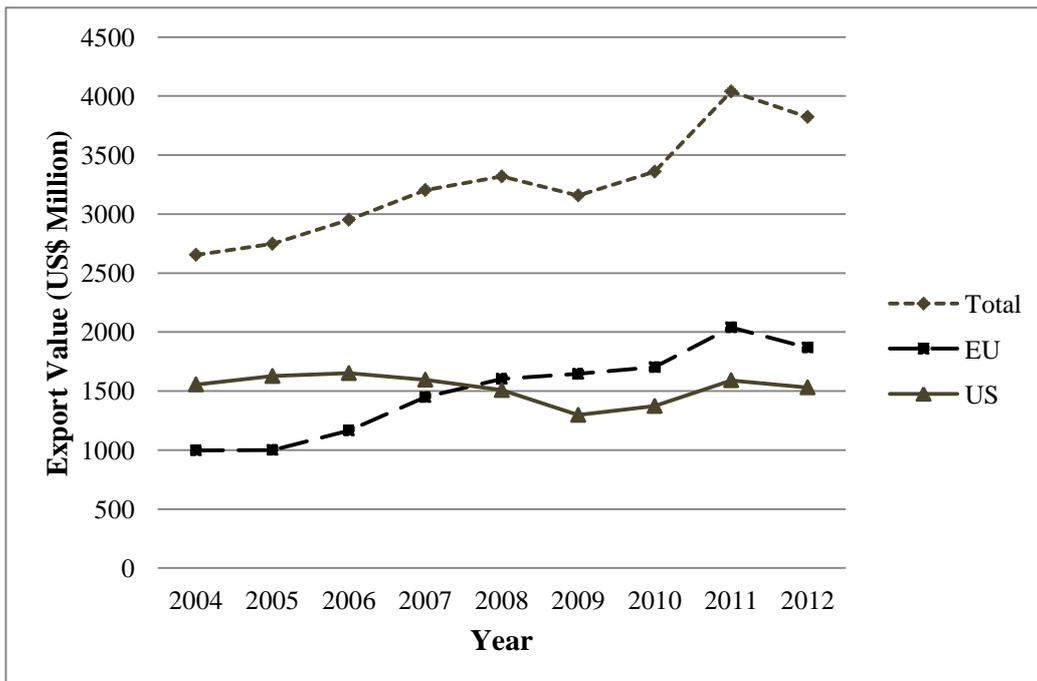


Figure 2.2: Apparel export value from Sri Lanka to US, EU and total

Source: (JAAF, 2013)

Sri Lankan apparel industry depends on two main markets US and EU. In 2005, 59% of the apparel was exported to US and only 37% was exported to EU. However these percentages changed year by year and in 2008 exports to US accounted for only 45%, where exports to EU were increased to 48% (Figure 2.2). With the removal of GSP+ the garment companies have to bare additional 9.6% tariff which was removed due to the scheme. The EU buyers are not willing to take the additional cost and ask the Sri Lankan manufactures to bear the cost making the situation difficult for the industry. While the government is trying to reapply for GSP+ in 2014, manufactures are trying to expand their market to countries other than US and EU, resulting an increase the market of other countries from 7% in 2009 to 11% in 2012 (Figure 2.3).

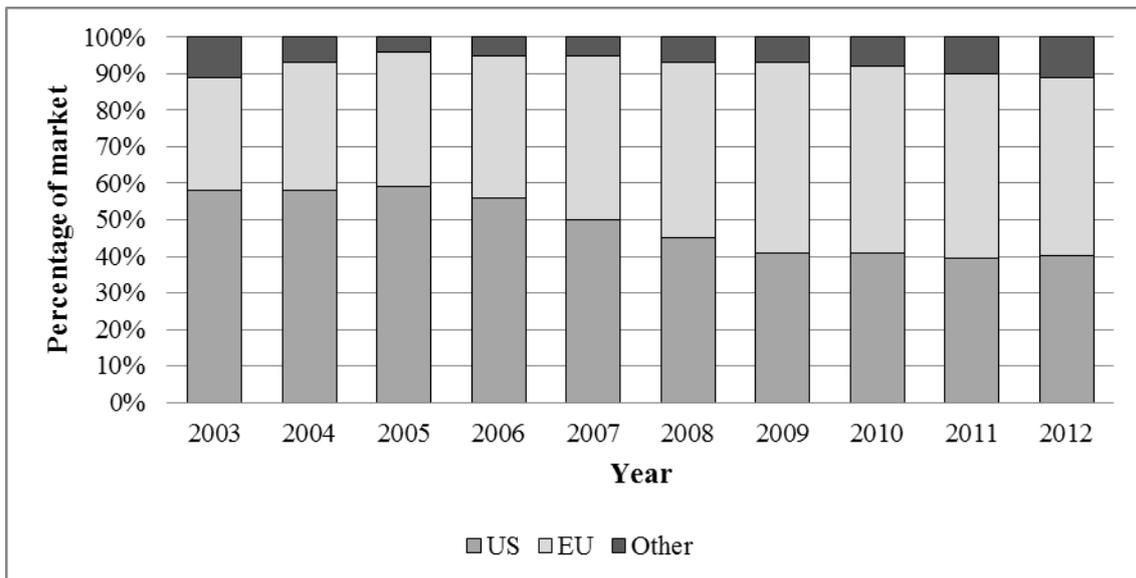


Figure 2.3: Market share of Sri Lankan apparel exports

Source: (SLAEA, 2012; JAAF, 2013)

Sri Lankan apparel industry has established itself as a reliable manufacturer of quality garment. Many buyers request certain standards to be met by manufacturing countries with regard to labor and safety standards and Sri Lankan manufactures have benefited from that being complied to those international labor and environmental standards (Kelegama, 2009). Sri Lanka has strict labor laws governing factory standards, working conditions welfare and prohibited child labor in factories and signed up to 39 of the ILO core conventions (Wijayasiri and Dissanayake, 2008).

The labor standards are regulated and monitored by Labor Department and BOI and the trade union activities and relatively high level of education of the garment workforce has made a foundation for implementing labor laws (Ruwanpura, 2012). One of the programs implemented under the five year plan of JAAF is to communicate the brand image of Garment Without Guilt (GWG) through packaging material, letterheads and websites etc. A Swiss based SGS Group (The world's largest organization in the field of inspection, verification, testing and certification) monitors the code of conduct audit to give the GWG certification (Wijayasiri and Dissanayake, 2008).

However there are several weaknesses that lead to competitive disadvantage such as weak backward integration, higher lead time, low worker productivity, higher labor shortage and high production cost (Kelegama, 2009). Although many efforts have been made to attract investment to build a strong fabric base for the country, it has been slow due to higher cost of machinery, non-availability of local raw material and high cost of electricity (Wijayasiri and Dissanayake, 2008). Increasing cost of labor is one of the reasons for the lack of price competitiveness in the Sri Lankan apparel industry. Currently the labor cost account for 15-30 percent of the total production cost of an average garment factory in Sri Lanka (Kelegama and Epaarachchi, 2002; Central Bank, 2011). Further there is a higher labor shortage in the

apparel industry which forces the factories to increase the wages (Knutsen, 2003; Kelegama, 2009). The higher utility cost has increased the production cost of the factories which is also a reason for lower competitiveness.

In 1977 there were only 5 garment factories in operation and by 2000 it grew to 891 factories. Out of these factories 80% were SMEs employing up to 500 employees (Kelegama and Epaarachchi, 2002). These SMEs were heavily dependent on quota and after MFA phase out many started closing down. From that time the number of factories is gradually shrinking from 830 factories in 2003 (Kelegama, 2009) to 300 factories in 2009 (Lopez-Acevedo and Robertson, 2012). This shrinking is partly due to shutting down of SMEs or been acquired by or merged with large firms (Kelegama, 2009). The buyers are now more concentrated on large suppliers to maintain fewer supplier base and the SMEs are largely depend on the subcontracts from the large companies.

2.3. Structure of the Apparel Manufacturing Industry

Many industries and services involve during the life cycle of a garment including agriculture, textile manufacturing, chemical, apparel manufacturing and retail sector. However when considering the apparel manufacturing industry, textile manufacturers and retailers are directly related to the industry. The retailers (buyers) are responsible for identifying the consumer patterns and requirements and designing the garment. According to that design a price inquiry is sent either to the buying office (intermediary between the buyer and the apparel manufacturer) or directly to the manufacturer.

Apparel manufacturer estimates the cost and send the price quotation to the buying office or the buyer and the order will be placed in the companies who have reasonable price

quotation and considering other factors such as compliance to certain standards, previous experience with the manufacturer etc. Most of the SMEs deal with the buying offices while few large companies have the direct access to the retailers. Apparel manufacturer contacts the fabric and accessory manufacturers after the order is placed. When finishing the garment the manufacturer need the other supporting services such as garment dyeing, embroidery, printing and washing etc. Some large companies own those facilities and most of the SMEs outsource these services.

CHAPTER 3: ENERGY USE AND EET IN THE APPAREL INDUSTRY

3.1. Introduction

Energy efficiency and conservation has become a major component in achieving energy security in the world and recently the trend has shifted from energy conservation to energy efficiency (Tanaka, 2011). Energy efficiency (EE) is defined as, the adoption of improved technologies and practices to reduce energy requirement to produce the same output (Sarkar & Singh, 2010). In addition to the function of providing energy security, improving EE is considered as the fastest and cost effective method to reduce CO₂ emission (Schleich, 2007). The level of EE is determined by economic incentives such as energy prices and the availability of information. Distorted energy prices do not provide necessary economic incentives for the EE which eventually results in lower investment in EE. (Schleich, 2007). In addition to the lower energy prices, higher percentage of fixed charges for electricity and gas also discourages EE investments, as considerable component of the charge is not depending on the energy consumption (Gruber and Brand, 1991). However the factors such as, cutting energy cost (if the energy is a substantial input to the process), regulations (the pressure from the government) and the shifting consumer preferences (the consumers are beginning to favor companies with minimum environment impact) have the ability to drive the industry towards achieving EE (Morris et al., 2011).

Although large companies are more eager to implement and easily adapt EET, the SMEs are reluctant to those technologies even though those projects are financially benefited. Majority of those SMEs believe only on their existing technologies and are risk averse to the unfamiliar technologies (Thiurchelvam et al., 2003). A project work in Cambodia also has found out that the smaller apparel factories have lower energy management practices (Better

Work, 2009a). According to Jananthan et al (2006), there is 15-30% potential for energy saving in the apparel industry in the South Asian region.

3.2. Energy Use in the Apparel Industry

The energy use in the apparel industry is not well discussed in the academic literature although the industry has a significant importance in developing countries (Morris et al., 2011). Garment factories have energy intensive operations that require energy sources, which are categorized as electrical energy and thermal energy (Jananthan et al., 2006). The electricity is supplied through a grid connected power system and stand-alone generator (Mendis and Perera, 2006). Electricity is used for lighting, air conditioning, for machines, heating and ironing, and thermal energy is used for irons and pressures (Jananthan et al., 2006).

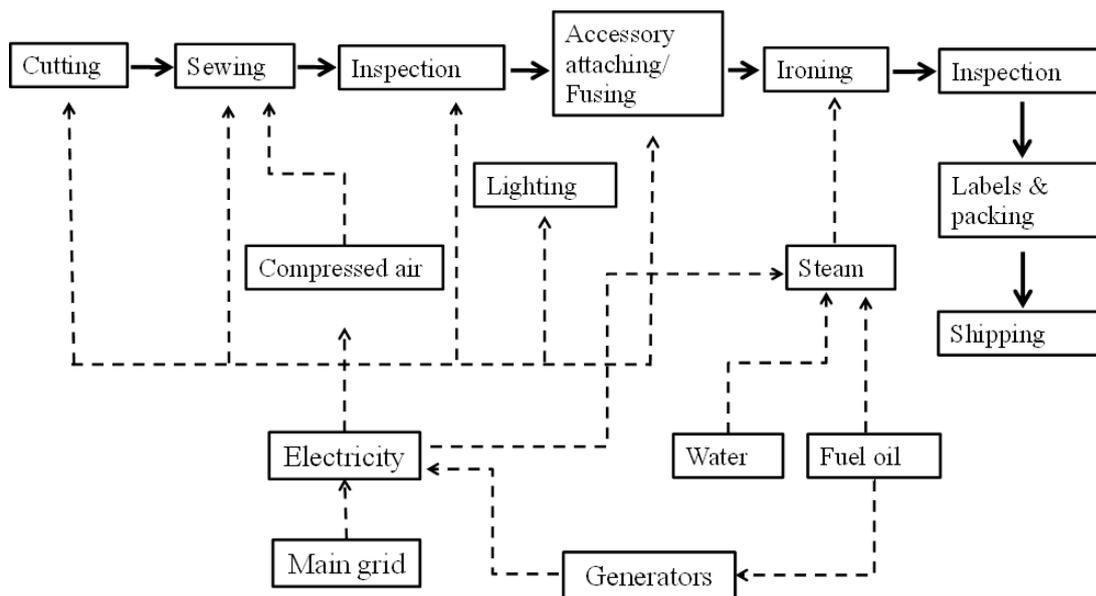


Figure 3.1: Energy use and energy sources of a typical garment factory

Source: Energy Conservation Center Japan (ECCJ), 2006

Figure 3.1 illustrates the energy using operations and energy sources of a typical garment factory. However, the uses of energy from those energy sources can be different from factory to factory with different types of garments, raw materials etc. The energy use in the apparel industry is not only for the production of garments but also for the thermal and visual comfort of the employees and maintenance purposes. Therefore the proportion of the energy use for each process or equipment depends on the working conditions of the factory or country and the technological development as well. The companies who are more concerned about the working conditions may have higher energy cost for air conditioning, ventilation and lighting to fulfill the compliance requirements.

