Abstract
The purpose of the study is to analyze the role of tech-pack for the development of a sustainable supply chain management. The purpose is addressed by analyzing if tech-pack contains standard sustainable requirements and acts as an enabling factor to integrate sustainability in current textile and fashion supply chain.

The nature of the research is qualitative and case study has been conducted to collect data through telephonic interviews. A Textile apparel buying agency from Pakistan was selected as a case study and data has been collected from company employees and managers from knitwear apparel manufacturers (suppliers) to ensure the relevance and validity of the research.

The results and the data analysis have been presented in various dimensions to understand the current practices in the textile supply chain management and future recommendations for designers, product developers and managers from the supply chain management. Findings show that in the current practices of supply chain management, tech-pack is not communicating the sustainable requirements efficiently and there is a need to standardize the sustainable requisites for product development. For progression in sustainable supply chain management, designers and product developers are required to adopt the Higg index as a standard source of information to standardize the sustainable requirement for each stage of the supply chain.

Keywords: Sustainability, Tech-pack, Higg Index, Product development, Sustainable requirements
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2016, August 17th
Ahsan Shafiq
1 Introduction

This chapter aims to introduce the purpose of this research as well to explain and formulate the research questions. The section presents a brief introduction of sustainability in the textile and fashion industry, sustainable apparel product and sustainable requirements for product development. Furthermore, it provides the reader with information about tech-pack and its role as a communication tool for the product development process during garment manufacturing. Later in this chapter, problem statement is underlined to further explain the purpose, motivation and relevance of the research.

1.1 Background

The clothing and textiles sector plays a significant role in the world’s economy (Allwood et al. 2006). In 2000 the world’s consumers spent around US dollar 1 trillion on clothing, however recent figures raised to US dollar 2.4 trillion in 2016 (Mckinsey & company, 2016) for which Asian countries are leading exporters of clothing. Still, Mckinsey & company (2016) stated 2016 as the toughest year for the fashion sector. Several reasons have underpinned such as companies have been looking inward, implementing changes to the core strategies that are reshaping the entire fashion system, by reducing seasonal length and integrating sustainable innovations into the core design and product development processes. Mckinsey & company mentioned on the report that “Perhaps surprisingly, 67 percent of executives said conditions for the fashion industry have worsened over the past 12 months” (Mckinsey & company, 2016). The average consumer increased 60 percent from 2000-2014 due to falling costs, streamlined operations and rising consumer spending and production of fashion clothing increased to double.

As consumer buying increases, especially in emerging markets, the clothing industry’s impact on environment could increase greatly. Figure 1, describes the statistically increase in CO2 emissions, water use and land use and alarms the key stakeholders in the fashion sector to obtain a sustainable approach and integrate sustainability at organizational level. Allwood et al (2006) underpinned the major environmental impact by addressing the climate change, toxic chemicals used for cotton agriculture, waste volumes and water consumption during pre and post-consumer phases.
The fashion and textile’s responsibility has been a debatable topic in the media, especially along the last decade. In recent years Rana plaza and fire in one of the garment factories in Bangladesh brought serious concerns over corporate social responsibilities in the fashion and textile industry (Clean clothes 2016). As the sustainability debate began to emerge, Carter and Rogers (2008) concisely discussed the sustainable supply chain management with Triple bottom line (TBL) and its integration to ensure social, economic and environmental requirements. In fact, Supply chain management is in the frontline of sustainability in business as it provides a valuable opportunity for the company to incorporate the objectives of Triple Bottom Line performance also known as corporate social responsibility into its decision-making processes (Meixell & Luoma, 2015). Based on this, when a company intends to adopt minimum level of sustainability, it has been suggested to implement TBL in all the processes of supply chain management. As textile and fashion supply chains are becoming increasingly global, outsourcing from developing countries has placed focus on sustainability. Therefore, the need to understand and integrate sustainability and corporate social responsibility in textile and fashion supply chain is highly required (Bruce et al, 2004). A key challenge for companies operating in the textile

### Increases in environmental impact if 80% of emerging markets achieve Western per capita consumption levels

<table>
<thead>
<tr>
<th>CO2 emissions, millions of metric tons</th>
<th>Water use, billions of cubic meters</th>
<th>Land use, millions of hectares</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015: 1,714</td>
<td>2015: 141</td>
<td>2015: 38</td>
</tr>
<tr>
<td>2025: 3,030</td>
<td>2025: 170</td>
<td>2025: 41</td>
</tr>
</tbody>
</table>

