Impact of Environmental Practices on Triple Bottom Line: Insights from Vertically Integrated Textile Units in Pakistan

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A thesis submitted to NUST Business School for the degree of Master of Science in Logistics and Supply Chain Management

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Submitted to: Dr. Waqas Ahmed

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Declaration

I certify that this research work titled "***Impact of Environmental Practices on Triple* Bottom line: *Insights from Vertically Integrated Textile Units in Pakistan***" is my own work. I hereby state that no portion of this work has been presented elsewhere for assessment or in support of an application for another degree or qualification of this or any other university. The material used from other sources has been properly accredited and referred.

Student Name: *Amna Fida*

Signature:

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Abstract

Businesses no longer consider themselves as only profit-bearing entities but also as systems responsible for incorporating stakeholders' view of sustainability, accounting for the influence of their operations on the society and the planet. Organizations are becoming actively involved in mitigating adverse environmental and societal impacts of their supply chain activities. Although the initial focus of global expansion was only towards improving the economic performance of organizations through lower cost of production and access to "economical" labor recent years have seen a collective interest of industry specialists towards three-fold dimensions of sustainable performance. These dimensions are the environment, society, and economy. The presented research addresses the effects on firm performance in all three dimensions of sustainability. It will assist corporations in designing eco-friendly supply chains, with lower negative social and economic impacts, hence, moving towards sustainable development. The study employs a cross-sectional approach by surveying vertically integrated textile units operating in Pakistan. Apart from three performance-related variables, four constructs were included in the theoretical framework. These were environmental management practices, sustainable design for products & processes, sustainable distribution initiatives, and resource and emissions control initiatives. The research reports that collective adoption of environmental practices directly or indirectly has a significant impact on firm performance. Analysis of collected data through SEM reveals that adoption of environmental management practices positively impacts environmental and social performance of firms while there is no significant influence on economic performance. Further to this, it has been found that the resource & emission control initiatives can significantly improve the environmental performance, however; they have no significant potential to enhance the social and economic performance. Research limitations, areas for future research, and implications for practitioners are also discussed in the final chapter.

Keywords: Textile supply chain; Environmental practices; Firm performance; Triple bottom-line; Sustainability; Structural equation modeling.

CHAPTER 1: INTRODUCTION

This chapter establishes the rationale for the present study by providing background of the research problem and introducing the proposed research questions. A brief overview of Pakistan's Textile Industry is provided followed by the scope and context of the research. Lastly, the chapter concludes by stating the aims and objectives of the presented study and contribution of this research to the literature. The structure of the thesis is outlined in the final section of the chapter.

1.1. Background

The last few decades have seen the expansion of organizations from various industries, into global markets for the main aim to gain a competitive advantage (Christopher, 2011; Chopra & Meindl, 2013). This is also evident from the colossal increase in the world merchandise export value from US$ 3.67 billion in 1993 to US$ 14.8 billion in 2010, reaching US$ 17.73 trillion in 2017 (World Trade Organization, 2018). As per the statistical review provided by WTO in 2018, developing economies accounted for 44% of the overall merchandise trade.

Although the initial focus of this global expansion was only towards improving the economic performance of organizations through lower cost of production and access to cheaper labor, recent years have seen a collective interest of researchers and practitioners towards three-fold dimensions of sustainable performance: environment, society, and economy. Radical climate change due to an increased level of greenhouse gas (GHG) emissions, extensive energy use, exaggerated fossil fuel consumption, use of child labor and differences in pay structures of employees are only a few of the environmental and social concerns that need addressing (Howard-Grenville *et al*., 2014; Soosay *et al.,* 2014; Christ & Burritt, 2015).

Businesses no longer consider themselves as only profit-bearing machines but also as systems responsible for incorporating stakeholders' view of sustainability, in terms of the influence of operations on the society and the planet as a whole. Given the aforementioned concerns, organizations are becoming actively involved in mitigating harmful environmental and societal effects of their operations (Carter & Easton, 2011; Soosay *et al.*, 2012). Moreover, one of the reasons companies have started to take

responsibility for incorporating sustainable practices is that such initiatives also present numerous opportunities for business growth, as discussed by White (2009). Corporate activities resulting in high levels of carbon monoxide emissions (along with other GHG emissions), toxic discharge, a large number of wasted packaging materials, and other variants of industrial pollution pose a momentous threat to the environment (Wisner *et al.*, 2012). The impact of environmental degradation has gone beyond a territorial limit, consequently, the need for implementation of efficient and responsible management systems and networks has emerged. This entails that improving profitability should no longer be the only focus: impact on social systems as well as the environment are also essential (Pagell & Wu, 2009).

Enterprises have started to implement environmental initiatives to optimize their supply chain networks for reduced social and environmental impacts for the whole industry. Supply chain activities, such as materials acquisition, manufacturing, reverse logistics, and recycling, etc., if not managed appropriately can negatively affect not only the financial outcomes of the firm but also the community (as evident from growing social inequality and discontent) and the surrounding environment (noticeable by accelerated climate change) (Wisner *et al.,* 2008; Guest, 2010; Howard-Grenville *et al.,* 2014).

In the late 1990s, the term triple bottom line (TBL) was introduced which was based on survey results that were conducted by international experts related to corporate social responsibility as well as sustainable development. With respect to sustainable practices in supply chain networks, TBL is regarded as the framework in which three main pillars are combined, namely; environment, society, and economy. TBL in the supply chain is also linked with the practices that can ensure greater business value. For this purpose, the establishment of requirements on a minimal basis and selection of the parameters on which sustainable practices can be evaluated are two essential factors.

A way of ensuring sustainability into the supply chain is to adopt sustainable and/or “green” initiatives to maintain a low environmental footprint of the company, and the industry as a whole. Another way is to ensure that activities of social stakeholders (e.g. suppliers) of the firm and the industry are monitored in order to check whether they are operating under sustainable initiatives and conditions. This can be achieved by identifying whether the supply chain partners are working under the identified environmental

principles (Seuring & Müller, 2008). The main motivation of this research is to explore the interface between the adoption of ecological conservation practices and organizational performance. The present study draws on literature such as sustainable supply chain management, sustainability, sustainable practices, and the consequences on triple bottom line performance, particularly in the context of textile-composite firms operating in Pakistan.

1.2. Problem Statement

Sustainability has become a major concern of businesses across the world because mere financial performance or growth is not enough now to ensure the long-term success of any firm. Rather, firms need to ensure better environmental as well as social performance because stakeholders now tend to evaluate and view firm performance through social and environmental performance as well. Therefore, firms are looking for different ways to enhance their three-fold performance i.e. economic, social, and environmental performance. It is noted that many firms operating in developing countries are not fully realizing the gains of sustainability practices because they overlook the importance and role of such practices in enhancing their triple bottom line. Furthermore, many firms in developing countries like Pakistan tend to focus only on economic or financial gains while they ignore the equal importance of environmental and social performance.

This problem is more prominent in the textile sector of Pakistan because they are facing a number of challenges due to the nature of operations and the consequent environmental impacts (Ahmed *et al.*, 2019; Lun, 2011; Maheswari *et al.*, 2018). This problem is not limited to the textile sector or Pakistan only; rather different sectors across different countries are facing similar issues due to a lack of proper sustainability practices. Given the domestic and global context of this problem, it becomes crucial to identify antecedents of this problem and to find and explain different factors that can assist firms to enhance their three-fold performance instead of financial performance only. Among different reasons behind the poor triple bottom line performance of the firms, an important reason is associated with the ignorance of sustainability practices. When firms only want to pursue their short-term economic concerns without considering their long-term environmental or social effects then, their economic and environmental performances suffer.

These challenges accentuate the argument that in order to minimize the adverse influence of textile industry's operations, there is a dire need for sustainable solutions (Muthu, 2014). However, in order to do so researchers and industry specialists must understand the possible environmental and social burdens arising due to their products and processes. Being aware of materials and processes that are creating the most harmful impact, problem areas can be identified. Investments towards these areas can result in leaner production processes, efficient resource use, decrease in pollution and more control over material flows. Decreased vulnerability from threats, enhanced communication with the stakeholders of the firm and increased supply chain transparency are only a few of the benefits that firms can benefit from if they operate in a more sustainable manner.

Therefore, there is a strong need to explain this phenomenon efficiently in order to address the problem being faced by firms regarding the three-fold performance. However, studies in the existing literature do not provide efficient solutions and explanations for this phenomenon. The current study attempts to address this problem by assessing the role of sustainability practices including environmental management practices, sustainable product and process design, sustainable distribution initiatives, and resource and emission control initiatives in improving the economic, social, and environmental performance of textile firms of Pakistan.

1.3. Overview of Pakistan's Textile Industry

The apparel and textile industry has emerged as one of the proliferating industries, representing over thirty percent of all global industrial sectors. Commodities such as textiles and apparel have a supply-driven value chain. The textile supply chain is complex, comprising of multiple tiers of suppliers, merchandisers, retailers, contractors, subcontractors, and buyers. In addition, the textile sector has one of the longest production chains, with multiple stages starting from cotton harvesting, fiber processing, and finishing to marketing and trading, with potential opportunities of value addition at each stage and level.

The agriculture sector is, without a doubt, the lifeline of Pakistan's economy. Pakistan is the fourth largest cotton producer in the world, with 6.5 million metric tons of annual production. Given the amount of potential of the agricultural sector, the

government focus has been on developing agro-based industries in the country. The textile industry plays a noteworthy role in Pakistan's economy mainly for three reasons. The first being the strong backward linkage of the textile and apparel sector with the agricultural sector. The second reason is the presence of the highest number of manufacturing units, signifying the manufacturing investment and direct and indirect labor employment. The last and most important reason is that the textile and apparel manufacturing companies are of high export interest for the country.

Pakistan's textiles industry is categorized into three main groups: spinning, weaving, and composite-units. According to the Textile Industry Division of Pakistan, the textile industry contributes to almost 65% of the total merchandise exports of the country. More importantly, being the largest manufacturing industry of Pakistan, it employs roughly 40% of the workforce in the country, which accounts for almost 15 million people (International Labor Organization, 2014). The industry, given the magnitude of its operations, engages in a large number of supply chain practices, however, given the nature of operations, has been criticized for various practices as well. Factors such as internal security and a global recession have also made it difficult for the cotton and textile industry to sustain competitiveness. Additionally, the major issue, in terms of the environmental impact of sustainable supply chain practices, arises in the manufacturing process because the industry is associated with a high level of water consumption, untreated waste and chemical discharge into water sources, GHG emissions, and inefficient resource and chemical use (Oecotextiles, 2013).

The textile industry is highly water-intensive (Saxena *et al.*, 2017) and has a high water consumption potential and wastewater discharge resulting in a high rate of pollution (Gomes De Moraes *et al.*, 2000). The processes used in textile manufacturing such as dyeing, bleaching, washing, and printing all employ water as a primary medium (Tong *et al.*, 2012). Chemicals used in these processes and the wastewater produced as the result not only cause water and land pollution but also pose a threat to human health (Hussain & Wahab, 2018). Moreover, high water consumption in the manufacturing processes is directly linked to higher energy costs (Hasanbeigi, 2010). Not only that, but textile consumers are also becoming warier of the environmental toxicity that synthetic dyes and the resulting industrial wastewater (Savvidis *et al.*, 2013). Life cycle assessment (LCA) of carbon footprints from black cotton products reported that wastewater discharge accounts

for almost 64% of the carbon emissions (Li *et al.*, 2011), the remaining resulting from energy consumption in manufacturing processes. Furthermore, an analysis of GHG emissions in the Chinese textile industry showed that cotton textiles and clothing are the primary sources of high GHG emissions (Huang *et al.*, 2017).

The textile sector is among the most labor-intensive industries. In Pakistan and other emerging economies in South Asia, low-cost labor is imperative for industry competitiveness. Carbon emissions from supply chain processes can have huge social costs (Tseng & Hung, 2014). The industry has been subjected to different accusations of labor abuse, low wages, child labor, gender inequality, and such (Annapoorani, 2017). Hazardous working conditions, poor wages, and excessive working hours have become a problem at various industrial textile units operating in developing countries and impact sustainable development in a negative manner (Locke & Romis, 2007). Unauthorized subcontracting is also a recurrent issue in the apparel sector, resulting in labor law violations and labor abuse since these unauthorized sites manage to elude accountability. Moreover, due to the trend of fast fashion and rapid changeability in retailing, a rather non-eco-friendly culture of clothing disposal has arisen in which consumers dispose of products after one or two uses. Such a culture affects energy used for recycling of products and the percentage of landfill spaces available (Chau, 2012).

Nevertheless, a large number of companies in the textile industry have been dedicated to adopting practices that are environmentally friendly and improving their social standing as well through several campaigns and improving their supply chain practices. As a consequence of high negative environmental and social impacts resulting from non-eco-friendly practices prevailing in the textile industry, sustainability has become a dominant concern for businesses and consumers of the industry (Khan & Islam, 2015). Firms in Pakistan have also started to engage in practices that ensure transparency in supply chain operations by mapping their supply chains and identifying problem areas that need monitoring and control. This research was conducted with the aim to identify the extent to which those practices prevail in the textile-manufacturing firms, with the focus on the composite (vertically integrated) units within the sector. Furthermore, the impact of these practices on the environmental, social, and economic sustainability of the firms and the industry as a whole is reported.

1.4. Research Gap and Contribution

Adopting environmentally responsible practices has become increasingly important in efforts to improve business performance. Previous research in SSCM context has majorly focused on cost implications and economic performance associated with the adoption of environmentally sustainable practices in a single supply chain function (Lock & Seele, 2016) instead of focusing on multiple stages within a supply chain. Moreover, there is an absence of comprehensive practical evidence, in context of developing countries, on the adoption of environmental initiatives (Mitra & Datta, 2014). While different environmental practices have been studied with a focus on numerous constructs for firm performance, there is a lack of incorporation of all dimensions of triple bottom line while measuring firm performance. Recent studies also argue that economic performance continues to be the focus of firms that adopt environmentally responsible initiatives (Schaltegger *et al.*, 2014). Moreover, social aspect of performance has started to gain attention only recently (Winter & Knemeyer, 2013).

The majority of the adopted environmental practices have been identified and studied for the case of the "conventional" supply chain. Joyce and Paquin (2016) presented a business model canvas based on the triple bottom line performance concept. Through their study, they aimed to conceptualize sustainability in business models and sustainability-related innovation. However, their research presents a conceptual tool for the integration of the TBL concept for traditional economic-centered business models and lacks demonstrable impacts on social and environmental performance of the organization. This study addresses above-mentioned gaps by incorporating environmental constructs in a comprehensive manner and providing empirical evidence of the effect of four major categories of environmental practices on the performance of a firm's triple bottom line.

This research aims to provide clarification in terms of whether the adoption of environmental practices leads to ecological and social benefits in addition to the enhanced economic performance of the organization. Moreover, the presented research aims to contribute to the literature by integrating fragmented concepts and constructs in one practice-performance framework.

As far as the academic relevance of the presented study, the results of the study will provide scholars and students with a framework for environmental practices that can help control the environmental imprint of the textile industry. The topic of environmental practices employed in the context of SSCM is still an unexplored research domain in Pakistan, particularly within the textile-manufacturing industry. The results will highlight the importance of efficient resource use and waste minimization, emphasizing the sustainability dimension in the said industry. The findings of the presented study will aid researchers and industry specialists in understanding the extent to which environmental practices influence environmental, social and economic performance of firms in the textile sector of Pakistan and pave way for the research in sustainable development.

1.5. Research Implications

Supply chain management contributes significantly towards minimizing the negative impacts of industrial activities on the environment and the surrounding society. It involves administration of all major processes within a textile supply chain (Gupta & Palsule-Desai,2011; Howard-Grenville *et al.*, 2014). The environmental impact of supply chain activities and related issues have gained increasing attention from the research community over the past two decades (Howard-Grenville *et al.,* 2014). Governments and legislative authorities are put under substantial pressure to formulate laws and regulations for the control of GHG emissions as well as to reduce the amount of hazardous solid and water waste being released in the environment. Due to this, firms are obligated to employ practices to mitigate negative environmental impacts at organizational, operational and supply chain levels (Gupta & Palsule-Desai, 2011).

Majority of the extant literature available on sustainability and supply chain management focuses on one or two dimensions of sustainability (Seuring, 2013; Brandenburg *et al*., 2014). The presented study is of large significance due to its theoretical and practical implications with respect to the sustainability and performance of the firm. Theoretically, it will enhance the existing literature of sustainability and performance through value addition by means of empirical evidence about the role of environmental practices in enhancing a firm's performance.