Table 3.1: Percentage of energy used for each equipment by Sri Lanka, Cambodia and Bangladesh

Equipment	Country and Company size			
	Sri Lanka (Large)	Sri Lanka (Medium)	Cambodia (Large & SMEs)	Bangladesh (Large & SMEs)
Air conditioning and ventilation	46%	42%	23.2%	10%
Sewing Machines	19%	24%	38.9%	45%
Lighting	20%	17%	23.9%	30%
Other (Other machines, Compressor, Boiler, pumps etc.)	15%	17%	14%	15%
Source	(Jananthan et al., 2006)	(Mendis & Perera, 2006)	(Better Work, 2009a)	(Hazan et al, 2011)

As per table 3.1, it is seen that the Sri Lankan large companies (who have the obligation to provide good working conditions) have the highest percentage for air conditioning and ventilation. The other two countries' data includes both large and SMEs and therefore have lower percentage for air conditioning. Therefore it is very difficult to determine the normal percentage level of energy use by each equipment as it varies from country to country and the size of the factory.

3.3. Energy Saving Opportunities in the Apparel Industry.

Energy saving opportunities for industry have two main categories; the direct reduction of energy consumption by optimizing the internal production processes and indirect reduction of energy consumption by changing the firm's products to consume less energy (Morris et al., 2011). The EE potential in apparel industry falls into the first category and in this thesis only the direct consumption reduction is discussed. Considering the apparel manufacturing industry, most common energy saving opportunities are with sewing machines, lighting systems, cooling system upgrade, boiler upgrade and load shifting (Better Work, 2009b; Morris et al., 2011).

3.3.1. Lighting

Lighting is one of the major energy consumers in the apparel industry and it is the most common EE improvement activity implemented in apparel companies in South Africa (Morris et al., 2011). All the EE improvements in lighting fall into three main categories as; optimizing, upgrading and maintenance.

3.3.1.1. Optimizing

In some cases, improved lighting efficiency can be achieved by having minor modifications to existing systems and maintenance practices. Adjusting lighting proximity is

one such modification where the factories can consider the feasibility of lowering the ceiling mounted lighting near to the working area. In addition using task lighting and installing automatic control systems are also such kind of optimizing solutions (Better Work, 2009b; Tetra Tech, 2006).

3.3.1.2. Upgrading

Apparel industry normally uses fluorescent lighting which requires a ballast to start up, control power and control light quality of the lamp, and the EE is achieved by upgrading both the lamp and the ballast. The garment factories typically use the magnetic ballasts which are the least efficient ballasts available. The most energy efficient one is the electronic ballast which has a lower heat dissipation, reduced flicker, lower weight, lesser noise and longer life (30,000 hours compared to 10,000 hours of magnetic ballasts) (Tetra Tech, 2006; Hazan et al., 2011; Singh et al., 2012).

The other method is to install energy efficient lamps. T5 lamp is the most efficient fluorescent lamp available and it has lower system wattage. Using either T5 or T8 lamp with electronic ballast is the best option and T10 and T12 lamps should be phased out (Tetra Tech, 2006; ECCJ, 2006). The incandescent lights should be replaced with Compact Fluorescent Light bulbs (CFL) which has an extended lifetime (Singh et al, 2012; Mendis and Perera, 2006). Another lighting improvement is that installing reflectors to improve the actual illumination (ECCJ, 2006; Jananthan et al., 2006).

3.3.1.3. Maintenance

Typically in the factories the attention to the lighting system is given only when the lamp fails. However, regular cleaning and maintenance of the lamps can enhance the overall performance. Energy programs have recommended to use strategic re-lamping where the

lamps will be replaced when they reach 70% of the life span at the point which the performance of the lamp begins to decrease (Better Work, 2009b; ECCJ, 2006).

3.3.2. Air conditioning and ventilation

Comfortable working environment is a requirement for the garment factories and many buyers consider it as a compliance requirement. Comfortable indoor environment requires ventilation not only air exchange but also control of humidity and temperature and such system consumes huge amount of electricity. The factors affecting thermal comfort in the factory include the temperature, wind velocity, humidity, building height and depth and building material (Chowdhury and Alam, 2011). Recently, installing evaporative cooling system has appeared as a good method for reducing the electricity consumption for cooling systems (Tetra Tech, 2006; Better Work, 2009b). Some garment factories are currently using evaporative cooling and it consumes around 75% less energy than traditional air conditioners. However evaporative cooling increases the relative humidity and is effective only in dry climates (Bakmeedeniya, 2010; Tetra Tech, 2006).

Polygeneration with desiccant cooling system which is a combination of cogeneration systems and thermal cooling systems is an emerging alternative cooling system. In this system the thermal energy is produced by solar power or municipal solid waste and the thermally driven chillers are used to produce cooling for the building (Bakmeedenniya, 2010). Mendis and Perera (2006) have mentioned about replacing constant speed drivers of air handling unit with variable speed drives to reduce the energy consumption. Roof garden, solar shading, permeable opening and controlled natural ventilation are the other methods mentioned in the literature (Naz, 2008).

3.3.3. Other equipment

Boiler is also a key energy user in the apparel industry and it is used to generate steam for ironing and pressing. The effort to improve the boiler efficiency depends on its size and larger boilers need greater attention and have a higher potential of energy savings. Repairing steam leaks, minimizing vented steam and implementing effective steam trap maintenance program are the short and medium term methods (Jananthan et al., 2006; Tetra Tech, 2006; ECCJ, 2006). Long term measures include using high pressure condensate to make low pressure steam, utilizing back pressure turbine (Tetra Tech, 2006) and using solar panels to heat water up to 75⁰C and then sending to the boiler (Mendis and Perera, 2006).

Compressed air system is also an important energy user in the garment industry and many existing systems have low efficiencies due to air leaks, inadequate selection of compressors and poor controls. By minimizing the air leaks, installing variable speed controller and installing intermittent controller, the efficiency of the compressors can be improved (Mendis and Perera, 2006).

Every operation in the apparel industry generates heat and contributes to the supplemental heat load of the factory, creating additional demand for cooling in the factories. Garment factories can consider about the energy consumption rating of the cutting and sewing machines when replacing old machines to reduce the heat load and also to directly reduce energy consumption (Tetra Tech, 2006). By renewing the sewing machines every four to five years, the energy efficiency will be improved in the factory (ECCJ, 2006).

3.4. Energy Audit

The above researches or the benchmarking piloting programs have provided information about the available energy efficiency opportunities in the industry. However in

order to identify the specific energy saving measures in a specific factory it is required to carry out energy audit as energy consumption is different from factory to factory. The energy audit is performed by an experienced contractor with the necessary equipment to measure the energy use of individual equipment. After an initial audit, more detailed audit will be carried out by installing additional meters. This audit not only shows the energy use in the factory but also gives the factories the options available to reduce the energy consumption, the costs and other benefits (Mendis & Perera, 2006).

CHAPTER 4: BARRIERS AND POLICIES FOR IMPLEMENTING EET

4.1.Barriers for Implementing EET in the Industries

EET do not diffuse very rapidly like some other technologies such as information technology, especially in developing countries. Several previous studies have been conducted to identify a comprehensive list of barriers to implement energy efficiency in the industries. In the literature, various categories of barriers have been identified and in this thesis the barriers are categorized as policy and regulatory barriers, financial barriers, information barriers and other barriers.

4.1.1. Policy and regulatory barriers

Some governments provide energy subsidies so that the energy price is kept below the marginal social cost. The energy subsidies may include; price controls, lower cost energy related services, grants and low interest loans for investment in energy supply (Schleich, 2007). These kinds of subsidies increase the energy consumption and discourage the investment of energy efficiency (Worrel and Price, 2001; Sarkar and Singh, 2010). In addition to the lower energy costs, the uncertainty of the energy price in the future is also a barrier for EET implementation (Worrel and Price, 2001).

One of the barriers which is more relevant to developing countries is the lack of institutions and capacities of the existing agencies to develop the markets for EET (Sarkar and Singh, 2010). Although when some EE regulations are introduced, if they are not properly enforced or coordinated it will lead to slow diffusion of EET. The other barriers include; procurement policies which favor lower cost, import duties on energy efficient equipment and the lack of appliance standards. (Sarkar and Singh, 2010).

4.1.2. Finance barriers

The financing barrier occurs when there is lack of capital for EET implementation. This is more prominent in the case of larger investments or SMEs. This is a significant barrier for EET diffusion even though the EE project is profitable (Fleiter, 2012). The energy efficiency gains can only be achieved if proper financing mechanism is available and other barriers such as lack of information and awareness are addressed (Painuly et al., 2003). Further the energy efficiency investments are not considered as a priority for many firms. In case of limited capital availability, the energy efficient investments have to compete with other investments and which are perceived as less risky (Thollander et al., 2007; Worrel and Price, 2001). However the empirical research does not support the idea that the energy efficient investments are more risky than other projects (Schleich, 2007).

The most convenient way of getting the capital for a firm is to use the internal funds. However if the internal capital is used for other priorities which provide more rate of return, it would be difficult to compete with them (Worrel et al., 2001). In developing countries access to the external capital is more important as the companies' tendency to use internal funds to energy efficient projects is very low (Schleich, 2007). Loans are such common external funding source where the firms can borrow from international or local commercial banks. In some cases international funds provide loan facilities with low interest and flexible time frames. In that case for energy efficiency projects are more attractive for commercial banks (UNIDO, n.d.).

The lack of access to finance is more prominent in SMEs and one of the main reasons is identified as lack of access to bank facilities (Gamage, 2003). The higher administrative cost compared to the loan size is one of the reason for lending for SMEs become low profitable for the banks (Levitsky, 1997; De Alwis and Basnayake, 2009). Previous studies

have mentioned several categories of reasons for SMEs to have less access to finance such as; inability to provide financial information, lesser assets to offer as collateral and considered as high risk borrowers.

Most of the SMEs in developing countries face difficulty in access to credit from banks because of the lack of proper financial records. When the companies are small, there is no legal obligation to report financial information or to maintain audited financial accounts and therefore they usually lack of accounting skills as well (Pandula, 2011). Only the SME knows the information about the energy efficiency project and their willingness to pay the debt and it is difficult for them to submit a good project proposal or business plan to get the loan (De Alwis and Basnayake, 2009).

Due to the above asymmetric information problem, the banks are willing to lend based on collateral rather than project cash flow. This collateral is an assurance of the bank on the commitment of the borrowers' loan repayment (Pandula, 2011). However SMEs have lack of collateralisable assets due to the labor intensity of the operation and lower value of the machinery and the property compared to large companies. Land is mostly considered as collateral for commercial loans in Sri Lanka and the lack of well-developed land market prevents the banks to provide mortgage based loans to the SMEs in rural areas (De Alwis & Basnayake, 2009).

The SMEs have a higher failure rate which leads the banks to consider them as high risk borrowers (De Alwis and Basnayake, 2009). Moreover, the poor business performance is another reason for not receiving loans and the companies with increasing sales and profits have less credit constraints (Pandula, 2011).

Energy efficiency project lending is difficult in developing countries as banks are unfamiliar with those projects and perceive high risk as they are not traditional projects (Painuly et al., 2003). Most of the EET investments require lower investments and do not generate separate revenue stream which can provide the banks some kind of collateral and this makes difficult for companies to get loans for EET projects if they are not a part of the core production process (Schleich, 2007).

4.1.3. Information barriers

Although many energy efficient technologies with relatively short payback time are available, the lack of awareness of those technologies leads the lower investment to EET (Morris et al., 2011; Gruber and Brand, 1991). Also the energy awareness to reduce the production cost is not a priority for most of the companies (Worrell et al., 2001; Worrell and Price, 2001). Studies have shown that significant number of EET available in the market is not known by the firms specially in case of SMEs (Kounetas et al., 2011; Thollander et al., 2007). Further in most industries benchmarking of industrial energy use is not available and the firms have lack of information about the best practices about EET. As the SMEs do not have own expertise to quantify the cost and benefit of the EET, they are discouraged to implement those EET in their companies (Morris et al., 2011).

Information collection and processing is usually time consuming for the firms which creates another reason for lack of information about energy saving measures (Worrell et al., 2001). The cost of investing to EET is increased when the information is not readily available. The increase in search cost further increase the uncertainty regarding the EET investment. Further the managers or the owners in SMEs are reluctant to consume their time to search for information about energy efficiency. In some cases it is difficult to monitor or evaluate the performance of the EET investments such as control systems, motors or variable

speed drivers and the feedback of that technology is not available (Schleich, 2007). Since it is difficult to show the positive returns from those investments, some firms are reluctant to implement those technologies (Chai and Yeo, 2012).

Obtaining information from the equipment suppliers is the most cost effective and less time consuming way of transferring information to the firms. However equipment suppliers also may not have the information about the energy efficiency potential or the assessment methods (Worrell and Price, 2001). Some equipment sellers try to include the energy efficiency information to their marketing process, but most of the end user companies do not believe the information provided by the equipment suppliers (Schleich, 2007). The suppliers are more discouraged to mention about the energy saving when the companies are more concerned about initial cost rather than energy saving (Chai and Yeo, 2012).

4.1.4. Other Barriers

Lack of skilled personal to; install, operate and maintain the technology also lead to lack of investment of EET in industries (Worrel and Price, 2001). This is mostly seen in SMEs where most technical personal are busy with production operations (Worrell et al., 2001). In addition to the problems regarding the human resources in firms, the lack of experts in the banking sector regarding energy efficiency project financing also affect the lower energy efficiency investment (Schleich, 2007). Due to sunk costs, increasing returns of scale and network effects, the firms may lock-in to technologies which are sub optimal. This kind of lock-in effect will slower the technological change and will prevent the EET entering the market (Schleich, 2007).

4.2. Policies for Implementing EET

The policy measures for implementing EET in the previous studies are in mainly two types; the measures that help to overcome financial barriers and measures that provide information, motivation and consulting. However in this chapter the policy measures are discussed in various sub categories to discuss them broadly.

4.2.1. Regulations and energy tax

The regulations and legislations include minimum efficiency standards for machinery and equipment, mandatory requirement for energy manager and mandatory energy audits. These types of energy regulation programs have been successful in some EU countries (Chai and Yeo 2012). However for SMEs, instead of sanctions it would be better to use compliance strategy (Thiruchelvam et al., 2003).

By imposing energy tax the environmental externalities and the social costs will be internalized (Gruber and Brand, 1991). This would improve the energy efficiency in the industries, as higher energy prices encourage energy savings (Schleich, 2007). The taxes encourage energy efficiency in all the industries but will be more effective in more energy incentive industries (Tanaka, 2011). Most of the developing countries have imposed energy subsidies to the energy price in order to address poverty and it is difficult for them to impose taxes or remove those subsidies (Schleich, 2007).