![Figure 1. Increase in environmental impact](Mckinsey&company, 2016)
industry is to maintain balance between achieving competitive advantage and acquire sustainable supply chain while fulfilling stakeholders’ requirements (Oelze, 2017). Meixell & Luoma (2015) further explained that sustainable supply chain management has attracted scholars and practitioners in recent few years. Mostly fashion companies are intended to change their focus from social responsibility to specific additions in their supply chains which are brought by the requirement from society, as well as international and national regulations. Fashion companies are demanding a sustainable fashion supply chain management from upstream suppliers in order to fulfill the social, economic and environmental requirements. Thus, previous studies also show that suppliers use different strategies such as managing supply chains for sustainability, or managing the supplier base to diminish risks, in order to enhance performances (Oelze, 2017). She further concluded that specific forms of buyer-supplier collaboration can enable sustainable policy implementation and can reduce internal and external organizational barriers in place.

Furthermore, the textile and clothing industry has a specific negative impact on the environment through all the stages of the product life cycle, from fiber growth and manufacturing to dyeing, printing, finishing, packing and logistics till disposal of product (Allwood et al, 2006). As per Martin (2013) the world’s garment and textile industry is playing a vital role in the global economy. Hence, this forms a need of focused attention for sustainability development for this industry. The overall consumption of textile clothing has increased 20% per capita which means this industry is growing rapidly. Sustainability requires awareness for consumer to reuse or recycle the garment, but the global increase in textile clothing is not a true sign of sustainable development. He further took an example of the Dhaka incident in April 2013 where 1133 garment workers died. The current challenge for the textile and fashion industry is to identify collaborative strategical approaches with upstream suppliers to achieve a sustainable management system.

Environmental sciences refer to sustainability as the quality of not being harmful to environment or compromising on natural resources and therefore balancing long-term ecological balance (Khan and Islam, 2015). The sustainable textile product can be defined as a product derived from renewable resources, with low environmental impact by creating a long term ecological balance (Muthu et al. 2013). To achieve sustainable development, designers need to be aware of the product’s environmental impact, and to incorporate environmental awareness into the design (Adam and Frost 2008). Product sustainability is the reliable factor where designers and buyers can control environmental impact through
design and product development process. Transforming product sustainability may be achieved through various approaches such as fiber selection, fabric choices, dyeing methods, consumer behaviors, reuse and recycling.

Lack of knowledge has been found as a major barrier for the integration of standard sustainability requirements for the required modifications in conventional supply chain management (Oelze, 2017). Thus, communication with suppliers needs to take place through an efficient tool in order to diminish external barrier such as lack of knowledge, to be able to implement sustainability for environment, economic and social requirements.

Several sources are used to transmit details from buyer to supplier to ensure a sustainable product development process during garment manufacturing. One of the sources is through the Product detail sheet (Tech-pack). Tech-pack is considered as a bridge of information flow between buyer and respective supply chain to ensure right details of product development, production and logistics (Rosenau & Wilson, 2006). Designers and design technicians from buyers/retailers creates tech-pack and transmit all product related information to merchandisers to the respective departments of upstream suppliers (Rosenau & Wilson, 2006).

Tech-pack (product detail sheet) is used as a documentary source for all the instructions a factory needs to create an apparel product. Tech-pack is the detailed design document of any style with which a supplier can easily read and make the product accordingly (Chinaimportal, 2016). This also means that most of the brands around the world have shifted to tech pack as a source to help them again and again over time. When there is a claim or a supplier fails to assure any specified requirements, tech-pack serves as a contracted document which can prove the exact product development specifications and requirements.

Oelze (2017) also explained that textile firms make particular use of Code of conduct to ensure a supplier’s compliance for sustainability through third-party yearly auditing. Compliance yearly audits mainly address working conditions and wages, child labor, and welfare of workers. However, this study determines tech-pack as a routine and efficient tool for standard documentation of sustainability requirements for product development.

Previous research is concerned with sustainable management of the supply chains by identifying internal-external enablers and internal-external barriers (Oelze, 2017). Internal-external enablers encourage and motivate policy makers to the integration of sustainable supply chain management in an organization by tools such as employee involvement as internal enabler and industry collaboration as external enabler. However, internal-external
barriers resist the development of sustainable supply chain management due to resistances such as lack of structure and processes as internal barrier and lack of knowledge as external barrier. The focus of the present research is to highlight the importance of tech-pack as a management tool for the diminishing lack of knowledge, which subsequently, enhances the development of a sustainable supply chain.

