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Study on Social and Environmental challenges influencing Supply Chain Sustainability: Textile Industries

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ABBREVIATION

TVET: Technical and Vocational Education and Training

SSCM: Sustainable Supply Chain Management

UNIDO: United Nations Industrial Development Organization

ETP: Effluent treatment plant

ITC: International Trade Centre

NGO: Non-Governmental Organization

BOD: Biological Oxidation Demand

COD: Chemical Oxidation Demand

SPSS: Statistical Package for the Social Sciences

MLR: Molecular liquor ratio

MRLS: Material Restricted Substance List

ZDHS: Zero Discharge Hazardous Substance

MSDS: Material Safety Data Sheet

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Abstract

The sustainability of textile industries is a multiple, interrelated, and complicated issue due to the nature of the industry across the manufacturing process. The textile industries in Ethiopia are more important in the supply chain for their sustainability development because of the workers' insecurity and irregular operations, while social and environmental concerns are not well controlled. Textile industries' survival and productivity are very difficult to achieve without effective control of social and environmental issues, as well as their economic status, in order to overcome pressure from government regulations, customers, and stakeholders. This study used primary data from 14 Ethiopian textile manufacturers and 60 stakeholders, including TVET institutes and universities, to assess the social and environmental importance of textile industry for sustainable development. Twelve basic social and environmental issues were identified as a result of the survey, and a correlational analysis was conducted to determine their links, Environmentally friendly resource use, emission to air, emission to land, packaging material, waste disposal system, and company policy are the key concerns associated with environmental sustainability that are analyzed in the study. Employment, health and safety issues, training, communication systems, equality, accessibility, and worker engagement are all challenges related to social sustainability. The spears man coefficient shows that social and environmental factors in general has a moderate positive correlation to each other. Beside this, waste disposal had weak relation with efficient use of resources and proper handling of workers.

Keywords: Supply Chain, Sustainability, Social issue, Environmental issue, Textile Industries

Chapter One

1 Introduction

1.1 Background

Mike Hachtman; (2019) defines supply chain sustainability as embedding environmental, social, or corporate governance considerations as raw materials are sourced, converted to products, and delivered to market, resulting in supply chain sustainability becoming a vital – and increasingly visible – element of social corporate responsibility. However, the supply chain does not end when the product hits the market. As a result, Wilson defines sustainability as (2020) a decision-making framework that analyzes the economic, social, and environmental ramifications of decisions in order to balance people, profits, and the environment. The right supply chain solutions can help the sector seek for, and eventually achieve, long-term viability rather than merely immediate risks, rewards, and costs, due to their broad term and complexity to customize for developing countries. Furthermore, businesses of all types should pay attention to sustainability challenges by identifying and analyzing implications in their upstream and downstream value chains (Dr. Moritz Nill, Norbert Jungmichel, 2017). For these reasons, industries used traditional supply networks for a long time before transitioning to a sustainable supply chain that prioritized demand and supply for long-term mutual benefit (Masoumi et al., 2019). In this case, one reason driving an increasing attention on supply chain sustainability is attracting customers for value sustainability. Manufacturing sectors account for 27.6% of Ethiopia's GDP, agricultural production for 31.19 percent, and service industries account for the remaining value (H. Plecher, 2020). From those manufacturing sectors, the textile and garment sector needs to bolster its efforts of being one of the major hubs in the world by focusing on sustainable production (Plein, 2021). As an opening for the study, both the government opportunity and problem raised in sustainability concerns related to textiles, such as resource usage reduction, emission reduction (water, air, land), product innovation, and social, well-being for society, customers, and workforce. Because we are familiar with sustainable challenges, focusing on textile supply chains can help us reduce risk, improve efficiency, and attract clients who value our efforts (Chopra & Peter, 2016).

Textile manufacture was also designated as a priority sector due to the abundance of resources, its export potential, and the possibility for creating large numbers of jobs. However, Sustainability issues in textiles due to the influences emerging from outside the boundaries of the conventional textile industry, cotton and garment supply chain and actors (Ministry of industry, Ethiopian Revenue & Customs Authority, Textile Industry Development Institute, Suppliers, stakeholders) influences the sector. Therefore, problems that emerged from this boundary play their role to solve a problem of incapability to compete in the global market.

Large number of general approaches of supply chain assessment in line with sustainability issues and methods for the development of sustainable products has been proposed and reviewed in the literature. Nevertheless, this study focus on how social and environmental challenges can corporately influence workers' security and continual operation. Particularly in the Ethiopian textile industries, in the production area. Having these challenges, affects commitment to the organization, quality of products and service, and organizational effectiveness in operational competitiveness internationally, leads for the industries lose long-term risk mitigation system and potential customers especially export orders.

Taking this global issue to the Ethiopian textile sector and assessing the current approach and challenges of sustainability in social and environmental aspects for continual improvement of the organizational performance is the main objective of the study, and it mainly focuses on firms that process cotton textile factories. The issue reflects a human perception of the actors, assessing the data with operational managers that are on the front line of managing operations in which management's ability has a role to integrate the company's networks of business and workers.

Since textile industry is indicated to be one among the most polluting industries, it becomes mandatory to adopt sustainable practices in order to conserve natural resource, having available land and weather suitable for cotton production used to integrate agriculture to industry. In addition, initiating import substitution industrialization to protect, strengthen, and grow local industries using a variety of tactics, including tariffs, import quotas, and subsidized government loans. Generally, the sector needs ethical approach to do business and has to be very transparent at each level of its activities and an innovative approach to the production and supply chain needed related with social and environmental issue.

1.2 Problem statement

The textile sector is assumed labor intensive for getting wide market, having available land and weather suitable for the production. But cotton based textile factories have a difficulty in sourcing workers due to being unskilled (Ethiopian Investment Commision, Ministry of trade and industry, Ethiopian Textile Industry Development Institute, 2018), coupled by low efficiency and productivity, followed by consequences' of unfulfillment of export orders. Hence, the textile sector needs continual follow up of the supply chain and commitment for the resource use. In a world where labor and materials are characterized as resources (IEC), 2021), factories are vulnerable to operational failures as a result of a lack of continuous follow-up in identifying skilled personnel and materials (chemical, water, and energy).As a result, the main factors are worker instability and operational inconsistency.

Mostly dimensions of sustainable issues are sight separately and covered related with their effects on one to another's (Fu Jiaa, Laura Zuluagab, Adrian Baileyb, 2018). Accordingly, to the significance of social and environmental issues to the industries, concerned bodies which are universities, institutes, colleges, and enterprises' graduate students lack an awareness, leads to be reasons practically workers inefficient. Nowadays evaluating the social concern against environmental performance is difficulties for the companies' (Walker & Jones, 2012) , because needs to focus on efficiency and governance issues. In addition, Dubey et al. ; (2017) suggested that analyzing the corporate issues and challenges can add to logistics sustainability and allow companies to improve their approach to sustainable supply chain management.

Even though, cotton base textile industries engaged in knitting, weaving & finishing industries are both material and labor utilization area, but social and environmental issues synchronized with elements of supply chains is not well studied. As Blog; (2021) said social compliance categorized with 9 requirements and Gammaz & Hagras; (2020) summarized with the provisions of natural resources, in infrastructure environment, and threats & hazards, thematic areas are identified and assessed. Those from social issues concerned to employment, health and Safety, Training and development, Communication, Equity, Accessibility, and Participation. And, from environment issues concerned to resource use, emission to land, air, and transportation, government regulation and policy, packaging materials and waste. Meanwhile, transportation, information, waste disposal, packaging, and networking are all taken into account.

As an opportunity, the national cotton development strategy begins with the goal of becoming the world's top producer of sustainable quality cotton and promoting and managing environmentally and socially sustainable cotton supply chains" (H. Plecher, 2020). This endorses the textile industry sector to go through and focus on the root challenges that influenced to high risk of infringement in the area of environment as well as concerning to working condition. This brings to us relate the social and environmental relationship through correlational analysis. This assists to extract the common challenges faced in case factories and opportunities the another, in developing countries mostly challenges can be related to geographical distance from supplier to the production area brings different product, the controlling and frequent auditing (Boström & Micheletti, 2016). Challenges raised as Middlthe e East and Africa Textile portal; (2020) report said efficiency in factories which is as slow as 40 to 45% in production both in textile or garment assembly units, mainly due to underdeveloped processes and lack of education amongst manpower. The other is adapting traditional supply chains; that about strained relationships between customers and suppliers, which leads to a short-term focus and little regard for mutual long-term success (Board, 2000). Again, Ethiopia ranked fourth in Maplecroft's Child Labor Index 2019 (“underage working remains a problem in Ethiopia. 41.5% of the country's population that is aged between 7 and 14 is employed in some form of work.”) (Technical and social compliance, 2019). Likewise, occurrence of abuse of worker for excessive working time, unsafe workplace, misbehaving with employees seen.

Like (Kusi-Sarpong et al., 2019) reviewed , the differences in most companies were the rate of intention to sustainability issues that corporately reduce the problem. Therefore, investigating sustainable supply chain through determining challenges in environmental and social dimensions in the cotton-based textile industries will be **the focus of this study**. The identification is based on qualitative and quantitative approaches.

More precisely, this study focused to answer the following research questions:

1. How are social and environmental issues assessed in supply chain sustainability among textile industries with workers insecurity and operation consistency?
2. How critical is social and environmental, issues aimed at complying with international requirement.
3. What are the challenges and opportunities in social and environmental sustainability dimensions?

1.3 Research objective

1.3.1 General objective

The general objective of the study is to assess social and environmental challenges of sustainable supply chain in Ethiopian textile industry.

1.3.2 Specific objective

- To assess companies' nature of resource utilization and processes related to social and environmental issues
- To assess the critical social and environmental issues
- To relate the social and environmental issues through correlational analysis and extract challenges
- To analyze improvement strategies

1.4 Scope of the research

The study focused on assessing the social and environmental challenges in the Ethiopian textile supply chain. The study covered cotton-based labor-intensive textile industries where they are supposed to have high level of environmental and social effects, excluding garment industries. The study focused on the production area in which processes were evaluated to identify where issues are done more efficiently. Employment, health and Safety, Training and development, Communication, Equity, Accessibility, and Participation were the social issues assessed. In addition, environment issues assed were concerned with resource use, emission to land, air, and transportation, government regulation and policy, packaging materials, and waste.

Chapter Two

2 Literature Review

2.1 Introduction

2.1.1 Supply Chain and Supply Chain Management

The procurement, production, and distribution of products and services to meet the needs of stakeholders is managed by a supply chain, which is a continuous movement of information, product, and funds (Chopra & Peter, 2016). Supply chain management hole wide-ranging of actives, is employing the maximum resources to produce services and products for customers (Basiago, 1999), and assists to integrate the key business processes for serving customers. Possibly requirement for supply chain management system is not just for the timely manufacture of goods; it is also a very critical system for ensuring meeting that customers' requirements (Faris, 2021).

2.1.2 Textile Supply Chain

The textile supply chain starts from farming to finishing, considering health and working condition, production/manufacturing and customer demand. Therefore, keeping to the track of supply chain and guarantee the sustainability supply chain helps sectors to control over the suppliers to whom they outsource the production and their customer. However, corporate supply chain will lead to have corporate culture and more engaged workers.

Textile supply chain

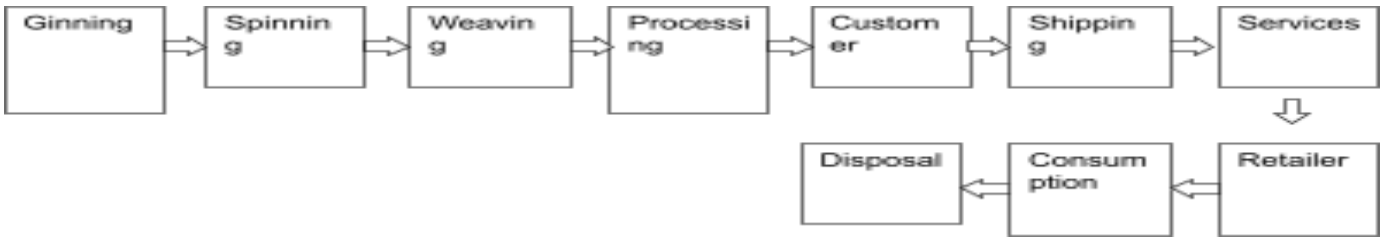


FIGURE 2A LINEAR TEXTILE SUPPLY CHAIN

Source; BCL&IKEA, 2009

Process flow diagram

Farming is the one and initial process of harvesting of cottonseed and delivery of cotton gin and the ginners works on the process of separation of cottonseed and cotton lint. Then making of cotton yarn and processing of knitting, weaving, dyeing, finishing and washing. Finally, disposal will take place in process and final output, which can be recycled, reuse or landfill. In which Customer, Shipping and Retailer assist to deliver the product; interpreted as anyone who want grey fabric as a final product or garment sector who took finished fabric to process, any fright used to take the raw and final product and someone who is responsible for distributing and selling simultaneously.

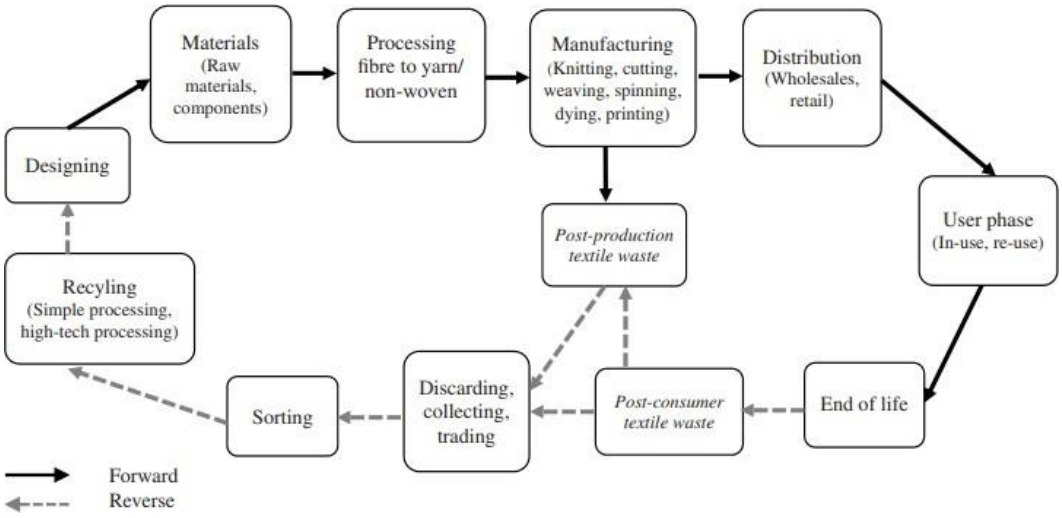


FIGURE 2B CIRCULAR TEXTILE SUPPLY CHAIN

Source (Kazancoglu et al., 2020)

Nowadays globally systematic and holistic approach of circular (Figure 2b) Economy in the textile industry, is required all through the supply chain encompassing all entities through circular supply chain (Kazancoglu et al., 2020) to fully accomplish linear (Fig. 2a) economy sustainable manufacturing process,. In which products can be reused, remanufactured, recycled, redesigned, reduced, or recovered.