4.2.2. Voluntary agreements

A Voluntary Agreement (VA) is a new approach of industrial energy efficiency improvement in several industrialized countries which is a contract between the government and a private company or other institution. According to this agreement, the private company will promise to achieve energy efficiency improvement and the government will promise to

provide some policy support (Worrel and Price, 2001). VA is usually coupled with policy measures such as tax incentive, subsidies or exemptions, investment grants and awareness programs such as; energy audits, energy management systems and energy manager training (Chai and Yeo, 2012).

The success of the VAs strongly depends on the accompanying policy mix, supporting framework, potential for energy efficiency of the company (Chai and Yeo, 2012; Worrell and Price, 2001). It was found that this type of agreement is less effective with small companies (Chai and Yeo, 2012). However VA is very popular with the governments as it has minimum effect to the industry competitiveness and it increases the awareness about financial incentives offered by the government (Chai and Yeo, 2012).

VA has been successfully implemented in Netherlands, Germany, Japan, Singapore and Korea (Chai and Yeo, 2012). In Netherland the companies who have participated VA are receiving tax relieves, simplified procedures for environmental regulation compliance etc. (Worrel and Price, 2001). In Japan and Singapore the VA is used to increase the awareness of the energy efficiency by employing energy auditing and energy management systems (Chai and Yeo, 2012).

4.2.3. Providing information

According to the study of Palm and Thollander (2010), the companies receive information through various sources such as; colleagues in the company, consultants, conference and seminars, from suppliers, colleagues in the sector, written sources such as journals, industry associations and energy audits. The oral information was identified as more important than written information and most of the companies have used the information from colleagues. However when the companies use colleagues as information sources, the

existing behaviors and perception regarding energy efficiency will prevail and new technology will not be introduced to the company (Palm and Thollander, 2010).

Study of Gurber and Brand (1991) suggests that the companies should be educated by using trade literature, communications and annual meetings. The meetings should have an overview of energy saving potential, financing and consulting possibilities and public policies. For the large firms, trade specific training can be applicable and for small firms it is better to use the service of consultants. This study further mentions that the best way to overcome the information barrier in the SMEs is not to train the managers, but to encourage them to use consultancy services. Some other researches also mention about the importance of giving training, information sharing and education (Tanaka, 2011) and contracting specialized personnel, demonstration projects, exhibitions and cooperation with specialized agencies and research centers (Kounetas et al., 2011)

In order to build the capacity for information providing, Sri Lankan government conducted an energy auditor training program from 1984 to 2007. Under this program more than 300 energy sector professionals were trained (Wickramasinghe, 2009).

4.2.4. Financial supports

Subsidies and soft loan programs are considered as more effective policy measures to implement EET in the industries. One of the loan programs which had a large impact was energy conservation loan program implemented by China in 1980. In addition to the loans, some energy efficiency funds have been using in many countries in order to promote energy efficiency investments. Czech Republic, India, Hungary, Korea, Brazil, Romania and Thailand have developed such kind of funds (Painuly et al., 2003). One successful example can be identified in Germany, the special fund for energy efficiency in SMEs which provides

grants to obtain consultation for energy efficiency investments (Tanaka, 2011). In globally, International finance corporation and Renewable energy and efficiency fund has some funding schemes. These schemes are very useful for the developing countries where the banks are reluctant to lend to the energy efficiency projects (Painuly et al., 2003).

Sri Lanka has similar kind of fund called “Energy Conservation Fund” from 1985 to 2007 aiming to finance, promote and initiate energy conservation programs in Sri Lanka. Due to the increasing importance of energy efficiency in Sri Lanka the fund was replaced by forming a new institute named “Sustainability Energy Authority” in 2007 to provide more staff and to give independency (Wikramasinghe, 2009). Under these programs tea industry, hotels and apparel industry was identified as the subsectors need the EE improvement. However the program covered only the tea industry and hotel sector (Wickramasinghe, 2009).

Grant programs are also effective in promoting EET investment. However the grants are awarded for short time period and will not be a long term measure. US has a program called energy efficiency and conservation block grant program aiming installation of EET (Tanaka et al., 2011).

Direct subsidies mostly used by governments to encourage more investments and some studies have shown that the use of subsidies helps to improve the adoption rate of EET in the SMEs (Worrell et al., 2001). There are some examples of various subsidy programs in several countries such as; China (Subsidy in improving energy efficiency and environmental quality), Czech Republic (State subsidy program for energy saving in industry), France (energy efficiency subsidies to prioritize new technology, financing roe energy efficiency investments) and Norway (Subsidies for energy efficiency and renewables) (Tanaka, 2011). However one problem regarding the direct subsidies is that it may lead to free riders problem

where the companies who already have the capacity will use the subsidies to make the investment (Worrell et al., 2001).

4.2.5. Subsidized energy audits

Energy audits are more targeted and effective type of information transfer method which exists in many countries (Worrell and Price, 2010). The largest energy audit program in the world was conducted by the American industrial assessment centers and it offered the industrial SMEs free energy audit without any agreements (Thollander and Dotzauer, 2010). In Finland the energy audit program provided 40% of the energy audit cost and in Norway the program was free of charge (Thollander and Dotzauer, 2010). Australia offered energy audit program at 50% discount (Thollander et al., 2007). In addition to these countries Canada, France, Italy and New Zealand also have subsidies for energy audit programs (Tanaka, 2011).

Although various kinds of subsidies are available literature suggest that partly subsidized programs are more effective as the companies are also able to join the program (Thollander et al., 2007). However the only problem associated with this subsidized energy audit programs is, there is a possibility that the companies may not implement the measures identified in the energy audit (Thollander and Dotzauer, 2010).

4.2.6. Promoting Energy Services Companies (ESCOs)

ESCO is a company which engages in developing, installing and financing the energy efficient projects (Vine, 2005). The projects are performance based and duration is typically from 5 to 10 years. The most popular ESCO models are shared saving contracts and guaranteed savings contract. In shared saving contract, the ESCO finance the total project by

themselves or borrowing from third party. In the guaranteed saving contract the ESCO guarantee the saving and the company has to borrow it from a bank (Painuly et al., 2003).

Promoting energy efficiency through ESCOs is an effective method of overcoming both information and finance barriers. However as the SMEs have higher financial risks and the projects in SMEs are relatively small the ESCOs may be reluctant to have contracts with them (Fleiter, 2012).

4.2.7. Collaborations

For policy options to be successful, coordination among government, environmental agencies, industry associations and other agencies is required (Thiruchelvam et al., 2003). When the government and industry associations work together, there will be easy access to industry data and increased cooperation. The industry associations collect data which can be used for policy development and it reduce the transaction cost for policy making by the government (Tanaka, 2011). However the effect of industry association to be significant, most of the firms in the industry should join the association. In case of Cambodia, all the exporting apparel companies are required to be the members of the Garment Manufacturers Association of Cambodia (Better Work 2019a). One of the successful collaboration program include the China motor system energy conservation program (A pilot training program to build the technical capacity to implement system optimization evaluations and solutions) by United Nations Industrial Development Organization (UNIDO), US department of energy, the energy foundation and Chinese government (Morris et al., 2011)

Majority of previous literatures (except few studies) have concentrated the research only addressing either information or finance barrier. As the SMEs in developing countries have both types of barriers it is necessary to conduct a study considering all the barriers

together. Most of the above policy measures are only applicable to developed countries and the majority of the policies are not suitable for the apparel industry except the Cambodia garment manufacturing case. The work done by Better Work (2009a) in Cambodia also aimed at transferring the EET from developed country to Cambodia rather than diffusion of the technologies among SMEs. In case of Sri Lanka the large companies have already adopted the EET successfully and need to develop a framework to diffuse those technologies to SMEs.

CHAPTER 5: METHODOLOGY

The research was conducted based on 2 main research questions and 6 sub questions as follows.

Q1. What is the current framework of EET diffusion in Sri Lankan garment industry?

- q1. What are the available EET in the apparel industry?
- q2. What are the barriers for diffusion of EET in SMEs in the apparel industry?
- q3. What are the policies that can promote EET in SMEs in the apparel industry?
- q4. What is the current energy efficiency situation in the apparel industry Sri Lanka?
- q5. Who are the main stakeholders responsible for EET diffusion in apparel industry Sri Lanka?
- q6. What are the current functions of the stakeholders in EET diffusion in apparel industry Sri Lanka?

Q2. What are the more appropriate functions of stakeholders for EET diffusion in apparel industry Sri Lanka?

5.1. Identifying Existing EET, Barriers and Policies for EET

The secondary data sources such as academic papers, websites, trade journals, trade policy reports were used to collect data on the existing EET in the market and the barriers the firms face when implementing EET and the policies implemented by governments and other agencies to ease the diffusion of EET.

5.2. Identifying the Current Functions of Stakeholders in EET Diffusion and Current Energy Efficiency Situation in Apparel Industry Sri Lanka

In this section mainly the primary data sources such as questionnaire survey and interviews were used for collecting data. However some data had to be obtained by secondary data sources such as company websites.

5.2.1. Questionnaire surveys and interviews of SMEs

The data from the secondary data sources was used to create the questions for the questionnaire survey. The questionnaire included questions related to the general company information, waste management, energy management, social aspects, economic aspects, networks and collaborations. The questions were structured and the respondents had to choose or write the direct answer. In addition to the questionnaire an interview was also conducted with unstructured questions to clarify the answers in the questionnaire and to discuss the problems the companies are currently facing (Refer appendix 1 for full questionnaire).

The contact list of 268 registered garment companies was obtained by visiting an apparel association and companies were selected by referring the websites or directly calling them to check whether they are falling in to the required category. There is no clear definition to categorize the SMEs in Sri Lanka and various studies use their own categorizations. The most common definition in the literature is based on the number of employees and some of the categorizations are shown in table 3.1.

Table 5.1. Categorization of apparel companies based on number of employees

Source	Size of the company		
	Small	Medium	Large
Arai, 2006	Less than 200	201 - 500	More than 500
Deerasinghe, 2003	Less than 100	101 - 500	More than 500
Weerarathne, 2004	Less than 100	101 - 500	More than 500
Thollander et al., 2007	Less than 250	251 - 500	More than 500
Kelegama and Epaarachchi, 2002)	Less than 100	101 - 500	More than 500

According to the above information all of the studies considered SMEs as the companies with less than or equal to 500 employees. However apparel associations categorize the SMEs as the companies with less than 250 machines. The normal labor to machine ratio in the Sri Lankan garment industry is 1.8:1 which makes both the categorizations almost same. However to avoid confusion in this research the SMEs are defined as the companies which has less than or equal to 500 employees and less than or equal to 250 machinery.

The companies which have less than 30 employees were ignored as they have too much barriers to undertake EET implementation. Further the companies catering only local market and not doing sewing operations were also included in the company list and they were also ignored as they are not within the scope of this research. However some of the contact information in the given list was inaccurate and could only select 37 SMEs meeting these requirements. Out of those SMEs only 19 companies agreed to participate in the survey (The

basic details about the interviewed SMEs are presented in appendix 6). Those interested companies were visited and the owner or a person who is in top management level was interviewed while filling the questionnaire. After this questionnaire session the companies who have not joined any apparel association were identified and they were contacted again through telephone. A detailed interview was conducted to identify; the reasons for not joining the associations, the factors that might motivate them to join the associations and the sources of information regarding associations and technology (Refer appendix 2 for interview questions).

5.2.2. Interviews of organizations

The interview consisted of semi structured or unstructured open ended questionnaires, and each interview took more than 40 minutes (The basic details about interviewed organizations are presented in appendix 7). The interviewed organizations were;

- a) Joint Apparel Association Forum Sri Lanka (JAAF)
- b) Sri Lanka Apparel Sourcing Association (SLASA)
- c) National Cleaner Production Center Sri Lanka (NCPC)
- d) Sri Lanka Chamber of Garment Exporters (SLCGE)

JAAF is the apex body of all the textile and apparel associations in Sri Lanka. The members of JAAF include Sri Lanka Apparel Exporters Association, Apparel Exporters Association-200GFP, SLCGE, SLASA, Free Trade Zone Manufacturers Association and Fabric and Apparel Accessory Manufacturers' Association. One of the directors was interviewed by visiting the office and interview was mainly aimed at identifying the problems faced by the industry, the competitive situation, environmental performance and the contribution of JAAF for the environmental improvement of the industry (see appendix 3 for

the main questions in the interview). The purpose of interviewing JAAF was to have a broad industry perspective for the study.

SLASA was formed in 1993 and the members are the buying offices of international reputed brand names. One of the director of SLASA was interviewed by visiting his office to get the buyers perspective for the study. The problems, competitiveness, environmental performance of the industry and the buyers view about the environmental performance of the garment factories were discussed during the interview. The main questions were similar to the questions for JAAF but the discussion was different as it is from the view of the buyers.

NCPC was established by UNIDO to assist the companies in cleaner production in 2002. It is also considered as an ESCO registered under Sustainable Energy Authority and it provides energy audits for the companies. The director of NCPC was interviewed by visiting the head office using unstructured interview questions. During the interview it was discussed in detail about the main issues NCPC addresses in the garment industry and the financing options.

SLCGE is the association representing SMEs in the apparel industry. The Chairman of the SLCGE was interviewed over the telephone and semi structured questions were used. The main areas covered in the interview was the accessibility of the association to the SMEs, the benefits of joining the association, energy efficiency situation in the apparel industry SMSs, their commitment to diffusion of EET in SMEs and financial barriers of SMEs in apparel industry (The interview questions are available in appendix 4).

5.2.3. Interview of financial institutions

Lack of access to finance is considered as a main barrier for EET diffusion in the SMEs. Therefore it was decided to interview some banks and get the idea from the financial

institution's perspective. Two government owned commercial banks (GB01 and GB02), one private commercial bank, a bank specialized for SMEs and the Central Bank of Sri Lanka was selected to conduct the interviews (The basic details about those financial institutes are presented in appendix 8). Specialized personnel for the SME lending and the credit guarantee scheme was interviewed in the banks to identify the reasons for lack of access to loans to SMEs and garment companies. The interviews of the three commercial banks were semi structured (Interview questions are available in appendix 5) and other two were unstructured interviews. The information about loan scheme for apparel industry SMEs was discussed with SME bank and the details about credit guarantee scheme for apparel were discussed with the Central Bank.