The gap in the literature regarding the influence of those practices on the three-fold performance of the firm in a single study will also be fulfilled through the current research.

The presented research addresses effect on firm performance in all three dimensions of sustainability due to the implementation of environmental practices along the supply chain. This will assist companies in designing eco-friendly supply chains, with lower negative social and economic impacts, hence, moving towards sustainable development (Howard-Grenville *et al.,* 2014). Moreover, the research findings will provide guidelines to manufacturing firms in different industries for improvement of their economic, environmental and social performance, which will eventually construct competitive advantage for the firms.

The policymakers of Pakistan will get useful assistance from the implications and suggestions of the current study that what practices are useful and important to be adopted by textile sector for improving environmental, social and economic contribution of those firms to the country so, they will be better able to develop appropriate policies for the textile sector of Pakistan.

1.6. Research Aims

The main aim of this research is to find the impact of environmental practices, adopted along the supply chain, on environmental, social and economic sustainability of firms. Given the above-mentioned gaps, the research will be addressing the following objectives:

- To assess the impact of environmental supply chain practices on a firm's triple bottom-line.
- To suggest policy measures for improving supply chainsustainability of the textile-composite firms.

1.7. Research Questions

This research will be answering the following question:

What effects do the practices, related to the environmental dimension of sustainability, prevailing in the textile-composite sector have on a firm's triple bottom line?

1.8. Scope of the Research

Since the focus of this research was on determining the performance impact of environmental practices prevailing in the textile supply chain, vertically integrated textile units operating in Pakistan were studied.

An organization is considered “vertically-integrated” when it controls at least two or more stages of its supply chain (Amadeo, 2020). In this study, we review the extent to which different environmental practices are being adopted in different phases the textile supply chain of vertically integrated firms, and whether these practices are necessary for improvement in performance outcomes. The industry was chosen because of its relevance to research objectives in terms of the high level of resource consumption and waste generation. The majority of extant research focuses on individual phases within supply chains and different performance dimensions. Moreover, limited research is available for the textile supply chains of developing countries, such as Pakistan. Hence, the scope of this study includes supply chain operations within the textile sector through an extended focus on manufacturing and distribution phases within the supply chains of vertically integrated units operative in Pakistan.

1.9. Overview of Thesis

Chapter 2

All relevant concepts that emerged from the literature are presented in this chapter. The section begins with outlining a general supply chain and key concepts of sustainability, proceeding by narrowing the focus towards a textile/apparel supply chain. This is followed by literature on best environmental practices and measures of performance outcomes within the supply chain. The theoretical framework derived from the literature review is presented in the final section of the chapter.

Chapter 3

This chapter begins with a detailed synopsis of the research methodology adopted for the presented study. Research approach and explanation of the research design followed by the selection of the target population and sample for the study is discussed. The following sections review the acquired methods of data collection and instrument development and administration. Finally, the reliability and validity design for the research is stated.

Chapter 4

Chapter 4 focuses on the presentation of the results of the data analysis methods discussed in the previous chapter. The analysis comprises of two sections: examining the distribution statistics, reliability, and validity of data and testing the hypotheses to understand the causal relationships between variables. Descriptive statistics of respondents are provided in the next section of this chapter, followed by issues related to multicollinearity, reliability, and common method bias. Confirmatory factor analysis is performed in the subsequent section to evaluate the fitness of the measurement model. Lastly, regression analysis is performed to test the posited hypotheses.

Chapter 5

The purpose of this chapter is to relate back to the objectives of the presented study and assess the empirical results. Hence, this chapter offers important insights in relation to the literature review and the results of statistical analyses of data. Limitations of the current study and future research recommendations are also presented.

CHAPTER 2: LITERATURE REVIEW

In this chapter, all relevant concepts from the literature review are presented. The section begins with an overview of a general supply chain and sustainability-related key concepts, proceeding by narrowing the focus towards a textile/apparel supply chain. This is followed by literature on best environmental practices and performance indicators within the supply chain. The theoretical framework based on the literature review is presented in the last section of the chapter.

2.1. Sustainable Supply Chain Management

In this study, supply chain management is used as a foundation towards incorporating sustainability in different phases of the textile supply chain. The concept is linked directly to implementing *sustainable* supply chain management initiatives within the industry. Hence, before jumping into theoretical discussions on the sustainability-oriented research topic, a brief background of the concept is presented.

The term SCM was first introduced in 1982 by consultants Oliver and Webber and has gained incredible attention from researchers since then. A standard supply chain (SC) is merely a network of material, information, and services processing links with three basic characteristics: supply, transformation, and demand. Internal and external management and coordination of these links through planning and control of their physical and information flow along with logistics activities are what supply chain management is all about (Christopher, 1992; Cooper *et al.*, 1997). The literature is filled with definitions of the term "*supply chain management*", each definition relevant to the research context under consideration. As per the definition provided by Lambert *et al.* (2006), SCM is

"The integration of key business processes from end-users through original suppliers that provides products, services, and information that add value for customers and other stakeholders."

(Lambert *et al.,* 2006)

One definition emphasizing relationships between the key players within a supply chain defines SCM as:

"The management of upstream and downstream relationships with both suppliers and customers in order to deliver superior value at fewer costs into the entire supply chain."

(Christopher, 2011)

Heizer and Render provide a similar definition by stating:

"Supply chain management is the integration of the activities that procure materials and services, transform them into intermediate goods and final products, and deliver them to customers."

(Heizer & Render, 2017)

These definitions indicate upstream as well as downstream flows among the companies to manage system-wide costs within a supply chain. Effectively managing the supply chain was initially a tool for companies to gain a competitive edge; however, it has now become a requirement to exist in the business community (Stock *et al.*, 2010). The concept was coined partially in efforts to improve the economic profitability of the supply chain while increasing its efficiency and competitive standing through minimizing waste (Beske & Seuring, 2014). However, one company within one supply chain may simultaneously belong to a different supply chain as well, playing a different role all together (Hervani *et al.*, 2005). This indicates the level of complexity existing within any supply chain due to multiple tiers of suppliers and customers (Tancrez, 2013), hence, making the management of all the factors and players cumbersome. Due to the nature of this complexity, today's supply chains are considered 'networks' instead of linear 'chains' (Snyder & Shen, 2011).

SCM is being considered one of the fastest evolving research fields in management (Wieland *et al.*, 2016). The main reason behind increased attention to the field includes an emphasis on shorter lead times, increased customer awareness, increased global sourcing and environmental impacts of entire supply chain (Mentzer, *et al.*, 2001). Based on relevance to the changing aspects of supply chain ecosystem, Wieland *et al.* identified several themes under the umbrella of SCM that remain

understudied and are prone to receiving increased attention by the research community. *Sustainability, complexity, innovation, ethical issues,* and *reverse logistics* are a few from the extensive list of subjects.

Sustainability (economic, ecological, ethical and social) in business has become one of the main aspects of the new era of SCM. Research on this context exemplifies improved processes and practices leading to a more sustainable way of existing, resulting in new business models and ultimately, sustainable supply chains (Wieland *et al.,* 2016) . Numerous published studies show sustainable supply chain management as an emergent concept in developing countries (Tritos *et al.*, 2013; Tseng *et al.*, 2015; Green *et al.*, 2015). Although the body of research knowledge is extensive on the concepts relating to SCM, the performance implications with respect to the context of sustainability in an industrial supply chain remain under-studied. The next section introduces the concept of sustainability, its three dimensions under the view of the "*Triple Bottom Line"* and the relevant theories that support the argument.

The World Commission on Environment and Development defines the concept of sustainability as:

> "*Development that meets the needs of the present without compromising the ability of future generations to meet their own needs*."
>
> (WCED, 1987)

This definition, although lacking specificity and being rather broad in its scope became a starting point for organizations to consider sustainable initiatives as a part of their core operations. Table 2.1 presents the most widely used definitions of sustainability developed and presented in the literature over time**.**

Table 2.1: Sustainability definitions from the literature

DEFINITION	Author(s)
"Any state of a business in which it meets the needs of its stakeholders without compromising its ability also to meet their needs in the future"	(Hockerts, 1999)
"Securing long-term economic performance by avoiding short-term socially detrimental and environmentally wasteful behavior"	(Porter & Kramer, 2006),
"Achievement of an organization's social, environmental and economic goals"	(Carter & Rogers, 2008),
"Performing well on not only traditional measures of profit but also in social and natural dimensions"	(Pagell & Wu, 2009),
"Intersection of economic, environmental and societal superiority"	(Paulraj, 2011)
"Efforts a company makes related to conducting business in a socially and environmentally responsible manner. It contains elements including sustainable development,corporate social responsibility(CSR), stakeholder concerns, and corporate accountability"	(Council of Supply Chain Management Professionals, 2013)
"Trade-off between multiple dimensions of social, economic, and ecological features"	Osmani & Zhang (2017)

The relationship between conventional supply chain management and sustainability management has gained growing importance in the business research community. In the context of business operations, sustainability is most commonly viewed

from an ecological perspective, hence, whenever reduction in environmental and societal impacts of supply chain operations are stressed, the term *sustainable supply chain management* (SSCM) is specified. The past two decades have seen the focus of organizations towards developing strategies to manage environmental, social, and economic challenges simultaneously that emerge in their supply chains (Carter & Easton, 2011). Successful integration of all three aspects is a key strategic issue in terms of competing at global platforms (Seuring & Müller, 2008).

The literature presents several perspectives while defining the approach to SSCM depending on the nature of industries and the particular objectives of conducted researches. This study views SSCM as "*management of product inputs, processes, and outputs from material extraction, procurement, manufacturing and distribution to the point of consumption and disposal by the final customer at the end of product life cycle*". This cradle-to-grave perspective suits the objectives of the presented study and is an effort towards closing the loop (Diabat & Govindan, 2011).

Furthermore, contrary to traditional supply chains, sustainable supply chains are primarily managed by taking into account the environmental and societal impacts created by production processes (Simpson *et al.*, 2007). Hence, a sustainable supply chain is frequently viewed as an extension of the conventional supply chain, encompassing activities that undertake initiatives aimed towards reducing environmental impacts throughout the product life cycle. Some of the most common initiatives include green procurement, reduced materials consumption, adherence to international environmental management standards, eco-design, reduced consumption of hazardous materials, resource efficiency, reduced energy consumption, product reuse, and recycling, and availability of multiple disposal options (Seuring & Müller, 2008).

SSCM furnishes the concept that firms should mitigate the environmental damage caused by their operations and incorporate social responsibility through business activities all while achieving performance gains (Tseng *et al.*, 2015). Decision-makers and strategists are focusing on the environment and the subsequent social and economic effects of a rather fast-paced industrial growth. Consequently, SSCM has emerged as a collective notion in organizations across multiple industries and considered imperial to business growth. Within the supply chain context, SSCM addresses the environmental,

social, and financial dimensions through three main sun-intersections as shown in figure 2.1. In 2008, Carter and Rogers conceptualized intersection of environmental, social, and economic dimensions in efforts to provide a 'win-win-win' opportunity for firms. In simple terms, supply chain initiatives targeted towards these three dimensions of performance provide prospects for firms to go beyond the objective of survival and to thrive, as long as these endeavors are "equitable", "viable", and "bearable" (Carter & Easton, 2011).

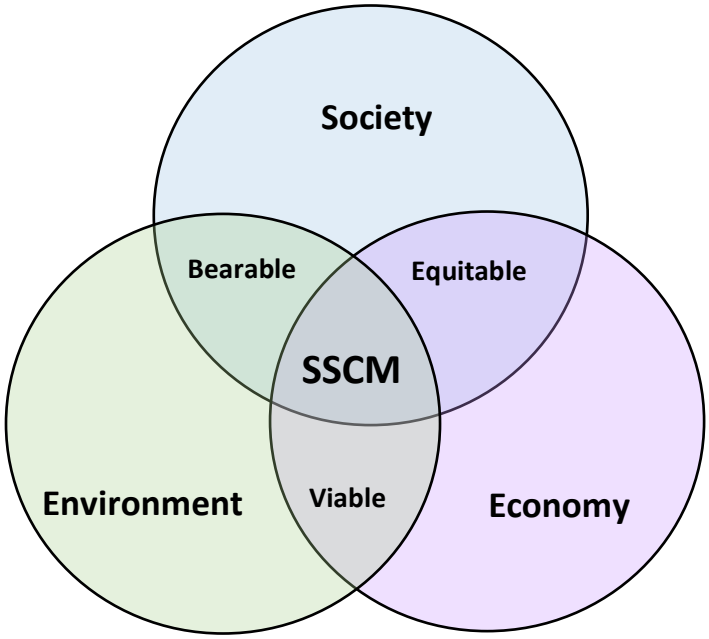

Figure 2.1: SSCM as an intersection of three pillars of sustainability

As mentioned earlier, the focus of SCM in earlier stages was on reduced lead times, in efforts to ensure a steady product and information flow along the company's value chain. Furthermore, waste reduction was another reason companies were focusing on their supply chain activities. However, this was not due to any social or environmental concerns, but largely for enhancing economic profitability (Sarkis *et al.*, 2011). Recent literature presents the concept of SSCM as consolidation efforts aimed at improving social responsibility performance of firms, SCM, and environmental management (Tseng & Chiu, 2013).

Several upstream practices have been acknowledged in the literature as an effort to incorporate sustainability in the supply chains of focal companies. These practices include green initiatives such as, green procurement, green packaging and eco-design (Green *et al.*, 2012), and other practices aiming at the three R's of environmental aspect

of sustainability namely; *reduce, recycle and reuse*. Process redesign, waste reduction and recycling, product reuse, adherence to environmental standards, use of alternate energy sources, emissions monitoring, and material substitution are few of the practices mentioned in sustainability-related literature (Ageron *et al.*, 2012). It is to be noted that merely adopting sustainable production and consumption (SCP) practices is not enough; organizations must address issues of natural resource scarcity, social inequalities, energy demands, and financial crises (Joyce & Paquin, 2016). Moreover, the involvement of up and downstream partners of an organization contributes significantly to the sustainability-oriented supply chain performance (Ageron *et al.*, 2012).

In order to manage and conserve the ecological, social, and economic resources, businesses must respond to these challenges in an eco-efficient and eco-effective manner (Rifkin, 2014). Simply put, businesses and industries should assign value to products, services, and processes relative to the ecological impact they carry over a life cycle. To thrive, it has become critical to take upon these challenges as an opportunity to improve business sustainability and competitive advantage (Adams *et al.*, 2015).

2.1.1. Sustainable Supply Chain Management vs. Green Supply Chain Management

Ashby *et al.* (2012) present two terminologies used most commonly when discussing sustainability in SCM context: “sustainable supply chain management (SSCM)” and “green supply chain management (GSCM)”. Both terminologies have overlapping concepts, therefore, requiring an understanding of the differences between the two terms and explaining the choice of SSCM as a relevant one. A green supply chain focuses on enhancing the environmental performance of a firm through integration of several environmental criteria into activities along its supply chain (Emmett & Sood, 2010). Reducing negative impacts of the supply chain on the environment is the ultimate goal of GSCM, hence it focuses on material sourcing and selection, logistics activities, product, and process design and post-usage activities, for instance, recycling and disposal (Zhu *et al,.* 2005).

The term sustainable supply chain management (SSCM) promotes an association of SCM practices with the notion of sustainability, however, GSCM and SSCM are used interchangeably in studies based on different perspectives and the broad scope of

sustainability (Ashby *et al.*, 2012). The majority of existing studies proclaim that GSCM focuses only on the collective environmental and economic impacts of operational activities while neglecting the societal impacts of SC operations. However, due to growing attention towards environmental concerns which include resource scarcity, global warming, and social issues such as work environment and human rights, companies have broadened their strategic objectives to include social aspects as well (Gupta & Palsule-Desai, 2011). Several studies over the years conclude that SSCM accounts for all three dimensions of sustainability: the environment, the society, and the economy (Zhu & Sarkis, 2004; Pagell & Wu, 2009; Tseng *et al.*, 2015). Addressing social concerns is among the major intentions of sustainable-development oriented research (Dehghanian & Mansour, 2009); hence, the concept has taken dominance in research from 2010 onwards. Ahi and Searcy provided an all-inclusive definition of the term:

> "*The creation of coordinated supply chains through the voluntary integration of economic, environmental, and social considerations with key inter-organizational business systems, designed to efficiently and effectively manage the material, information, and capital flows associated with the procurement, production, and distribution of products or services, in order to meet stakeholder requirements and improve the profitability, competitiveness, and resilience of the organization over the short- and long-term".*
>
> (Ahi & Searcy, 2013)

Operating in a sustainable manner is essential for businesses to address social, economic, and environmental responsibilities (Epstein, 2012). Sustainable supply chain initiatives of the firm can lead towards competitive advantage as the SSCM approach seeks to address economic and ecological objectives as well as social matters associated with firms' supply chain activities (Carter & Easton, 2011). In fact, sustainable production and consumption practices (SCP) along with the management of three performance-outcome dimensions (society, economy, and environment) of sustainable development, collectively contribute to the concept of sustainability in supply chains.