As mentioned earlier in this chapter, tech-pack performs as a documentary guide in the product development process during garment manufacturing and contains all the information related to materials, fabrics, accessories, labelling, packaging, patterns and garment specifications (Rosenau & Wilson, 2006). However, there is a need to implement standardize information system in textile and fashion supply chain by specifying the sustainable requirements for each product. A comprehensive tool can help designers and product developers to choose sustainable product requirements. Higg Index certainly claims to be a groundbreaking tool for the sustainability development at every stages for the retailers, brands and facilities (Apparel Coalition, 2016). This is an indicator based tool for apparel that assist companies to evaluate materials, products, facility and processes with respect to the triple bottom line (TBL) requirements. It also helped designers and developers to design sustainable products for environmental standpoint by providing sustainable alternatives for design development, production and logistics. A current necessity is to evaluate if designers and product developers are taking the initiative by specifying sustainable requirements through tech-pack to upstream suppliers, and therefore, this research plays a very important role.

The current globalization demands transition from conventional product development processes to sustainable ones. Product design and development specifications are required to have low impact on environment in its life cycle. This study highlights the role of tech-pack by assessing the presence of a sustainable requirement for the product development process. However, also as an efficient and relevant tool to accelerate the transition from a conventional to sustainable product development processes.

1.2 Problem Statement
The rising level of outsourcing from developing countries requires sustainability to be addressed regularly and integrated at each stage of the supply chain management (Seuring and Muller 2008). There has been found no research addressing the development and communication of standard sustainable requirements for product development by using the tech pack, neither that it has been used in current practices of supply chain management.
Thus, the current research studies the tech-pack as an enabling tool for a more sustainable supply chain management by encouraging designers and product developers to utilize it for the progression of the sustainable supply chain management.

1.3 Research Purpose
The purpose of the research is to study the role of tech-pack for the development of a sustainable supply chain management (SSCM). Previous researches mainly have focused on the development and integration of sustainability in the supply chain management through collaboration and organizational restructuring. However, current research enlightens another dimension by analyzing the importance of tech-pack for the communication of standard sustainable requirements for the development of SSCM.

1.4 Research Motivation
“Research is a work process devoted to creating knowledge” (Eriksson, 2014). Therefore, the motivation of this research is to create awareness for the textile and fashion industry to integrate sustainability through tech-pack to regularize sustainable development. However, the vast previous research on sustainable supply chain management and limited research on tech-pack as a communication tool brings another opportunity to this study be a significant call of attention for the stakeholders, practitioners and researchers for future contributions.

1.5 Research Relevance
First, supply chain management has a strong and deep impact on natural environment because it trades in natural resources needed for the production of the textile and fashion product (Mentzer et al, 2001). This encourages the importance of incorporating sustainability at every stage of the supply chain management. Second, efficient designing and buying practices can also impact a supplier ability to develop sustainability. Thus, integrated strategical approaches in textile and fashion management for the development of sustainable supply chains are indeed required.

1.6 Research Questions
The purpose of this study has two dimensions to analyze for the development of a sustainable supply chain. However, tech-pack is a central element for building research questions emerged from the specific theoretical framework described in the previous
chapter. First dimension is to critically investigate the presence of standard sustainable requirements in the tech-pack for product development process. Since, tech-pack blueprints product development and provides all necessary initial specifications to the supplier for the procurement of materials and accessories, details of patterns, specifications of garments and packaging details. And as described by Adam and Frost (2008), designers and product developers need to be aware of the environmental impact of each product to underpin sustainability and use tech-pack as an efficient tool. Thus, the first dimension of the study is to critically analyze tech-pack as a tool for communicating the sustainable requirements for product development.

**RQ. 1** How efficient tech-pack communicates sustainability requirements for product development in the current supply chain practices?

However, the second dimension of the study is to critically investigate the effectiveness of tech-pack for progression in a sustainable supply chain management. This dimension mainly focuses on the contribution of tech-pack as a tool for the development of a more sustainable supply chain. As discussed earlier, tech-pack specifies product related requirements for every stage of the supply chain so this dimension inquires how effective is its role in the current supply chain management practices.

**RQ. 2** How effectively tech-pack contributes for the development of a sustainable supply chain management in current supply chain practices?