5.2.4. Collecting information about ESCOs

There are three types of ESCOs in Sri Lanka;

- I. ESCOs providing Energy Audit Services (EA) – 6 companies
- II. ESCOs providing Energy Efficiency Services (EES) – 4 companies
- III. ESCOs providing both EA and EES – 14 companies

Out of these 24 ESCOs only 11 have company websites. Referring those websites the information was collected on available contracting schemes, services provided by them and the nature of the clients. Appendix 9 presents some basic information about the selected 11 ESCOs.

5.3. Identifying More Appropriate Functions of Stakeholders for Diffusion of EET

The primary and secondary data was qualitatively analyzed to identify the most important stakeholders for the apparel industry SMEs and their roles to accelerate the diffusion of EET in the apparel industry.

CHAPTER 6: RESULTS

This Chapter includes the results of the data collected during the questionnaire survey and interview of the SMEs, organizations, banks and ESCOs. The results are discussed under five sub sections as; overview of the companies, the energy management of the companies, awareness and access to information, access to finance and stakeholders and networks.

6.1. Overview of the SMEs

SMEs play a very important role in the Sri Lankan apparel industry. JAAF and SLCGE pointed out that SMEs need to be in the industry to carry out certain types of orders such as smaller quantity which cannot be handled by a large factory. According to JAAF, previously Sri Lanka had around 100 to 150 SMEs and now there are only 40 to 50 in the apparel industry. The SMEs interviewed were well distributed according to number of employees and number of sewing machines (Figure 6.2) which enabled covering many areas about SMEs in the Sri Lankan apparel industry.

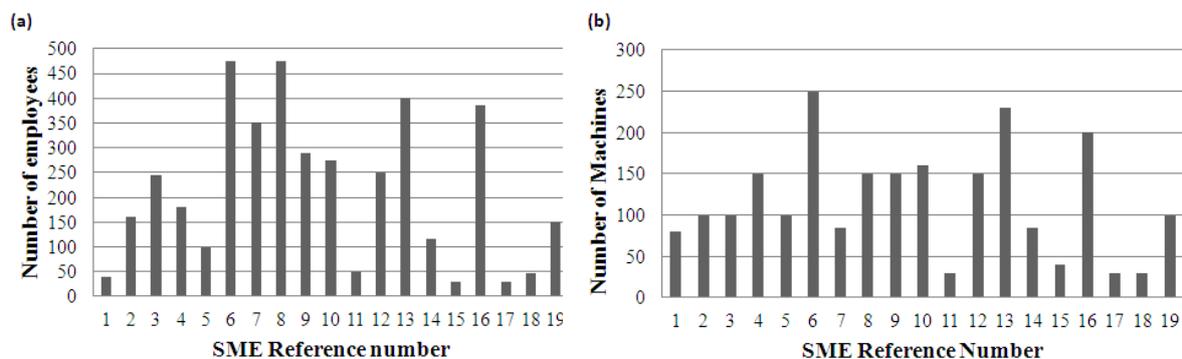


Figure 6.1. (a) Distribution of number of employees in the case study SMEs; (b) Distribution of number of sewing machines in the case study SMEs

All the factories had a satisfactory level of labor and safety standards. Minimum age for working in the factories are; 18 for 10 companies, 17 for seven companies and 16 for two companies. The companies request the birth certificate and the national identification card when recruiting to confirm the age. All the companies pay considerably more amount than the minimum wage stipulated by the government mainly because there is a huge competition for attracting labor to the factories these days. The machine operators are attracted to higher wages and will leave the company if they fail to provide so. Further the employment type for all the employees is permanent. All the companies are equipped with fire extinguishers and 12 companies had emergency exits and 13 companies have conducted emergency drills in their factories.

Except for one company which is loss making and three companies which were just started, the other companies are making profit. However all of them, especially the factories situated in urban areas are experiencing problems due to increasing utility cost and labor shortage. 63% of the companies are operated by private funding and 20% of the companies have access to bank loans (Figure 6.2). There are several companies which run by support of buying office or large companies. However 26% of the companies have only rented building and machinery and is run by the revenue from the production.

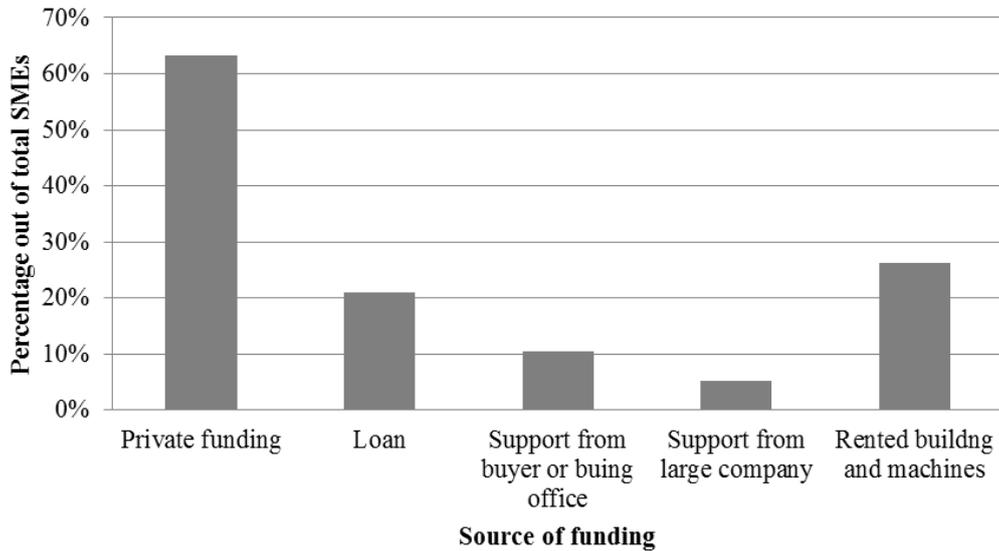


Figure 6.2. Sources of funding for the SMEs

Although in the apparel industry the waste is not hazardous and not considerable in terms of amount, all the factories are concerned about the waste management. Out of the 19 companies 12 companies separate all the waste and the others separate some waste. The largest waste from the garment companies is the large fabric pieces and 18 companies sell it to outside sellers and the other company incinerates them. Some buyers request the companies to burn the remaining fabric as it includes their brand name. The small fabric pieces and fabric dust is collected by the municipal waste collectors. The paper and cardboard waste are mostly recycled and rest is collected by the municipal waste collectors. However majority of the food waste is sent to animal farms and the rest goes to municipal waste.

6.2. Energy Management of the SMEs

As shown in figure 6.3, the main energy sources in the selected factories are electricity and fossil fuel (Diesel). One company had a Diesel boiler and others had electric boilers. Fifteen companies have generators to produce electricity in case of power failure and few companies use it to produce electricity during peak hours.

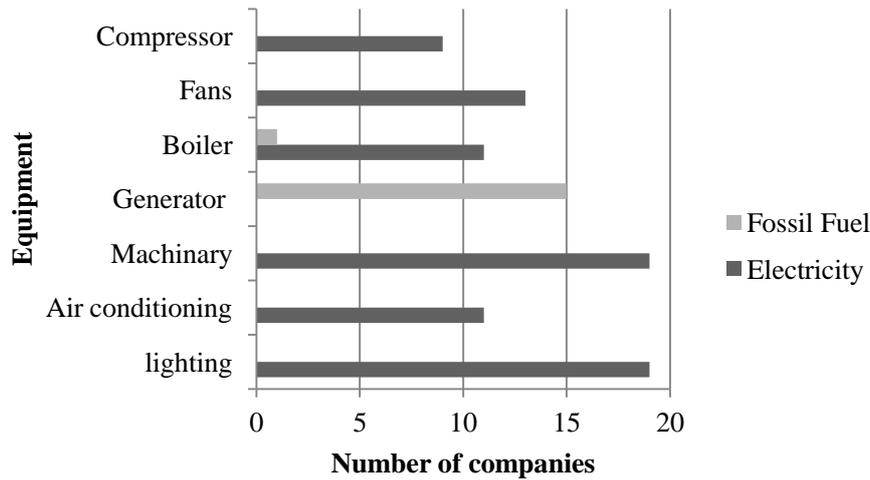


Figure 6.3. Type of energy source used in the case study SMEs

All the industry associations and the NCPC emphasized that increasing energy price is a great issue for the apparel industry. According to JAAF, the energy cost in Sri Lanka is higher compared to countries in the region but power quality (uninterrupted supply) is better at the same time. SLCGE also has a negative perception about energy price. The interview took place before the recent electricity tariff hike in 20th April and SLCGE mentioned that:

The main problem we are currently facing is the electricity price. If the electricity price increased as scheduled under new tariff scheme it would be difficult to maintain the industry competitiveness. Currently also we are struggling with higher price competition and adverse economic situation. Increase in electricity tariff will create a very hard situation for SMEs as it will be an additional burden with the price disadvantage and economic crisis. With the continuous increase in electricity prices we cannot have a positive image about the future of the industry.

According to JAAF, higher energy price is not only a problem for apparel industry, but also a barrier for the expansion of the textile sector. Some of the companies are trying to

address this energy issue by themselves by looking for alternative energy sources and EET. JAFF further mentioned that large companies are looking for alternative energy sources to face the energy issue, but the cost of conversion is very high. Further some companies are looking for the possibility of using biomass, but that is also limited by scarcity of biomass. Therefore JAAF has proposed the government that a new fund should be created to help the industries to convert to alternative energy and should give some tax breaks or help to meet the capital expenditure for the renewable energy projects. Despite the higher electricity tariff, the resources used by SMEs also responsible for the higher energy cost. NCPC stated that:

In cleaner production assessment, the main issue we try to address is the higher energy consumption. Many factories have old machinery and lighting which need more energy to operate. The buildings are also very old and energy loss is very high.

There are some factories which have identified that their machines and other resources consume lot of energy. A newly started SME mentioned that the old second hand fusing machine they purchased is consuming large amount of energy. One company had already replaced their old machines with new machines which have servo motors³. Several factories are using LED bulbs for machine lighting to reduce heat and power consumption. Two respondent SMEs are planning to implement “power banking system” (electricity stabilizer) since the payback time is only one year, even with higher initial cost. One of those two SMEs is very keen to have energy efficiency in their factory and said that:

We feel like that we need to implement EET as soon as possible. Sometimes we think it is already late compared to large companies. We have some plans for improving energy efficiency such as having large windows to permit natural lighting and placing

³ Servo motors are highly energy efficient than traditional clutch motors in industrial sewing machines.

a UV protected glass on the top by cutting the roof. When we build the factory we didn't think about the energy saving and now it is very difficult to make changes. Now we are willing to do anything which saves energy.

Furthermore, SLCGE also stated that some economically capable SMEs have invested in servo motors and energy efficient lighting. Out of the 19 companies, 10 have identified that their energy consumption is high. As shown in the figure 6.4, those companies are more motivated to implement EET than the companies who think their consumption level is normal⁴.

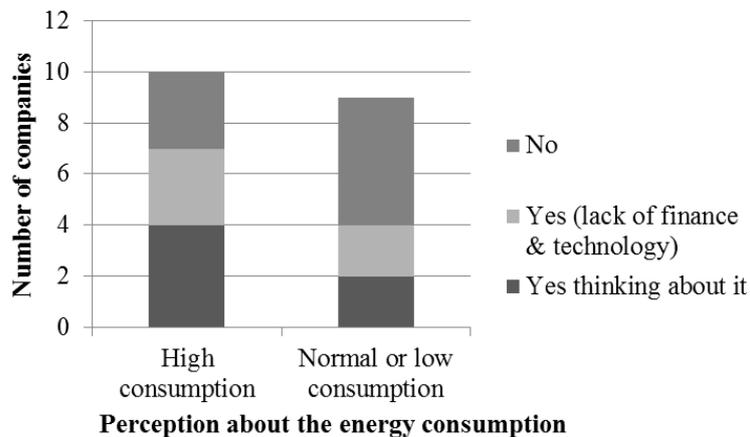


Figure 6.4. Perception about own energy consumption and willingness to implement EET

The SMEs provided several reasons for not implementing EET in their factories. Most of the companies are not aware of the existing technologies and machines which can save energy. Although variety of machinery exist which can perform same operation with less energy and less labour, some SMEs mentioned that there are no alternatives for the machinery. Some of them are aware about the new types of machinery but having some

⁴ None of the companies think that their energy consumption is low.

problems due to higher cost. Using second hand machinery and rented machinery to lower the initial cost is the main reason for lack of knowledge regarding energy efficient machinery. They are not conscious about the difference they can make by having EET as none of them have conducted energy audits in their factories. Few companies believe that EET is not benefited for a small company and there are some SMEs that do not feel the need. Figure 6.5 shows the summary of the above mentioned reasons.

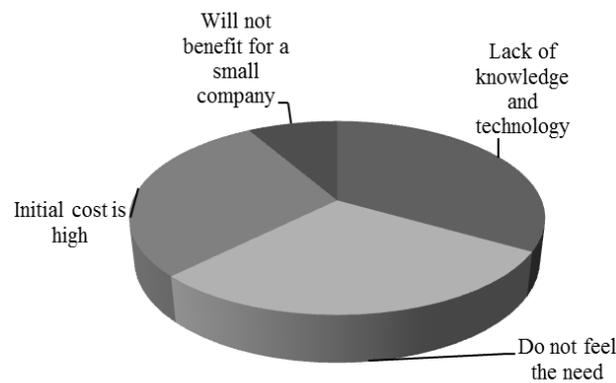


Figure 6.5. Reasons for not having any EET

6.3. Awareness and Access to Information

The main channels of information flow about technologies are trade exhibitions and internet. The managing director of one company has visited Japan to see an apparel machinery exhibition. They have received the information about the exhibition through Japanese embassy. Another company is receiving information through an external company. They pay a small fee for that company for introducing new buyers and providing information about new technologies. Therefore when there is a trade fair, the external company informs by email. Few companies use trade magazines and colleges in the industry as information sources.