The concept of supply chain sustainability has been operationalized through the "Triple Bottom Line" framework, which was introduced in the early 1990s. Several recent studies such as that of Joyce and Paquin (2016) aimed to conceptualize sustainability in

business models. These studies presented conceptual tools for integration of the TBL in efforts to improve the traditional economic-centered business models; however, they lacked demonstrable impacts of the environmental policies and practices on the social and financial performance of an organization and the relevant industry as a whole. The presented study focuses on the adoption of practices such as emissions monitoring and material flow analysis (specifically for the textile-manufacturing industry of Pakistan) and quantifying the effects on performance in all three dimensions of sustainability. The research addresses the core dimensions of SSCM through the TBL framework keeping the business context in view (Blewitt, 2014). The next section gives an overview of the main concepts relating to the triple bottom line.

2.2. Triple Bottom Line

Various terms and management models have been used by industry researchers and presented in the literature to interpret the concept of sustainability (Crittenden *et al.*, 2011). However, a review of the literature on sustainability and performance shows the existence of a common theme, with a collective focus on three impact areas. Findings from a systematic review of literature on SSCM conducted by Carter and Easton across a 20-year period suggest that research focus has shifted from a standalone point of view of sustainability. The multidimensional focus has taken prominence to include all three aspects of the triple bottom line (Carter & Easton, 2011). These are referred to as the dimensions of sustainable performance, namely: the environment, the society, and the economy (Elkington, 1998) also indicated as 3P's: people, planet and profit dimensions. Some studies also use the term 3Es of sustainability: "Economy, Environment and Equity" (Winter & Knemeyer, 2013). The previous section describes sustainability in supply chains by conceptualizing three dimensions on the TBL. All these terms use the concept of "Triple Bottom-Line" as a way to operationalize sustainable performance on a microeconomic level (Elkington, 1998; Seuring & Müller, 2008; Closs *et al.*, 2011; Edgemam *et al.*, 2015).

Industries and businesses are making conscious efforts to extend their focus to include all domains of the triple bottom line approach simultaneously and move beyond traditional economic-centered goals (Gimenez *et al.*, 2012). The environmental dimension of TBL deals with considerations and initiatives aimed towards minimizing the

negative environmental impacts of a firm's business activities (Lai *et al.,* 2013). The social dimension endeavors to include social and ethical values through the management of social outcomes of business activities (Sarkis *et al.*, 2010). The Global Reporting Initiative (GRI) states four dimensions of the social bottom line: labor practices and working conditions, labor rights (including security practices and policies against child labor) relationship with local communities, and product responsibility (Global Reporting Initiative, 2013). The economic dimension takes into account the traditional economic objectives while considering social and ecological domains included in profit calculations (Lai *et al.,* 2013). For example, costs associated with eco-design and cost of effluent treatment, etc.

However, this is easier said than done. Achieving true sustainability throughout the supply chain is difficult as several trade-offs exist. The majority extant conceptual and empirical research on the topic follows a win-win paradigm, which advocates that SSCM practices allow firms to balance three principal domains of TBL simultaneously (Esfahbodi *et al.*, 2016). Meaning, undertaking environmental initiatives, for example, will improve the social standing as well as the cost performance of the firm. However, win-win situations may only exist under limited conditions and, given the complexity of supply chains and sustainable development, the assumption that all three aspects of TBL can be improved upon concurrently is rather simplistic (Ozanne *et al.*, 2016).

Many situations exist where economic profitability, consequently, may not be desirable from an environmental or social perspective, or vice versa. This is in support of the claim presented by Chaabane *et al*. in 2010 who argued that with a 2% increase in total supply chain cost, CO_2 emissions can be reduced by up to 10%. For instance, to improve environmental performance, the design of the products are made more environment-friendly or "green" (Esfahbodi *et al.*, 2016). This comes with investments related to eco-design and green-procurement, affecting the cost performance of companies but resulting in a more eco-friendly product.

As per Evans and Johnson (2005), there are five noteworthy concerns that supply chain managers have to be aware of:

a. Globalization (and resulting outsourcing of functions)

b. Product knowledge as to which material is harmful

c. Economic factors within and between supply chains

d. Product lifecycle management.

e. Risk management and security threats due to network complexities

These concerns put financial, social, and ecological goals against one another. Consequently, it becomes difficult for organizations to accomplish 'true' sustainability on parameters of triple bottom line.

2.3. The Textile Supply Chain

Studies, such as that by Caniato *et al.* (2012), have addressed the association between environmental management and SCM. SCM stresses on planning and configuration of policies, processes, and activities such as material sourcing, procurement, supply chain partner relationship-management, and logistics and distribution services (Canadian Supply Chain Sector Council, 2015). All these activities are central to providing the customers with accurate products, at the precise time and in correct quantities. Caniato *et al.* (2012) emphasizes that in order to manage the sustainability of a company, insights pertaining to product development, supplier relationships, and company structures are required.

Nevertheless, given the complexity of the textile supply chain due to the involvement of numerous suppliers, agents, and retailers, determining the environmental impact of products and supply chain processes becomes a cumbersome task. Furthermore, organizations involved in purchasing of finished goods find it difficult to go beyond the main manufacturer when tracing inputs and raw materials (Caniato *et al.*, 2012; Muthu, 2014). Addressing impacts of activities of second and third-tier suppliers needs a considerable amount of time and effort from the organization, regardless the company is considered responsible for the environmental impacts resulting from its entire supply chain. Furthermore, since supply chain management also includes activities at the customer end, consumption and washing patterns and available disposal options and choices of end-consumers are usually very challenging to assess (Muthu, 2014). In conclusion, lack of transparency in the textile supply chain restricts acquiring pertinent data, which, in result, undermines sustainability assessment.

Having said that, despite the given lack of transparency, general phases and input related sub-phases of a textile supply chain can be identified and are summarized in figure 2.2. These are further summarized in table 2.2 as identified by Herva *et al.* (2011), Gardetti and Torres (2013) and Muthu (2014).

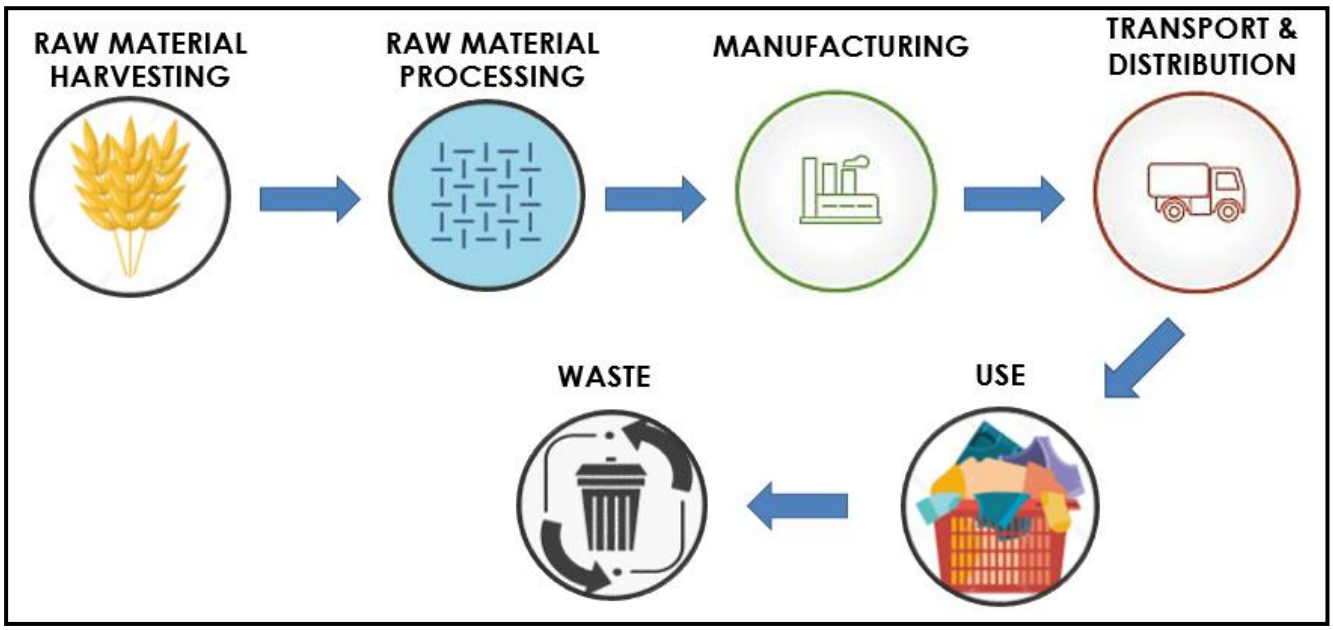

Figure 2.2: Depiction of a textile supply chain

Table 2.2: Phases and sub-phases of a textile supply chain

Phase	Sub-Phase	Process Inputs
Raw Material Harvesting	Preparation	Direct and indirect use of land for production of fiber, production sites, and landfills Pesticides, fertilizers, chemicals, and other additives Energy for activities related to production and logistics Water for processing and washing activities Machines and inventories in manufacturing facilities Packaging materials
Raw Material Processing	Fiber conversion Yarn preparation Grey fabric preparation Finished fabric preparation	
Manufacturing	Apparel manufacturing **Activities:** Cutting Sewing Washing	
Transport & Distribution	Transport systems (sea, land, air) to warehouse, retailer or consumer	
Use	Wearing and washing habits of consumers	
Waste	Reuse Recycle Incineration	

The table constitutes a cradle-to-grave perspective by listing the six main phases of a textile supply chain, with the phases further divided into sub-phases and process inputs. Based on the required material and the process acquired to yield a product for each phase, the activities in the sub-phases may vary and can occur in several of the

multiple sub-phases. To illustrate, an example of transport mechanisms can be taken. These mechanisms are employed not only from the manufacturer to the retailer but also from the supplier to the manufacturing units. Similarly, some form of packaging is typically essential for all types of transports; hence, process inputs for every phase cannot be presented in any particular order of occurrence.

With the general phases of the textile supply chain identified, along with sub-phases, processes, and inputs, determining the appropriate key environmental indicators is the next step for assessing sustainability within each phase. By mapping the whole supply chain and investigating where the key indicators occur, companies can develop progressive environmental management strategies for their supply chain (Caniato *et al.*, 2012). Similar to the case of process inputs, these environmental indicators can surface in various instances throughout the supply chain (Muthu, 2014). Therefore, a specific phase within the supply chain cannot be assigned as the main source. Table 2.3 presents several key environmental indicators connected with a textile supply chain as reported by Muthu (2014).

Table 2.3: Key environmental indicators of a textile supply chain

Indicator
Treatment and discharge of effluents.
Extraction of raw materials - sources and production methods.
Production of chemicals, other materials, and auxiliaries for production and manufacturing.
Energy production processes and utilizations - sources and quantities.
Water sources, quantities and processes for cooling and/or heating.
Overconsumption and production.
Emissions to air, water and land.
Production of solid waste and disposal.
Transportation of materials, semi-finished and finished goods.

2.4. Environmental Practices & Firm Performance

The review of the literature showed employment of various constructs for examining the environmental practices-firm performance link. The focus of the present study was on supply chain practices, specifically, activities designed to either eliminate or reduce the negative environmental impacts of business functions and processes. Hence, these practices take into account environmental efforts in all phases from design, development, manufacturing, and delivery to the end customer. Incorporating the environmental aspect of sustainability in SCM is frequently associated with multiple benefits. Improving the "greenness" of the supply chain assures improved environmental performance, a synergy between partners, cost savings, and waste reduction (Rao & Holt, 2005). Furthermore, low environmental impacts and increased ecological efficiency help businesses improve their profit and market share (Zhu *et al.*, 2005). However, in order to achieve such benefits, one perception needs addressing, i.e. short-term costs of SSCM practices outweigh the benefits. There is a strong case for improvement in competitiveness, profitability, and resilience of organizations that are integrating the concept of environmental sustainability (Ahi & Searcy, 2013).

Firm performance has been conceptualized in multiple ways in the literature. As per the objectives of this study, firm performance has been measured keeping three dimensions of the triple bottom line in context: environment, society, and economy. Furthermore, those measures have been adopted that appeared most frequently in business and supply chain centric research.

Relationship between environmental supply chain practices and firm performance has been examined through various constructs depending on the context of the research. The focus of the presented study was specifically on the manufacturing and distribution phases within the textile supply chain. Hence those management systems, processes, and practices have been looked at which are targeted towards design, manufacturing/production and delivery of products to customers. Firm performance has been operationalized based on TBL dimensions that are most frequently used in supply chain oriented research.

2.4.1. Environmental Performance

The environmental aspect of firm performance centers on the ability of an organization to reduce hazardous air emissions, effluent and solid wastes, energy consumption and the ability to decrease consumption of hazardous and toxic materials (Zhu *et al.,* 2008). In the context of SSCM, environmental performance is measured by the extent to which manufacturing organizations conserve energy, natural and non-renewable resources and carefully manage the footprint of their operations, ensuring the longevity of our natural systems (Emmett & Sood, 2010). As per ISO 14031 guidelines, indicators of environmental performance can be classified into three categories (Shaw *et al.,* 2010):

1. Management indicators : present efforts of management on a strategic level that influence a company's environmental performance such as deciding for an environmental budget, setting environmental targets and auditing performance.
2. Operational indicators : evaluate the environmental performance of operations such as measuring energy consumption, resource (materials or water) use per unit and average fuel consumption during transportation.
3. Environmental condition indicators : focus on national, regional or global environmental effects of business operations such as rehabilitation of total landfill area or controlling the concentration of contaminants present in ground/surface water.

El Saadany *et al.* (2011) argues that the environmental performance of a firm can be gauged by measuring the number of released pollutants and harmful substances released by its industrial plants and affecting soil and water quality. "Green performance" is one of the most commonly used terms when business and environment interface is measured (Yang *et al.*, 2013). Adoption and implementation of environmentally responsible initiatives such as investing in an Environmental Management System, involving suppliers and customers in decisions for product design and conducting regular environmental audits are known to improve environmental performance of a business (Green *et al.*, 2012).

2.4.2. Social Performance

The social dimension of firm performance focuses on employee-oriented performance, measured by the level of job satisfaction of employees, safety and working conditions, and development of policy measures for employee equity, development and well-being (Walker & Brammer, 2012). Practices to ensure social sustainability and consequent value creation focuses on creating benefits for stakeholders and more broadly, society as a whole. Although the past decade has seen increased interest in the field of SSCM, socially related aspects of sustainability remain neglected. The social, environmental, and economic dimensions of the TBL complement each other (Zorzini *et al.*, 2014) and thus, the social aspects should be integrated into the framework on the same level as the other two aspects.

Social performance is measured on two levels, external, which focuses on people and communities affected by business activities, and internal, which focuses on employee-oriented policies of an organization (Gimenez *et al.*, 2012). The focus of this study is on the later. Engaging in environmentally responsible activities has been associated with improvement in an organization's corporate image and eventually enhanced social reputation and performance (Fombrun, 2005; Zhu *et al.*, 2013).

2.4.3. Economic Performance

The economic aspect of firm performance focuses on financial improvements resulting from meeting the traditional economic objective of profit maximization all the while avoiding adverse social and environmental implications (Rogers *et al.*, 2007). Improvements are measured in terms of reduced cost of energy consumption, reduction in costs related to waste discharge, an increase in the average profit of the company and so on. Therefore, focal relationships in the presented study are between environmental practices and the above-mentioned three classifications of firm performance. These dimensions address all primary stakeholders within the textile supply chain (suppliers, employees, customers, and society).

The debate has been going on over the financial viability of the environmentally responsible supply chain practices and critics have argued that the environmental aspect of sustainability and its goals can hurt the growth and profitability of the firm (Tarantino *et al.,* 2011). However, carrying out of environmental and/or social initiatives has been linked

to potential economic advantage as well (Golicic & Smith, 2017; Van-Hoof & Lyon, 2013; Yusuf *et al.*, 2013). Taking guidance from the resource bases view of society and operations, improved economic performance, under the context of this study, urges optimal and responsible use of resources available at the firm's disposal to ensure long-term profitability (Blewitt, 2014).