### 1.7 Delimitations
The present research mainly encounters tech-pack for its contribution for the development of sustainability in upstream supply chain. The current study is limited to Asian suppliers and specifically buying agency and knitwear garment manufacturers from Pakistan, which are upstream stakeholders in the textile and fashion supply chain management. The criteria to assess sustainability requirements on tech-pack is limited to the Higg Index DDM (beta) tool as this provides product related environmental requirements which certainly challenges existing tech-pack contents. The sample size for the research is relatively small due to time constraints and access to respondents.
2 Literature Review and Theoretical Framework

To be able to answer the research questions, it is important to first understand global sustainability requirements and expectations from the textiles and fashion supply chain management. Afterwards, this chapter focuses on understanding the true interpretation of a sustainable apparel product and what are the primary sustainable requirements needed at each stage of the product development. This section also thoroughly describes what is the sustainable apparel coalition and their contribution through developing the Higg Index as a product assessment tool for sustainability standard requirements. However, the major focus of this chapter is to define the role of tech-pack in apparel designing, product development and the supply chain management. The section ends with the formulation of the conceptual framework for this research.

2.1 Sustainable Supply Chain Management

The often-cited definition of sustainability proposed by the world commission on environment and development (WCED) outlines social, environmental, and economic concerns with a goal of preservation (WCED, 1987). Through increased transparency and free flow of information, international marketing and advertisement creates external pressure as an opportunity for companies to use higher standards in their supply chains (Meixell & Luoma, 2015). Sustainable supply chain management is already distinguished from conventional supply chain management in previous researches. For example, Seuring and Muller (2008) describe SSCM as “Sustainable supply chain management is the management of material, information and capital flows as well as cooperation among companies along the supply chain while integrating the goals from all three dimensions of sustainability i.e., economic, social and environmental which are derived from customer and stakeholder requirements”.

Supply chain management is in the frontline of sustainability in business as it provides a valuable opportunity for the firm to incorporate the objectives of the triple bottom line or corporate social responsibility (Meixell & Luoma, 2015). These demands create pressure on apparel buyers to provide not only economic benefits but to also address environmental and social concerns. Thus, sustainability is always demanded to be implementation across supply chain to create a positive impact at social, economic and environmental levels. Without exceptions, all sustainability leaders show extensive efforts in communicating with their stakeholders (Carter & Roger, 2008). As per Burns, Mullet and Bryant (2011) below are the requirements that the conventional supply chain management needs to incorporate
in conventional supply chain management to make it sustainable and socially responsible. Fashion brands need to claim these changes to upstream suppliers from developing countries to become environmentally friendly and become a socially responsible stakeholder for the complete supply chain.

1- Change in Materials
2- Socially responsible design
3- Socially responsible production
4- Socially responsible marketing
5- Socially responsible distribution

Above mentioned key factors effect positively to society, environment and economic systems to keep the current resources sustainable to provide a flourishing future to the upcoming world. Observed sustainable supplier relation management practices include consistent communication of codes of conduct, instructions to procurement staff, suppliers and other stakeholders (Hartmann E, 2013). Pagell (2004) suggests that aligning performance measures, supportive culture, management commitment, organizational structures and communication processes are among the most important determinant factors for the integration of sustainability across downstream and upstream supply chain management. It seems close at hand to simply transfer existing knowledge of supply chain integration to sustainability. However, if this would be the perfect solution then why researches have observed several practical cases where this does not hold true? Previous studies suggest that the lack of sustainability integration is due to lack of knowledge. For the purpose of this research, tech-pack is taken into consideration to be studied as an efficient communication tool for sustainability requirements transformation to upstream supply chain.
According to Beard (2008), the difficulty in fashion industry is to see how all suppliers can be tied to one component of sustainability from labor used to garment manufacturing, from transport to outlets and from aftercare to disposal. Previous researches addressed sustainable supply chain management by investigating and identifying the existence of acting barriers and enablers in its implementation. Figure 2 precisely identifies enablers and suggests beneficial effect of organizational collaboration for the implementation of sustainable supply chain management. Internal enablers such as internal collaboration, strategic approach and training provokes managers and policy makers to integrate sustainability requirements at each level of supply chain. External enablers however, such
as supplier relationship and industry collaboration in textile and fashion supply chain management also act as a motivation for the implementation of sustainability (Oelze, 2017). However, the current research conceptualizes previous research findings as internal and external enablers and study tech-pack as a tool to enhance internal enablers. Adoption of tech-pack as a tool for communication can play significant role for the development of sustainable supply chain management.