The above information channels are mainly applicable to the companies who have not joined an industry association. The SMEs which have joined the association are receiving the information through industry associations as well. SLCGE stated that:

We send our members all the information we receive from the labour department and government institutions. Also we provide information about the buyers, accessory supplier information to them and give them opportunities to meet those buyers and suppliers. We help their marketing and purchasing process too. We have many training programs to improve productivity and marketing etc. for free of charge for the members.

Therefore the associations act as an important actor for providing information not only for technology but also for other activities. The companies who have joined the association do not have the need to contact an external company to obtain information and the only company which is using that information source mentioned that they are about to rejoin the association⁵. In addition, the associations are trying to increase awareness through seminars and sending them to see exhibitions. JAAF said that they are encouraging the member garment companies to participate in seminars sponsored by ADB and Swedish government and now planning to send some SMEs for international seminars to educate them about energy saving methods. They have already sent some people in the garment factories including SMEs to see the Japan International Apparel Machinery Trade Show held in Osaka Japan in 2012. JAAF further stated that the main reason to sending the members to see the exhibitions is to educate the companies regarding new automated machinery which are less labour and energy consuming, as the SMEs are less exposed to new machinery types.

⁵ This company was previously a member of JAAF but the membership was not continued due to time constraints.

The seminars and programs of SLCGE are mostly conducted locally allowing more member participation. The seminars cover wide area by inviting the relevant organizations to provide knowledge to the members. In the interview SLCGE mentioned that:

We are conducting seminars and programs every month for various matters. Recently we invited Sustainable Energy Authority and educated our members through seminars regarding renewable energy options, how to save energy and the alternatives etc. Then we conducted a seminar, inviting carbon foot print authority and educated the employees on how to calculate the carbon footprint. Also we asked the financial institutes to educate our members about available low interest finance schemes. We had a seminar with Export development board also on how to improve the productivity of the companies by using less labour intensive machinery and how to create a system which is mainly based on machinery rather than labour.

The motivation to implement EET was also discussed during the interviews. The main motivator for EET is economic and the companies who wish to have EET stated that they will do anything which reduces cost. JAFF is trying to negotiate with the foreign buyers to recognize the sustainable and green companies and to offer them better prices. JAAF anticipates that if it is possible to negotiate successfully, it would be easier to create awareness with the SMEs. NCPC suggested that the motivator for large companies to implement green manufacturing is the international pressure and for SMEs it would be the large companies. NCPC which is also acting as an ESCO, provides services such as; awareness and training, environmental assessment and certification etc.

6.4. Access to Finance

The three apparel associations emphasized the lack of access to finance to apparel industry SMEs. According to JAAF the main problem with the SMEs is the lack of access to finance and development of the SMEs are constrained by this issue. Being an SME association SLCGE has broadly recognized this issue:

It is difficult for garment industry SMEs to get bank loans. Many companies are struggling economically and do not have a smooth relationship with the banks. Because of the higher risk the banks are reluctant to give loans to the SMEs. Also most of the banks are little bit reluctant to finance the apparel industry itself and request high security.

The banks acknowledged the fact that apparel industry faces some difficulties to access to bank finance, whereas it is not applicable to whole industry. According to Government bank 01 (GB01), the well-established garment companies generally do not have any problems in access to bank finance although the industry is recently becoming unstable and risky. The private bank (PB) mentioned that the bank considers the future cash flows when approving loans. When the industry is uncertain, the banks will be reluctant to grant loans for that industry. Government bank 02 (GB02) stated that the adverse industrial environment does not always create barriers to access to finance and they received a World bank fund to help the garment companies who are affected from the world economic recession.

As per the PB, financial statement analysis, field visits, past records of the company, account history, business future cash flow forecasts and securities are mainly considered in evaluation process. The banks further explained that the main concern of the banks is to reduce Non Performing Advances (NPA) ratio and the credit appraisal procedure would be

tough due to challenges with global economic crisis. The other banks also conduct similar kind of evaluations:

The access to loans depends on the number of years the company has been operating. If the companies are profitable and maintain good financial records there is no issue in getting bank loans. However if the factories are loss making and having other problems we are reluctant to approve loan as there is a risk that we cannot recover the loan by even selling the factory. (GB01)

Problems with the project proposals submitted by the SMEs also result rejection of the loan applications. GB02 noted that, when the SMEs bring proposals that beyond their capabilities, technical knowhow or experience, the banks are reluctant to approve it even with collateral:

The SMEs in Sri Lanka are always targeting a bigger scale. They try to get the full loan amount even it is too much for them. But when the bank feels this kind of project should be done in step by step and they don't have the capability to do so, the loan application will be rejected. (GB02)

Sometimes the companies claim that it is difficult to get loans when there are delays in the loan approving process. The delays mainly happen because of the documentation problems. When the company presents security, the bank has to check the validity (e.g. by checking the deed of the land) as otherwise it would cause a legal issue in the future. Further GB02 mentioned that state banks have higher volume of services compared to private banks and that is another reason for the delay.

The loans for SMEs always request collateral, mainly fixed assets. According to SLCGE, the SMEs without collateral assets cannot obtain loans from banks. Further, bare

lands are normally not preferred and in some cases they ask the directors' personal assets for collateral. The questionnaire results of SMEs proved this collateral requirement and the only four companies who have received bank loans are profitable and have own land, buildings and machinery. GB01 admitted that in some cases they have to check about the assets of the directors and the success of the other businesses. GB02 mentioned that being a state bank they are bound to care about the security of the loan:

We don't give loans by just following the cash flow of the company. We need a guarantee to give the loans. So the startup companies have problems as they don't have any assets to give for security. As a state bank we have some rules and regulations. If they don't give collateral, we cannot approve any loan to the SMEs.

The interest rate of the loans for SME in state banks is very low compared to private banks and in GB02 sometimes it is even less than cost of fund. However due to delays and higher security requirements, the number of loans the government banks offer is lesser than private banks. In 2012 the private banks have invested SLR 231.5 billion when the state banks invested only SLR 34 billion (According to the information given by PB). However the interest rates in private banks are very high to compensate the risks of SMEs.

When the SMEs become a member of SLCGE, they are well recognized by the Export Development Board and Treasury department. When a certain fund is issued by Treasury department, the SLCGE can recommend their members for loans. However still there is no system to recommend the members to the banks directly. JAAF has identified the financing issue for the SMEs and currently has proposed the government to build a special financing scheme for the SMEs. SLCGE has proposed a new project called "100 machines, 100 factories for Relocation and sustainability of the industry" with the objectives:

- a) to relocate the factories in villages where low income people live,
- b) to build new factories and buy machinery with new technology which consume less energy, and
- c) to introduce renewable energy

The proposal has already been sent to the treasury department and association is discussing with ADB for the funding. In addition to the above project for new factories, SLCGE has proposed the government to provide low interest loans to get renewable energy (Solar panels) and change the roof to clear glass. Further SLCGE mentioned that:

Although there are many companies that introduce EET, the SMEs do not have a financial institute to get loans. We cannot do this with the current high interest rate (18%) in Sri Lanka. That is why we are trying to get long term finance through ADB.

NCPC mentioned that they normally do not provide finance for the EET project, being an ESCO conducting only energy assessment. However NCPC said sometimes they use the grants for environmental improvement offered by foreign countries to fund some projects.

One SME banking scheme was introduced for apparel industry through Lankaputhra Development Bank (LDB), which is specialized for SMEs (currently not functioning). The ongoing operational factories which are located outside Colombo are eligible for the loans. However sub-contractors are not given priority and the recommendation from the Clothing Industry Training Institute (CITI) and JAAF is required to get the loan. The loans were provided to modernize factory building and to upgrade machinery and purchase new machinery at 10% interest rate per annum. Still the SMEs had to provide land, building or machinery for collateral. According to LDB, the loan scheme operated from 2009 until 2010

and now is closed as the allocated fund is finished. At that time LDB evaluated 10 companies and five companies received the loans.

The Central Bank Sri Lanka (CBSL) established a credit guarantee scheme for apparel in 2005 which was funded by the government of Sri Lanka. The loans for upgrading and modernization of infrastructure and technology were eligible for guarantee cover. According to the interview with CBSL, they received only part of the initial fund from the government. Not many companies applied, but the applied companies got the guarantee cover. The loans of those companies are fully recovered now. Before starting the scheme, the CBSL had a meeting with banks and the guarantee scheme was implemented with the agreed banks. There was no specific refinance scheme attached to this loan scheme and it was decided to close the fund in 2012.

6.5. Relationship with Stakeholders

During the questionnaire survey the SMEs were asked to give 1 to 5 marks based on the importance of the stakeholder for them. As shown in figure 6.6, the respondents identified that, employees, buyers and suppliers are the most important stakeholders for them. Large companies, government and other SMEs were identified as the next important types of stakeholders. According to the figure 6.6, JAAF was identified as of lower importance to SMEs. However that is because the 10 companies out of 11 companies who have not joined any associations have marked JAAF as not important (Figure 6.7). Some companies didn't know anything about JAAF. Most of the other companies marked JAAF as very important or important.

Only three companies stated that other SMEs are less or no important for them and those companies didn't have any kind of relationship with the other SMEs at that time. Eight

companies have joined SLCGE and other eight companies only have some informal network with the other SMEs. Those companies use the network to share the machinery, raw material and information about new styles etc.

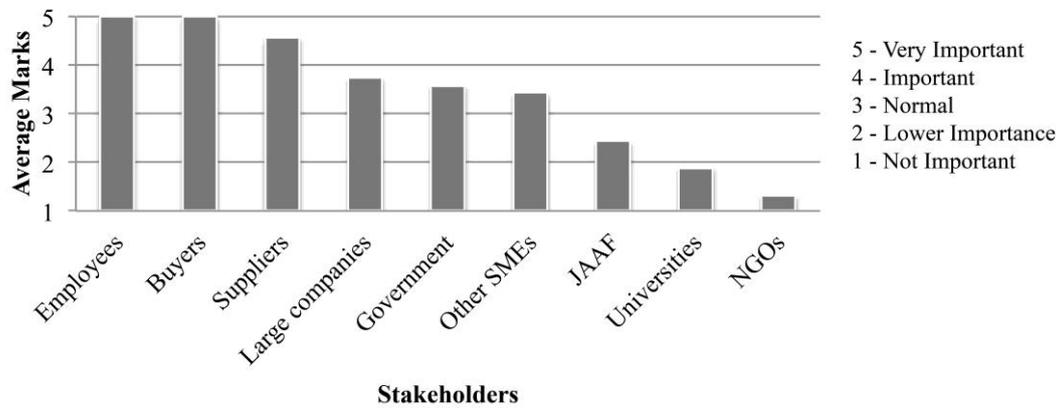


Figure 6.6: Importance of stakeholders for SMEs based on average marks

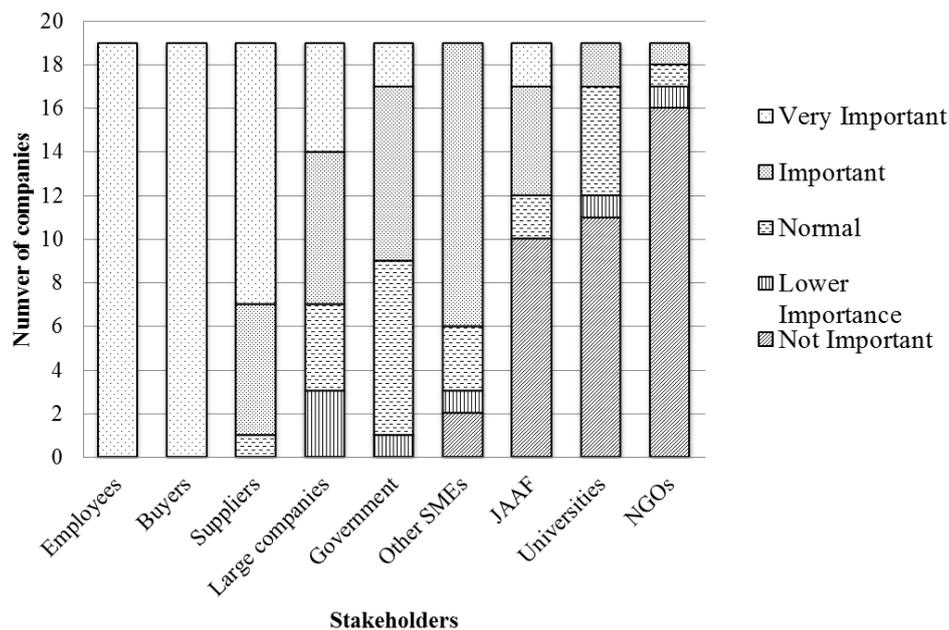


Figure 6.7: Importance of stakeholders for SMEs

Universities were also identified as close to very low importance, and none of the companies marked it as very important. Two SMEs who have participated to the productivity improvement program of CITI marked universities as important. Other 5 companies consider them as normal. During the interview most of the respondents stated that universities are not

much interested in the activities of SMEs and rather prefer to work with large companies. However 13 companies expressed that they like to work with universities in the future. Out of 19 companies, 16 stated that NGOs are not important to them at all (Figure 6.7) and only four companies said that they would like to work with NGOs in the future. SLASA confirmed this claiming that NGOs are more interested in helping senior citizens and poor people than SMEs.

During the questionnaire survey we could only identify the importance of stakeholders for their overall activities. The stakeholders important for EET implementation could not be identified, as most of the SMEs had lack of knowledge about EET. Therefore it was decided to explore it by the interview of the associations. The associations noted that the external stakeholders such as buyers, industry associations, banks, government, universities, ESCOs (such as NCPC) and sustainable energy authority are more important for diffusion of EET in a broader context rather than suppliers or employees. The buyers of the SMEs are mostly the large companies or buying offices which have already joined JAAF.

Industry associations have a very good relationship with all those important stakeholders. NCPC said that they are working with Ministry of industry and JAAF. Also JAAF has a good relationship with the government, the foreign buyers and the universities and technical institutes (University of Moratuwa and CITI). CITI currently provides productivity improvement programs for the SLCGE member SMEs and University of Moratuwa also has some short term courses for garment industry employees. University of Moratuwa and some other universities have contributed to the industry by consulting and designing the green factories for the large companies.