As mentioned earlier, there has been an increased focus on research studies associating the environmental dimension of sustainability and organizational performance. The reason behind this change of focus is that business entities are considering the adoption and implementation of eco-friendly practices internally as well as in collegiality with their supply chain partners. However, research findings from studies on this context show positive, negative, and, in certain cases, no association. This creates confusion and perplexity for practitioners as to which practice or course of action would prove beneficial if pursued. The purpose of this research is, therefore, to provide clarity in terms of the results that can be achieved through the adoption and implementation of such practices in multiple phases of a supply chain. Based on a review of literature, the following sections present identified measurement items adopted for this study and used in hypotheses development.

2.4.4. Environmental Management Practices

In this manuscript, environmental management practices (EMP) are defined as an amalgamation of policies and procedures that determine the environmental initiatives and activities of an organization (Bindal & Dwivedi, 2013). Simply put, any initiative undertaken at a strategic level by the firm to minimize the adverse impact of its economic activities on the natural environment" constitutes EMP of that firm (Christmann, 2000). Environmental management practices and certification have been adopted industry-wide to reduce emissions and increase production efficiency through improved waste management and reduced consumption of toxic materials through an eco-friendly product design (Bansal & Roth, 2000; Lintukangas *et al.*, 2015). Moreover, evidence from several empirical studies also proves that the implementation of environmental management systems results in improved environmental performance (Zhu & Sarkis, 2004; Beske & Seuring, 2014).

These considerations lead to the first hypothesis:

H1a: ***Adoption of Environmental management practices have a significant impact on improvement in environmental performance of firm.***

Environmental management practices, such as regular environmental audits, are expected to positively influence internal and external social aspects of firm performance (Wang & Dai, 2017). Efforts aimed at lowering the emission of hazardous pollutants during production processes are linked directly with improved working conditions for the employees and the community, resulting in the enhanced social reputation of the firm. Firms, which show a higher tendency towards adoption of environmental management policies and systems, are also associated with improving their human resource policies (Bohdanowicz *et al.*, 2011). Recent research provides clear evidence that employees of organizations that are proactive in adopting environmental management practices are more satisfied with their employer (Ahmad, 2015). Furthermore, improvement in employee engagement and retention is reported by organizations that aim to incorporate environmental policies on a strategic level (Benn *et al.*, 2014)

Hence, we assume that:

H1b: ***Adoption of Environmental management practices have a significant impact on improvement in social performance of firm***

Several studies such as that of Kassinis and Soteriou (2003) argue that high investment in environmental management practices and systems is a drain on financial resources, which will ultimately result in reduced economic performance. However, numerous studies support the integration of environmental responsibility and economic strategy at top management level, which corresponds to improvements in production efficiency and ultimately economic performance (Rao & Holt, 2005; Green *et al.*, 2012). Moreover, reduction in energy consumption during production processes and a reduced ecological footprint has been linked to the reduction of total production cost in manufacturing firms (Branker *et al.*, 2011).

Based on these research findings, we aim to prove that:

H1c: ***Adoption of Environmental management practices have a significant impact on improvement in economic performance of firm.***

2.4.5. Sustainable Design for Products & Processes

Textile and apparel products influence ecological systems at every point in their lifecycle (Fletcher, 2014). The use of energy, resources, such as water and natural materials, and chemicals are the main sources of environmental impact in the textile industry. Khan and Islam (2015) argue that improvements in sustainable performance are possible only when products and processes do not generate harmful impacts on the environment and society during all points of a product's lifecycle. Keeping the six phases of a textile supply chain in view, it is apparent that product design plays a crucial role in determining the behavior of textile products in the subsequent stages in the product life cycle (Rebitzer *et al.*, 2004). Consumers are becoming increasingly conscious of the environmental and social impacts of the products they use on a daily basis (Allwood *et al.*, 2006) thereby driving the adoption of eco-conscious design practices and the use of clean technologies in manufacturing processes (Challa, 2014).

Sustainable product design ensures usage of materials that are reusable and recyclable all the while guaranteeing no hazardous substances have been used while making the product. Similarly, an environmentally conscious process design ensures the use of alternative sources of energy and employing cleaner technology with the aim of enabling efficient resource use in manufacturing processes (Giovanni & Vinzi, 2014). The concept of incorporating sustainable design for products and processes in the context of the present study has been adopted from Lakshmimeera and Palanisamy (2013), who regard the idea as efforts in altering the design of products and processes through the use of inputs that generate little or no waste or pollution .

As discussed earlier, the general perception is that implementing environmentally responsible practices throughout the supply chain will result in the improved environmental performance of an organization. A recent survey conducted by Chiou *et al.* (2011) on supplier relations revealed a positive association of the sustainable product and process innovations with the environmental performance of firms. Sustainable design of products can help reduce up to 80% of environmental damage caused by a product (Khan & Qianli, 2017). Results from studies such as that of Zhu *et al.* (2013), Lai and Wong (2012) and Lai *et al.* (2012) propose substantial improvements in environmental and logistics performance through improved process efficiency and reduction in waste

and harmful emissions during manufacturing and logistics processes. This leads to the following proposition:

H2a. ***Adoption of Sustainable design for products and processes significantly improves environmental performance.***

Various studies establish the case for a positive link between productivity of employees and sustainable manufacturing practices such as collaborating with stakeholders for eco-design and employing resource-efficient technologies in logistics and manufacturing activities (Holmes *et al*., 1996; Zailani *et al.*, 2012). In general, environmental initiatives at manufacturing plants lead to safer working conditions, which ultimately increase motivation levels of employees *(*Holmes *et al.*, 1996*).* Implementation of cleaner technologies results in enhanced competitive market position, which in consequence results in an improved image of the organization (Ramayah *et al.*, 2013*).* Furthermore, the availability of eco-conscious product assortments and the adoption of sustainable manufacturing and distribution practices, such as environmental-friendly packaging, results in enhanced social reputation of a company, by making it more appealing to consumers, employees, and shareholders (Zailani *et al*., 2012). This leads us to our next assumption, which aims to prove whether:

H2b: ***Adoption of Sustainable design for products and processes significantly improves social performance***

Organizations participating in environmental practices in textile manufacturing phases reported lower inventory levels and waste disposal costs (Lee *et al.*, 2014). Multiple studies, such as that of Green *et al.* (2012), support the adoption of sustainable practices by manufacturing organizations arguing that sustainable initiatives are central to enhanced economic and environmental performance. Furthermore, studies by Lai *et al.* (2012) and Kuei *et al.* (2015) report a positive association of sustainable manufacturing practices with the firm's financial performance. Given increased customer awareness towards the environmental impacts of their buying decisions, innovations in product design lead to improved company image, which is expected to improve customer loyalty and consequently financial returns for the business (Ashby *et al.*, 2012). However, the adoption of such initiatives requires large investments in technology, which is regarded

as a drain on company resources, thus not contributing positively to economic benefits (Zhu & Sarkis, 2004; Zhu *et al*., 2005). As the initial stage of adoption of initiatives such as the use of cleaner technology in manufacturing, waste, and effluent treatment plants and organizing stakeholder training, etc. requires large sums of investment, economic performance of the firm may not be affected directly (Geng *et al.,* 2017). Results of empirical research in the context of emerging economies by Chiappetta-Jabbour (2015) and Gawankar *et al.* (2017) are also in favor of these findings.

The hypothesis reported below attempts to provide clarity on the matter by aiming to prove:

H2c. ***Adoption of Sustainable design for products and processes significantly improves economic performance.***

2.4.6. Sustainable Distribution Initiatives

For the purpose of this research, definition of sustainable distribution initiatives is adopted from Sarkis (2006) who describes the term as

"*Activities that deal with environmental issues related to packaging decisions and transportation that aim to have the least possible negative environmental impact*".

(Sarkis, 2006)

There has been an increased focus on upstream and downstream partners in SSCM oriented research (Ramanathan & Gunasekaran, 2014). The term is usually coined as "supply chain collaboration". In order to develop a competitive business advantage and ensure sustainable development, firms must develop and employ relevant technologies in all areas of its supply chain including transportation and reverse logistics. Moreover, organizations face stakeholder pressure (especially from the end-consumers) which leads to the inclusion of environmental policies, such as green packaging, reverse logistics mechanism such as product take-back for recycling and reuse (Soosay & Hyland, 2015).

The transportation sector is linked with high levels of secondary carbon emissions and the use of alternate, environment-efficient modes of energy in transportation results in a significant reduction of harmful emissions throughout the supply chain (Glock & Kim,

2015). A few studies such as that of Wong *et al.* (2012) have reviewed green logistics and the use of fuel-efficient modes of transportations and found a positive relationship with the financial performance of firms. However, the inclusion of the above-mentioned activities requires substantial investments in planning and implementation and may only yield profitable results after a long period. Although product take-back mechanisms are anticipated to control waste generation, reverse logistics related to take-back of consumer products is expensive and usually, the costs of such initiatives exceed revenues (Klausner & Hendrickson, 2000). Furthermore, there is limited research available on any relationship between sustainable distribution initiatives, such as the use of cleaner technology, transportation cost, environmental and social performance of enterprises.

Based on the aforementioned facts, the following hypotheses are proposed for testing.

H3a: ***Adoption of Sustainable distribution Initiatives significantly improves the environmental performance of firms.***

H3b: ***Adoption of Sustainable distribution initiatives significantly improves the social performance of firms.***

H3c: ***Adoption of Sustainable distribution Initiatives significantly improves the economic performance of firms.***

Resource & Emissions Control Initiatives

Resource and emissions control initiatives are described by Zhu *et al.* (2008) as the ability of organizations to reduce air emissions, effluent waste, and solid wastes along with collaboration with supply chain partners to reduce the collective environmental impact of activities. As mentioned throughout the literature review section of the presented thesis, businesses have begun to adopt environmental strategies due to drastic climate change resulting from an increase in GHG emissions. Enterprises are seen participating in new product developments, exploiting alternative energy sources, and setting organizational targets aimed at GHG reduction (Duc & Ba, 2017). Supply chain activities account for up to 80% of GHG emissions, mainly from production, transportation, and consumption practices (Huang *et al.*, 2009). In response to these challenges, organizations are becoming more focused on mitigating the harmful effects of their operations on the environment. Firms make use of several pollution control initiatives as well as build waste treatment plants on and off-site. Managing these issues,

however, requires large investments in technology and management training. This is seen as a drain on company resources and is viewed as a hit to profitability.

Furthermore, streamlining all these initiatives to create a win-win situation and balance the triple bottom line becomes a cumbersome task. Several studies are aimed at answering the most frequently-asked question: “Does it pay to be green?”. Golicic and Smith (2013) provide arguments in favor of enhanced environmental responsiveness and financial performance due to environmental initiatives. Several studies such as that of Giovanni and Vinzi (2014) and Zhu *et al.* (2013) also provide evidence that environmental practices along the supply chain, such as pollution control and waste management, improve firm performance, although indirectly. Zailani *et al.* (2012) and Gimenez *et al.* (2012) also provide evidence from manufacturing firms demonstrating a positive relationship between resource and emission control practices and performance of firms. Furthermore, organizations that are involved in pollution control activities and resource conservation are considered more socially responsible. This further improves stakeholder perception about the firm, which may ultimately lead to an increased customer base and improved financial performance.

The presented research aims to prove:

H4a: ***Adoption of Resource and emissions control initiatives have a significant impact on improvement in the environmental performance of firms.***

H4b: ***Adoption of Resource and Emissions Control Initiatives have a significant impact on the social performance of firms.***

H4c: ***Adoption of Resource and emissions control initiatives have a significant impact on improvement in the economic performance of firms.***

2.5. Theoretical Framework

Based on the above-mentioned concepts, the following theoretical framework is proposed.

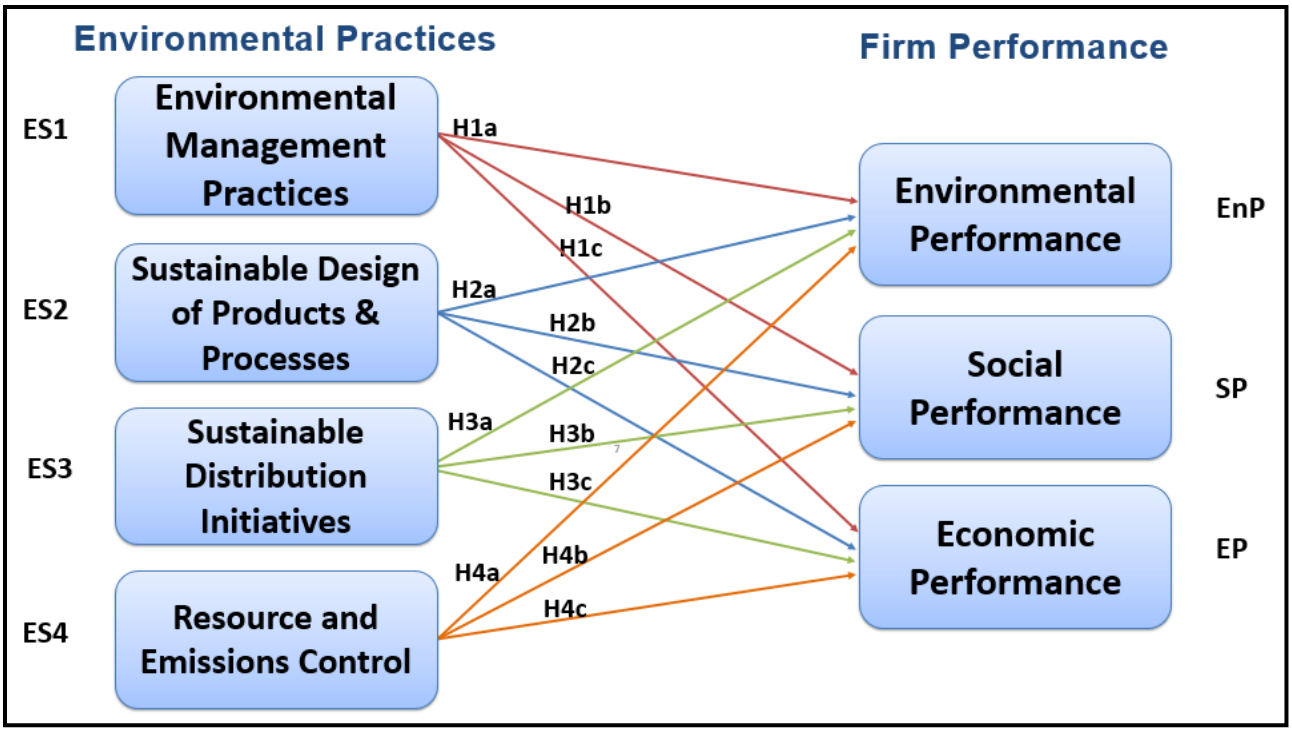

Figure 2.3: Theoretical framework of the presented study

CHAPTER 3: RESEARCH METHODOLOGY

This section provides a detailed synopsis of the research methodology adopted for the presented study. The chapter begins with the research approach and explanation of the research design. Next, target population and sample selection for the study is discussed, followed by instrument development and administration. Finally, the reliability and validity design for the research is stated.

3.1. Research Approach and Research Design

Given the main objective of the presented research that aims to find the causal relationship between environmental practices along a textile supply chain and firm performance, a quantitative approach is taken. Information is collected through a survey questionnaire in order to obtain categorical data required in order to run statistical tests.

In social sciences, research philosophy can be determined through three approaches: epistemology, ontology, and axiology (Saunders *et al.*, 2016). Based on philosophical beliefs, researchers will design their research in a different manner by adopting different philosophies (Bryman & Bell, 2015). Ontological assumptions respond to the basic question: 'what is the nature of reality?' or simply put 'what is there that can be known?' (Guba & Lincoln, 1994). Keeping in view the objectives of the research, the presented study adopts a realist ontology. Realism dictates that reality is understood only through "objective" measures. Meaning, the researcher must separate himself from the research context and only gather factual data by taking an outsider's view. Since the research aims entail a quantitative, experimental approach to determine the causal relationship between variables, the researcher, therefore, has taken an objective stance.

Ontological beliefs further dictate the epistemological beliefs of the researcher. Epistemology simply explains the relationship between the researcher and the research context (Annells, 1996). Since the focus of the research in on ascertaining facts and regularities that are observable and measurable, the implemented epistemological stance is positivism. The research focuses on the conception of credible and meaningful data through deductive methods with the underlying aim to identify causal relationships to create generalizations within the context of the research. Saunders *et al.* (2016) identify

several characteristics of deductive approach: 1) determining the causal relationship between variables; 2) hypotheses testing; 3) a well-structured methodology that facilitates replication; 4) quantitative measurement of facts that allows operationalization of concepts, and 5) representative sample size that allows generalization. As the study's main objective is to determine the level of impact of environmental practices on the performance of vertically integrated textile firms and the relationship between determining variables through acceptance or falsification of hypotheses, the deductive approach is deemed most suitable.