2.2 Sustainable Apparel Product

The definition of sustainable apparel product stands underpinning for the current research because as per Muthu et al (2010) it is essential to understand textile product produced using raw materials, energy, various resources and other ingredients which are derived from renewable resources that cannot be exhausted and do not affect the next generation. The textile apparel has a long and complicated supply chain consisting of many operations such as material procurement, yarn manufacturing, fabric manufacturing, garment manufacturing, packaging, logistics, consumer use, and recycling or disposal (Lewis et al, 2006). Sustainable apparel product is always accountable for all sustainable requirements which contributes to the environment impact. The major environmental impacts are associated with the production and use of apparel along its entire life cycle. That includes, water wastage, CO2 emissions, dyeing and finishing toxic chemical, solid waste, washing processes and significant depletion of resources. Considering all challenges to ensure sustainability, the apparel industry has concentrated on its responsibility for environment by developing eco-friendly raw materials, for some understandable reasoning material choices are among the most effective in terms of environmental impact because it leads to how the garment will be produced, cared of and disposed of (Lewis and Chem 2006). Further to apparel product processes, multi-step procedures includes spinning, weaving, knitting, pre-treatment, dyeing and finishing, cut and sew, and packaging. During these processes, the apparel product is subjected to various toxic chemicals from which many are non-degradable (Kadolph 2010). There are some fiber processing sustainable standards use of toxic chemicals such as Organic Trade Association´s (OTA), American organic standards for fiber processing and Global organic textile standards (GOTS). However, upstream suppliers intend to get approved with these certifications to compete in current textile apparel sourcing standards. Alternative approaches and choices distinguish a sustainable apparel product from the conventional supply chain manufacturing. However, sustainable
apparel product requires low environmental impact selection of choices at every stage of apparel product development, production, transportation and after use.

The global textile and apparel sector cover various areas that includes manufacturing, marketing and retailing. According to world trade organization, China has been leading the world in export of textile and clothing followed by the European Union and India (Wolf et al. 2011). Eco-friendliness is the main objective of textile industry and consumers are becoming very much aware of its impact and seeking apparel products with sustainable standards (Speer, 2005). However, sustainable apparel coalition (SAC), which helps apparel and footwear industry to assess their product with numerical sustainability scores and communicates to customers with regard to conservation of environment through Higg Index.

Beyond SAC with its self-assessment tool Higg index, there are several other initiatives that serve the purpose of lowering the environmental impact such as Bluesign private company which claims how to decrease the environmental effect from textile apparel products by implementing a supply chain system in order to produce environmentally friendly products (Bluesign 2016). However, several more initiatives have been discussed earlier which claims standards and strategies to maintain ecological balance with low environmental impact.

Figure 3. Sustainable apparel coalition (Higg Index & RDM)

(Apparel Coalition, 2016)
2.3 Higg Index

The Higg Index is an indicator based tool for apparel that assist companies to evaluate materials for products, facility and processes with respect to their impact on the environment. However, in current practices designers use Higg Index as a set of standard assessment tools to evaluate the environment impact of apparel and footwear products. The index was initially released on June 26, 2012 as the Higg index 1.0, and it has been used by many organizations. The Rapid Design Module (RDM)-Beta and the material sustainability Index (MSI) data explorer are the two assessment tools for measuring the impact of products on environment. Recently DDM (Design and Development Module) formerly RDM has been launched with better features to assist designers, buyers, suppliers for product development (The Higg Index, 2012). The most significant feature required is a product design that contributes to develop sustainable apparel product. The DDM helps to guide designers toward sustainability product design decisions. The MSI data explorer is an online interface that helps the users to understand the method and strategy behind the MSI base material scores used in the DDM-Beta. DDM and RDM mainly contains following product development requirements:

1) **Materials:** Capture the primary materials used in the product
   - Item name:
   - Weight
   - Material name
   - Material percentage
   - MSI Material
   - Recycled percentage
   - Organic percentage
   - Other sources certifications
   - Coating or Laminate applied
   - Dyeing Method
   - Reduce Chemical Impact