According to SLASA, most of the SMEs are not flexible and do not cooperate with the external parties such as associations and universities. Among the SMEs who are members

of CGE, 88% are willing to work with universities, whereas only 55% of non-members like working with universities. Furthermore as shown in figure 6.8, 90% of the companies who are willing to implement EET like to work with universities and none of the companies who do not like EET like to work with universities at all.

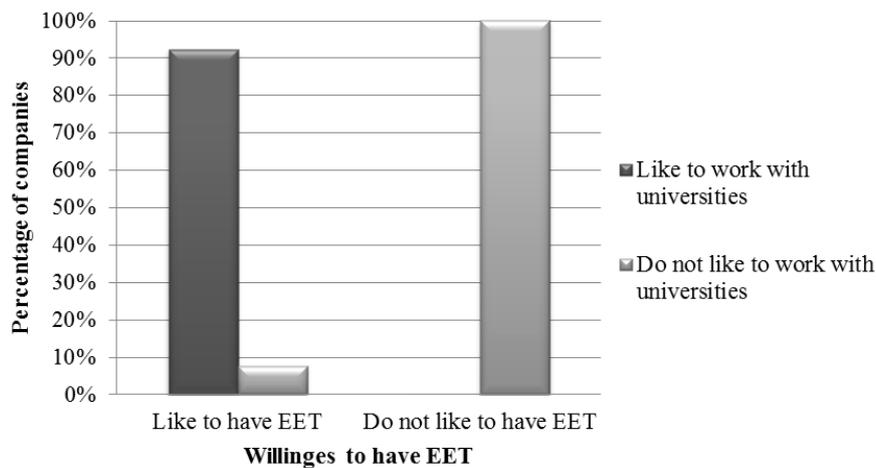


Figure 6.8: Willingness to have EET and working with universities

According to SLCGE, no recommendation is required to join the association and they can just fill the application by giving information such as the industry and the name of the owner etc. However the association does not monitor the performance of the members. Some non-member SMEs didn't know about CGE and the association is not well promoted among all the SMEs. Recently they have advertised through local newspaper to attract more members. Three non-members have decided to join the association and two of them have got the information through the BOI. The other companies do not have a clear idea what are the benefits of joining the association and the encouraging factors for them to join the association are to get support with loans, productivity improvement and increasing orders.

Industry associations have relationship with some ESCOs such as NCPC. Recently SLCGE prepared a proposal for EET project to present ADB with the help of such auditing company.

We could only access to the information from the 14 ESCOs which has company website and most of the ESCOs are performing other types of activities and do not promote EE much. Both energy efficiency and renewable energy are targeted by most ESCOs and some provide both performance contracting and shared saving mechanism. In performance contracting, the ESCO guarantee the energy saving and the company has to finance the investment. In the shared saving mechanism, the ESCO invests the technologies and takes a fee as a share of energy cost saving. One ESCO has clearly mentioned that they will provide the initial audit free. Another ESCO has conducted some energy projects with more than 100 garment factories including several medium sized factories. Therefore ESCO also can be considered as an important stakeholder for EET diffusion process.

CHAPTER 7: DISCUSSION

7.1. Current Framework of Stakeholder Functions

The results described in the chapter 6 were analyzed to identify the current functions of the various stakeholders regarding awareness and access to information and access to finance. In the frameworks discussed in this chapter, JAAF and SLCGE are categorized under Industry Associations as the members of SLCGE are eventually benefited from the actions of JAAF too.

7.1.1. Awareness and access to information

As shown in figure 7.1 the industry associations play the major part in information providing to SMEs as very few SMEs have direct relationship with the information or knowledge providers. The members are well aware of the information from the labour department and government institutions as the associations send the information through email. The members have more opportunities to see exhibitions as the associations send them even to overseas exhibitions. However the awareness about the facilities provided by the associations is lacking among the non-member SMEs. Recently SLCGE advertised about their association through newspapers and some SMEs got to know about SLCGE from the BOI. SMEs do not have a direct relationship with universities and technical institutes. The universities are having a good relationship with the very large companies and carry out their researches and projects with them. The industry associations work closely with institutes such as CITI and try to conduct training programs to their members. CITI also has helped many SMEs to improve the labour productivity and train skilled workers to the industry. Industry associations try to educate the members by conducting seminars with various relevant institutes such as financial institutes, Export development board and Sustainable energy authority.

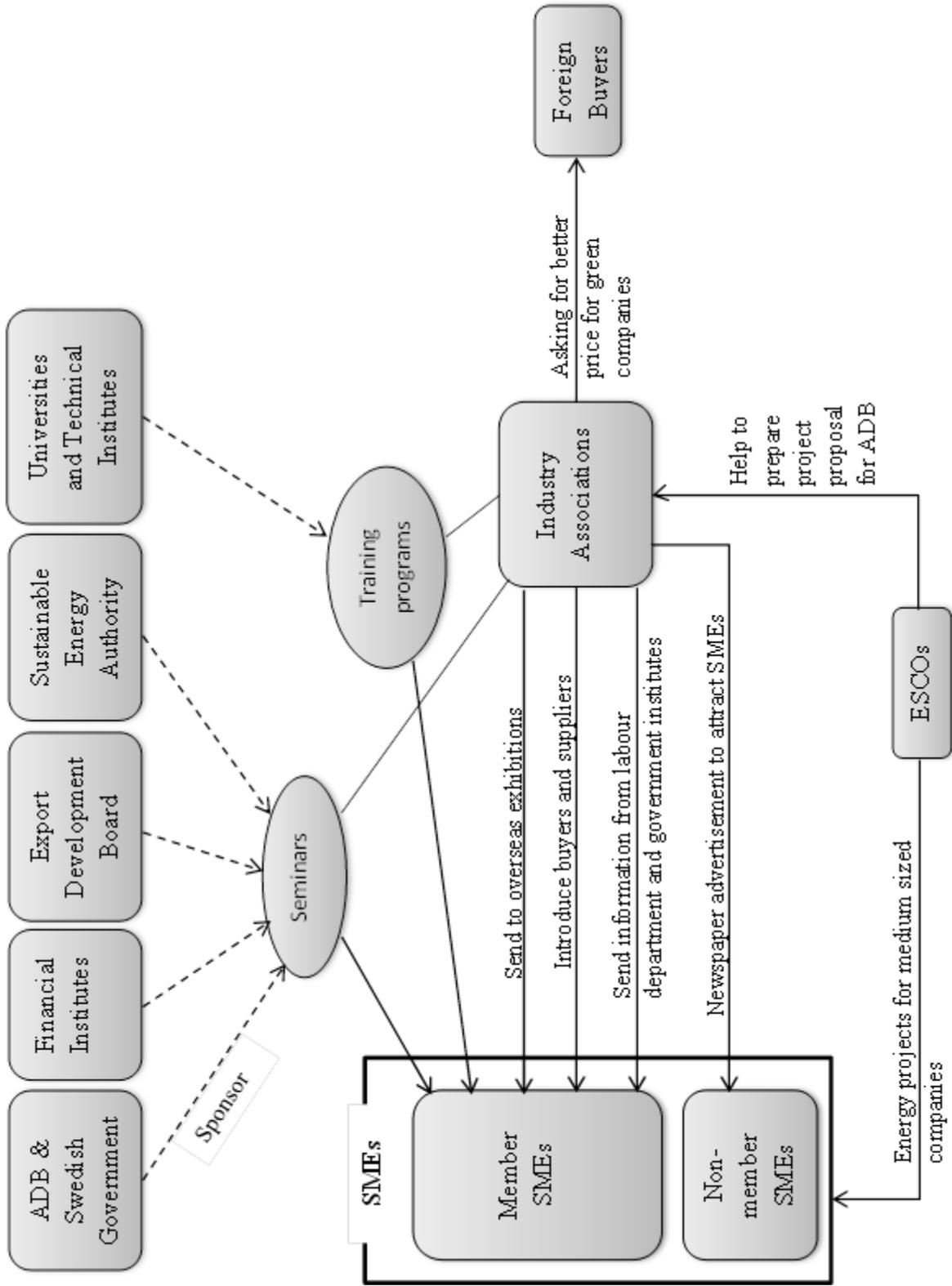


Figure 7.1: Current framework for awareness and access to information

ESCO is another important knowledge provider and some medium-sized companies have already done some energy installations with some ESCOs. Industry associations also have a good relationship with the ESCOs and use their help to prepare energy project proposals. Moreover the industry associations are having discussions with foreign buyers to get a better price for the green companies and hope it will help them to motivate the SMEs to become energy efficient.

7.1.2. Access to Finance

Figure 7.2 illustrates the various functions of industry associations, banks, government and foreign funders regarding the SMEs' access to finance. The banks and the SMEs generally do not have a very smooth relationship and the SMEs always find difficulties in accessing bank loans. The interest rates for the SMEs are very high except for some state banks. The low interest loan scheme for apparel industry SMEs was aimed at addressing this issue. However this also requested some collateral in addition to the recommendation from JAAF and CITI. The access to loans becomes more difficult as the bank request collateral and state banks request very high security to compensate the risk. The CGS for apparel was introduced to address this issue. But few companies applied for this due to lack of knowledge. The government receives funds from the foreign funders, such as the World Bank and ADB and allocates them to develop schemes such as CGS and SME loans. Both CGS and SME loan scheme for apparel industry has been closed now as the funds are over and there were no refinancing systems for both schemes. The industry associations recommend the members to treasury and to the special loan schemes, but do not have a system to directly recommend them to commercial banks. Currently the associations are trying to negotiate with the foreign funders to obtain funds for their proposed EE projects and requesting the government a new low-interest loan scheme for SMEs.

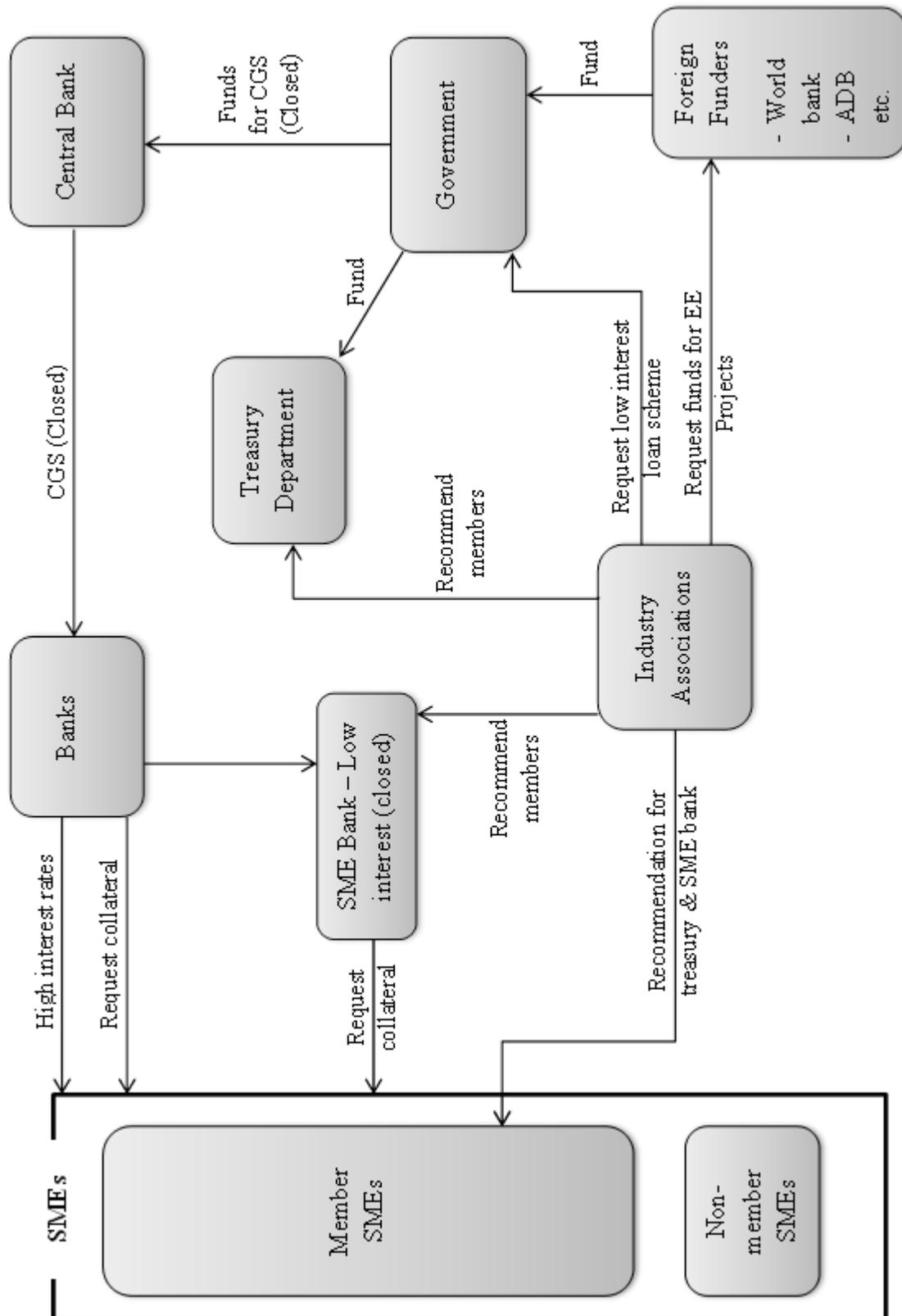


Figure 7.2: Current framework for access to finance

7.2. Framework of Stakeholder Functions for Improved EET Diffusion

The policies for EET diffusion should be aimed at both providing knowledge and access to finance. In the current framework the industry associations play a major role in providing general information and trying to become an intermediary between the SMEs and other relevant institutions. Therefore in this section the stakeholders are categorized into three groups according to their main functions; industry associations (as an intermediary), funders (providing access to finance), and technology and knowledge providers (providing knowledge) as shown in figure 7.3. The buyers of the SMEs are mainly the large companies or buying offices which are already in the main association. Therefore the buyers are also categorized under the industry associations in this section.