TABLE 2A – A GENERAL TEXTILE SUPPLY CHAIN STRUCTURE, ITS SUB PHASES AND PROCESS INPUTS (Gardetti & Torres, 2017)

No.	Supply chain phase	Sub phase (Included processes)	Process inputs
1.	Raw material harvesting phase	Raw material preparation	Direct and indirect land usage for fiber production, production facilities and landfills
2.	Raw material processing phase	Raw material to fiber conversation	
3.	Manufacturing phase	Yarn preparation	Pesticides, fertilizers, chemicals and other additives
		Grey fabric preparation	
		Finished fabric preparation	
		Apparel manufacturing, including cutting, sewing and washing	
4.	Transport and distribution phase	Boat, air, train or truck transports to warehouse or retailer	Water for processing and cooling Machines and inventories in manufacturing facilities
5.	Use phase	Wearing and washing habits of consumers	Packaging materials
6.	Waste phase	Recycling	Energy for production and transportation
		Reuse	
		Landfill/Incineration	

- Here this (Table 2a) diagram shows the current textile supply chain to each individual processes of textile product. This forms interlinkage between the processes and identify the elements of the supply chain.

2.1.3 Sustainable Supply Chain Management

Driving an increased focus on supply chain sustainability divided into three distinct categories (Chopra & Peter, 2016) which is reducing risk and improving the financial performance of the supply chain, community pressures, government mandates and attracting customers that value sustainability.

Hence, Sustainable Supply chain is the management of material, information and capital flows (Sabbaghi, 2011) as well as cooperation among companies along the supply chain. While integrating goals from all three dimensions of sustainable development, these are economic, environmental and social which are derived from customer and stakeholder requirement (Seuring & Mu, 2008), and Sustainable supply chain risk management is the ability of a firm to understand and manage its economic, environmental, and social risks in the supply chain.

TABLE 2B. THE PARADIGM SHIFT FROM "TRADITIONAL" TOWARDS "MODERN" ENVIRONMENTAL PROTECTION APPROACHES (Finkbeiner et al., 2010)

Characteristics	**"TRADITIONAL" environmental and social protection**	**"MODEREN" environmental and social protection**
Political background	control of risks, dangers	sustainability ("triple bottom line"
Primary policy principle	command & control	push & pull
Main actor	Governments	society ("shared responsibility")
Policy setting	Confrontation	cooperation
Tasks	separation of tasks, individual solutions	integration of tasks, system solutions
Principle for action	Reactive	proactive
Regional scope	local, national	international
Focus	production ("single processes")	products ("process networks")
Environment	single compartments and emissions	complete cross-media view over the complete life cycle

Social	single task delegation &intensivist	concerned with the welfare of the society (social responsibility)
Technology	separate processes, end-of-pipe	integrated processes, innovations

- This (Table 2b) shows that how the traditional and conventional sustainability is defined, interpreted and applied in 11 characteristics, including social and environmental aspects.

2.1.4 Textile Sustainability

Supply chain sustainability is defined as (Kusi-Sarpong et al., 2019) embedding environmental, social or corporate governance considerations as raw materials are sourced, converted to products and delivered to market. Our health and well-being, our economy, and our social life and safety all require a high quality environment (Ozek, 2017). Hence, Textile Industry is a fast-growing industry in the twenty-first century in terms of both production volume and employment, the industry's impact is huge on the society, economy, and environment. In addition, of indicates to be one among the most polluting industries, also, is a thirsty industry with huge consumer of water, a resource that is becoming scarce day by day (Aindustryss7). Textile industries best practices drives specifically reducing waste and creating efficiencies that lower resource consumption and can lower costs, with the ultimate objective of preserving conditions to support future generations.

Textile related factories that get benefit with the implementation of sustainability are Burberry, leading manufacturer of apparel and other fashion accessories like perfumes and handbags, works on employees with safe working conditions, fair policies regarding appointment and remuneration and ethical workplace standards. Welspun, is a group that is chiefly engaged in the production of textiles, has developed the concept of 5 Es – Enrichment of mind, enrichment of body, education, empathy, and empowerment of women. Moreover, Arvind Mills is a leading Indian producer of textiles, has developed an environmental policy strives for optimum utilization of energy, cotton and water. It takes steps to ensure minimum discharge of waste and for the recycling of waste as far as possible (Petry, 2008). In addition, multinational clothing-retail implement sustainability in the Garment store, working collectively and transparently with suppliers and manufacturer. From this, all societies need to decide who will get the output from the country's economic activity, and decide the best combination of factors to create the desired output of goods (Ozek, 2017). Corporately with supply chain leaders to focus on product

planning on elements Material (Forum, 2018).

2.1.5 Dimension of SSCM

2.1.5.1 Environmental sustainability

It is a measure of a firm's impact on the environment, including air, land, water, and ecosystems (Chopra & Peter, 2016). Environmental pillar in firms categorized as resource reduction, emission reduction, and product innovation, can be reducing packaging material, energy use, or transportation. Resource reduction activities result from inefficient usage of natural resources in the supply chain. The production and processing of conventional cotton are associated with a broad range of environmental aspects (Hilbert et al., 2018). The production of cotton is the stage of the value chain with the highest environmental impacts in the categories of greenhouse gas emissions, water consumption, and land use in the textile supply chain.

2.1.5.2 Social sustainability

Social pillars are the workforce, customers, and society (Chopra & Peter, 2016). Some of the workforces are employment quality, health, and safety, training, and development, the customer under social issues with transferring accurate product information and labeling, along with the impact of the product on the customer's health and safety. (Blog, 2021)Human rights and the impact on local communities are under society. Social sustainability encompasses notions of equity, empowerment, accessibility, participation, sharing, cultural identity, and institutional stability. Generally, deals with planning that encourages people to cooperative rather than their competitive impulses.

2.1.6 Supply Chain Barriers Related to Sustainability

Sustainability challenge involves multiple, interrelated, and complicated issues (Boström & Micheletti, 2016) with having plurality and heterogeneity of actors, interests, and values connected. Yet considering sustainability and responsibility can co-exist in fruitful interaction with the very basic human desire to look good, elegant, cool, and clean. Even though, there are barriers investigated depends on internal barriers like strategic issue Walker & Jones, (2012) a lack of strategic prioritization for sustainability issues. The other is the organizational size (Oelze, 2017), a small overall firm size can hinder the level of engagement in SSCM due to a lack of available resources. Also, external barriers defined by Walker & Jones; (2012) like non-governmental organizations demanding requirement, too much pressure on a single supplier, media, sectorial standard code of conduct, and global language & cultural influence. (Rathinamoorthy, 2020) defined barriers as cultural, technological, market, and government regulations.

Kazancoglu et al.; (2020) divide the challenges for SSCM as cost increase, operationalization of sustainable development, changing cultures and mindsets, strains in control and management of uncertainties and tradeoffs, and the complexity of problems. From those challenges, the operationalization of sustainable development is a major one to work on for having a manufacturing unit. As a result, market participants in the textile sector are increasingly under the spotlight for their involvement in social and environmental issues (Kozlowski et al., 2015). Already there is huge supply chain issue are mentioned for businesses, (Forum, 2018) challenges like the continuity of supply competing for a limited number of commodities is the one, the other is supply chain traceability, and business financial incentive system is often based on short term goals strategic sustainable goals. Considering the implementation of sustainability policies along their supply chains constitutes a major concern for textile companies' practice of sustainability.

2.1.7 Impact of Textile Sustainability

Compared to many other business sectors, the sustainability impact of the textile-manufacturing sector is particularly high, and the global stretch of its commodity chains creates extra challenges both on the side of supply and demand (Petry, 2008). Particularly sustainability challenge is the need for a functioning interplay between supply-side and demand-side actors that brings in sustainable values and practices more directly into focus (Boström & Micheletti, 2016).

Accordingly, (Mutuerandu & Iravo, 2014) sustainability has a positive effect on an organization's performance in terms of lowering its operational costs, reduction of lead time, high customer service levels. an environmentally unsustainable will, in all likelihood, be considered socially unacceptable and, therefore, socially unsustainable (Rathinamoorthy, 2020) reviewed that consumer generally are not aware of the pollution and environmental impact created by the manufacturing process of the apparel industry and attitude toward Textile Reuse and Recycling not addressed among society by the local government.

Textile chemicals and auxiliaries have more than 7,000 commercial products, based on 400 to 600 active ingredients (Commission, 2008) reports. It is highly concerned about toxic and polluting chemicals in textile processing such as Alkyl phenol ethylates (detergents, wetting agents, leveling agents) toxic to aquatic life and reported disturbing the reproduction of aquatic species by disrupting the endocrine system (Bajpai, 2017). Sequestering agents capable of forming very stable complexes with metals. Chlorine and chlorine-releasing compounds such as sodium hypochlorite (bleaching agent) and sodium dichloride isocyanate (wool anti-felting agent): are capable of reacting with organic compounds to form absorbable organic halogens. Dye bath effluents contain heavy metals, ammonia, alkali salts, toxic solids, and large amounts of pigments. Printing gums (Preservative pentachlorophenol): Dermatitis, is Carcinogenic. In addition, most sizing additives have very high BOD values, and the sizing agents are also responsible for up to 80% of the total COD load in the wastewater.

Moreover, wastes as well as atmospheric pollutants categorized as. Solid wastes: Fabric scraps and trimmings from salvages and seams; fiber dust and fragments from napping, shearing, and related operation, paper tubes, and empty chemical drums. In addition, Lint originates from textile production steps particularly from preparation, dyeing, and washing operations.

Liquid: Discarded finishing mixes and rinses water from finishing implements and equipment as well as facility clean up. Vapors: Exhaust gases from drying and curing .all manufacturers and designers are using eco-friendly organic catalysts, Products of reduced toxicity, and increased biodegradability to substitute environmentally harmful chemicals and Cleaner solvents as replacements for the flammable, toxic and volatile solvents polluting the atmosphere (Ozek, 2017).

Socially, has a significant negative impact on unemployment, downward wage pressure, negative effects on rural women's status, living standards, and health. Economically, has a significant impact on government revenues (losses to social, education, and health expenditure). Further, the evaluation of social, economic, and environmental impacts of organizational actions is necessary to make effective operational and capital investment decisions that positively influence organizational objectives and satisfy the objectives of multiple stakeholders(Epstein & Buhovac, 2014).

Generally, the Textile Industry has a considerable environmental and social sustainability impact, concerning to environmental use of chemical and dying textiles brings pollution of rivers and other ecosystems as well as land and water use. This adds to the climate impact of the globalized mass consumption and fast fashion industry. Besides problems concerning human rights, women minority, and migrant workers. Adaption of temporary employment contracts, low wages, long working days, and unsafe and unhealthy working environments enhance to be normal through time by the workers.

2.1.8 Sustainable Assessment Tool for Textile Products

The most appropriate tools according to; Desired Perspective(s) of the Assessment (eco centric& anthropocentric), Desirable Features of Sustainability Assessment (integrated, predictive, distributional, precautionary and participatory), Acceptability Criterion Adopted (objective-led assessment, environmental impact assessment led and assessment for sustainability) and the Values of the Affected Stakeholders (human, non-human and self-interest concern) (Gasparatos & Scolobig, 2012).

Sustainability assessment prerequisite requirements and evaluation system for carpet products accordingly National Centre for Sustainability Standards due to Public health and environment, energy efficiency, recycled content materials, environmentally preferable materials, Reclamation, end-of-life management, and Innovation (Amutha, 2017). For furnishing fabrics, fiber sourcing, safety of materials, water conservation, water quality, air quality, end of use, and social accountability. Environmental impacts of packaging through life cycle assessment tool to assess the impacts of a well-established product (Pauer et al., 2017).

Dacos; (2011) provide sustainability impact assessment (SIA) of the Euro-Mediterranean Free Trade Area, examine the potential impacts of trade measures on sustainable development in the region, identify flanking measures for mitigating and enhancing possible impacts – as well as recommendations and a post-SIA monitoring mechanism. Gammaz & Hagras; (2020) intersect sustainable development environmental, economic and social pillars through social impact assessment tool, related to infrastructure, security, services, community capabilities and job opportunities, and social equity. Guidelines & Business; (2008) seek to help companies report their environmental impacts in a meaningful and cost-effective way consistent with other standards and reporting guidance as far as possible.

Bajpai; (2017) brings best practice implementation in textile sector accordingly of environmental aspects through cleaner production option, consists several sub activities' in each option, considering with good housekeeping, better process control, raw material change, technology change, Recycling and equipment modification. Higg Index ;(2019) said the Higg Facility Environmental Module also standardizes how facilities measure and evaluate their environmental

Performance, designed to measure, quantify the sustainability impacts of a facility, and reduce redundancy in measuring and reporting sustainability performance. Considering all those assessment points and indicators helps for the company to get the basic critical points.

2.1.8.1 Strategic Issues

Following to the assessment of current companies' status, improvement strategy is necessary as reviewed Tucker; (2020) longer-term opportunities for supply chain sustainability As supply chain leaders, focus on product planning and the elements that change over time for a more sustainable supply chain. Which are material, suppliers, packaging, circular models and new revenue models. Wilson; (2020) said five ways to improve your supply chain sustainability, understand the risks and opportunities in your supply chains, Set sustainability targets within the procurement process, set a baseline supplier performance, collect data to make informed decisions and use software to analyze data and automate processes. Although Mike Hachtman; (2019) reviewed Six ways to achieve supply chain sustainability, considering in **creating map**; thorough map of the chain accounts for how human and natural resources are used along each step of operational and production process. Second one, **Educate and change the culture**, then, **Encourage and assist upstream, Leverage technology, collaborate and build on success**.

TABLE2.1.8A SUMMARY OF STUDIES REGARDING TO SCM AND SUSTAINABILITY BASED ON THE RESULTS OF THE LITERATURE

Thematic areas	Authors	Issues covered for SSCM implementation
Social and environmental standard requirement	K. Amutha	Sustainable Practices in Textile Industry: Standards and Certificates
Environmental, resource use, emission to air and land	Ozek, H Ziya, 2017 Inga Hilbert, Tobias Schleicher. Dr. Tadesse Amera, Dr. Klaus Hennenberg, October 2018	Increasing Impact on Textile and Apparel Industry. the focus on the current Ethiopian cotton value chain
Challenges	Boström, Magnus, Micheletti, Michele 2016	Analyses the sustainability challenge by focusing on the role of responsibility among the various actors and institutions involved in the production and consumption of textiles and clothing.
Supply chain barriers	Kazancoglu, Ipek, Kazancoglu, Yigit, Yarimoglu, Emel, Kahraman, Aysun 2020	propose a holistic conceptual framework for barriers of circular supply chain for sustainability in the textile industry
Social,	DenizKöksalone, *, JochenSträhle 1 , Martin Müller 2 and Matthias FreiseJanuary 2017	focusing **on social issues** in sustainable supply chain management (SSCM) by considering the textile/apparel sector as the field of application
Environment	Andalib Ardakani D, Soltanmohammadi A., 2019	Investigate through the environmental performance management and the green supply chain management.