As mentioned earlier, one of the main objectives of this research is to explain causal relationships between environmental practices and firm performance using well-defined concepts and models. In such situations where a phenomenon is expressed in a theoretical manner with the help of propositions, the approach is mainly explanatory as opposed to exploratory, which aims at categorizing and measuring the relevant concepts in accordance with the context of research, and takes place during early stages of research (Saunders *et al.,* 2016). Furthermore, positivism categorizes all assumptions in three groups: true, false, and meaningless (neither true nor false). This categorization is observable as the research model is based on the development and validation of several hypotheses in a cross-sectional setting.

The research design for the presented study includes identifying and examining relevant variables through a review of literature, formulating hypotheses, collecting numerical information, and using statistical procedures for testing. As a method of data collection and inquiry where the nature of research is deductive, survey research is adopted as a suitable method, as suggested by Croom (2009). Since the nature of the present research concerns questions like "how are the variables related" and "to what extent the relationship holds", survey and experiment are considered appropriate strategies.

3.2. Instrument design: Survey questionnaire

To investigate the proposed model, a structured survey questionnaire was developed after a thorough review of the literature on environmental practices adopted by organizations at various stages within their supply chain. The questionnaire comprised of multiple items, which intended to measure two primary constructs: Environmental practices and firm performance. “Environmental practices” is considered a second-order variable with four sub-categories: environmental management practices; sustainable product and process design; sustainable distribution initiatives; and resource and emissions control initiatives. Firm performance is measured in the context of sustainability performance and also considered as a second-order variable. It includes three sub-categories: environmental, social, and economic performance.

Scales for each of construct were developed from literature and marginal modifications were made to include important aspects of the constructs. This was done to lessen the number of items in each sub-category. An overview of the items employed by the survey questionnaire is presented in table 3.1**.** The table also states the references from which the items were derived. Ultimately, excluding questions that inquired about company demographics, the final questionnaire included forty-three questions that covered all variables discussed in the model.

3.3. Content Validity

Content validity is assessed by the degree to which a measure represents all facets of the employed construct. To ensure content validity, a thorough review of literature is required which guarantees that the final set of questions is relevant and appropriate to the scope of the research (Bryman & Bell, 2015). Following this approach, an extensive literature review was conducted which is presented in chapter 2. The theoretical model in section 2.5 includes the final set of 43 questions used for the survey. In cases where the literature review fails to identify a definite set of measurement items (questions), the researcher needs to either modify existing items or develop new ones (Hair *et al.*, 2010). This was not necessary in the case of the presented research as during literature review various studies were identified from which an appropriate set of questions was developed as can be seen in table 3.1. A systematic review of the literature

led to the identification of essential environmental practices. Section 3.4 details the operationalization of the final seven constructs presented in the theoretical framework.

Table 3.1: Measurement items of the research

Construct	Variable	Item	Adapted From
Environmental Practices	Environmental Management Practices (ES1)	**ES01:** Adherence to environmental standards and certifications **ES11:** Presence of EMS focused on the emissions reduction **ES12:** Inclusion of environmental initiatives in strategy development, goal setting, and support from senior management **ES13:** Regular audits at different production stages to monitor material consumption **ES14:** Regular audits at different stages of production to monitor energy consumption **ES15:** Presence of a system to examine trade-offs between investments in environmental initiatives and cost performance **ES16:** Presence of internal auditing team for conducting environmental audits of the firm	Zhu *et al.* (2008) Burgos-Jimenez *et al.* (2013)
	Sustainable Product and Process Design (ES2)	**ES21**: Design of products for lower material consumption **ES22:** Design of products to avoid/reduce the use of hazardous materials. **ES23:** Design of products for minimum waste **ES24:** Use of technology in manufacturing processes for optimal use of operating resources **ES25:** Collaborating with suppliers and customers for eco-design. **ES26:** Assessment of suppliers based on their environmental performance **ES27:** Environmental audits of suppliers **ES28:** Organizing training of suppliers regarding emissions reduction practices	Bowen *et al*. (2001), Esty & Winston, (2009), Zhu *et al.*, (2008) Yu *et al.* (2014) and Claudia *et al.* (2016)
	Sustainable Distribution Initiatives (ES3)	**ES31**: Collaboration with suppliers and customers for green packaging. **ES32:** Use of eco-friendly technologies for transportation **ES33:** Product take-back from customers/retailers for recycling **ES34:** Product take-back from customers/retailers for reuse.	Zailani *et al.* (2012) Dang & Chu (2016)

	Resource & Emissions Control Initiatives (ES4)	**ES41**: Use of tools and methodologies to reduce hazardous air emissions **ES42:** Monitoring water consumption patterns for controlled consumption **ES43:** Recycling of waste water **ES44:** Recycling of solid waste **ES45:** Collaboration with other supply chain partners to reduce the collective environmental impact of activities. **ES46:** Training sessions for suppliers for understanding and reducing negative environmental impact of activities	Azevedo *et al.* (2011) Avci *et al.* (2015) Zhu *et al.* (2008) Bowen *et al.* (2001)
Firm Performance	Environmental Performance (EnP)	**EnP1:** Reduction in energy consumption during manufacturing processes. **EnP2:** Reduction in hazardous air emissions (GHG emissions). **EnP3:** Reduced consumption of hazardous materials during manufacturing **EnP4:** More efficient consumption of operating resources **EnP5:** Reduction in waste water **EnP6:** Reduction in solid waste	Daily *et al.* (2009) Gitman & Zuttler (2014) Gopal & Thakkar (2016)
	Economic Performance (EP)	**EP1:** Decrease in the cost of energy consumption **EP2:** Reduction in Inventory levels (Raw material and semi-finished) **EP3:** Increase in market share **EP4:** Increase in average return on investment **EP5:** Increase in average return on sales **EP6:** Increase in average profit of the company	Chen *et al.* (2009) De Giovanni *et al.* (2014) Green *et al.* (2012)
	Social Performance (SP)	**SP1:** Increase in job satisfaction of employees **SP2:** Improvement in occupational health/safety/working conditions for employees **SP3:** Improvement in compensation packages for employees **SP4:** Improvement in HR policies to ensure improved working conditions, equity, development, and wellbeing of employees **SP5:** Willingness to continue working for the company **SP6:** Improvement in company's corporate image	Kassinis & Soteriou (2003) Gimenez *et al.* (2012).

3.4. Questionnaire Administration

As per the official working language of Pakistan, the questionnaire was devised in English. The survey questionnaire contains three sections in addition to the introduction. The introduction section aimed to brief the reader with the purpose and number of sections in the survey. The first section of the survey aims to collect pertinent information on the characteristics of the respondents and their organizations including their titles, the organization's scope of the business, number of years in the business, and size of the organization. The second section elaborates on the level of different environmental initiatives adopted by the organization covering the four main domains introduced in the literature review. The third section solicits information on the consequent impact on the firm's environmental, social and economic performance.

Considering the research aims, an internet-mediated self-administered medium was employed for instrument administration. Self-administered questionnaires have no interviewer variability, have a wider reach in terms of geographical areas, and are more convenient for respondents (Bryman & Bell, 2015). The questionnaire was sent via Google Forms to operating-level managers working in different departments of the chosen sample of firms. An online channel was chosen due to its cost-effectiveness and convenience in terms of automating data entry for statistical testing.

3.5. Operationalization of Constructs

All constructs discussed in the model are measured using multiple-item scales. The respondents were asked to provide their answers on a five-point Likert scale. To avoid confusion, the Likert scale for environmental practices was made consistent with the scale for firm performance. For measuring the independent variable, the scale ranges from "not at all" to "implemented successfully". Responses for effect on the sustainability performance of firms (dependent variable) were measured on a five-point Likert scale ranging from "not at all" to "a lot".

The final questionnaire is provided in Appendix A**.**

3.5.1. Environmental Practices

Environmental practices is measured as a second-order variable. Its four sub-categories include environmental management practices, sustainable product and process design, sustainable distribution initiatives, and resource and emissions control initiatives.

a. Environmental Management Practices (ES1)

A seven-item scale, adopted and modified from Zhu *et al.* (2008) and Burgos-Jimenez *et al.* (2013), is used to measure the level of implementation of environmental management practices within the surveyed firms. The included items assess the level of practices through the presence of an EMS, adherence to environmental standards, regular audits for monitoring energy and material consumption, and inclusion of environmental initiatives in strategy development.

b. Sustainable Product and Process Design (ES2)

An eight-item scale adapted and modified from several sources is used to measure the extent to which the surveyed firms incorporated sustainability in the design of their products and manufacturing processes. Three items were adapted from Zhu *et al.* (2008) and Yu *et al.* (2014), four items from Claudia *et al.* (2016), and finally the last item was adopted from Esty and Winston (2009).

c. Sustainable Distribution Initiatives (ES3)

Sustainable distribution initiatives is a four-item scale measure. Similar metrics are proposed by Zailani *et al.* (2012) and Dang and Chu (2016). The items inquired about environmental practices that resulted in carbon-efficient (eco-friendly) modes of transportation, the use of green packaging, and systems for product take back for the intent to recycle or reuse. (Dang & Chu, 2016)

d. Resource & Emissions Control Initiatives (ES4)

For measuring resource and emissions control initiatives, a six-item scale was drawn and modified from various sources in the literature, the prominent being Azevedo *et al.* (2011) and Avci *et al.* (2015). The finalized set of items inquired about firm practices

regarding water, air, and land emissions and collaboration with supply chain partners to reduce the harmful impact of activities on the environment.

3.5.2. Firm Performance

Firm performance, as mentioned earlier, is a second-order variable, comprising of three parts: environmental performance, economic performance, and social performance.

a. Environmental Performance (EnP)

A six-item scale measures the environmental performance of the surveyed firms. The items measure efficient consumption of energy and operating resources, reduction in the use of hazardous materials, and reduction in water and solid waste. Items in the scale are adopted and modified from Gitman and Zuttler (2014) and Gopal and Thakkar (2016).

b. Social Performance (SP)

Social performance of the surveyed companies is measured using a six-item scale derived from the literature by Kassinis and Soteriou (2003) and Gimenez *et al.* (2012). The items measure employee-oriented factors that contribute to social sustainability in organizations.

c. Economic Performance (EP)

The economic performance of the surveyed firms is measured through six items; cost of energy; level of raw material and finished goods inventory, market share, return on investment, return on sales, and average profit. The selected metrics are proposed and validated by Giovanni *et al.* (2014) and Green *et al.* (2012).

3.6. Population and Sampling

The target population is the entire set of units from which the samples of the research study are selected. The presented research focuses on determining the relationship between the adoption of environmental practices in the textile supply chain and performance of firms. Purposive sampling has been used to select samples for data collection. The nature of sampling for this research is purposive because a pre-determined group is selected as the sample based on the objectives of the research and characteristic of the population (Saunders *et al.,* 2016).

In efforts to answer the pre-defined research question, all vertically integrated units operating in Pakistan's textile industry were considered. Employees working in head offices and regional offices of each firm were taken as the population. This selection was deemed appropriate as the data collected from the sample was expected to be reliable with the focus of the theoretical model. Exclusive focus was on selected firms within the textile industry as classified by the Pakistan Stock Exchange (PSX) and All Pakistan Textile Mills Association (APTMA). The final list comprised of 57 composite-units compiled from the sources mentioned above. The unit of analysis was senior and operating-level managers working in different departments of the sample firms. On average, the number of employees per office was 300.

Response rates vary depending on the nature of research and the target population (Bryman & Bell, 2015). In the case of online surveys conducted in the context of supply chain management and operations, Klassen and Jacobs (2001) report an expected response rate ranging between 5 to 12 percent. To ensure the credibility of the research and to attain a better response rate, employees of the organizations were approached through personal connection and through an invitation letter in collaboration with the National University of Sciences and Technology (NUST) (see Appendix B). The total number of firms, which agreed to participate in the study, was 37. On average 6 responses per firm were obtained, the researcher was able to obtain responses from 37 vertically integrated units located in Lahore, Islamabad, Multan, Faisalabad, and Karachi. Overall, 207 responses were available for statistical analysis.

Table 3.2 presents the sample statistics for the current research.

Table 3.2: Sample statistics

Sample size (n)	358
Confidence level	95%
Margin of error	5%
Number of Responses	207
Response rate	57.9 % (207/358 * 100)

3.7. Data Analysis

Having discussed the data collection technique employed in the presented research, the next step is to discuss the relevant data analysis approach. The choice of the selected approach largely depends on the purpose of the research (Hair *et al.*, 2010). The research, as discussed earlier, is explanatory in nature and aims to determine cause-and-effect relationships in order to comprehend the impact of environmental practices on the triple bottom line performance of firms. Based on the proposed multivariate theoretical model in section 2.5, it is evident that multiple relationships exist among the variables. In light of these factors, the data analysis technique applicable is structural equation modeling (SEM) (Hair *et al.*, 2014).

Structural equation modeling is a multivariate statistical analysis technique used to analyze structural relationships. This technique is in fact a combination of factor analysis and multiple regression analysis and is used to analyze the structural relationship between measured variables and latent constructs. Multiple regression analysis involves a single metric dependent variable and several metric independent variables. SEM was preferred for analysis because unlike a multiple regression analysis, it estimates the multiple and interrelated dependence in a single analysis and can accommodate multiple dependent variables. In SEM, two types of variables are used: exogenous variables and endogenous variables. Within the context of structural modeling, exogenous variables represent those constructs that exert an influence on other constructs under study and are not influenced by other factors in the quantitative model. These are similar to independent variables. Those constructs identified as endogenous are affected by exogenous and other endogenous variables in the model . They can be identified as being similar to dependent variables.

SEM includes two components : measurement model and structural model. The measurement model is the confirmatory factor analysis (CFA) and depicts the pattern of observed variables for latent constructs in the hypothesized model. A major component of CFA is the test of the reliability of the observed variables. In other words, CFA examines whether the items included in the measurement of the research concepts are consistent with the researcher's understanding of the construct and how well the collected data fit the theoretical model. Moreover, researchers also use the measurement model to examine the degree of interrelationships and covariation (or lack thereof) among the latent constructs . As part of the process, factor loadings, unique variances, and modification indexes (should a variable be dropped or a path added) are estimated to derive the best indicators of latent variables before testing a structural model.

The structural model comprises the other component of SEM. The structural model displays the interrelations among latent constructs and observable variables in the proposed model as a succession of structural equations—similar to running several regression equations. Simply put, the structural model tests all the hypothetical dependencies based on a path analysis (Hoyle, 2011; Kline, 2010).

Several software were available to run the above-mentioned analysis, however, IBM SPSS (statistical package for social sciences) version 23 and AMOS (analysis of a moment structures) module version 23 was used for CFA and SEM.

3.8. Reliability

Reliability of research is established when there is a high degree of consistency in results obtained through the selected measurement scale. Reliability is measured through internal consistency, which assesses whether the survey items actually measure the constructs they claim to measure. The most common approach to measuring internal consistency is Cronbach's alpha (Field, 2009). To verify the internal consistency of the employed constructs, this study also used Cronbach's alpha, computed through SPSS v.23. Cronbach's alpha measures the consistency of research items by estimating how closely they are related as a group (Hair *et al.*, 2012). The acceptable value for Cronbach's alpha is 0.60; however, a value of 0.70 or above indicates high construct

reliability. The results discussed in section 4.3 indicate that all values are above 0.70, signifying high construct reliability (Cronbach, 1987; Hair *et al.*, 2010).

Furthermore, to test convergent validity, Average Variance Extracted (AVE) and Composite Reliability (CR) scores were calculated. AVE is the quantity of variance captured by a construct as compared to the magnitude of variance captured due to measurement error (Fornell & Larcker, 1981). The recommended threshold for AVE is 0.5 and 0.6 for CR. However, if AVE is less than 0.5 but the composite reliability (CR) score is higher than 0.6, then the convergent validity of the construct is acceptable (Fornell & Larcker, 1981).

3.9. Ethical Considerations

In any research conducted in the context of social sciences, research ethics play a crucial role. According to (Saunders *et al.,* 2016), research ethics constitute the behavior of the researcher towards the research subjects. Informed consent, the confidentiality of information, no harm to participants, and voluntary participation are key aspects, which are central to any research project (Bryman & Bell, 2015). These considerations were addressed by ensuring that the participants understood the objectives of the study and that their participation was voluntary. Each questionnaire included a brief overview of the research topic and stated that by continuing to complete the survey, the participant is agreeing to provide informed consent. Moreover, participating firms have ensured the anonymity of research participants and the confidentiality of the provided data. Participants were also ensured that the acquired data would be used only for academic purposes and will not be distributed to any third party. Additionally, to avoid the issue of time consumption, the questionnaire was kept short and relevant to the research objectives and took an average of 13-14 minutes per participant to complete.