7.2.1. Knowledge providers

Knowledge providers (KPs) include ESCOs, universities and technical institutes. The KPs such as universities and technical institutes do not have a direct relationship with the SMEs and the current programs are also conducted through the industry associations. Therefore in order to get the maximum participation, the training programs and seminars for the SMEs should be conducted through the association. The main reasons given by the banks for the delay or rejection of loan applications are the errors in the documents and the lack of financial records of the SMEs. Therefore the universities can help industry associations to conduct seminars to educate how to prepare loan documents to meet the requirements of the banks. Further, training programs should be conducted by universities and technical institutes to educate the SMEs to maintain financial accounts properly.

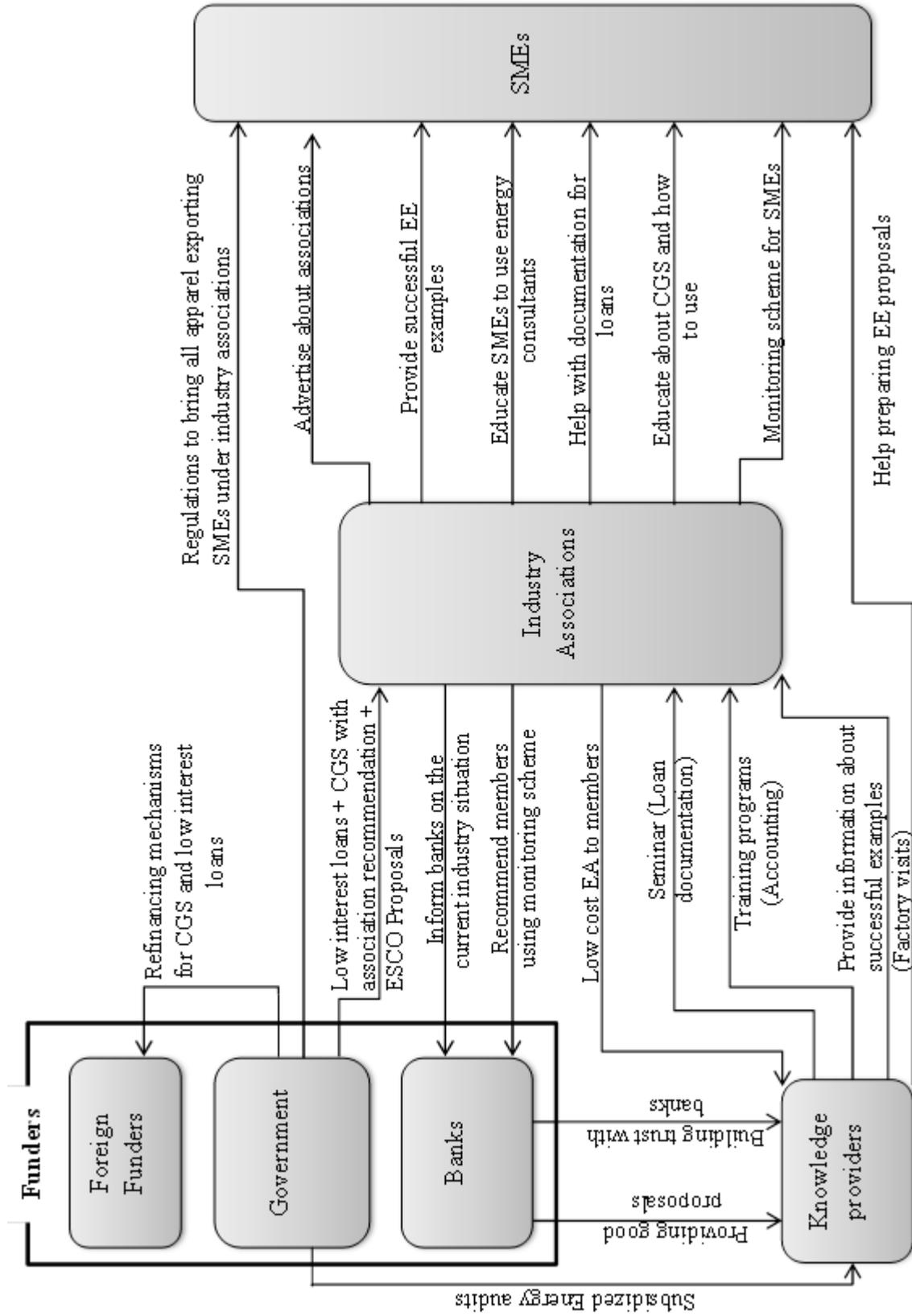


Figure 7.3: Framework for improved EET diffusion

ESCOs have a major role in the EET diffusion process as some of the SMEs have already conducted energy projects with them. One of the main barriers for the EET diffusion is that the SMEs do not have proper idea about the real energy saving potential of those technologies. Therefore the ESCOs can provide the information about successful examples of EET implemented by SMEs by arranging factory visits to the industry associations. Failing to provide a good project proposal also leads to rejection of the loan application. After the energy audit, ESCOs can help the SMEs by preparing an EE project proposal which is acceptable by banks. In fact the ESCOs should earn the trust of the banks by providing accurate and practical proposals.

7.2.2. Funders

Government, banks and foreign funders are the most important funders for SMEs. Among them the government has the power to implement the policies and allocate the funds. Therefore the government has a major role in the EET diffusion process. The SMEs in the apparel industry are not listed under one institute and they are registered to the BOI, government or other institutes. Furthermore not all the SMEs have joined the industry associations and it is difficult to implement common policies to all the SMEs in general as information about many SMEs is not available. As the industry associations are acting as a valuable intermediary, the government should impose a regulation for all the apparel exporting SMEs to join industry associations.

SMEs are facing difficulties in implementing EET with the current higher interest rates. However the previous low interest loan scheme for apparel also requested collateral from the SMEs in addition to the recommendation from the JAAF and CITI. Many SMEs in the apparel industry do not have enough assets to present as security. Therefore the CGS is the best solution for those kinds of companies. The government should introduce new CGS

for EE projects and it should be coupled with a low interest loan scheme. The loan can be granted for the SMEs who have presented the EE proposals prepared by ESCOs and the recommendations by industry associations. Previous studies about CGS has mentioned about moral hazard associated with it. Moral hazard occurs when there is asymmetry of information and the banks have to bare higher risk as they cannot monitor the SMEs adequately. However the previous CGS for apparel has not experienced such default and all the loans have been fully recovered. Due to this good reputation, implementing a new CGS will not be a great issue with the banks.

The common problem with the previous financing schemes is that they do not have a refinancing mechanism. Both the low interest loan scheme and CGS for apparel has been closed after the funds are over. Therefore the government should build a long term refinancing mechanism when implementing the new low interest loan and CGS for EE projects using the funds from foreign funders such as ADB and World Bank. As the proposed loan scheme is associated with the proposal from ESCO, subsidized energy audits will be a good option to reduce the burden on SMEs.

7.2.3. Industry associations

Industry associations have a major role in EET diffusion as they act as intermediary between the SMEs and the other main stakeholders. Their main responsibility would be to facilitate the services by the other stakeholders, such as communicating the successful examples of EET implementations to the members, facilitating seminars and training programs etc. Rather than trying to train the SME managers to become experts of energy, it would be better to educate them to use energy consultants (ESCOs) in their projects. Moreover a proper monitoring scheme should be developed to evaluate and monitor the performance of the member SMEs so that the associations can provide accurate and

acceptable recommendations about the members to the banks. Such monitoring scheme will enable the associations to identify the poor performing companies and give a special attention to help them too. Further if the subsidized energy audits are not possible with the government, the associations can negotiate with the ESCOs to provide low cost energy audits for the member SMEs. The banks do not have a good image about the future of the apparel industry. Therefore the associations should inform the banks about the real situation of the industry, the steps taken by the associations to address the existing issues and how they will affect the industry in the future.

The collaboration of all the three stakeholder categories is required for effectively diffusing EET in the apparel industry SMEs. The both barriers of information and finance should be addressed at once and only removing one barrier will not be sufficient to help SMEs implement EET.

CHAPTER 8: CONCLUSION

8.1. Summary and Implications

The Sri Lankan apparel industry is becoming less price-competitive with the continuous increase in energy prices and the labour cost. Many large companies have identified this issue and already implemented EET in their factories to reduce the energy cost to remain competitive. However many SMEs still experience barriers such as knowledge and finance to implement such technology. Therefore this study was aimed at identifying the current framework of stakeholder functions and identifying an improved framework for diffusion of EET in the apparel industry SMEs.

During the study, the buyers, industry associations, banks, government, universities and ESCOs were identified as the key stakeholders required for EET diffusion. The industry association acts as an intermediary as the SMEs do not have a direct relationship with the universities and technical institutes and they are experiencing difficulties in dealing with banks. In the study it was identified that while the higher energy cost is a critical issue in the apparel industry, the awareness among the SMEs regarding the existing EET is still lacking.

The apparel associations are currently trying to remove the knowledge barrier by conducting seminars and training programs with various institutions, still many SMEs have a lack of awareness regarding EET. There are some ESCOs who provide services to medium sized garment companies and using the service of them will be an efficient way of creating awareness as the energy efficiency potential can be accurately presented in monetary terms. The proposals they create after the energy audit should be recognized by the banks to give finance to the SMEs and ESCOs should build a trust with the banks to do so.

The other main barrier is the lack of access to finance and many banks have higher interest for SME loans. Also they request collateral, and even many SMEs cannot provide sufficient assets for security. Considering these factors, a low interest loan scheme coupled with a CGS for energy efficiency will be more suitable. A proper refinancing mechanism also should be developed as the previous schemes are now closed due to the finishing of the fund. The industry associations should create a monitoring scheme to evaluate the performance of their members to recommend them more effectively to the banks. The recommendation from the industry associations, project proposal from the ESCOs and the CGS for energy efficiency will help the SMEs to get the low interest loans for the EET projects without any issues. The SMEs in the Sri Lankan apparel industry are scattered and it is difficult to get the information about them in a single institution. Therefore it is recommended to make it mandatory for the apparel exporting SMEs to join industry associations so that the information gathering and policy implementation will be effective.

8.2. Limitations and future research

The main limitation of the research was poor response from the SMEs as only 19 out of selected 37 companies agreed to participate. Also the unavailability of accurate contact details was also an issue as it was difficult to identify the actual number of operating SMEs in the industry. If there were better number of companies, a quantitative analysis also would have been included to the study. A further study should be conducted by analyzing the energy consumption quantitatively using the required energy meters for whole apparel industry SME sector. This should identify the key EE areas to address, as the studies from the other countries cannot be directly applicable due to differences in the equipment used, working condition and the energy sources. Further the refinancing mechanisms for the government funding for energy efficiency should be broadly studied to develop a better mechanism.

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APPENDIX 1: SME QUESTIONNAIRE

Reference Number: SME [REDACTED]

1. General questions

- 1.1. Please indicate the approximate number of employees [REDACTED]
- 1.2. In which year did this factory started manufacturing? [REDACTED]
- 1.3. Please select the types of companies which you are currently supplying garments.
- a) Large company (Sub contract)
 - b) Buying office
 - c) Direct buyer
- 1.4. Who are the main buyers of your garments? [REDACTED]
- 1.5. What is the country of the Buyer? [REDACTED]
- 1.6. What is the value of your assets (approximate)? [REDACTED]
- 1.7. Please indicate the approximate number of sewing machines. [REDACTED]

1.8. Resource consumption and energy sources

	Electricity	Water	Pneumatics	Fossil fuel	Solar power	Wind power	Other
Lighting	<input type="checkbox"/>	[REDACTED]					
Air conditioning	<input type="checkbox"/>	[REDACTED]					
Machinery	<input type="checkbox"/>	[REDACTED]					
[REDACTED]	<input type="checkbox"/>	[REDACTED]					
[REDACTED]	<input type="checkbox"/>	[REDACTED]					

1.9. Waste, material and resources

- 1.9.1. Do you separate your waste?
- Always Sometimes Never
- 1.9.2. What are the problems with waste separation?
- a) It takes time and money
 - b) It is useless and there is no possibility of recycling
 - c) There are no problems
 - d) Other [REDACTED]

1.9.3. How do you manage the solid waste

	Land fill	Recycle	Reuse	Incineration	Other
Fabric waste	<input type="checkbox"/>				
Paper	<input type="checkbox"/>				
Cardboard	<input type="checkbox"/>				
Water	<input type="checkbox"/>				
Food	<input type="checkbox"/>				
Plastic	<input type="checkbox"/>				
	<input type="checkbox"/>				
	<input type="checkbox"/>				

1.9.4. What are the barriers for recycling programs?

- a) Lack of waste recycling centers
- b) Difficulty of investing in infrastructure
- c) Lack of convenience and/or difficulty associated with sorting on premises
- d) Lack of obligation to recycle
- e) Lack of knowledge about recycling
- f) Recycling is a lower priority
- g) Other

1.9.5. What are the barriers for water reuse?

1.9.6. Do you have a rain water harvesting system? Yes No

1.9.7. Do you try to reduce material waste? Yes No

1.9.8. How do you reduce material waste?

1.10. Energy

1.10.1. Is your factory equipped with energy saving equipment? Yes No

1.10.2. If "no" what is the reason?

- a) Lack of knowledge and technology
- b) Do not feel the need
- c) Initial cost is high
- d) Will not benefit for a small company
- e) Other

1.10.3. Do you have any green energy supply?

- a) Solar power
- b) Wind power
- c) Hydropower
- d) Other
- e) No

1.10.4. If “no” what is the reason?

- a) Lack of knowledge and technology
- b) Do not feel the need
- c) Initial cost is high
- d) Will not make any difference
- e) Other