Environment	Lisa Lindskog and Maria Roth, 2011	Controlling Sustainability in the Cotton Supply Chain through defining issue **on environmental dimension**
Corporate social responsibility (social, environment and economic)	Carter, C.R.; Rogers, D.S.,2008	**the integration of environmental, social, and economic** criteria that allow an organization to achieve long-term economic viability –
Elements of supply chain	Eskinder ayele, 2017	assessment of **internal supply chain performance** of textile industry in Ethiopia, Addis Ababa, Ethiopia related to key performance indicators of Quality, cost, productivity and time
Sustainability supply chain	Veronika P ereseina * Leif-Magnus Jensen * ,2013 Susanne Hertz	Understanding of the challenges and conflicts in sustainable supply chain management through empirical evidence (the heavy-vehicle industry in Sweden and China).

2.2 Summary of Studies Regarding to SCM and Sustainability Based on the Results of the Literature

Ethiopia as a developing country has variety opportunities supported and outsourced to balance and fit the dynamic global changes. That creates a movement for qualifying Sub-Saharan African countries to improve their rule of law, human rights, and respect for core labor standards. Ethiopian Institute of Agricultural Research (EIAR), 2016 reported the government of Ethiopia and other stakeholders/partners developed strategic plan for demand-driven improved cotton technologies. Therefore, this initiates local and foreign investors to invest on the potential area of cotton.

Taking this opportunity from the government and (Hilbert et al., 2018)) works on the evaluation of cotton certificates and due diligence schemes reduce pesticides and using food spray (organic cotton certification requirement). It mainly deals with endorsement of organic cotton standard requirement as an Ethiopia usually adapts conventional cotton farming, but this standard requirement could not stop in cotton process further have to proceed to textile process.

However, textile-manufacturing needs to comply with international certification requirement, (Amutha, 2017) focuses on standards and certificates like Global Organic Textile Standard (GOTS), American National Standard and OEKO-TEX® , standard for sustainable development in the textile industry and across the textile supply chain. Those standards required resource use initially from the raw material selection as natural cotton for more responsible farming, including every step-in cotton production to customer. Nevertheless, not only standards are indispensable but also commitment and awareness needed. Rathinamoorthy; (2020) tried to analyze sustainability in accordance with the knowledge of the consumers regarding the environmental impact of the disposal phase of textile and clothing. Sustainability indicator criteria globally considered in variety and ambitious way. Commonly categorized into three dimensions of social, environmental, and economic issues.

Environmental Key Performance Indicators considered significant to UK businesses defined (Guidelines & Business, 2008). Those related to direct textile indicators are water use & abstraction, greenhouse gases, waste and organic pollution. This guide and reporting techniques limited only for environmental issues. Several environmental issues are reviewed as (Bevilacqua et al., 2014) compares the impacts of cotton yarn production in environment due from four country supplies (Egypt, China, India and USA). (Dr. Moritz Nill, Norbert Jungmichel, 2017) focused in eight manufacturing industries found in Germany such as (textile and Fashion Retailing, Chemical Industry, Electronics Industry, Automotive Industry, Food Retailing, Machinery Industry, Metal Production and Processing Paper Industry), from which textile environmental impact assessment needs highly consideration in water consumption. Environmental analysis of textile value chain studied (Dr. Moritz Nill, Norbert Jungmichel, 2017) aims to give an insight into the comprehensive details relating to the various processes in the value chain of textile and clothing manufacturing. Although the environmental issues are many and complex, one thing is certain; these major issues affect humankind and must be addressed corporately.

Beside environmental issues, social issues reviewed in the labor-intensive Ready Made Garments industry of Bangladesh, (Huq et al., 2014) considering the cultural and socio-economic conditions of the developing country during the implementation process but they faced barriers during implementation because the codes of conduct do not reflect the local context of Bangladesh. Further (Köksal et al., 2017) reviewed Social Sustainable Supply Chain Management in the Textile and Apparel Industry, found company's internal orientation is the main assisting factor in sustainable management practices. Social impact assessment (Gammaz & Hagras, 2020) carried out comparative integrated flexible model between socio-economic, the socio- demographic dimension, and the socio-environmental dimension, highlights the variance according to the nature of the development project and its objectives. Nevertheless, those raised reflection of reviews and concepts are helpful, variety factors clearly seen in characteristics and affordances, surrounding environment, and the community.

Not merely of urban sustainability but of urban vitality Gammaz & Hagras; (2020) wrote in the book of Best Practices in Managing and Measuring Corporate Social, Environmental, and Economic Impacts included with nine principles. Those principles help for uniformity but more of its importance is during implementation phase. Beside the principles Sustainability issues discussed in turkey, searching in 34 textile and apparel industries, reached with idea of environmental and social sustainability applications will inevitably have a significant effect on economic sustainability at both the micro and macro level in accordance of Global Reporting Initiatives (Abubakar, 2014). Even if, Saygili et al.; (2020) reframed and customized Germans chemical industries sustainable prerequisite and practices into Ethiopian textile industries in 4 factories through interviewees, The identified prerequisite and criteria aspects in the factories are not elaborated well and, thus, merit will be studied further in performance dimension through both social and environmental effects to cover particularly on textile industries.

2.3 Identified Literature Gaps

Even though, a large number of general approaches of supply chain assessment in line with sustainability issues and methods for the development of sustainable products has been proposed and used in the literature. Nevertheless, no studies focused on corporate social and environmental challenges identification that corporately influence workers' stability and continual operation, particularly in the Ethiopian textile industries, in the production area.

Although several environmental and social requirement criteria's have built internationally but not only standards are indispensable but also commitment and awareness necessary. In Ethiopia, fulfillment of standard requirement could not stop in cotton process further have to proceed to textile process. In fact, the environmental issues are many and complex, one thing is certain; these major issues affect humankind and must addressed corporately. The major problem faced in developing countries, including Ethiopia, is during implementation because the codes of conduct do not reflect the local context, due of improper identification of corporate challenges.

Having these challenges, affects commitment to the organization, quality of products and service, and organizational effectiveness in operational competitiveness internationally, leads for the industries lose long-term risk mitigation system and potential customers especially export orders. The study used those social and environmentally sustainable issues, economic issues considered deliberately. The integrated impact is shown in economic benefits strongly dependent on technological development and implementation of domestic and regional policies. Mostly in textile sector, the effects of social and environmental issues clearly seen and their indicators to measures, checks and reports is almost similar to globally used. This benefits the key terms to compare relative to standard benchmarks and guideline helps to set goals for improvement. Whereas economic issues are seen in a wide variety of industrial trade effects in terms of the average of globally domestic product, significant adverse seen in government revenues.

Chapter Three

3 Research Methodology

3.1 Research Design

In this study, qualitative and quantitative is taking place based on explanatory and descriptive nature of the objective. The data source from the primary source (well-developed questionnaire from targeted population of the integrated textile mills, concerned TVET and universities and Ethiopian Textile Industry Development Institute) and relevant secondary data collected from, books, journals, internet and seminar reports used.

3.2 Data Collection

As far as the procedure of data collection is concerned, contacts has been initially made to respondents to explain the purpose and nature of the study to achieve the desired response rate. Then pilot study has done to validate whether the objectives met or not in the research study, through semi structured interview. Accordingly, of secondary data referred in the current Ethiopian factory's status, questioners are distributed. So generally, tools used in the data collection are Questionnaires, semi structured Interviews, Observation Techniques and secondary data. Subsequently, the questionnaire distributed to and collected physically from the potential respondents at their site.

Questionnaire employed as the instrument of data collection. Four rating alternatives applied that meant to dimensions of the SSCM namely environmental and social developed referred as yes, partially, no and not available. The parameters were viewed on checklist, with a qualitative question related to the study objective and questions, which used as pilot study and moved on to the questioners. Respondents requested to allocate/select choice for each of the items on the instrument by taking their knowledge and actual situation in mind. Observational techniques are used for evaluating cognitive and non-cognitive aspects of a person. It is in evaluation performance, interests, attitudes, values towards their life problems and situations.

3.2.1 Primary Source

The primary source is from a well-developed questionnaire from the entire targeted population of the integrated textile mills, concerned TVET colleges and universities and Ethiopian Textile Industry Development Institute. Checklist and questionnaires developed after conducting an

Extensive review of literature on supply chain performance of the textile sector. The layout of the questionnaire kept very simple to encourage meaningful participation by the respondents.

3.2.2 Secondary source

Relevant secondary data collected from books, manuals, journals internet and seminar report of Textile Industry Development Institute, as well as any other concerned bodies used to extract any sort of essential information to strengthen the study findings.

3.3 Sampling

3.3.1 Population:

The entire population of Textile and Apparel factory found in Ethiopia are totally in number 236 (Institute, 2021), from which the garment sector takes the major one and next textile, which is knitting and weaving factory. There is also category based on ownership and raw material used

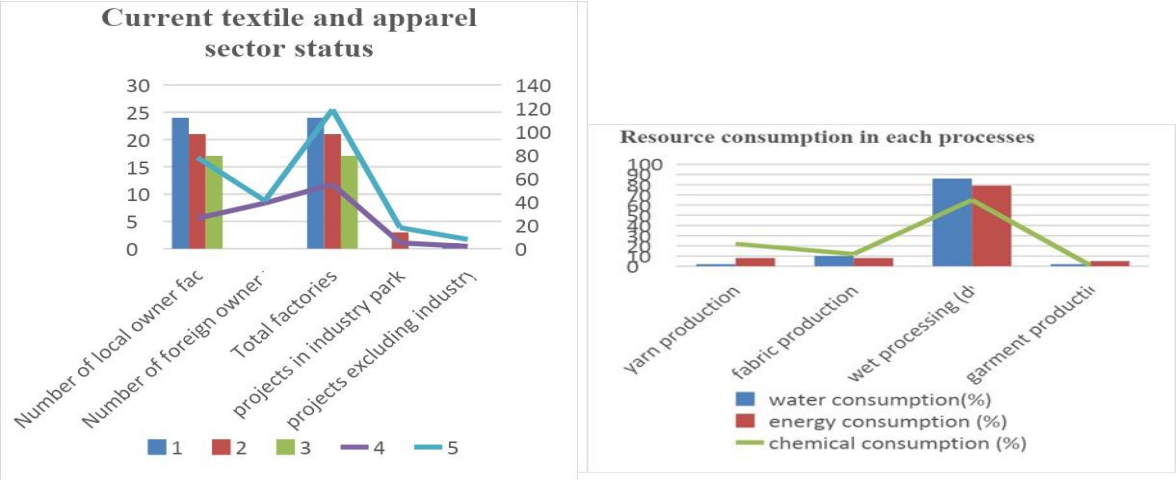


FIGURE 4.1A; CURRENT TEXTILE AND APPAREL SECTOR STATUS 2013 (SOURCE: ETHIOPIAN TEXTILE INDUSTRY DEVELOPMENT INSTITUTE)

The diagram shows that the relations of the processes in general, particularly the line and bar graph together highly show the relations of textile and garment factories on each other and effects of water, energy and chemical in each processes accordingly to the current factories.

In this case, total integrated textile factories, which processes fabric, are fifty-five, including local and foreign development investors (FDI). Total textile TVET colleges are ten and universities engaged in textile engineering are five (Institute, 2021).

3.3.1.1 Sample size determination

Sample Size Formula helps in calculating or determining the minimum sample size, which is required in order to know the adequate or correct proportion of the population along with the confidence level and margin of error (Pauro, 2017). From which total twenty-six textile factories are there, yet 19 factories are available and currently working. With having the following selection criteria, diversity of material & production process (yarn, knitted and woven dyeing, and printing), inclusion of both automated and hand loom machine, local and export order oriented. Finally, fourteen factories selected as a survey.

The key concepts that considered when conducting a survey, including confidence levels and margins of error, power and effect sizes (Pauro, 2017). Formula for the sample size n

$n = N*X / (X + N - 1)$, Where $X = Z\alpha/22 *p*(1-p) / MOE^2$, N = Population size,

Z = Critical value of the normal distribution at the required confidence level, the probability that the margin of error contains the true proportion. p = Sample proportion, what you expect the results to be.

So, from this the sample size formula, with a total population twenty-six, a confidence level of 95%, α is 0.05 And the critical value is 1.96 and proportion (p) is considered 80% then it becomes 15, the other stakeholders are limited with the textile courses, so it is taken exact to the population in advance to considering their willingness.

3.3.1.2 Selection of Respondent

Respondents are from four stakeholders in which they are inter-related and have great roles to work on developing workers' knowledge at academics on the identified social and environmental issues.

Firms: Operational mangers who are on the front line of managing operations, legal mangers for the complexities involved in managing the product, services, processes and other activities, Inclusive of supervisory.

Colleges/universities; textile lecturers and instructors and Institute; senior experts

3.4 Data Analysis

The respondents have to make rank as well each factor in terms of existence, the factors are a very critical aspect of the component and with rating 1 is not available and 4 is yes for the component. Correlational analysis used to measure strength of the association (linear relationship) between two variables. SPSS (Statistical Package for the Social Sciences), is used by various kinds of researchers for complex statistical data analysis. These mathematical formulae used to organize and interpret the information that has collected through variables. As the general categories of statistics, descriptive and inferential mentioned. Descriptive statistics used to describe the collected information, such as the range of values, their average, and the most common category. Descriptive statistics helps investigators learn more about the study sample. Inferential statistics used to make comparisons and draw conclusions from the study data. Inferential statistics allows investigators to make inferences and generalize beyond their study sample to other groups. Therefore, both statistics has done. Then the data is interpreted based on tables and charts.

3.4.1 Research Model

As Rogers, (2012) article reviews a model is defined as a representation of an idea that is used to describe phenomena, explaining for prediction as time goes on. As a classification of model descriptive model is the one, follows basic steps of identifying, describing, generating, embodying, and finalizing. In order to complete the model, conducting empirical research is essential, the quantitative and qualitative analysis. Then carried out econometrics steps for improving the understanding of the main concepts, consolidating the essential information, through requiring an in depth understanding of the process for testing statistical analysis (Juneja, n.d.).

Steps that econometric take to carry out an empirical studies are selection of an observed phenomenon; in which determining the variables is the initial stages, as per this study workers instability and operational instability is considered as the dependent variables, caused the independent variables of social and environmental challenges. Then establishing the objectives of the study is the second, in which to determine and examine the extent to which the social and environmental issues affect the workers instability and operational inconsistence. Finally validation is took place if the estimation is in coefficients values and anticipated as expected magnitudes respectively.