CHAPTER 4: RESULTS AND INTERPRETATION

This chapter focuses on the presentation of results of data analysis methods discussed in the previous chapter. The analysis is divided into two sections: examining the reliability and validity of data and testing the hypotheses to understand the causal relationships between variables. The chapter begins with statistics relating to the distribution of data. The next section gives an overview of descriptive statistics of respondents, moving towards issues related to multicollinearity, reliability, and common method bias in the succeeding sections. Confirmatory factor analysis is performed in the subsequent section to evaluate the fitness of the measurement model. Lastly, regression analysis is performed to test the posited hypotheses.

4.1. Statistical Distribution of Data

Field (2009) states that two issues related to data must be addressed before proceeding with any statistical analysis. The first issue is missing data. Since the survey was conducted through an online platform, the presence of missing data was avoided by using a feature that prevented the submission of the questionnaire in case any question was unanswered. The second issue is related to data normality. To check whether the data were distributed normally, the data set was exported to SPSS, and summary values (average) for each response for the constructs were calculated. Descriptive statistics for the data were then computed, along with the skewness and kurtosis coefficients. These two coefficients are used as indicators of data normality (Field, 2009). Skewness is simply the measure of variation in the frequency distribution of data from a normal distribution. A positive value for skewness indicates that the tail on the right side of the distribution curve is longer than on the left side.

Majority of the variables have a negative skewness value, which indicates that bulk values/responses lie to the right of the mean. This was anticipated as the majority of the responding firms were expected to have implemented or been in progress of adopting environmental practices, hence mostly choosing values from 3 to 5 as their responses for the said practices. Kurtosis, on the other hand, indicates if the “tails” of the distribution curve contain extreme values. Negative kurtosis indicates that in comparison with the

normal curve with the same mean and standard deviation (SD), the data distribution is flatter.

For the data to be normally distributed, the coefficients must lie between the recommended range of -2 and +2 (Field, 2009). Some sources also report the recommended range to be -1 and +1. Based on the results shown in table 4.1, we assume data normality as all values lie within the recommended range. Figure 4.1 shows histograms for each employed construct with their normal curves.

Table 4.1: Distribution statistics

Construct	N	Min	Max	Mean	SD	Skewness	Kurtosis
ES1	207	3.0	5.0	4.23	0.498	-0.739	-0.055
ES2	207	3.0	5.0	4.28	0.495	-0.833	+0.027
ES3	207	3.0	5.0	4.20	0.460	-0.755	+0.397
ES4	207	3.0	5.0	4.58	0.308	-0.434	-0.555
EnP	207	3.0	5.0	4.29	0.487	-0.186	-0.559
SP	207	2.0	4.3	3.24	0.491	-0.253	-0.094
EP	207	2.0	4.5	3.30	0.512	+0.077	+0.133

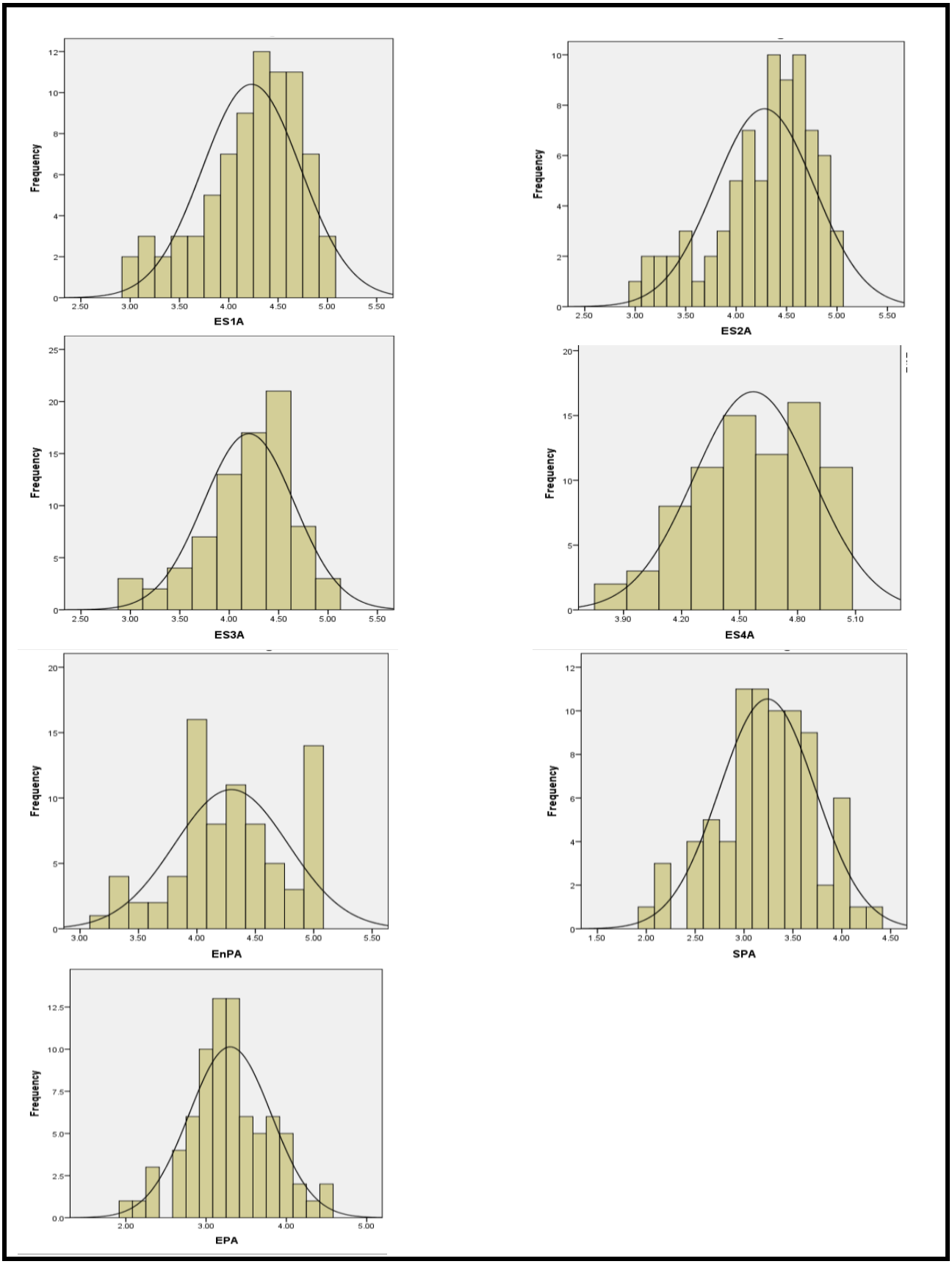

Figure 4.1: Normal distribution of data

4.2. Descriptive Statistics

This section presents the demographic data of the data collected from 207 respondents**.**

Table 4.2: Demographic profile

Item Description	Frequency	Percentage
Total no. of responding firms	34	
No. of employees		
Less than or equal to 100 employees	0	0
100-250 employees	9	4.3
251-500 employees	28	13.5
501-1000 employees	47	22.7
More than 1000 employees	**123**	**59.4**
Total	207	100
No. of years in business		
1-10 years	0	0
11-20 years	0	0
21-35 years	96	46.4
More than 35 years	**111**	**53.6**
Total	207	100
Department		
Operations	**36**	**17.4**
Accounts and Finance	**34**	**16.4**
General Manager	**25**	**12.1**
Human Resource	25	12.1
Product Development	18	8.7
Supply Chain	18	8.7
Procurement	17	8.2
Other	12	5.8
Managing Director/Director	9	4.3
Marketing	9	4.3
Health and Safety	4	1.9
Total	207	100

Table 4.2 summarizes the demographic profile of the respondents. 19 out of 34 (57%) head offices of the responding firms were located in Lahore, 19% in Karachi , 14% in Faisalabad and the remaining 10% were located in Islamabad and Multan as can be seen in figure 4.2. On average, 300 employees were working in each head office making the population size 17,100. Additionally, 36% of the responding firms reported Denim apparel and fashion as their main product line. The remaining firms belonged to the categories as mentioned in figure 4.3.

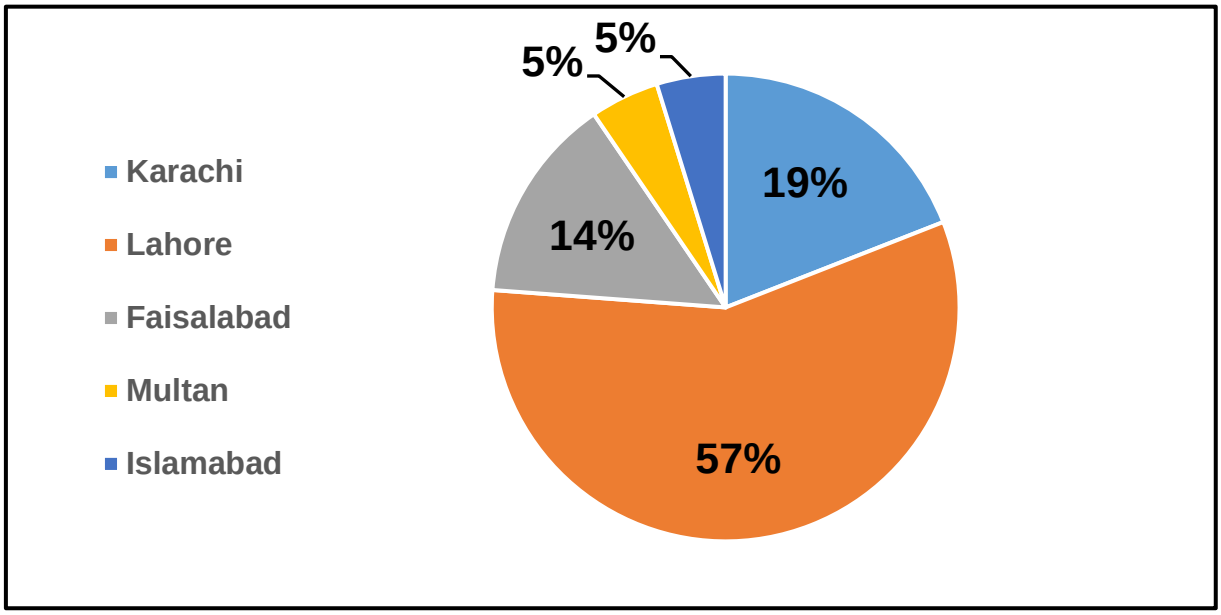

Figure 4.2: Location of responding firms

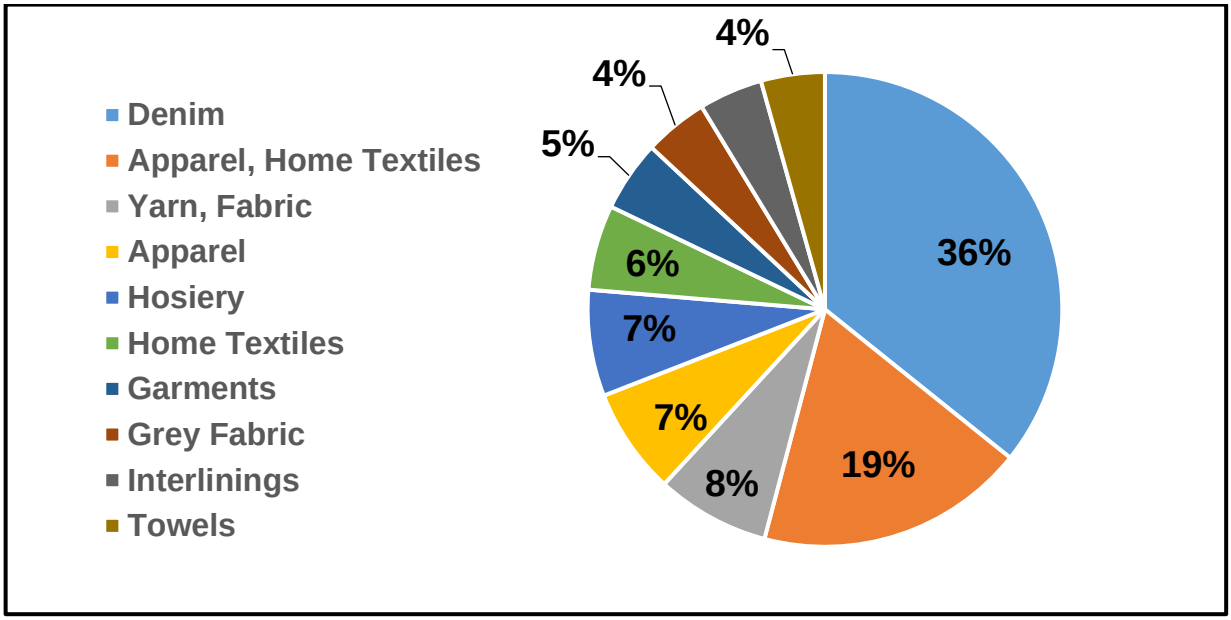

Figure 4.3: Main product line of the responding firms

4.3. Reliability, Convergent and Discriminant Validity

The reliability of the measurement scale used in the presented study was assessed by computing Cronbach's Alpha (α) through SPSS v.23. Correlation simply tells the strength of association between two variables The value of correlation coefficient (r) shows the extent of change in a variable based on the change in another variable. If no relationship exists between any of the paired variables, the analysis may be redundant (Kaplan, 2004). All hypothesized relationships in the theoretical model have positive and significant correlation coefficients. Since all values are positive, this shows that if one variable increases, the other variable will increase as well. The results of the reliability analysis and correlation are presented in table 4.3. All values for α were found to be above the recommended threshold of 0.60 and ideally 0.70, as suggested by Hair *et al.* (2010). This indicates high construct reliability for the posited model. This proves the existence of internal consistency among the research variables and that the measurement items for each construct represents the latent variable it is supposed to represent (Kaplan, 2004; Hair *et al.*, 2010). Moreover, as evident from table 4.3, all of the values for **r** appear to be below the maximum threshold of 0.8. This also relieves any concerns that may arise for multicollinearity between variables.

Table 4.3: Correlation, reliability, convergent and discriminant validity

	Items	Cronbach's Alpha	CR	AVE	MSV	ES1	ES2	ES3	ES4	ENP	SP	EP
ES1	6	**0.827**	0.931	0.771	0.306	0.878						
ES2	8	**0.851**	0.967	0.787	0.401	0.413	0.887					
ES3	4	**0.837**	0.982	0.931	0.398	0.553	0.601	0.965				
ES4	6	**0.824**	0.924	0.715	0.282	0.355	0.531	0.367	0.846			
ENP	6	**0.851**	0.905	0.658	0.255	0.424	0.461	0.449	0.375	0.811		
SP	6	**0.823**	0.943	0.769	0.401	0.488	0.633	0.375	0.478	0.446	0.877	
EP	6	**0.849**	0.923	0.707	0.364	0.402	0.512	0.603	0.380	0.505	0.484	0.841

Note: ES1=Environmental Management Practices; ES2=Sustainable Design for Products and Processes; ES3=Sustainable Distribution Initiatives; ES4=Resource and Emissions Control; EnP=Environmental Performance; EP=Economic Performance; SP=Social Performance; CR= Composite Reliability; AVE= Average Variance Extracted; MSV= Maximum Shared Variance

4.4. Multi-collinearity Analysis

Variance Inflation Factor (VIF) is the most commonly used measure, which assesses the level of multicollinearity (Hair *et al.*, 2010). The recommended threshold of VIF scores is 5, a value of less than 5 guarantees that collinearity is not an issue in the model. However, according to Lee and Hong (2016), the model should have a tolerance of less than 1 and VIF score less than 3. SPSS was used to calculate the VIF value and tolerance score for each regression coefficient. All VIF values are less than 3, ranging from 1.324 to 1.783 as can be seen in table 4.4. Moreover, the tolerance level for each coefficient is less than 1. These values suggest that multicollinearity is not an issue in the proposed model.