1.10.5. Do you switch off lights which are unnecessary? Yes No

1.10.6. Do you switch off machinery which are unnecessary? Yes No

1.10.7. Do you have green roof? Yes No

1.10.8. For lighting

- a) Sometimes use natural light
- b) Use fluorescent (CFL) or LED lights

1.11. Transport

1.11.1. Do you have round trip container concept?

Yes No Never heard about it

1.12. Miscellaneous

1.12.1. Do you consider about environment when purchasing new equipment?

Always Sometimes Never

1.12.2. If yes can you give an example?

1.12.3. Do you reuse paper?

- a) Yes: we use one side paper for photo copy
- b) Yes: Others
- c) No

1.12.4. Have you taken any action to reduce the paper use? Yes No

1.12.5. If yes can you give an example?

1.12.6. Do you print emails? Yes No

1.12.7. Do you buy recycled paper? Yes No

1.13. Sponsorship of natural environment events

1.13.1. Do you support any planting trees or avoid deforestation program? Yes No

1.14. Environmental education

1.14.1. Do you conduct environment training programs for your employees? Yes No

2. Social practices

- 2.1. What is the minimum age for working in this company?
- 2.2. How do you check the age when recruitment?
- 2.3. What is the minimum wage of the machine operators?
- 2.4. What is the average wage of the machine operators?
- 2.5. What is the legal minimum wage of garment industry?
- 2.6. What is the maximum overtime limit per month per worker?
- 2.7. Do the operators have the right for trade union activities? Yes No
- 2.8. What is the employment type?
- a) Permanent
 - b) Temporary
 - c) Contract
- 2.9. What are the social compliance requirements by the buyers?
- 2.10. What are the social compliance requirements by the government?
- 2.11. Does your factory have any labour compliance certification (SA8000, ETI, WRAP etc)?
Yes No
- 2.12. Does your factory have a proper fire evacuation procedure?
- a) Yes: Equipped with fire extinguishers
 - b) Yes: Have emergency exists
 - c) Yes: Conduct emergency drills
 - d) No

3. Economic situation

- 3.1. What is the sales value of last year (Approximately in Rs)?
- 3.2. Is your company profitable?
- a) Yes: with positive growth rate
 - b) Yes: have a stable profit rate
 - c) Yes: with a negative growth rate
 - d) No

4. Resource availability

- 4.1. How many university graduates are there in your company?
- 4.2. How is your company funded
- a. Private funding
 - b. Loan
 - c. Support from NGO
 - d. Support from buyer or buying office
 - e. Support from large company
 - f. Others

5. Awareness

5.1. Perception of the financial benefits of the eco efficiency measures

	Has a financial benefit and already implemented	Has a financial benefit and willing to implement	Has financial benefit but difficult to implement due to higher initial cost	May have financial benefit but the current system is enough	Do not have a financial benefit	Do not know
Energy reduction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Waste minimization	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Material reduction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CO2 emission reduction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

5.2. Do you like to apply environmental sustainability practices

- a) Yes: Willing to start as soon as possible
- b) Yes: But no idea of where to start
- c) No: My effort would not make a difference
- d) No: Environmental sustainability is for big businesses
- e) No: Changing to greener methods will put me out of business
- f) No: My factory does not have an impact on the environment
- g) No: We only take action to meet legislation
- h) Other

5.3. What do you think about energy cost and the consumption

		Energy consumption			
		High	Normal	Low	Do not know
Energy cost	High	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Normal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Do not know	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

5.4. Do you think you need energy efficient technologies

- a) Yes: thinking about it
- b) Yes: but problem of lack of finance
- c) Yes: but lack of knowledge
- d) No: do not believe it would be effective
- e) No: initial cost is too much
- f) No: do not want those technologies
- g) Other

6. Possibility of networks

6.1. Current situation

- 6.1.1. Do you have any network or relationship with other SMEs? Yes No
- 6.1.2. If "Yes" What kind of network or relationship?
- 6.1.3. If "No" Why?

6.2. Barriers to future situation

- 6.2.1. Do you think it would be beneficial to have a network with other SMEs?
- a) Yes: Gain from pooled resources
 - b) Yes: Knowledge sharing
 - c) Yes: Can act as a big company in the market
 - d) Yes: Other
 - e) No: They are competitors
 - f) No: Becoming visible creates problems
 - g) No: We don't need to change
 - h) No:

7. Possibility of collaboration

7.1. Current situation

- 7.1.1. How many research projects have been carried out by universities in your company?
- 7.1.2. How many in plant trainees (university or technical institutes) in your company?
- 7.1.3. Are you reluctant to give your time /resources for universities to do research/ projects?
Yes No
- 7.1.4. Have any universities contacted you regarding an environment or social related project?
- a) No
 - b) Yes – Environmental related
 - c) Yes – Social related

7.1.5. Importance of stakeholders

	Very important	Important	Normal	Less important	Not important
Employees	<input type="checkbox"/>				
Government	<input type="checkbox"/>				
Buyers	<input type="checkbox"/>				
Suppliers	<input type="checkbox"/>				
Large companies	<input type="checkbox"/>				
NGOs	<input type="checkbox"/>				
JAAF	<input type="checkbox"/>				
Universities	<input type="checkbox"/>				
Other SMEs	<input type="checkbox"/>				

7.2. Barriers for future situation

7.2.1. Do you like to work with universities to implement sustainability practices? Yes No

7.2.2. Do you like to work with NGOs to implement sustainability practices Yes No

7.2.3. Rank the main factors affecting your environment sustainability decision.

- a) Tax benefit from the government
- b) Government regulations
- c) Buyer's compliance requirements
- d) Economic benefit from eco efficiency
- e) Gaining competitive advantage

7.2.4. If you get the required resources from funders and the universities do you like to implement environmental sustainability practices? Yes No

For any further clarifications can we contact you by email or phone? Yes No

Thank you very much for your time and cooperation

**APPENDIX 2: QUESTIONNAIRE FOR CHAMBER OF GARMENT EXPORTERS
NONMEMBER SMES**

Reference Number: SME

1. Have you ever heard about Chamber of garment exporters?

2. Yes	3. No
2.1. Why didn't you join CGE?	3.1. How do you normally get the information about associations?
2.2. What are the things that can motivate you to join CGE?	3.2. What are the things that can motivate you to join any association?
2.3. How do you know about CGE?	

4. How do you get the information about new technologies? (Newspapers, trade magazines, exhibitions etc)

APPENDIX 3: QUESTIONNAIRE FOR JAAF AND SLASA

1. About SMEs

- 1.1. Do you have a good relationship with SMEs in the garment manufacturing industry? Yes
No
- 1.2. If “yes” what kind of relationship is it?
- 1.3. Do you have a contact list of the garment industry SMEs? Yes No
- 1.4. How do you categorize the SMEs in the garment industry?
- 1.5. Are you concerned about the environmental performance of garment industry SMEs? Why?
- 1.6. How do you help SMEs in the other industries to implement better environmental practices?
- 1.7. Do you think garment industry SMEs are practicing good environmental performance? Yes
 No
- 1.8. If “no” what can be the reason?
- 1.9. What is your contribution to make the garment industry SMEs more environmentally sustainable?
- 1.10. Do you think garment industry SMEs can gain competitive advantage by better environmental performance?

2. SME network

- 2.1. Have you seen any network relationship among SMEs (in general) in Sri Lanka? Yes
No
- 2.2. If “yes” what kind of networks?
- 2.3. What are the networks available among garment industry SMEs?
- 2.4. Have you taken initiatives to build SME networks? How?
- 2.5. How is it possible to create SME networks?
- 2.6. Do you think SME network create visibility to the other stakeholders?

3. Stakeholder collaboration

- 3.1. Do you like to take the initiative to build SME network in the garment industry? Yes
No
- 3.2. How do you get the required finance for the environmental improvement of SMEs?
- 3.3. What do you think about the government's tasks or ability to help the environmental improvement of SMEs?
- 3.4. Is tax concession possible for environmental responsible SMEs?
- 3.5. Do you think it will help to bring the SMEs environmentally sustainable? Yes No
- 3.6. What is the role of NGOs or international organizations in bringing SMEs to environmental sustainability?

APPENDIX 4: QUESTIONNAIRE FOR CGE

1. What is the procedure for joining Chamber of Garment exporters? [REDACTED]
2. How do the SMEs find you? [REDACTED]
3. Do you have any advertising or awareness campaigns? [REDACTED]
4. What are the benefits the SMEs receive after joining the Chamber of garment exporters? [REDACTED]
5. How do you define SMEs in the garment industry? [REDACTED]
 - 5.1. Can you define it either using number of employees or number of machinery? [REDACTED]
6. According to your knowledge how many SMEs are there in the garment industry? [REDACTED]
7. What do you think about the energy price situation in Sri Lanka? [REDACTED]
 - 7.1. Do you think it will affect the SMEs in the garment industry? [REDACTED]
8. Do you help SMEs to be more energy efficient? Yes No
 - 8.1. How do you help SMEs to be more energy efficient? [REDACTED]
9. Do you conduct or invite companies or organizations to do seminar or exhibitions for energy efficiency technologies? [REDACTED]
10. Do you have a good relationship with universities or technical institutes? [REDACTED]
11. Are there any special bank loans to fund energy efficient investments? [REDACTED]
12. Is it difficult to get loans for energy efficient investments? [REDACTED]
13. Is it difficult for garment industry SMEs to get bank loans? [REDACTED]
14. Do you support SMEs to get bank loans? Yes No
 - 14.1. How do you support? [REDACTED]
15. Is there any credit guarantee scheme for garment industry or SMEs? Yes No
 - 15.1. What is the current situation of that? [REDACTED]
16. What are the main problems for SMEs in the garment industry? [REDACTED]
17. What is importance of having SMEs for the garment industry? [REDACTED]
18. Can your organization influence JAAF or the government regarding the requirements of the SMEs in the garment industry? [REDACTED]

APPENDIX 5: QUESTIONNAIRE FOR BANKS

Reference Number:

1. Garment manufacturing companies complain that there is lack of access to loans for the garment industry.

1.1. According to your opinion is there any difficulty to access to loans for garment industry?

Yes No

1.2. If there is any difficulty what is the reason?

2. Why is it difficult for SMEs (Small and medium sized enterprises) to access to bank loans?

3. Do you know about the credit guarantee scheme for apparel? Yes No

4. If Yes: Have your bank joined the credit guarantee scheme for apparel? Yes No

5. If No: What is the reason for not joining?

APPENDIX 6: BASIC INFORMATIONS ABOUT SELECTED SMEs

Company Reference Number	Starting Year	Number of Employees	Number of Machines	Profitability
SME01	1991	40	80	Profitable
SME02	2004	160	100	Profitable
SME03	2011	245	100	Breakeven - just started
SME04	1984	180	150	Profitable
SME05	2004	100	100	Loss making
SME06	2011	475	250	Profitable
SME07	1994	350	84	Profitable
SME08	2006	475	150	Profitable
SME09	1994	290	150	Profitable
SME10	2008	275	160	Profitable
SME11	2012	50	30	Breakeven - just started
SME12	2008	250	150	Profitable
SME13	1991	400	280	Profitable
SME14	2011	115	85	Breakeven - just started
SME15	2008	30	40	Profitable
SME16	2005	385	200	Profitable
SME17	2010	30	30	Profitable
SME18	2000	48	30	Profitable
SME19	2000	150	100	Profitable

APPENDIX 7: BASIC INFORMATION ABOUT THE INTERVIEWD ORGANIZATIONS

	Joint Apparel Association Forum	Sri Lanka Chamber of Garment Exporters	Sri Lanka Apparel Sourcing Association	National Cleaner Production Centre
Year of establishment	2002	1983	1993	2002
Number of member companies	6 Associations	62 companies	38 companies	N/A
Characteristics of member companies	Consist of all the associations in the apparel industry	SMEs in the apparel industry - including the apparel manufacturers and support services	Apparel buying offices	Established by UNIDO
Activities of the organization	Represent all the associations in the negotiation processes with the government and the foreign buyers. Preparing policies for the apparel industry	Representing SMEs when discussing issues with JAAF and other relevant institutes	Connecting the buyers and the manufacturers	Conducting cleaner production assessments, cleaner production projects and energy audits

APPENDIX 8: BASIC INFORMATION ABOUT THE INTERVIEWD BANKS

	GB01	GB02	PB	LDB
Ownership	Government	Government	Private	Government
Total assets (LKR Billion)	873	1048.2	512.2	6.56
Banking services and main customers	Personal banking, Corporate banking, and Development assistance including SMEs	Personal banking, Corporate banking, development assistance including SMEs and investment banking	Personal banking, Corporate banking including SMEs and investment banking	SMEs in the agricultural and industrial sector
Total amount of loans (LKR billion)	660.6	714.8	372.8	2.24

APPENDIX 9: BASIC INFORMATION ABOUT THE SELECTED ESCOs

Name	Type of ESCO	Services	Special Information	Contract types
Professional MET Consultancy Services (Pvt) Ltd	Energy Audits (EA) + Energy efficiency services (EES)	Bio mass boilers, thermal and hot water heaters, biomass power plants, energy audits, training programs for energy conservation, LED and solar lighting systems		N/A
Access Energy Solutions (Pvt) Ltd	EA + EES	Electrical Installation, Energy Management, Power & Renewable Energy	Free initial walk-through energy audit	Performance contracting & Shared saving mechanisms
Rotax Limited	EA + EES	Lightning & Surge Protection Proposals, Total Turnkey Lighting Solutions, Energy Audits	Providing services to institutes and industries including Apparel industry	N/A
Diesel & Motor Engineering PLC	EA + EES	Renewable energy, lighting solutions, machinery solutions		N/A
Shin Nippon Air Technologies Co., Ltd.	EA + EES	Infrastructure energy efficient technologies	Carry out large infrastructure projects	N/A
Sri Lanka Energy Managers Association	EA + EES	Energy efficiency information providing, training programs, consultancy services, energy efficiency projects	Provide facilities to hire instruments related to energy audits	N/A

Enerfab (Pvt) Ltd	EA	Detailed energy audits and implementation assistance, equipment wise energy audits and performance tests, engineering services for tailor-made energy conservation projects, corporate energy planning and energy costing, technology sourcing for energy efficiency projects, capacity building and customized training packages	Already conducted energy audits for garment factories, Free initial energy audit , energy audit instrument hiring services	Performance contracting & Shared saving mechanisms
Industrial Services Bureau	EA	Energy assessments and auditing, consultancies on international energy management systems, mini and micro hydro solutions, national and international reporting, wind and solar energy solutions, on and off site training on energy and environmental management		N/A
National Cleaner Production Centre	EA	Energy audits, technology assessments, capacity building programs		N/A
Energy Management Systems (Pvt) Ltd	EES	Energy management systems, energy conservation, renewable energy		N/A
Clarion International Limited	EES	Power Factor Correction Capacitor Systems, energy management systems	Provide services to medium to large companies, has provided various services to more than 100 garment companies	N/A