3.4.1.1 Correlational analysis

Statistical analyses like Spearman correlation are useful because it shows how different trends or patterns within society might be connected (Epstein & Buhovac, 2014). With Spearman's correlation, it is measuring the direction of association between the two variables, just using rankings. The main features of correlation analysis (*Eight Things You Need to Know about Interpreting Correlations:*, n.d.) are free from implication to causality, the size of a correlation can be influenced by the size of the sample, linearity or monotonic of the relationship, Homoscedasticity (equal variability), Effects of discontinuous distributions, Deciding what is a "good" correlation, report of the results of a correlation test, Statistical significance versus importance is well covered.

Therefore, the interpretation of the correlation coefficient is written in verbal description, in which this interpretation consists two groups, positive and negatives, the first is for the positive numbers whereas the second is for negative numbers. Then reporting is based on the correlational matrix of the specified variables.

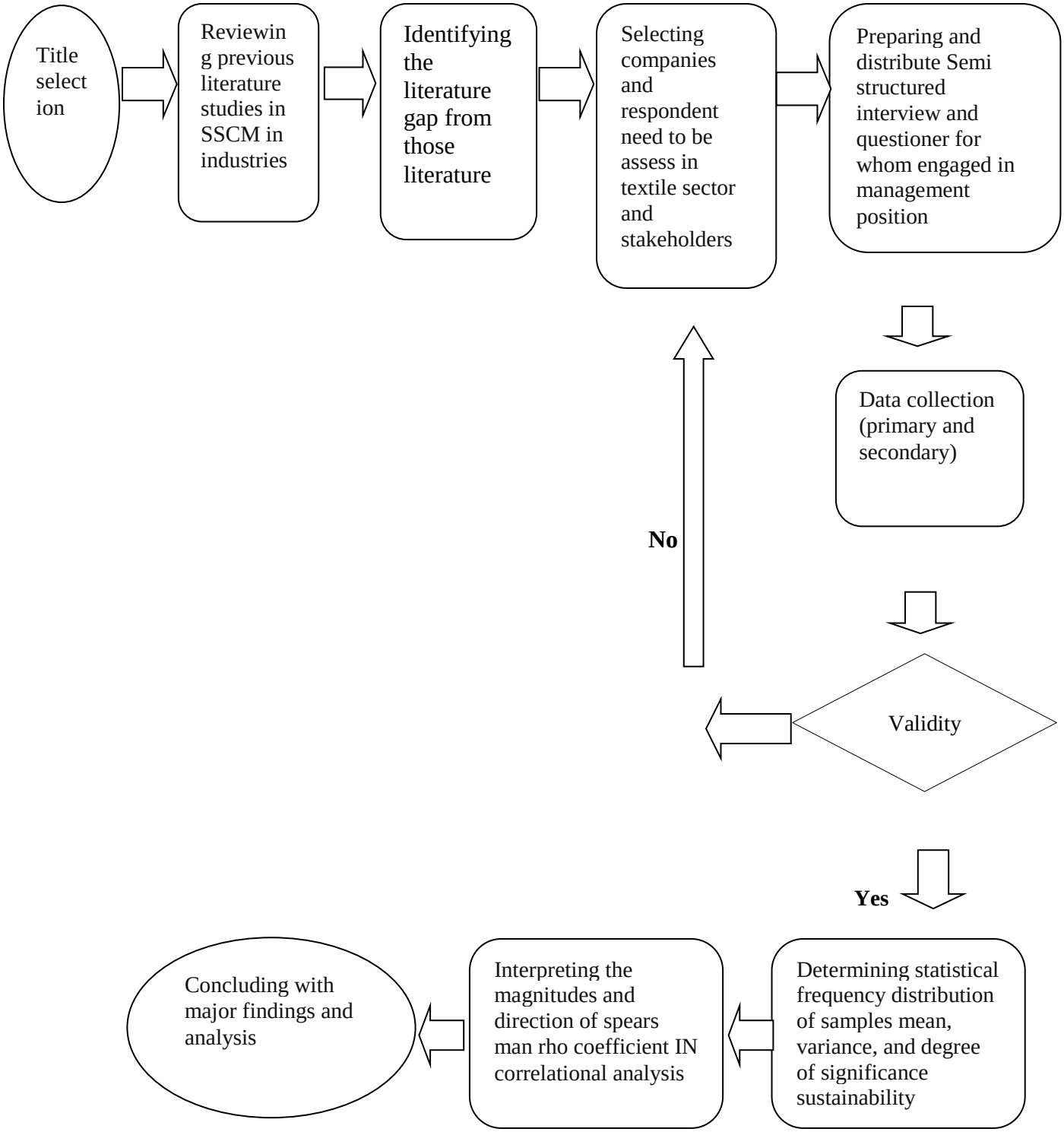
Table3.4.1A spears man correlational coefficient reporting

No	Spears man coefficient value	Reporting
1	±0.90 to ±0.99;	very high positive/negative correlation
2	±0.70 to ±0.90;	high positive/negative correlation
3	±0.50 to ±0.70;	moderate positive/negative correlation
4	±0.30 to ±0.50;	low positive/negative correlation
5	±0.10 to ±0.30;	very low positive/negative correlation
6	±0.0 to ±0.10;	Markedly low and negligible positive/negative correlation.

3.4.1.2 Water Fall Chart

A waterfall chart used for explaining the gradual transition in the quantitative value of an entity that is subjected to increment or decrement. Waterfall plots go from the worst value, such as greatest progression of disease, on the left side of the plot, to the best value, i.e., most reduction of tumor, on the right side of the plot (Socinski et al, 2008).

Research flow diagram



Chapter Four:

4 Result, Discussion and Interpretation

4.1 Respondent Demographic Information

In this study, group of respondents' are interrelated directly and indirectly. Main actors that directly affected by the workers instability and operation inconsistency are selected local cotton textile weaving and processing) factories. Which are Kanoria Africa Textile, Kombolcha textile share company, Bahirdar textile share company, Arbaminch textile share company, Crown textile, Tricraft, Maa garment, Muya textile, Ethiojapan, Etur, Eltex, Yirgalem, MNS, Saba Har. Those indirectly sectors assed in the studies are universities, poly technique colleges and textile institute; EiTEX, Wello university, Welkite, Awassa, again Ethio china, Gofa, Winget, Misrak technic Nefas silk, Tegebare Ede, Ledeta, Debre Birhan and Textile Institute respectively.

TABLE 4.1A DEMOGRAPHIC OF THE RESPONDENT

No.	Position of the Respondents	Sectors	No. of universities/colleges/institutes	No. of respondent
1	Quality and system senior expert, Processing and garment head ,Textile technology(12+3), Director and CEO , Production and HR, Weaving senior expert, System senior expert, Technical expert, Quality assurance and social compliance manager, Technical expert, Finishing senior expert, Project manager, Production Manager	Factory	14	14
2	Instructors'	Universities	4	12
3	Instructors'	Industrial colleges	1	5
4	Instructors'	Polytechnic colleges	6	29
5	Lecturers'	Manufacturing colleges	1	5
6	(Spinning, weaving, finishing, engineering, environmental and laboratory)senior experts	Institutes	Ethiopian textile institute	6
	Total			75

4.2 Finding and Interpretation

The data is collected in two ways, one with checklist form in semi structured interview and questioner form in which the respondent filled accordingly of respondent current situation. However, the study proceeds to get the factories and related stakeholders current operational trend integrated with their inter supply chain features that expected to be internationally accepted during production.

Coming to the results, based on the particular social and environmental issues, factories status seen. Before that, pilot study is taking place in (Kanoria, Ethio-japan and Elias Textile) factories that is similar base line of raw material and tried to understand their factories status interviewed in fifteen questions and observed their processes. The interviewee is in those three factories are technical managers who have intermediate understandings in sustainability issues, so points mentioned is well understood. From those three factories, Kanoria is a known denim jeans factories which processes 100% cotton yarn, have 1200 workers under sub sections, relatively to the other two used latest automated machines, and fully engaged in local market.

Accordingly, the descriptive statistics analysis of the checklist result, it has seen the frequency distribution, variance and degree of significance sustainability importance. Although factory sample number taken for the semi structured interview is three and its nominal measure, the analysis identifies and categorizes the basic points which are ignored by default and took significantly important as per the interviewee understand. From those points, denim factory who has certified by OEKO-TEX, initiated by the external body NGO, sustainability importance thought has omitted but practically the factory already implemented. Nevertheless, company 2 and 3 are not certified.

As an observation and secondary data, the external body who pushed to implement and improve the status is seasonal at the time of first implementation and auditing time. Accordingly of the analysis, showed high significances but not considered like the issues of distortion and unemployment related to social sustainability requirement, considering recyclable raw material to environmental sustainability and responsible person for evaluation.

Generally, the supply chain setup of factories from the raw material up to delivering of customers are similar, they mislead the value chain with supply chain., elements like information, transportation, inventories and disposal considered well. For the denim company, long waited time for raw material that imported from another country happened due to shipment and transportation. In addition, these company do not have consistent supplier and selection criteria that involves reliability and consistent, mostly engaged and pressurized in one supplier only. Similarly, the required specification to deliver an order, unlike to garment product with label, is difficult to attach with the final fabrics roll. However, these factories whose market mixed in local, and export do have machine, which wrap consistent polyethylene-packaging material for final fabric product roll, includes final roll length in meters and kilograms excluding environmentally friendly material. But the other two factories do not have consistent system for packaging to an order.

Even though being certified is one thing but the evaluation and regulation time and the responsible person, again updating the standard requirement and awarding new worker with developing training is other thing. Here in Denim Company, frequently changing the management and skilled labor shortage are the problem and they face difficulty in meeting the export market. Therefore, as per the interview, they certified once and runs good way, but needs to awarding the current level of performing as per the planned reached from middle level managerial level to higher managerial and lower worker. Therefore, the pilot test of the checklist assessed with in three companies forwarding to the rest 11factories, with having five main environmental indicators and seven other social sustainability indicators. Accordingly, of the precondition found in the checklist, clear picture of input, process and effects are essential. So here in the (figure 4.2a) below tried to visualize well.

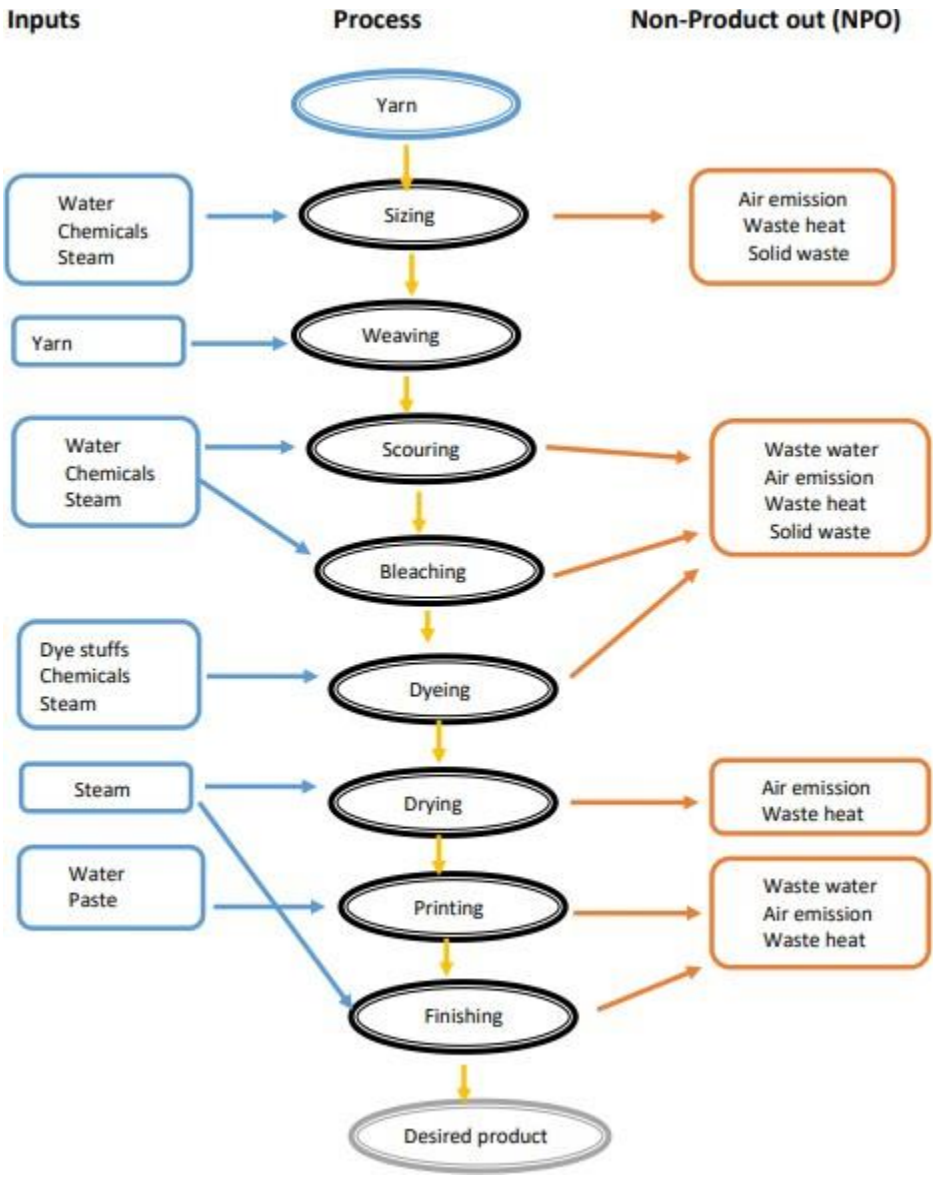


FIG 4.2A THE INTEGRATION DIAGRAM OF THE RESOURCE WITH THE PROCESSES (WEAVING & PROCESSING) AND THEIR EFFECTS

Here is the flow diagram shows the basic input resources, the weaving and finishing processes and their sustainability initiatives. Based on this, factories selected for the questioner assisted to cover the whole processes, inclusive of their workers condition and environment. So accordingly, of those below shown secondary data from the Ethiopian textile institute and took with the questioner result and analysis.