Table 4.4: Variance inflation coefficients

Coefficients

Model		Collinearity Statistics	
		Tolerance	VIF
1	Sustainable Design for Products and Processes	.563	1.776
	Sustainable Distribution Initiatives	.652	1.533
	Resource and Emissions Control	.706	1.417

a. Dependent Variable: Environmental Management Practices

Coefficients

Model		Collinearity Statistics	
		Tolerance	VIF
1	Environmental Management Practices	.712	1.405
	Sustainable Distribution Initiatives	.638	1.567
	Resource and Emissions Control	.832	1.202

a. Dependent Variable: Sustainable Design for Products and Processes

Coefficients

Model		Collinearity Statistics	
		Tolerance	VIF
1	Environmental Management Practices	.852	1.173
	Sustainable Design for Products and Processes	.660	1.515
	Resource and Emissions Control	.716	1.396

a. Dependent Variable: Sustainable Distribution Initiatives

Coefficients

Model		Collinearity Statistics	
		Tolerance	VIF
1	Environmental Management Practices	.707	1.141
	Sustainable Design for Products and Processes	.660	1.516
	Sustainable Distribution Initiatives	.549	1.820

a. Dependent Variable: Resource and Emissions Control

4.5. Measurement Model: Confirmatory Factor Analysis

Confirmatory factor analysis (CFA) assesses the consistency of the researchers' understanding of the measurement items employed for the research constructs (Schumacker & Lomax, 2010). There are certain criteria, known as the goodness of fit indices, which assess whether the measurement model is a good fit. Six indices, which are central for "goodness-of-fit", are the relative Chi-square ($\chi 2$) ratio, normed fit index (NFI), comparative fit index (CFI), incremental fit index (IFI), root mean square error of approximation (RMSEA) and non-normed fit index (NNFI) also called the Tucker Lewis Index (TLI). AMOS v.23 was used to run CFA. The results, presented in table 4.5, show that the values for NFI, IFI, and TLI are as per the recommended threshold. Initially, the Chi-square ratio was higher than 3. It was reduced by covarying certain measurement items, as suggested by the output indices in AMOS v.23 and removing factors that were either contributing negatively to the variable or showing low contribution. Hence, the measurement model was modified to achieve the results presented in table 4.5. We conclude that the overall results are satisfactory, showing a good model fitness.

Table 4.5: Model fit indices

Overall fit for the model			
	Before Correlating	**After Correlating**	**Acceptable Fit**
Chi-square/degree of freedom (χ2/df)	2.216	**1.465**	**3 or less**
Normed Fit Index (NFI)	0.843	**0.911**	**0.90**
Relative Fit Index (RFI)	0.860	**0.900**	**0.90**
Comparative Fit Index (CFI)	0.910	**0.970**	**0.90**
Incremental Fit Index (IFI)	0.910	**0.970**	**0.90**
Root mean square error of approximation (RMSEA)	0.074	**0.047**	**x<0.08**
Tucker Lewis Index (TLI)	0.903	**0.966**	**0.90**

The following figure from CFA conducted through AMOS shows the factor loadings of each item along with co-variation among constructs.

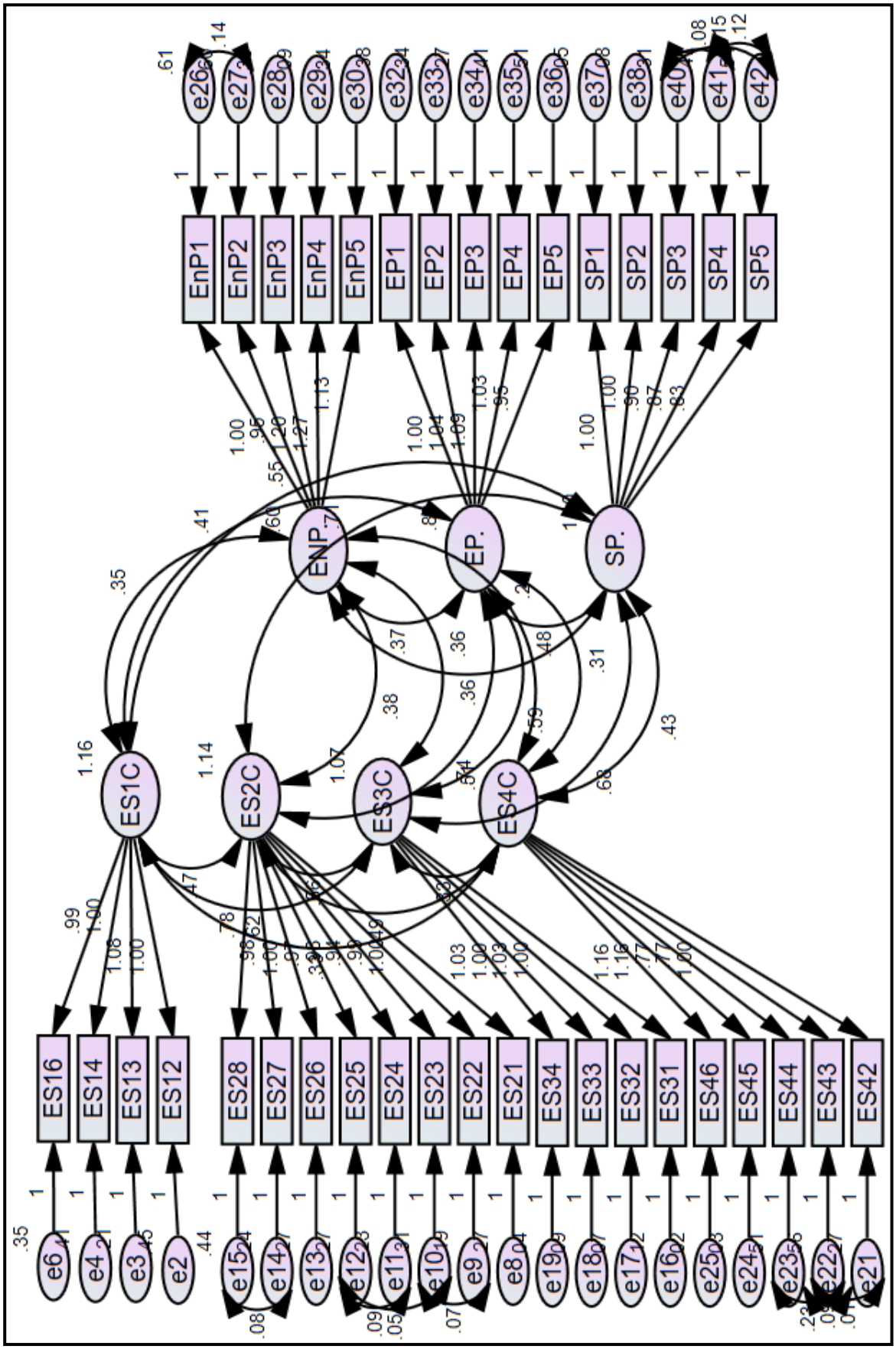

Figure 4.4: Confirmatory factor analysis model

4.6. Structural Model: Hypotheses Testing

To test the impact of independent on the dependent variables, structural equation modelling (SEM) were done through AMOS. Section 3.7 elaborates on the choice of SEM as the method of analysis.

4.6.1. Structural Equation Modelling

To analyze the effect of different sustainability practices on three performances of firms, the structural equation modeling (SEM) is performed. The effect of each practice on each of the three performances is computed along with P-value against that effect. The decision to accept or reject the hypothesis is based on the P-value against the estimated effect because effects with P-value < 0.05 are considered as significant effects while other effects with P-value > 0.05 are insignificant. Following table provides the summary of SEM results found for the current relationships.

Table 4.6: Structural equation modelling results (Path Analysis)

Path			Unstandardized Estimate	Standardized Estimate	S.E.	C.R.	P	Hypothesis
ENP	<---	ES1	.126	.156	.059	2.126	.033	H1a
SP	<---	ES1	.128	.143	.052	2.484	.013	H1b
EP	<---	ES1	.066	.074	.059	1.120	.263	H1c
ENP	<---	ES2	.187	.214	.070	2.654	.008	H2a
SP	<---	ES2	.306	.317	.061	4.992	.000	H2b
EP	<---	ES2	.166	.173	.070	2.374	.018	H2c
ENP	<---	ES3	.153	.178	.070	2.178	.029	H3a
SP	<---	ES3	.283	.298	.061	4.640	.000	H3b
EP	<---	ES3	.369	.391	.070	5.295	.000	H3c
ENP	<---	ES4	.090	.087	.073	1.223	.003	H4a
SP	<---	ES4	.191	.168	.064	2.994	.221	H4b
EP	<---	ES4	.133	.117	.073	1.818	.069	H4c

The results of table 4.6 are depicting that the adoption of environmental management practices has a significant and positive effect on environmental as well as

social performance because p-value against both these effects is less than 0.05. Therefore, it can be suggested that the increased adoption of environmental management practices by the firm will enhance the environment as well as the social performance of the firm. However, the impact of environmental management practices on economic performance (**H1c)** is not getting significant support of current results because p-value against the effect of environmental management practices on the economic performance is higher than 0.05.

The next sustainability practices tested in terms of its effect on the three-fold performance of the firm is the adoption of sustainable product and process design. The results depict that the adoption of sustainable product and process design has a significant and positive effect on environmental, economic, as well as social performance because p-value against all these effects is less than 0.05. Therefore, it can be concluded that increased adoption of sustainable product and process designs by the firm will enhance its environmental, economic, and social performance. Hence, hypotheses **H2a, H2b,** and **H2c** are accepted.

Results regarding the effects of adopting sustainable distribution initiatives on environmental, social, and economic performance depict that adoption of sustainable distribution initiatives by the firm will enhance its environmental, economic, and social performance as evident from the p-value against all these effects being less than 0.05. Hence hypotheses **H3a, H3b,** and **H3c** are accepted.

The last sustainability practice analyzed in the current study in terms of its influence on three-fold performance is the resource and emission control initiatives taken by the firm. The results show that resource and emission control initiatives taken by the firm will enhance environmental performance of the organisation as the p-value against this effect is greater than 0.05. However, the effects on the social and economic performance are not getting significant support from current results because p-value against both these effects is higher than 0.05 (**H4b** and **H4c**). Figure 4.5 shows the structural equation model tested in the current study:

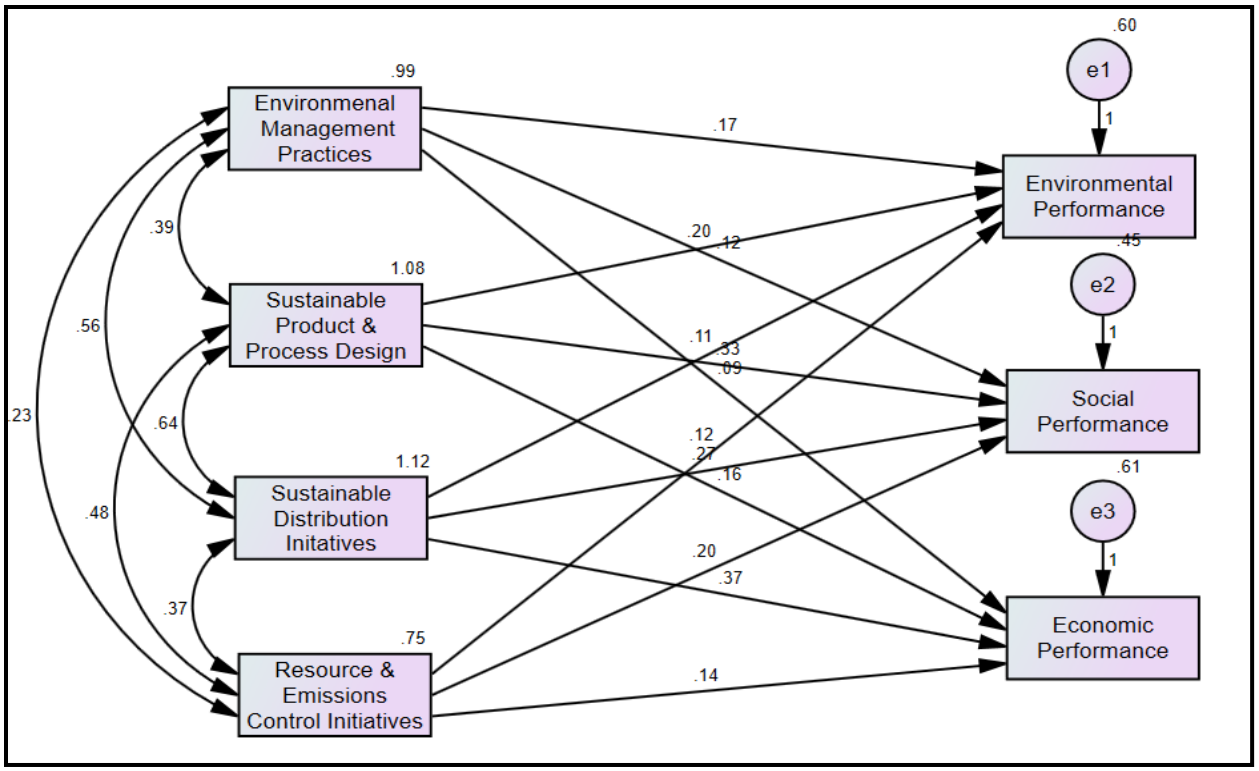

Figure 4.5: Structural equation model (Path analysis)

The results of the hypotheses are summarised in the table 4.7.

Table 4.7: Summary of hypotheses

Hypothesis	
H1a: *Adoption of Environmental management practices have a significant impact on improvement in environmental performance of firm.*	*Accepted*
H1b: *Adoption of Environmental management practices have a significant impact on improvement in social performance of firm*	*Accepted*
H1c: *Adoption of Environmental management practices have a significant impact on improvement in economic performance of firm*	*Rejected*
H2a: *Adoption of Sustainable design for products and processes significantly improves environmental performance.*	*Accepted*
H2b: *Adoption of Sustainable design for products and processes significantly improves social performance*	*Accepted*

H2c: *Adoption of Sustainable design for products and processes significantly improves economic performance*	*Accepted*
H3a: *Adoption of Sustainable distribution Initiatives significantly improves environmental performance of firms.*	*Accepted*
H3b: *Adoption of Sustainable distribution initiatives significantly improves social performance of firms*	*Accepted*
H3c: *Adoption of Sustainable distribution Initiatives significantly improves economic performance of firms*	*Accepted*
H4a: *Adoption of Resource and emissions control initiatives have a significant impact on improvement in environmental performance of firms.*	*Accepted*
H4b: *Adoption of Resource and Emissions Control Initiatives have a significant impact on social performance of firms*	*Rejected*
H4c: *Adoption of Resource and emissions control initiatives have a significant impact on improvement in economic performance of firms*	*Rejected*

These results are discussed further in detail in Chapter 5.

CHAPTER 5: DISCUSSIONS AND CONCLUSION

This chapter elaborates on the research findings presented in the previous section. The purpose of this chapter is to relate back to the objectives of the presented study and assess the empirical results. Hence, this chapter offers important insights and final observations in relation to the literature review and the results of statistical analyses of data. Limitations of the research and future research directions are also stated in the chapter.

5.1. Discussion

The current study examines the influence of the adoption of environmental management practices, sustainable product and process design, sustainable distribution initiatives, and resource and emission control initiatives on the economic, social, and environmental performance of vertically integrated textile firms in Pakistan. Enterprises have started to adopt environmental practices in order to optimize their supply chain networks for reduced social and environmental impacts for the entire industry. Supply chain activities, such as materials acquisition, manufacturing, reverse logistics, recycling etc., if not managed appropriately can negatively affect not only the financial performance of the firm but also the community and the surrounding environment. The results stated in Chapter 4 demonstrate the link between environmental practices and the overall performance of firms, the details of which are provided hereafter.

In response to the first hypothesis **H1a**, it is found that the adoption of environmental management practices has a significant positive impact on the environmental performance of a firm. Therefore, this hypothesis is accepted. These results are in line with previous studies e.g. (Bansal & Roth, 2000; Beske *et al.*, 2014; Bindal & Dwivedi, 2013; Lintukangas *et al.*, 2015). A business' compliance with environmental legislations satisfies its eco-conscious customers as well as helps organizations achieve international standards necessary for global reach. As the findings of this research state that environmental management systems focused on resource monitoring and emissions control form the basis of sustainable development of

organizations, the consequent results are seen in the form of reduced environmental costs.

In response to the second hypothesis **H1b,** it is found that the adoption of Environmental management practices has a significant positive impact on the social performance of firm. Therefore, this hypothesis is also accepted. These results are in line with previous studies e.g. (Ahmad, 2015; Benn *et al.*, 2014; Bohdanowicz *et al.*, 2011; Wang & Dai, 2017). In response to hypothesis **H1c** however, it is observed that there is no significant positive effect of environmental management practices on economic performance. These results are aligned with the findings of Kassinis and Soteriou (2003) who also do not support the positive role of environmental management practices on the economic performance of firms. However, these findings are contrary to numerous studies that support the positive role of these practices on economic performance e.g. (Rao & Holt, 2005; Schaltegger & Synnestvedt, 2002).