TABLE 4.2B FACTORIES RESOURCE USE IN THEIR PROCESSES

Source (Institute, 2021)

No	Factory Name	Arbaminch Textile Sh. Co	Ethio Japan	Bahirdar	MNS	Saba Har	Eltex	MAA Garment	Kanoriya	Kombolcha	Etur	Yirgalem
1	**Nature of production**	Dyeing and printing	weaving, pre-treatment, dyeing and printing processes	100 % cotton Dyeing and printing of woven fabric	Dyeing of 95% cotton and 5 % polyester	Yarn dyeing in hank form and small fabric dyeing (silk, cotton, wool and linen)	dyeing and printing 80% dyeing 20 % dyeing + printing 95 % cotton p/c 5% with 65/35 blend proportion	Cotton dyeing	Denim production Yarn dyeing	Dyeing and printing woven fabric	Recycling waste polyester and cotton	knitted, pre-treatment, dyeing and printing processes
2	**Nature of product**	Dyed and printed polyester fabric	Home furnishing such as bed sheet, mattress and polyester dyed fabrics	Bed sheet and mattress cover	Towel production	Scarves, showl scarves, pillowcase and handkerchief	Dyed and printed Knitted fabric	Dyed knitted fabric	Denim fabric	Bed sheet, terry towel, mattress cover	Finishing and washing of 100 % cotton and p/c blend knitted fabric	Blanket o Knitted fabric o Knit Dyeing o Garment
3	**Production capacity**											
	Design capacity	200000 meter/day	4,050,000 meters per year	45000-meter printed fabric /day	12 tons/day	10 kg yarn dyeing/batch 2 kg small fabric dyeing/batch	3600 kg/day/3 shift	8 tons/day		Dyeing 40 m/min Printing 90m/min	12 tons/day washing and finishing of knitted fabric 3 tons/day washing	1,800,000.00 kg/yr.

											and finishing knitted garment	
	Actual capacity	80,000 – 100,000 meter/day		30000-meter printed fabric /day	4 tons/day	16 kg yarn dyeing and 4 kg small fabric dyeing/day	2000 kg/day/ 3 shift	5 tons/day		Dyeing 20 m/min Printing 50000 m/day/ 2 shift	3.5 ton/day washing and finishing knitted fabric	
4	**Source of water**	Ground water	Groundwater	River	Ground water	Municipal water	Ground water	Ground water	Ground water	Ground water	Ground water	Ground water Municipal water
	Number of bore wales	2 bore wales	two boreholes	---	3 x 150 m each depth (1 bore wale is in active)		1 with 100m depth	2 x 180 m depth		4 (3 x 180 m depth and 1 x 330 m depth) 1 bore wale are failed		
	Quality of water (TDS)	TDS- 185 ppm		TDS 91 ppm	TDS	No data	TDS					
5	**Boiler**											
	Number of boilers	4	2	3 (2 electric and 1 Furnace Oil)	2	No boiler	3	2	5 for process 1 for ETP	4	1	1
	Type of boiler (steam or thermal)	Thermic and steam boiler	electric and steam boiler	Steam and thermic	Steam		Steam boiler	Steam and thermic		Thermic and steam	Steam boiler	
	Capacity of boiler		3 ton/hour.		Furnace Oil 15 tons/hr. Electric 4			3 tons/hr. each		6.5 tons/hr. each		

					ton/hr.							
	Type of heating system	Coal and electric	Liquid petroleum gas	Electric and Furnace Oil	Furnace Oil and electric		wood	Furnace Oil	electric	2 electric and 2 Furnace Oil	Furnace Oil, biomass, coal	
	Quality of feed water/blowdown	TDS – 183 ppm/ TDS – 183 ppm	Reverse Osmosis water	TDS 91 ppm/ TDS 360 ppm			Not measured / boiler not active	Reverse Oil water				
7	**Processing**											
	Process Flow	Washing – wet reduction – dyeing/printing – finishing	weaving, dyeing, washing and printing	Pretreatment – dyeing/printing – finishing	Pretreatment – dyeing – finishing	Pretreatment – dyeing - finishing	Pretreatment – dyeing – printing - finishing	Pretreatment – dyeing - finishing	ball warping-rope dyeing-LBN-sizing-weaving-dyeing-finishing-garment/garment washing	spinning, weaving and processing	Sorting – recycling – spinning –knitting – fabric finishing - gar	Knitting-Pretreatment – dyeing – finishing-garment
	MLR	1:15 for dyeing	1:8	1:8	1: 6 for soft flow 1:8 for yarn dyeing machine	1:6	1:8	1:6		1:8	1:8	1: 6 for soft flow
	Chemicals and auxiliaries	Dispersing agent, acetic acid, caustic soda for reduction, binder, thickener, sodium hydro sulphide, soda ash, Glauber salt, softener	Glauber salt, soda ash, soap, caustic soda, hydrogen peroxide, acetic acid	Caustic, hydrogen peroxide, stabilizer, wetting agent, thickener,	Caustic, hydrogen peroxide, wetting, stabilizer, acetic acid, soda ash, dispersing agent, leveling agent, washing-off agent, softener,	Glauber salt, soda ash, soap, caustic soda, hydrogen peroxide, acetic acid	Caustic, sodium, enzyme for bio-polish, chloride, acetic acid, hydrogen peroxide, dispersing agent, thickener and binder	Caustic, wetting agent, hydrogen peroxide, Glauber salt, soda ash, enzyme, dye fixing agent, washing off agent, acetic acid, softener	scouring agent reducing agent Dispersing agent wetting agent softener neutralizer sequestering agent dye fixing agent sizing agent binder lubricant desizer mercerizer	Caustic, hydrogen peroxide, wetting, stabilizer, acetic acid, soda ash, dispersing agent, leveling agent, washing-off agent, softener,	Glauber salt, soda ash, soap, caustic soda, hydrogen peroxide, acetic acid	Wetting agent Anti-crease Caustic soda Hydrogen peroxide Stabilizer Acetic acid Bio-polish OBA

												Peroxide killer Anti-crease Leveling agent Sequestering agent Common Salt Soda ash Soap Softener
	Dyestuffs	Reactive dye, cationic dye, disperse dye, pigment	Reactive dye,	Reactive dye,	Reactive dye and disperse dye	Reactive dye, acid dye, indigo dye,	Reactive dye, disperse dye and pigment	Reactive dye	Sulphur/indigo dye	Reactive dye,	Reactive dye,	Reactive dye
	Machines	13 Jet dyeing machine 3 printing machine 5 stenter 1 Singeing machine 3 wet reduction machine 1 CBR machine Pad batch plus washing machine Finishing Calandering and Decatazing machine	2 Jigger dyeing, 2 jet dyeing, 2sizing, 1 dryer, 3printing m/cs	1 Desizing and cold bleach 4 Reaction box 1 pad roll bleaching 3 automatics jiggers (Jambo jigger) 4 old jiggers 1 continuous washing machine 1 CPB machine 1 stenter m/c 1 rotary printing m/c (8	6 soft flow dyeing machines 1 1000 kg 1 750 kg 1 600 kg 1 500 kg 1 250 kg 1 100 kg 3 yarn dyeing machines 3 yarns drying machine Hot air-drying	Hank dyeing machine Washing machine	4 dyeing machines 1x 600 kg depending on GSM 1x 350 kg 2x 300 kg one is winch squeezer Relax dryer Vertical dryer Heat setting for p/c Compactor vertical	5 soft flow dyeing m/c 1 hydro extractor 1 corino slitter and opener 1 tumble dryer 1 relax dryer 1 stenter 1 compactor 1 reversing m/c	2warping machine,2 rope dyeing machine 2 LBN,15 weaving machine,1 stenter,2drying machine,1finishing machine,2 wrapping machine,5washing machine	6 soft flow dyeing machines3 yarn dyeing machine3 yarn drying machine Hot air drying machine1 stenter 6 chamber2 Hydro extractor	Singeing & de-sizing machine from Reggiani, Scour / Bleach range, Mercerizing range, Continuous dyeing, Washing range and Stenter from Textima, Cold Pad batch from Benninger, Jiggers from	12circular machine 10 winch dyeing machines Squeezer Relax dryer Tubularcalender Open calender Detwister and sliter Stenter Stone wash Cone dyeing Hank dyeing

				head but 4 heads are inactive due to spare part)	machine 1 stenter 6 chamber 1 Aeration and drying and softening m/c 2 Hydro extractor		Printing				OMEZ.	Dryer Centrifuge
8	**Wastewater treatment plant**											
	Capacity	10,000 m3/day		1000 m3/day	1200 tons/day		5m3 per hr. capacity	270m3/day	Design 400 m^3/day Actual 270 m^3			
	Quality of treated wastewater			BOD 2.6 COD 7.38					Meet the standards and 80 % of wastewater is recycled.			
	Process flow of ETP	Collection tank – aeration – primary clarifier-secondary-tertiary					Chemical for ETP as a coagulant, flocculant and color removal – (**EPOLY CR-D** eksoy product)	All chemicals are added at the same time	ZLD Conventional ZLD Equalization – Mechanical Vapor Recompression Evaporator (MVRE) - multi effective evaporation			
	Current status of ETP	**Under construction**	**Under construction**	**Active**	**Active but poor**		**Active but very poor**	**Active but very poor**	**Active**	**Active**	**Active**	**Active but very poor**

Those data roughly assisted to visualize the selected factories actual status on environmentally aspects such on their nature of product, their capacity, source of water, boiler, compressor, processing and effluent treatment plant. This initiates to proceed on the nominal type of data collection focused on their continual follow up of those issues related with the supply chain elements such on transportation, information, packaging, and disposal. Moreover, those social issues have seen together with those mentioned environment aspects. Accordingly, the assessed basic social and environmental issued are showed below.

4.2.1 Basic Considered Terms Accordingly of Environmental Sustainability

TABLE 4.2.1A BASIC CONSIDERED ISSUES ACCORDING OF ENVIRONMENTAL SUSTAINABILITY

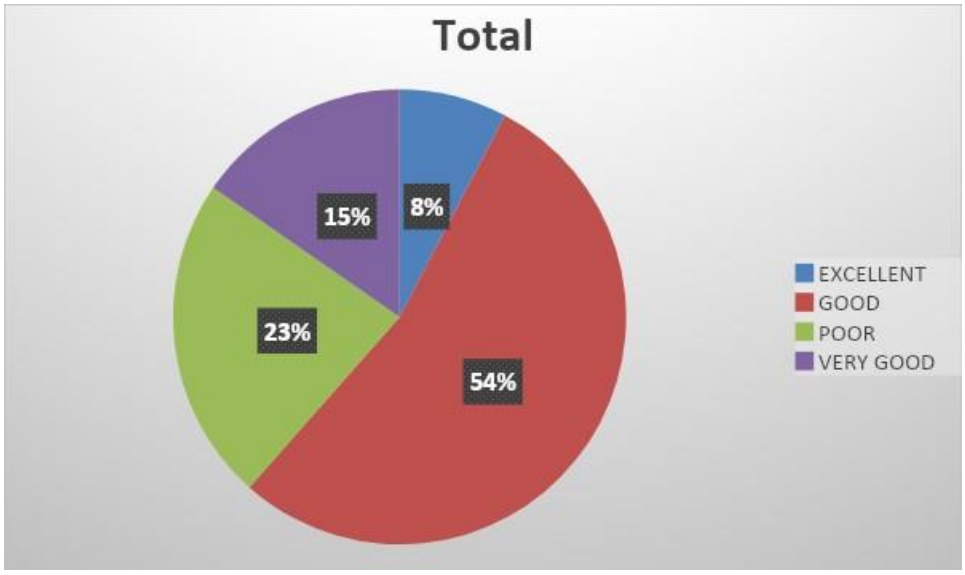
Frequency statistics	Sample size	Mean	Standard deviation	Minimum	Maximum
Resource use	75	2.8485	0.94	1	4
Emission to air		3	0.85	1.5	4
Emission to land		3.01	1.22	1	4
Complying in national and international policy		3	0.85	1	4
Consistency in Packaging material		3.2	0.67	2	4
Waste disposal system		2.44	0.67	2	4

4.2.2 Basic Terms Considered Accordingly of Social Sustainability

TABLE 4.2.2A BASIC CONSIDERED ISSUES ACCORDING OF SOCIAL SUSTAINABILITY

Frequency statistics	Sample size	Mean	Standard deviation	Minimum	Maximum
Employment	75	3.7	0.5	2.5	4
Health and safety		3.365	0.82	2.25	4
Training development		3.45	0.52	3	4
Communication system		3	0.93	1	4
Equality		3.82	0.6	2	4
Accessibility		2.85	0.85	1.3	4
Participation		3.09	0.96	1.5	4

Those descriptive statistical data are summarized as 54% majority with good and the rest laid on 15 % very good, 23% poor, and 8% excellent. However, consideration of standard deviation value in each parameter is highly varied. Because diversified process operation used.



Therefore, this diagram shows that an average companies' respondent perception and their factory currently practiced to emission to air considered on measuring of boiler and their internal vehicles, emission to land which focused on identification of hazardous chemical and management, compliance of internal policy and requirements, and their intention to packaging materials are laid on good one. Which is an average but there are factories that did not consider to measure and recognize transportation involvement in reduction of air emission and also other factories assumed meeting only national regulation and compliance is much better and enough to production. So, this shown on each factories deviation from the mean one. The other is communication and participation, which are big issues but not applicable well, most case companies adapted limited level of communication conventionally from top to lower hierarchal management and limited number of workers and areas allowed to be involved as participants.so this leads for lack of integration and collaboration.

The respondent's showed less consideration and application firstly on their **accessibility to equipment's** which has an importance to have flow meter to measure in metering of raw water and discharges, variable frequency driver which is attached to the boiler to balance the inlet gas and outlet and flue gas analyzer to measure the temperature, nitrogen and carbon amount. Accessibility for the childcare center, food service, and disabilities. Those issues seem little but had a great impact externally on the image of companies and internally used for companies to simplify the required issued to measure and reports in addition to creating workers stability on their working environment.

Secondly, **waste disposal** issues that companies ignored and forgot which assumed initially factories to recognize on the material to availability of recyclable material and good quality. Next to this, cloth scraps, dye and chemical container are common in all the processes again paper, carton, plastics sheet and rope are in packaging stage. In workshop, scrap metal and oil rage formed. Papers in domestic wastes wasted and retained sludges in wastewater treatments available. Therefore, case companies used cotton as an input raw material and processed an output of grey and finished fabric, showed their resource use, emission to land, waste disposal in environmental wing and communication, accessibility and participation in social wing variation in their processes. Meanwhile correlational analysis provided a picture of importance of their relation corporately, assisted to those identified issues in water fall chart as a precondition to consider in value.

4.3 Correlational Coefficient Analysis

As per the data collected, accordingly of critical elements categorized in social and environmental, Correlation analysis is used to determine the strength of the association between the two variables. Here in this case the two variables social and environmental issues corporately related to each case companies supply chain that leads for sustainability, shown in (Appendix 1) of the actual correlational analysis. In which all magnitudes represents relations of integrated issues mandated to interprets, but focus on the significant values. In fact the standard rho coefficient ranges from -1 up to 1, interprets as +1 (perfect positive correlation) through 0 (no correlation at all) to -1 (perfect negative correlation).