In terms of economic performance, activities such as waste reduction planning, effluent treatment plants, EMS, regular auditing of operations, and employee training require considerable amounts of investment. These initiatives come as a drain on the company's resources. Evidence from a research-based in China shows minor improvements in a firm's environmental performance and no significant enhancement in economic performance (Zhu & Sarkis, 2007). Many other researchers, such as Hillman and Keim (2001) and Gilley *et al.* (2000) supported the argument that firm efforts to incorporate environmental management systems and similar organization-wide practices may cause firms to incur heavy costs in form of investments and without any short-term financial benefits.

However, this can be debated as the long-term benefits associated with these investments are diverse. As mentioned in this text as well, this study is cross-sectional in nature. These effects can be further evaluated in a longitudinal study given that attention is given to choosing the right set of practices. For the purpose of this study, we can conclude that firms can enhance their environmental as well as social performance through adopting environmental management practices while the economic performance (short-term) may not be positively affected.

The second category of hypotheses was about the role of sustainable design of products and processes in improving triple bottom-line performance of firms. Results of the current study show that all three performances are significantly and positively affected if firms focus on improving the design of products and processes to be more sustainable. Therefore, all hypotheses claiming improvement in all three dimensions of firm performance due to the adoption of practices for sustainable product and process design (**H2a**, **H2b**, and **H2c)** are accepted**.** These results are in line with previous studies that highlight the positive contribution of sustainable productand process design initiatives of firms towards their economic, environmental, and social performances in different studies. Some of those studies are (Geng *et al.*, 2017; Savita *et al.*, 2016; Wong *et al.*, 2012; Zailani *et al.*, 2012; Zhu & Sarkis, 2004).

As mentioned earlier, environmental performance is measured by the ability of an organization to reduce harmful effects on the surrounding environment. Sustainable product design allows recycling and reuse of the products, which is crucial in terms of textile products as there is a culture of non-eco-friendly culture of clothing disposal in Pakistan. Hence, organizations that invest in initiatives, such as product take-back, are considered more environmentally friendly and have a better image in the global market as firms that focus on resource conservation and recycling options for consumers. Due to these reasons, environmental as well as the social performance of the enterprises are positively influenced. Improvement in these two areas results in improves the social image of the company in eyes of the stakeholders and thus results in better financial benefits. These outcomes are in accordance with the research findings of Younis *et al.* (2016).

The third category of hypotheses tests the role of sustainable distribution initiatives taken by firms. The results of the current study show that the triple bottom line performance of firms is significantly and positively affected by taking sustainable distribution initiatives. Therefore, **H3a**, **H3b**, and **H3c** are all accepted. These results are consistent with findings of previous studies e.g. (Glock & Kim, 2015; Ramanathan & Gunasekaran, 2014; Soosay & Hyland, 2015). The outcomes of the analysis also imply a significant positive impact of acquiring environment-friendly transportation methods on environmental performance. Use of transportations modes which focus on fuel consumption not only results in resource conservation and lower emissions of hazardous

gases into the environment thus improving environmental performance. Findings of Wong *et al.* (2012) are also in support of this finding.

The last sustainability practice tested in the current study in terms of its effect on the three-fold performance of the firm is the resource & emission control initiatives taken by the firm. Results reveal that only **H4a** is accepted because resource and emission control initiatives positively affect the environmental performance while **H4b** and **H4c** are rejected because adoption of resource and emission control initiatives does not show any significant effect on neither social nor economic performance of the firm. Results of **H4a** are aligned with many previous studies e.g. (Golicic & Smith, 2013; De-Giovanni & Vinzi, 2014; Zailani *et al.,* 2012; Zhu *et al.*, 2013). These researches also suggested that initiatives taken by firms with respect to resource & emission control play a positive role in enhancing the firm's performance. However, the results of **H4b** and **H4c** are contrary to those previous studies. This difference of findings may be due to the different context of studies. Initiatives taken by the organization to reduce harmful emissions into the society, such as recycling of waste and use of low carbon technologies and green packaging, depict a negative relation with the employee-oriented social performance of firms. This is understandable as these could be of little value to the employees and would not directly affect their safety or working conditions.

The study further shows that such initiatives do not contribute towards improvement in employee-oriented social performance as it may be of little importance to the employees as not only their responsibilities will be increased (more environmental regulations to follow at every job-level) but also these initiatives may result in demand for employees that have more expertise in this regard. Employee job satisfaction is associated more with factors like job security, flexibility at the workplace, perquisites, and a lesser workload, hence the resulting negative impact.

In reference to **H4c**, this may be because of the financial drain these initiatives cause on the company's financial resources and, unlike product and process design initiatives towards sustainability, are not a one-time investment for the firm.

In terms of employee-oriented social performance of firms, the results imply a significant and positive impact of environmental practices (except **H4b**). However, this concept can be put up for discussion, as the social performance dimension may not be

directly affected by implementing environmental practices. Melnyk *et al*. (2003) also supported the perception. The reason for this could be that implementing social policies and codes of conduct across all tiers of the working classes is a complicated task, especially in vertically integrated companies, which have a large number of employees. Moreover, given the comprehensive nature and scope of these policies, top and middle management support is required in policy development. Safer working conditions for employees due to lower emissions during manufacturing processes should have a positive relationship with the social performance of the firm.

However, this effect would also be indirect, as implementing environmental management practices affects the environmental performance of the firm, which indirectly affects social performance. Hence, the outcome of this research is a negative relationship between them both. Moreover, the scope of environmental practices is limited to more export-oriented organizations; therefore, there may be the presence of regulatory policies and social frameworks due to strict international monitoring systems that these firms must adhere to. The case could be different for organizations that only operate domestically. This can be further explored in future research dimensions.

5.2. Conclusion

The current study aimed to examine the influence of the adoption of environmental management practices, sustainable product and process design, sustainable distribution initiatives, and resource and emission control initiatives on the economic, social, and environmental performance of the firm. For this purpose, the textile sector of Pakistan was selected from which the data has been collected through a survey questionnaire. The analysis of the collected data through SEM reveals that the adoption of environmental management practices has a significant positive impact on the environmental and social performance of firms while it has no significant effect on the economic performance of the firm. Results further reveal that the sustainable design of products & processes and sustainable distribution initiatives taken by firms significantly enhance the environmental, social, and economic performance of firms. Further to this, it has been found that the resource & emission control initiatives can significantly enhance the environmental performance, however; they have no significant potential to enhance the social and economic performance of the firm.

5.3. Research Limitations and Future Directions

Due to globalization, companies are under immense pressure from stakeholders to not only improve their economic performance but also focus on environmental and social outcomes of their operations (Pagell & Wu, 2009). In recent decades, environmental initiatives and the related trade-offs between environmental performance, economic outcomes, and social influences have gained critical importance for researchers and practitioners. Based on the outcomes and limitations of the presented study, the following areas are proposed for further investigations

The study was cross-sectional and a longitudinal approach to the research topic has not been carried out. Given the scope and complexity of a supply chain, strategic incorporation of environmental initiatives throughout the supply chain operations is a time-intensive task. Moreover, the effects of such initiatives appear after a time lag. Hence, a longitudinal study is required to analyze and report the results from a long-term perspective. Besides, performance outcomes (environmental, social, and economic) may have dynamic impacts on one another over time. Hence, a longitudinal study using the same instrument would provide further clarity on the topic.

The research only targeted Pakistan's textile industry, specifically the supply chain of vertically integrated textile units. Different industries may employ different operations strategies as well as environmental practices. Hence, environmental issues from the perspective of different industries in Pakistan can be explored. The cement industry is one of the largest contributors to global GHG emissions (Chathan House Report, 2018). Hence, the scope of the presented research can be broadened by studying environmental practices in Pakistan's cement industry. Furthermore, the research model proposed in section 2.5 was developed by keeping large-scale vertically integrated units in view. It can be modified to include service industries and small-scale retailers as well. Furthermore, as the current study, its findings, and suggestions are limited to the textile sector of Pakistan so, they cannot be generalized to other sectors and nations.

The research focuses on three performance outcomes: environmental, social, and economic. The scope of the research can be broadened to include operational and market-based performance dimensions of the organizations as well. Moreover, additional constructs and relationships could be added to the model , which would require additional

theoretical justifications and data collection. The current study considers only four sustainability practices for examining their impact on the triple bottom line of the firm while there are numerous sustainability practices that can be adopted by firms depending on the sector and business model. As this would have complicated the present model, it was not feasible within the scope of the current research. Future researchers should assess different sustainability practices in terms of their contribution to firm performance. Furthermore, future researchers are suggested to conduct cross-sector as well as cross-country comparisons of the contribution of those sustainability practices towards the firm's three-fold performance

Lastly, this study is carried out from an SSCM context. Other programs as just-in-time (JIT), lean manufacturing, and the concept of agility may be integrated into the research model. Such programs are designed to enhance waste management and elimination capabilities of a firm and will support the minimization of negative environmental impacts of operations. The connection of these programs to the SSCM concept will be an interesting addition to research.

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APPENDIX A: Questionnaire

Impact Environmental Practices on Triple bottom line: Insights from Vertically Integrated Textile Units in Pakistan

The term "**sustainability"** integrates environmental, social and economic responsibilities with the aim to improve firm performance in all three dimensions.

Dear, Sir/Madam,

You are requested to participate in this study, which is a part of MS research thesis. The study aims to find the i**mpact of Adopting Environmental Practices on Performance** of textile composite (vertically integrated) firms in Pakistan.

Please note that by continuing the survey, you are agreeing to provide informed consent. Please be assured that your responses will be kept confidential and the collected data will be used for academic purposes only. If you have any questions related to the research topic, please feel free to contact me on **amnafida@live.com**.

If you would like to receive the results of this research, please include the name and postal address of your organization, along with your official email address.

Regards,
Amna Fida

MS Logistics & Supply Chain Management

NUST Business School

The questionnaire consists of three parts and will take 15 minutes to complete.

Part A

Name of the organization: (optional)				
Email address: (optional)				
Number of years in business:				
1-10	11-20	21-35	More than 35 years	
Number of employees:				
Less than or equal to 499	500-999	1000-2500	2501-5000	More than 5000
Main Product Line:				
Your designation:				

Part B

Our Company has the following certification(s)	YES	NO	YEAR
1. **ISO 9000** (Quality management and assurance)			
2. **ISO 14000** (For reduction in industrial waste and environmental damage)			
3. **GOTS** (Global Organic Textile Standard) (Limits use of toxic materials during production processes)			
4. **OCS** (Organic Content Standard) (Verifies the content of organically grown materials in the final product)			
5. **GRS** (Global Recycle Standard) (Verifies the use of recycled material in finished products and during processes)			
6. **OEKO-TEX®** (Testing and certification system for raw, semi-finished, and finished textile products at all processing levels)			
Please mention if your organization holds any other such certifications:			

Please answer the following questions, ranging your answers between:

1: *Not at all* ***2:*** *Plan for near future* ***3:*** *Implementation in progress* ***4:*** *Implemented recently* ***5:*** *Implemented successfully.*

Our Organization employs following practices						
		1	**2**	**3**	**4**	**5**
1	Has an Environmental Management System focused on emissions reduction (air, soil, water)					
2	Inclusion of environmental/green initiatives in strategy development, goal setting, and support from senior management					
3	Conducts audits at different stages of production to monitor material consumption					
4	Conducts audits at different stages of production to monitor energy consumption					

5	There is a system in place to examine the trade-offs between investments in environmental initiatives and cost performance					
6	Internal auditing team for conducting environmental audits of the firm					

Our Organization employs following environmental practices w.r.t Product and Process design						
		1	**2**	**3**	**4**	**5**
1	Design of products for lower material consumption					
2	Design of products to avoid/reduce use of hazardous materials					
3	Design of products for minimization of waste (recyclable, reusable products)					
4	Use of “CleanTech” in manufacturing processes- for optimal use of operating resources (water, energy, material) and lower waste generation rates					
5	Collaborating with suppliers and customers for eco-design					
6	Assessment of suppliers based on their environmental performance					
7	Environmental audits of our suppliers					
8	Organizing trainings for suppliers regarding emissions reduction practices					

Our Organization is employing following environmental practices w.r.t distribution of products						
		1	**2**	**3**	**4**	**5**
1	Collaboration with suppliers and customers for green packaging					
2	Use of eco-friendly technologies for transportation (low carbon emissions, better fuel consumption)					

3	Product take-back from customers/retailers for *recycle*. **(reprocessing used materials into new raw material/products)**					
4	Product take-back from customers/retailers for *reuse*. **(putting an item to same or a different use, after its original function is fulfilled)**					

Our Organization is employing following practices for resource and emissions control						
		1	**2**	**3**	**4**	**5**
1	Use of tools and methodologies to reduce overall carbon emissions (in manufacturing and transportation activities)					
2	Monitoring water consumption patterns for controlled consumption					
3	Recycling of waste water					
4	Recycling of solid waste					
5	Use of technologies for reducing hazardous air emissions					
6	Collaboration with other supply chain partners to reduce collective environmental impact of activities					
7	Training sessions for suppliers for enhanced understanding and reducing environmental impact of their operations					

Part C

Please answer the following questions, ranging your answers between:

1: *Not at all* ***2:*** *A little* ***3:*** *Average* ***4:*** *Greatly* ***5:*** *A lot*

	By adopting above-mentioned practices, our company has achieved the following:	**1**	**2**	**3**	**4**	**5**
1	Reduction in energy consumption during manufacturing processes					
2	Reduction in hazardous air emissions (GHG emissions)					
3	Reduced consumption of hazardous materials during manufacturing					
4	More efficient consumption of operating resources (water, energy, production material etc.)					
5	Reduction in waste water					
6	Reduction in solid waste					
7	Improvement in company's corporate image					
8	Decrease in cost of energy consumption					
9	Reduction in Inventory levels (Raw material and semi-finished)					
10	Increase in market share					
10	Increase in average return on investment					
11	Increase in average return on sales					
12	Increase in average profit growth of the company					
13	Increase in job satisfaction of employees					
14	Improvement in safety/working conditions for employees					

15	HR policies to ensure improved working conditions, equity, development, and wellbeing of employees					
16	Do you see yourself associated with the organization in the next 5 years?					

Thank you for your time and effort to fill out the questionnaire.

APPENDIX B: Letter

To Whom It May Concern

Dear Sir/Madam

NUST Business School (NBS) at National University of Sciences and Technology (NUST) is a leading academic and research institute specializing in International Business & Marketing, Finance, Human Resources, and Logistics & Supply Chain Management.

One of our ongoing research projects centers on studying the effect of incorporating environmental practices on performance of virtually integrated textile firms in Pakistan. After a careful and detailed search for relevant Pakistani textile firms, we have identified your firm as of great potential in this area. We will appreciate your permission for allowing us to send our MS thesis student, Ms. Amna Fida, to visit your facility for conducting a questionnaire based survey of your Operations, Human Resource (HR), Supply Chain and Finance departments.

The survey would take only about 10-12 minute and the information provided will remain confidential and be used only for academic purposes. The names of the respondents and the organization will not appear in any thesis or publications resulting from this study unless agreed to.

Your approval to conduct this study will be greatly appreciated.

Thank you in advance for your interest and assistance with this research.

Kind regards.

Yours sincerely,

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APPENDIX C: Confirmatory Factor Analysis

Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	104	823.131	562	.000	1.465
Saturated model	666	.000	0		
Independence model	36	9210.664	630	.000	14.620

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.057	.828	.796	.699
Saturated model	.000	1.000		
Independence model	.558	.120	.070	.113

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.911	.900	.970	.966	.970
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.892	.812	.865
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

NCP

Model	NCP	LO 90	HI 90
Default model	261.131	188.500	341.751
Saturated model	.000	.000	.000
Independence model	8580.664	8273.614	8894.145

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	3.996	1.268	.915	1.659
Saturated model	.000	.000	.000	.000
Independence model	44.712	41.654	40.163	43.175

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.047	.040	.054	.719
Independence model	.257	.252	.262	.000

AIC

Model	AIC	BCC	BIC	CAIC
Default model	1031.131	1076.670	1377.734	1481.734
Saturated model	1332.000	1623.621	3551.591	4217.591
Independence model	9282.664	9298.428	9402.642	9438.642

ECVI

Model	ECVI	LO 90	HI 90	MECVI
Default model	5.005	4.653	5.397	5.227
Saturated model	6.466	6.466	6.466	7.882
Independence model	45.061	43.571	46.583	45.138

HOELTER

Model	HOELTER .05	HOELTER .01
Default model	155	161
Independence model	16	17