TABLE 4.3A SUMMARIZED SPEARMAN'S CORRELATIONAL COEFFICIENT

Spearman's rho	Employment, skilled labor r	Employment, wage policy	Health and safety, working environment	Health and safety, working condition	compliance with occupational safety and health	Health and safety, regulator and evaluation system	Training development for worker	Information communication system	Men and women equally hiring system	Accessibility for disable persons	Accessibility for food service	Accessibility for child center	Participation in grievance handling
Resources use in metering input and discharge water	0.203	-0.179	0.142	0.214	-0.089	-.333**	-0.115	.249*	0.091	0.108	-0.118	-.312**	-.272*
Resources use recipe for final wash	0.149	0.183	.250*	.235*	-0.107	0.152	-0.022	-0.031	-0.104	-.347**	0.174	-.245*	-.524**
Resources use on recipe update	0.09	0.164	.326**	0.089	-0.022	.352**	-0.032	-0.153	-0.062	-.245*	0.172	-0.076	-.467**
Emission to air metering input electricity	.500**	-0.11	.317**	.499**	0.008	-.319**	-0.152	.495**	-0.026	0.209	-0.085	-.259*	-0.169

Spearman's rho	Employment, skilled labor r	Employment, wage policy	Health and safety, working environment	Health and safety, working condition	compliance with occupational safety and health	Health and safety, regulator and evaluation system	Training development for worker	Information communication system	Men and women equally hiring system	Accessibility for disable persons	Accessibility for food service	Accessibility for child center	Participation in grievance handling
Transportation in vehicle fuel impact to CO2	.412**	0.087	.246*	.578**	-.303**	0.079	0.224	0.092	0.19	-.260*	0.136	-.414**	-0.193
Emission to land hazardous chemical identification	-.379**	0.156	-0.039	-0.181	.517**	.324**	-0.064	-0.146	0.096	.317**	-.269*	.327**	.318**
Emission to land training to handling hazardous chemicals	.336**	-0.145	0.17	0.225	0.154	-0.141	-.379**	.451**	-0.076	0.208	-.371**	-.294*	-0.218
Emission to land personal protection equipment for handling chemicals	0.17	.286*	.502**	0.205	0.191	-0.009	-.257*	0.123	-0.158	0.084	0.061	-.240*	-0.222
Regarding to policy, zero discharge hazardous chemicals requirement	.246*	0.097	.315**	0.163	0.14	-0.102	-.511**	0.212	-0.17	0.078	-0.064	-.353**	-.262*
Regarding to policy, national environment pollution regulatory requirement	.465**	0.164	0.147	.320**	-0.085	0.164	-0.14	0.197	-0.115	-0.192	0.078	-.341**	-.357**
Packaging material consistence	0.161	.536**	.317**	0.144	0.105	.300**	0.198	-.301**	0.223	-0.025	.278*	-0.008	-0.164
Waste disposal system	.327**	.648**	.435**	.246*	.333**	.335**	-0.177	-0.158	0.089	0.027	0.166	-0.003	-0.126

Spearman's rho	Employment, skilled labor r	Employment, wage policy	Health and safety, working environment	Health and safety, working condition	compliance with occupational safety and health	Health and safety, regulator and evaluation system	Training development for worker	Information communication system	Men and women equally hiring system	Accessibility for disable persons	Accessibility for food service	Accessibility for child center	Participation in grievance handling
waste disposal reuse of rags	-0.168	-0.165	-0.211	-0.207	0.097	-0.09	.260*	-0.059	-0.06	-0.079	-.314**	0.164	.240*
waste disposal appreciation for import rag substituti on	0.066	.295*	.298**	0.057	0.054	0.213	0.018	-0.079	0.171	-0.039	-0.165	-0.119	-.252*

After the correlational analysis through the statistics, interpretation of the major finding correlational coefficient values are here below in the diagram categorized under six groups. So from those shaded and selected as per values of significantly importance, majorly falls in moderate positive.

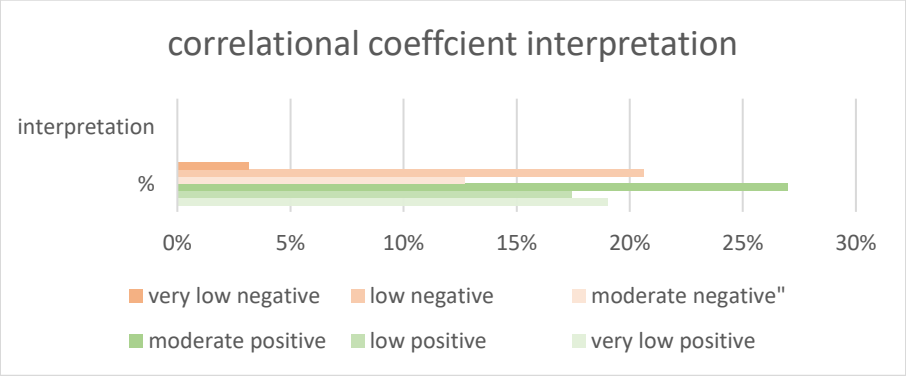


FIG 4.3A SUMMARIZED INTERPRETATION

4.3.1 Discussion on the significance relation of social and environmental issues based on the finding analysis

In fact, the direction of causality determined by the sign of the spearman coefficient, and it shows both linear and monotonic relationship. Spearman's rho measures the strength of the social and environmental variables; it is an indicator of monotonicity. It reflects the extent to which an increase (or decrease) in social elements is associated with some kind of increase (or decrease) in environmental, but the amount of increase does not have to constant over the whole range of values.

The selected companies' production is highly relationship with accessibility to services like food services, child center, and a place for disabled persons, and necessary equipment's. Moreover, have a relationship with waste disposal and packaging material. This indicated, as the production is increased, systems for waste disposal and packaging material would increase. Beside, worker influenced for effective utilization of the waste generated to reuse and recycle simultaneously with actual operations. So that Workers are highly exposed to on emission to land, which needs curiosity for hazardous chemicals and would lead to increases the number of personal protection equipment's and developments for training. Most importantly, particular involvement of females in higher positions initiates to be applicable the developed system for grievance handling and sexual harassment responses.

Hiring an employer taking place them with different levels in accordance with level requirements is the basic thing, thoroughly giving awareness on importance of sustainability as per their scope of understanding brings a commitment to develop and practices during their operations. This challenged companies' with hiring skilled labor and updating employee knowledge because they assumed the reasons to turnover and request higher wages. For this having, system for training is one way to be consistent for a new employee and the existed one also. In additions, most of the respondents mentioned environmental un sustained operation areas were fabric manufacturing and waste placing, this shows as companies have these manufacturing unit and generating waste, had to have a system for waste disposal in its operation for reuse and recycle or delivers for other company as the main input.

One of the main parameters for environmental sustainability is resource use, which involves metering in basic raw materials of textiles as water in initial and discharge stage, selecting of proper chemical and measuring of chemicals as per required process and through time updating of a recipe for efficient usage of chemicals. Taking this companies result indicates resource use benefits for increasing production, avoidance of restricted chemicals and hazardous chemicals, protections of employees' health and safeties, effective use fuel or coal used for vehicles and again will have a negative probability to waste generation system. This is because as effective resources reused, the waste disposal system will decrease.

Emission to air as a point source where companies used boiler, ovens, and storage tanks and raised as diffusion as solvent-based, wastewater treatments, warehouses, and spills. Textile factories, which prepare fabric, used heat setting and processes dyeing, printing, resin finishing, and dryer, wastewater treatments affected to emit hydrocarbons, formaldehyde, acid, and ammonia to the air. Those selected factories exposed to this emission. However, through their response, views have a direct relation with health and safety. Because as variety emission exists in companies, occupational health and safety, equipment's and awareness have to be developed and increased through time.

As pesticides and fertilizer in cotton harvesting emitted to land, waste is the one in fabric and garment processing, is co-disposal of hazardous and non-hazardous which is no longer permitted. Non-hazardous waste includes municipal (e.g., household) waste and office waste such as paper, cardboard, plastic, and metal packaging and organic materials that will be Landfilled, Incinerated, and Recycled. So this has a strong relation with resource use in which reusing waste is an area where community groups have led the way: they have been instrumental in promoting the reuse of items and relation with many workers. For those needed reuse operation accessibility of equipment is essential. Meanwhile, transportation is one essential supply chain interconnects supplier and customer that may be difficult to use one way of transportation mode but need to consider measuring the amount of CO2 relate with emission to air. Accordingly, the respondent recording transportation did not consider well one sustainability requirement in emission to air.

The Policy is both national and international code of conduct to be applicable for companies in which, in these selected companies and stakeholders the study focuses on both meeting international ZDHS, zero discharge hazardous chemicals requirement and fulfilling national environmental regulation. So, the frequency distribution as shown as respondent, half of the case companies partially fulfilled, and the other half is categorized as the policy is not available and or available but not applied. Unfortunately, those are environmental-related and directly related with emission to land, which is liquid waste generated from ETP, and the government considered exposal to society. There is also a national employee and social affair, but it is subjective and accordingly, of secondary data, workers misused their right and responsibility. Only availability of policy is not a parameter but having customized and applicable code of conduct, next to this inclusive with the companies' roles to communicate workers and stand by them. Also and internal framework for all workers to encourage participation for any grievances.

Next to this, the packaging material is another omitted feature of the supply chain expected to be consistent as internationally requirement to deliver an order in selected companies. It has a strong relationship with skilled workers and needs curiosity for consistent and accessibility to the equipment and slight relation with health and safety. Besides grievance, developing networks for communication within the level of upstreaming and down streaming is another thing; companies used either automated or manual systems to interchange any information including inventory data. Case company's data show that these omitted and did not give value for better cooperation.

While considering companies in which the small land area has used for manufacturing and processed with manual handloom, characterized with full-time labor engagement and export-oriented internationally with the cultural product order. The traditional way of labor handling, working conditions and inventory systems considered their uniqueness in one way but accordingly to the requirement fulfilling left that to be considered. In addition to waste disposal, recycling of the wastewater feeding being too high from processing and boiler, technological gap in effluent treated plant are the main causes, these made sensitive and picked out in being the most un sustained area and needs further study that requires feasibility study to conduct characterize the composition of the sludge to usage area. Generally, correlational analysis provided a picture of importance of their relation corporately, assisted to those identified issues in water fall chart as a precondition to consider in value.

4.3.1.1 *Investigating the challenges through water fall chart*

Here below in the (figure 4.3a) using the summarized tables, the water fall chart shows how the values accordingly of existed sequential orders of environmental issues considering of social sustainability increased and decreased.

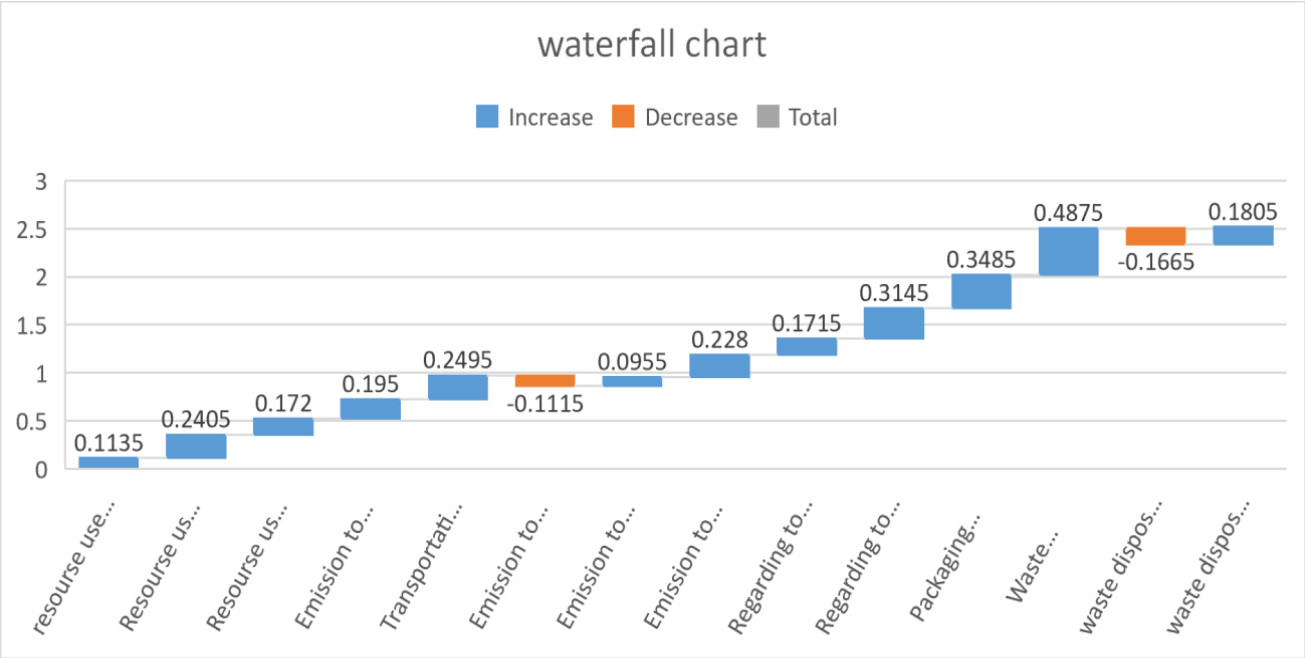


FIGURE 4.3A WATERFALL CHART FOR SUMMARIZED THE CORRELATIONAL ANALYSIS

Here the above chart shows the cumulative effect of the positive and the negative values between the social and environmental issues. **Specifically shows the omitted issues such as emission to land and disposal of solid and liquid wastes**, by breaking down the aggregate effect of positive and negative contribution. As per the assessment got from the spears man rho coefficient, summarizes as workers that highly exposed to on emission to land, which needs curiosity but shown 11.5% focusing on identifying hazardous chemicals, leads to increase 9% in development of refreshment orientation and training to a new skilled/unskilled employer, then took 22.8% share in fulfilling necessary personal protection equipment's. More over the information gap due of inadequate training reduce the value of available resource from 48.75% to 17%, in which lack of purpose why they collected and where to place the reuse of textile waste disposal. In additions, most of the respondents mentioned environmental un sustained operation areas were fabric manufacturing and waste placing, this shows as companies have these manufacturing unit and generating waste, had to have a system for waste disposal in its operation for reuse and recycle or delivers for other company as the main input.

Finding summaries

As per the finding result, the magnitude of spears man coefficient that distributed in different issues for both social and environmental issues found to be moderate positive and statistically significant ($0.35< r <0.6$, $p<0.001$). This told us the variables move together by slight difference percentage and direction, the standard deviation of the sample means is moderately close to the standard error. Since the standard error of the mean measures, the variability of the sample mean, it showed smaller, and it is more likely the sample mean is close to the true population mean. Hence, the assumptions was supported, this shows that an increase in focusing of environmental issues would lead to a lower abundance in social issues. Again, the following issues has been taken into account when interpreting the results of a correlation test, as less ambiguity is seen in reasons for causality, somehow moderate linearity of the variables, range of variability, variables statistical significance versus importance, and the interference of the size of a correlation by the size of the sample is less. Finally, investigating the performance of selected sectors operational trend particular site to the lowest value in corporate social and environmental issues are essential to get the status of, leads to introduce an improvement strategy.

5 Improvement strategy

As per the reviewed different authors and mentioned in the subtitles of sustainability assessment tools in the literature part, here the customized improvement strategy in explanatory form. In fact, a responsible supply chain typically ensures the operation within the legal and ethical parameters, but not affirms sustainability. For that, environmental and societal reference points are viable choice for having sustainable approach to supply chains for any company's long-term success. So selected companies had to consider their processes and actions been supported by nature and society over the long term. Mostly many authors categorized and prioritized as the best management practice to help the business strive toward, and eventually achieve, a bottom line defined by people and the planet, through developing strategy on their Compliance, Operating best practices, Skill and knowledge, Policy and systems, and Investment project.

Mapping the entire supply chain is the starting point but misleading the value chain with supply chain seen. Even if, value chain is subset of supply chain, elements like information, transportation, inventories and disposal have to see inclusively. A quality map of the supply chain that encounter with highly resource use will allow identifying impacts and risks in using chemicals and dyes, and consideration of recyclable material for reuse, thorough map of the chain accounts for the human and natural resources are used along each step of operational and production process. Education and training resources can help align everyone with the mission develop training programs that instill the mission from the time new employees are on boarded need support and co-operation all the way back upstream. Performing audits and/or enacting codes of conduct can encourage manufacturer to promote companies' sustainability efforts. Continued advances in technology are providing organizations with once-unconceivable abilities to analyze, tweak measure and optimize operational processes like inventory management, order and distribution management and transportation management. Many competing companies share collaborating to develop and establish sustainable practices that offers an opportunity for positive public perception.

For achieving success in corporate sustainability, Leadership and strategy play a major role by analyzing organizational design, executing management systems, feedback, and internal reporting. Moreover, the main actors are society, which involves management, workers, customers, suppliers, and stakeholders. However, corporately those actors are proactively

assisting to change the common trend of companies' operational managing system through both push and pull policy setting. In which government has provided some policy guidance on the interpretation of 'environmental matters' and 'social matter', that companies have to customize the policy set accordingly of the operations management with reporting on significant social and environmental key parameters. Then mitigating the confusion and lengthy reports on a wide range of measures through understanding the critical issues and measurement unit, through forming committee of Health & safety, Environmental auditing and Internal environmental, health & safety audit.

6 Contribution of the study

As it has been sustainability in textile companies broad and multi related, has external enablers like government, academies and sectorial, in addition to people issues and internal integrations. The study considered companies have global sustainability by enlightening the dimensions of sustainability supply chain corporately in social and environmental aspects that is not been assessed before. So that the companies will have uniform and continual operation in process and cooperation between the staff, then reaches to the agreement about their fulfillment to the international requirement. However, support the current strategy of the country to move towards making cotton farming and textile industry as a major contributor of foreign market generator and academics and sectorial contributes for having knowledgeable and skilled workers.

Since for being sustainable in a manufactured textile product considered an issue of social, environmental and economical, have to fulfill the requirement to compete globally. As per current factory status to move forward until reduction of the emissions being successes, through focusing the integration of the labor and the added components of water, chemicals, steams utilization. Doing these indicators of sustainability clearly assed, , flow of supply chain well seen that contributes for uniform and continual operation in process and cooperation between the staff, reaching to agreement.

Contribution to the company

The study mainly shows the importance of each individual of the company to the process used resources to reduction of the emissions. And to develop an awareness on how sustainability driven from higher level and built in every worker of the organization, through well information flow, accessibility of equipment’s and services and disposal of each solid and liquid wastes. Those assisted to engage with each other again with the supplier and customer accordingly of sustainability criteria.

Nowadays, most of the industry's best practices modified or transformed to achieve sustainability and for these, only standards are indispensable but also commitment and awareness needed. Therefore, the society rather has a clear idea of what indicators to evaluate, and then it will be a means in creating positive impacts.

7 Conclusions

The assessment characterized as pertinent which is relevant and applicable to firms, egoistic which is self-interested with the value of affected stakeholders. In which the study is descriptive with corresponds to social and environmental indicators related to textile sector. Assessed with fourteen factories which have commonly cotton based yarn and water as raw material, chemical and energy, solid and liquid waste, packaging material, used different kind of transportation mode in a processing. As all factories, used labor, material resources, focused customer order in respect of final product with less intention to the effective resource utilization that sounds to factories images in competing internationally. This leads to say common difficulties seen changing the arbitrary cultures to strain in control and management of uncertainties and trade-off.

The assessment is conducted as per the international sustainability initiatives which corresponds to international acceptable criteria which in environmental sustainability related to resource use, emission to air, emission to land, policies, packaging, transportation and waste disposal. In social sustainability; employment, health and safety, training, communication, equity, accessibility and participation. Those sustainability issues are in one- or other-way touches supply chain elements, so assessing corporately benefits to develop corporate culture and to have more engaged customers. Following with diversified production process and goods produced, an average companies' respondent perception and their factory currently practiced to emission to air, emission to land, to packaging materials, communication and participation laid on common trend.

In fact, the size of a correlation influenced by the size of the sample that interrelates the sample results repeated to be true in the population, so the resulted significance test and T-test showed somehow to be true for the population too. This significantly assist to practice on local factory, where their value addition starts from local raw material of cotton and proceed their operational trends ends to processed fabric that to be initiate and encourages their concerns of sustainability issues.

The magnitude of spears man rho coefficient laid on the most negative value that affect the workers insecurity and continual operation during production are, the emission to land, waste disposal, and accessibility, leads to be the great challenges and on the contrary, somehow equity practiced well and took as an opportunity. Therefore, due of well considering of social sustainability reduces distortion and unemployment of workers. Likewise, categorizing recyclable raw material accordingly and use of resource efficiently lead to environmental sustainability fulfillment. Hence, for sustaining these issues, establishing sectorial and company's code of conduct is essential, for continual requirement meetings, to customize the global language and current cultural influences, and to traceability the operational supply chain.

Generally, managers who ever engaged in the whole process of factories hopefully aware on understanding and situation with respect to the sustainability dimensions and analyzed their impact and importance. the study is conducted and analyzed accordingly of twelve basic social and environmental issues through assessing 14 local factories and stakeholders, where found in different regions helped in visualizing mainly the effects of geographical place, organizational size, mode of communication and waste disposal related, throughout the supply chain.

8 Recommendation

Assessing the occurrence level, severity, their impact and methods to mitigate the risks periodically for all possible impacts (air, land, water, society and ecosystem) is necessarily.

- Most factories sludge from wastewater treatment is store in company facility, However, two types of sludge are there, one is fertile sludge/activated sludge used to agricultural purpose & the other is unwanted sludge controlled and segregating the wastes based on the type, nature and incinerate and sell.
- Coming to recycling solid waste from spinning up to garmenting like rags and cotton wastes by installing a recycling machinery even if needs a high investment cost for installing tertiary treatment technology, implementing Zero liquid discharge assist for fish farming or other similar projects suitable for the company.
- companies where possible, there waste materials should be broken down into types and developing an awareness training for companies' workers on obligation under the packaging Regulations that should have records of the amount, and different types of packaging waste they send to a recycler, in order to demonstrate that they have met their recovery and recycling obligations.
- For air emission reduction, effluent water is recycled by evaporation condensation system is the one and changing the thermal and furnace boiler to electric boiler is the other, . wood boiler is new technology that contains emission control mechanism which have 3 filter stages and recycle the smoke, not all emit to the air. For workers easy to understand and identifies, the company have to adopt MRSL list from ZDHC and this integrated with the purchasing policy of the company. In fact, one of the requirements set forth by the company during purchasing is availability of MSDS from the supplier side and using this tool the hazardous nature of the chemicals have to identified

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Appendix 1 : Table 4.2.4a spearman's correlational coefficient

Correlations

			Resourse use recipe for final wash	supply chain that Enviromental unsustainble	Resourse use on recipe update	Emission to air metering input electricity	resourse use in metering input and discharge water	Transportation in vehicle fuel impact to CO2	landhazardious chemical identification	handling hazardious chemicals	Emission to land	pollution regulatory requirment	Packaging material consistence	Waste disposal system	waste disposal reuse of rags	import rag substitution	Employment,skilled labor	Empolyment, wage policy	saftey,working enviroment	Health and saftey, working condition	occupational safety and health	regulatory and evaluation system	development for worker	communication system	equally hiring system	Accessibility for disable persons	Accessibility for food service	Acessibility for child center	Participation in grievance handling	response framework
Spearman's rho	resourse use in metering input and discharge water	Coefficient	.339**	-.137	-.028	.393**	1.000	.059	-.227	.390**	.093	.302**	.189	-.274*	-.149	-.054	-.009	.203	-.179	.142	.214	-.089	-.333**	-.115	.249*	.091	.108	.118	.312**	-.272*	-.353**
	Resourse use recipe for final wash	Coefficient	1.000	.022	.332**	.046	.339**	.211	-.187	.184	.384**	.236*	.494**	.150	.072	-.203	.014	.149	.183	.250*	.235*	-.107	.152	-.022	-.031	-.104	.347**	.245*	.524**	.384**	
	supply chain that Enviromental unsustainble	Correlation Coefficient	.022	1.000	-.255*	-.285*	-.137	-.221	.404**	-.059	-.092	-.311**	-.239*	.109	-.179	.006	-.189	-.284*	.020	-.139	-.270*	.214	.040	-.075	.047	.026	.128	-.036	.387**	.234*	.127	
	Resourse use on recipe update	Correlation Coefficient	.332**	-.255*	1.000	.063	-.028	.253*	.078	.127	.326**	.302**	.391**	.225	.241*	-.367**	-.017	.090	.164	.326**	.089	-.022	.352**	-.032	-.153	-.062	-.245*	.172	.076	.467**	-.215	
	Emission to air metering input electricity	Correlation Coefficient	.046	-.285*	.063	1.000	.393**	.396**	-.267*	.628**	.319**	.316**	.353**	-.175	.101	.000	-.240*	.500**	-.110	.317**	.499**	.008	-.319**	-.152	.495**	-.026	.209	-.085	.259*	-.169	-.478**	
	Transportation in vehicle fuel impact to CO2	Correlation Coefficient	.211	-.221	.253*	.396**	.059	1.000	-.248*	.137	.101	.042	.429**	.150	.069	-.001	-.143	.412**	.087	.246*	.578**	-.303**	.079	.224	.092	.190	-.260*	.136	.414**	-.193	-.324**	
	Emission to landhazardious chemical identification	Correlation Coefficient	-.187	.404**	.078	-.227	-.248*	1.000	.036	.134	-.047	-.039	-.379**	-.064	-.146	.096	-.076	.269*	.327**	.318**	.153											
	Emission to land training to handling hazardious chemicals	Correlation Coefficient	.184	-.059	.127	.628**	.390**	.137	.036	.010	.053	.072	.336**	-.145	.170	.225	.154	-.141	-.379**	.451**	-.076	.208	.371**	.294*	.218	-.430**					

Employmen t,skilled labor	waste disposal disposal appriciation for import rag substitution	waste disposal reuse of rags	Waste disposal system	Packaging material consistence	Regarding to policy, national environment pollution requlatory requirment	Regarding to policy, zero discharge hazardeous chemicals requirment	Emission to land personal protection equipment for handling chemiclas	
Correl ation Coeffic ient	Correl ation Coeffic ient	Correl ation Coeffic ient	Correl ation Coeffic ient	Correl ation Coeffic ient	Correl ation Coeffic ient	Correl ation Coeffic ient	Correl ation Coeffic ient	
.149	.014	-.203	.072	.150	.494**	.236*	.384**	Resourse use recipe for final wash
-.284*	-.189	.006	-.179	.109	-.239*	-.311**	-.092	supply chain that Enviromental unsustainble
.090	-.017	-.367**	.241*	.225	.391**	.302**	.326**	Resourse use on recipe update
.500**	-.240*	.000	.101	-.175	.353**	.316**	.319**	Emission to air metering input electricity
.203	-.009	-.054	-.149	-.274*	.189	.302**	.093	resourse use in metering input and discharge water
.412**	-.143	-.001	.069	.150	.429**	.042	.101	Transportation in vehicle fuel impact to CO2
-.379**	.092	-.047	.134	.180	-.262*	-.108	.126	landhazardious chemical identification
.336**	.072	.053	.010	-.299**	.340**	.482**	.380**	training to handling hazardious chemicals
.170	.042	-.229*	.411**	.385**	.419**	.474**	1.000	personal protection equipment for handling chemiclas
.246*	.297**	-.181	.217	.004	.421**	1.000	.474**	chemicals requirment
.465**	-.136	-.028	.138	.049	1.000	.421**	.419**	requlatory requirment
.161	.079	-.293*	.552**	1.000	.049	.004	.385**	Packaging material consistence
.327**	.332**	-.225	1.000	.552**	.138	.217	.411**	Waste disposal system
-.168	.111	1.000	-.225	-.293*	-.028	-.181	-.229*	waste disposal reuse of rags
.066	1.000	.111	.332**	.079	-.136	.297**	.042	import rag substitution
1.000	.066	-.168	.327**	.161	.465**	.246*	.170	Employment,skilled labor
.346**	.295*	-.165	.648**	.536**	.164	.097	.286*	Empolyment, wage policy
.465**	.298**	-.211	.435**	.317**	.147	.315**	.502**	saftey,working enviroment
.783**	.057	-.207	.246*	.144	.320**	.163	.205	Health and saftey, working condition
-.251*	.054	.097	.333**	.105	-.085	.140	.191	occupational safety and health
.028	.213	-.090	.335**	.300**	.164	-.102	-.009	regulatory and evaluation system
-.025	.018	.260*	-.177	.198	-.140	-.511**	-.257*	development for worker
.263*	-.079	-.059	-.158	-.301**	.197	.212	.123	communication system
.305**	.171	-.060	.089	.223	-.115	-.170	-.158	equally hiring system
.075	-.039	-.079	.027	-.025	-.192	.078	.084	Accessibility for disable persons
.148	-.165	-.314**	.166	.278*	.078	-.064	.061	Accessibility for food service
-.474**	-.119	.164	-.003	-.008	-.341**	-.353**	-.240*	Acessibility for child center
-.394**	-.252*	.240*	-.126	-.164	-.357**	-.262*	-.222	Participation in grievance handling
-.399**	.090	.213	-.114	-.103	-.306**	-.377**	-.216	response framework

Accessibility for food service		Accessibility for disable persons		Men and women equally hiring system		Information communication system		Training development for worker		Health and saftey, regulatory and evaluation system		Health and saftey, occupational safety and health		Health and saftey, working condition		Health and saftey,working enviroment		Empolyment, wage policy		
Correlation Coefficient		Correlation Coefficient		Correlation Coefficient		Correlation Coefficient		Correlation Coefficient		Correlation Coefficient		Correlation Coefficient		Correlation Coefficient		Correlation Coefficient		Correlation Coefficient		
.174		-.347**		-.104		-.031		-.022		.152		-.107		.235*		.250*		.183		Resourse use recipe for final wash
-.036		.128		.026		.047		-.075		.040		.214		-.270*		-.139		.020		supply chain that Enviromental unsustainble
.172		-.245*		-.062		-.153		-.032		.352**		-.022		.089		.326**		.164		Resourse use on recipe update
-.085		.209		-.026		.495**		-.152		-.319**		.008		.499**		.317**		-.110		Emission to air metering input electricity
-.118		.108		.091		.249*		-.115		-.333**		-.089		.214		.142		-.179		resourse use in metering input and discharge water
.136		-.260*		.190		.092		.224		.079		-.303**		.578**		.246*		.087		Transportation in vehicle fuel impact to CO2
-.269*		.317**		.096		-.146		-.064		.324**		.517**		-.181		-.039		.156		landhazardious chemical identification
-.371**		.208		-.076		.451**		-.379**		-.141		.154		.225		.170		-.145		Emission to land training to handling hazardious chemicals
.061		.084		-.158		.123		-.257*		-.009		.191		.205		.502**		.286*		personal protection equipment for handling chemiclas
-.064		.078		-.170		.212		-.511**		-.102		.140		.163		.315**		.097		hazardeous chemicals requirment
.078		-.192		-.115		.197		-.140		.164		-.085		.320**		.147		.164		pollution requlatory requirment
.278*		-.025		.223		-.301**		.198		.300**		.105		.144		.317**		.536**		Packaging material consistence
.166		.027		.089		-.158		-.177		.335**		.333**		.246*		.435**		.648**		Waste disposal system
-.314**		-.079		-.060		-.059		.260*		-.090		.097		-.207		-.211		-.165		waste disposal reuse of rags
-.165		-.039		.171		-.079		.018		.213		.054		.057		.298**		.295*		import rag substitution
.148		.075		.305**		.263*		-.025		.028		-.251*		.783**		.465**		.346**		Employment,skilled labor
.204		-.053		.420**		-.117		-.023		.341**		-.020		.343**		.517**		1.000		Empolyment, wage policy
.228*		.026		.310**		.070		-.033		.082		-.033		.519**		1.000		.517**		saftey,working enviroment
.237*		.083		.406**		.296**		.137		-.004		-.310**		1.000		.519**		.343**		Health and saftey, working condition
-.349**		.164		-.370**		-.236*		-.321**		.211		1.000		-.310**		-.033		-.020		occupational safety and health
.210		-.374**		.044		-.433**		.251*		1.000		.211		-.004		.082		.341**		regulatory and evaluation system
.212		-.300**		.374**		-.198		1.000		.251*		-.321**		.137		-.033		-.023		development for worker
-.112		.443**		.230*		1.000		-.198		-.433**		-.236*		.296**		.070		-.117		communication system
.238*		.130		1.000		.230*		.374**		.044		-.370**		.406**		.310**		.420**		Men and women equally hiring system
-.156		1.000		.130		.443**		-.300**		-.374**		.164		.083		.026		-.053		Accessibility for disable persons
1.000		-.156		.238*		-.112		.212		.210		-.349**		.237*		.228*		.204		Accessibility for food service
.037		-.026		-.112		-.107		.138		.161		.139		-.397**		-.414**		.011		Acessibility for child center
-.057		.315**		-.129		.092		-.073		-.075		.261*		-.315**		-.459**		-.195		Participation in grievance handling
-.132		.018		.094		.066		.210		.042		.011		-.410**		-.373**		.017		

			Resources use recipe for final wash	supply chain that Environmental unsustainble	resources use on recipe update	Emission to air metering input electricity	resources use in metering input and discharge water	Transportation in vehicle fuel impact to CO2	Emission to land hazardious chemical identification	Emission to land training to handling hazardious chemicals	personal protection equipment for handling chemiclas	hazardeous chemicals requirment	pollution requlatory requirment	Packaging material consistence	Waste disposal system	waste disposal reuse of rags	import rag substitution	Employment, skilled labor	Employment, wage policy	saftey,working envirоment	Health and saftey, working condition	occupational safety and health	regulatory and evaluation system	development for worker	communication system	Men and women equally hiring system	Accessibility for disable persons	Accessibility for food service	Acessibility for child center	Participation in grievance handling	sexual harassement response framework
	Accessibility for child center	Correlation Coeffic ient	-.245*	.387**	-.076	-.259*	-.312**	-.414**	.327**	-.294*	-.240*	-.353**	-.341**	-.008	-.003	.164	-.119	-.474**	.011	-.414**	-.397**	.139	.161	.138	-.107	-.112	-.026	.037	1.000	.352**	.351**
	Participation in grievance handling	Correlation Coeffic ient	-.524**	.234*	-.467**	-.169	-.272*	-.193	.318**	-.218	-.222	-.262*	-.357**	-.164	-.126	.240*	-.252*	-.394**	-.195	-.459**	-.315**	.261*	-.075	-.073	.092	-.129	.315**	-.057	.352**	1.000	.442**
	Participation in sexual harassment response framework	Correlation Coeffic ient	-.384**	.127	-.215	-.478**	-.353**	-.324**	.153	-.430**	-.216	-.377**	-.306**	-.103	-.114	.213	.090	-.399**	.017	-.373**	-.410**	.011	.042	.210	.066	.094	.018	-.132	.351**	.442**	1.000

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Annex 1 **– Pre assessment check list form**

1. Can you describe the supply chain setup of your product?

2. What is the raw material (cotton, polyester or blend) and natural resource you used for produce (water, energy and chemical)?

3. Which materials do you consider the most unsustainable (socially (1) & environmentally intensive (2))?

Cotton

Wool (all types of wool) Polyester

Viscose Silk

Fur (all types of fur)

Other

4. How do you negotiate with your suppliers for the raw material and chemical use in the production?

5. When you think about the overall sustainability of a textile product, do you consider the economic, social or environmental sustainability to be of greatest importance?

6. In which parts of the process have you seen high labor intensity (dyeing, spinning, and weaving, printing)?

7. Which parts of the value chain necessarily high health care safety and used hazardous chemicals (dyeing, spinning, weaving, and printing)?

8. Which supply chain do you think the importance of getting perfect supplier that increase companies value (e.g., raw material producer, raw material processer, manufacturing, transport &distributer, usage and disposal)?

9. What good terms and conditions regulated regarding to product requirements with, is there any external agents involved?

10. Do social and environmental sustainability indicators request as a criterion when you have an export order?

11. Do you have agreements, policies or other certification regarding to sustainability?

12. How are both social & environmental sustainability requirements evaluated?

13. Do you think distortion of workers living standard and unemployment happen because not well considering of company's social sustainability requirements?

14. Have you considered companies' available recyclable raw material in related to (water, chemical and waste) highly necessary for environmental requirements?

15. Who will need to be responsible for making sure the requirements to evaluate (internal or external body)?

Annex 2 **– Questionnaire for assessment General Information**

I am writing a master thesis about social and environmental challenge assessment of textile industry for the department of Industrial Engineering at Addis Ababa University. I would like your help to perform any opinion assessment about what parameters that are important to consider for such an analysis. In order to achieve this, I have produced this questionnaire with 25 questions for you to answer. If you do not recognize some of the technical terms in the questionnaire, or for some other reason cannot answer a question, please answer "not available" and write the reasons on Remarks where possible.

Your answers will be treated with the utmost respect. If you wish for you, or the organization you are representing, to be anonymous in the report, please mark the box below with an X.

Questions about the interviewee

Question 1. What is your professional role/position?

Question 2. What age are you? Mark the most suitable interval

< 30 years	30 - 40 years	40-50 years	50 - 60 years	Over 60 years

Factory profile

Question 3. Can you please fill your factories profile?

Factory Profile	Response
Factory name	
Factory location	
Factory production capacity	
Factory utilization / actual production	
Nature of process	
Nature of product	
Total Number of workers	
Number of male and female	
Number of Female in higher position	
Number of working days/month	
Key Brands	
Certifications	

E. General information

Question 4. How do you consider your knowledge about sustainability regarding to textile industry? Mark the most suitable option and rate the degree of your knowledge accordance to the number 1 up to ten.

Very poor		Poor		Intermediate		Good		Very good	
1	2	3	4	5	6	7	8	9	10

Question 5. When analyzing the overall sustainability of a textile product, do you consider the economic, social or environmental sustainability to be of greatest importance?

Economic	Social	Environmental	Neither they are all equally important	No opinion

Question 6. Which parts of the supply chain do you consider the most unsustainable (environmentally intensive)?

Waste disposal t (after use)	Use phase	Transport	Apparel manufacturer	Fabric Manufacturing	Raw material processing	Raw material harvesting	Other

D. Regarding to Environmental issue

In which the response rate is interpreted as Yes=4, Partially =3, No=2 and NA= 1

Critical issues	Best Practices	Response				Remarks
		Yes	Partially	No	NA	
Resource use	Do you have meters to measure total input water in factory and for wastewater discharge?					
	Do you recover final washing bath for use?					
	Do you update recipe (lab and bulk) that helps for resource re use and productivity?					
Emission to air	Do you have metering at main electrical input and monitor daily electrical input, generation and process level consumption?					
Transportation of material, semi-finished and finished	Do your organization consider your vehicle fuel (petrol and diesel) record has direct impact to CO2 emission					

goods						
Emission to land	Do you identify hazard chemicals and classify them by hazard bands?					
	Do you train all the people working in handling or using chemicals on the hazards of chemicals, first aid & chemical disposal requirements?					
	Do you have adequate and correct personal protection equipment for handling & use of chemicals e.g., gloves, masks and safety goggles					
Regarding to Policy	Do you comply with ZDHC (zero discharge hazardous chemicals) requirements that deals with chemical management system, on identifying material restricted substance list and waste minimization?					
	Do you meet compliance requirement of national environmental pollution regulatory body?					
Packaging material use	Is your fabric packaging material having specific standard and consistent to every order?					
	Do your organization have a trend/ system of disposal recycling option of textile (using rags, charity shop,					

waste	modification & redesign, garage sale)					
	If you use rag (textile disposal) as a raw material, do your organization reuse the rag for direct similar purpose?					
	If it is yes, Is the business is appreciating for a factory to deliver their final disposal to you as a raw material for import rag substitution comes from outside?					

E. Regarding to Social issue

In which the response rate is interpreted as Yes=4, Partially =3, No=2 and NA= 1

Critical issues	Best Practices	Response				Remarks
		Yes	Partly	No	NA	
Employment	Does your factory have skilled labor in each department that perform a certain task up to certain level of complexity?					
	Do you have wage policy that acts on hiring unskilled labor and encourages to long-term growth?					
Health and safety	Do your factory fulfill safe, comfortable and productive working environment regarding to workers ergonomics?					
	Is the working condition (tools, fixture and physical device) for the worker compatible with the workstation					
	Is the company have certification regarding to Compliance with legal provisions on (occupational safety and health)					
	If you say yes, do you have a regulatory and evaluation system to check and balance the situation?					
Training and development	Do all workers get training accordingly of their position concern within a short period of time					

	gap?					
Communication	Is the worker can easily communicate and have system/trend of information sharing with each other including (bottom to top management)?					
Equity	Do the company have encouraged hiring system for new employee, which equally approach for both men and women in any position?					
Accessibility	Is the factory accessible to all person including person with disability?					
	Does the company have free food service center for the worker?					
	Do you have childcare center?					
Participation	Do you have labor union representative in your factory that handles grievance of worker's case?					
	Do you have a sexual harassment response framework?					

Annex 3 **– Questionnaire for assessment**

Questions about the interviewee

Question 1. What is your professional role/position?

Question 2. What age are you? Mark the most suitable interval

< 30 years	30 - 40 years	40-50 years	50 - 60 years	Over 60 years

Question 5. When analyzing the overall sustainability of a textile product, do you consider the economic, social or environmental sustainability to be of greatest importance?

Economic	Social	Environmental	Neither they are all equally important	No opinion

Question 6. Which parts of the supply chain do you consider the most unsustainable (environmentally intensive)?

Waste disposal system	Use	Transport	Apparel manufacturer	Fabric Manufacturing	Raw material	Raw material	Other

Factory/institute/university/college profile

Question 3. Can you please fill your faculty profile?

Factory/institute/university/college Profile	Response
Name of your university/college	
location	
Total number of students	
Yearly number of graduate students (textile)	
Number of male and female students	

General information

Question 4. How do you consider your knowledge about sustainability regarding to textile industry? Mark the most suitable option

Very poor		Poor		Intermediate		Good		Very good	
1	2	3	4	5	6	7	8	9	10

D. Regarding to Environmental issue

Critical issues	Best Practices	Response				Remarks
		Yes	Partially	No	NA	
Resource use	Does your textile curriculum insist students to have knowledge on equipment's used to measure the input water and for wastewater discharge?					
	Knowledge for recover final washing bath for use					
	Knowledge and skill for the development of recipe (lab and bulk) that helps for resource re use and productivity.					
Emission to air	Knowledge in metering at main electrical input and monitor daily electrical input, generation and process level consumption?					
Transportation of material, semi-finished and finished goods	Knowledge on consider vehicle fuel (petrol and diesel) record has direct impact to CO2 emission					

Emission to land	Knowledge and skill to identify hazard chemicals and classify them by hazard bands?					
	Do you train all the people working in handling or using chemicals on the hazards of chemicals, first aid & chemical disposal requirements?					
	Knowledge to have adequate and correct personal protection equipment for handling & use of chemicals e.g., gloves, masks and safety goggles					
Regarding to Policy	Knowledge and skill assist to comply with ZDHC (zero discharge hazardous chemicals) requirements that deal with chemical management system, on identifying material restricted substance list and waste minimization.					
	Knowledge required meeting compliance of national environmental pollution regulatory body.					
Packaging material use	Knowledge for packaging material that is specific standard and consistent to every order?					

waste	Knowledge and skill to a system of disposal recycling option of textile (using rags, charity shop, modification & redesign, garage sale)					

Regarding to Social issue

Thematic Area	Best Practices	Response				Remarks
		Yes	Partly	No	NA	
Employment	Does the college promote students to be a skilled labor in each department that performs a certain task up to certain level of complexity?					
	Knowledge on wage policy that acts on hiring fresh labor and encourages to long-term growth					
Health and safety	Do your students know their right to be fulfilled safe, comfortable and productive working environment regarding to workers ergonomics?					
	Knowledge to working condition (tools, fixture and physical device) for the worker compatible with the workstation					
	Knowledge on certification requirement regarding to Compliance with legal provisions on (occupational safety and health)					
	Knowledge on regulatory and evaluation system to check and control the situation?					
Training and development	Knowledge on the right for workers get training accordingly of their position concern within a short period of time gap					

Communication	Is the student aware on freely communicate and have system/trend of information sharing with each other including (bottom to top management)?					
Equity	Knowledge and skill to encourage hiring system for new employee, which equally approach for both men and women in any position?					
Accessibility	Knowledge on accessibility for all person including person with disability					
	Knowledge on importance of food service center for the worker in textile factory					
	Knowledge on importance of childcare center for the worker in textile factory?					
Participation	Importance of labor union representative in factory that handles grievance of workers case					
	Awareness of workers as it happens directly inform to sexual harassment response framework					

What do you think on the great opportunities/ challenge to implement corporate social responsibility on factories?