2) **Manufacturing:** Capture the marker or material efficiency for each of the items evaluated in the materials section.
   - Marker efficiency
   - Material efficiency
3) **Packaging**: Capture the efforts and strategies used by the company for sustainable packaging materials and systems.
   - Use of packaging
   - Efforts for sustainable product packaging
4) **Product Use**: Identify the level of after care of the product.
   - Level of care instructions
5) **End of Use**: Capture general technical and infrastructural requirements of product recycling.
   - Closed recycling product loop
   - Made of single material or blended

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**Figure 4. Higg Index Rapid design module- Beta**

(Apparel Coalition, 2016b)

The Higg index assists designers, suppliers, buyers and even customers to use product tools to evaluate the product sustainability under the key factors by providing the standard requirements such as organic percentage, recycled percentage, chemical finish, water usage, marker efficiency, and packaging and aftercare instructions (The Higg Index 2012).
In above diagram 48 and 64 are the results of 2 different apparels in RDM. The higher score of the product on Higg index RDM indicates a more sustainable product. Designer and production personals often use this tool for development of product specifications through tech-pack. By adding the product care instructions in DDM or RDM assist designers to evaluate product sustainability. So far Higg index is facilitating textile industry with numerous sustainable assistance tools. DDM and RDM plays a reference tool for designer for specification of right sustainable materials, chemical, water, and energy usage and logistics choices.

### 2.4 Tech-pack as Communication Tool

Based on previous research findings, the current study emphasizes and examines the importance of tech-pack to regularize sustainable development across all departments for reducing external barrier (lack of knowledge) and enhancing internal enablers.

![Diagram](image)

Figure 5. Collaboration to diminish barriers to SSCM

(Oelze, 2017)
Buyer and supplier collaborative approach for adoption of tech-pack and regularize strategical assurance to follow sustainable requirements can lead to effective sustainable communication across supply chain. Figure 5 explains internal and external barriers for the integration of sustainability in supply chain management. Ozele (2017) identified possible barriers in the progression of sustainable supply chain management, she claimed that suppliers are not fully aware of sustainable requirements and defined this as “lack of knowledge”. Findings from her research suggested collaborative strategies among supplier and buyer which can diminish barriers in the progression of sustainable supply chain management. However, current research conceptualize tech-pack as a communication tool for collaborative strategy at organizational level for the integration of sustainable requirements at each stage of supply chain.

Sourcemygarments (2016) describes tech-pack as a blue-print for design/ product development, production and logistics requirements. Furthermore, also provides several reasons explaining the importance of tech-pack for supply chain management.

1) A tech-pack serves as a blue print of the product, production and logistics requirements.
2) A tech-pack helps the factory estimate resources required for development of each product.
3) A tech-pack minimizes errors and ensures coordination between all departments.
4) A tech-pack provides a consistent communication through whole supply chain for efficient outcomes.
Figure 6 enlightens the communication flow chart across supply chain and pins tech-pack as a tool and blueprint for an efficient product development and assist supply chain to provide constant quality standards. As per Rita and Mahamud (2016), a well-developed tech-pack saves time and money by the way of systematic construction detailing and improve efficiency and productivity. The apparel industry however should be able to develop textile product, procure the right materials and follow the production processes by following the instruction from tech-pack. Below are some more important advantages of tech-pack in the current complex fashion apparel business.

1. Tech-pack leaves no room for interpretation causing the product to be consistent from sampling through to production.

2. A tech-pack is a specific and standardized form of documentary guide which could be send to any supplier around the world to follow the comprehensive specifications for product development, production processes and logistics.

3. After a continuous assistance by tech-pack, the factories can reduce errors and save ample time for production, reduce issues in communication and also bring all departments, workers to follow a single guide for authentic specifications.
4. A detailed tech-pack and continuous assistance helps suppliers to understand buyer’s value, value drivers, point of concerns during product development and most importantly to follow prescribed specifications.

Theoretical framework of current study encourages and motivates necessary communication of sustainability requirements through tech-pack to reduce barriers and governs regularize flow sustainable requirements through supply chain.

2.5 Conceptual Framework

Oelze (2017) supported internal and external organizational collaboration to diminish internal and external barriers for the development of sustainable supply chain. As shown in figure 5, the lack of knowledge is one of the external barriers for the integration of sustainable supply chain management. However, current research conceptualize the communication of standard sustainability requirements and support tech-pack as a tool of communication to diminish external barriers and to enhance internal enablers at organizational level. The current study consider Higg index as a source for standard sustainable requirements for product development and tech-pack as a tool to communicate those requirements through upstream supply chain in textile industry. Research questions for the current research are aimed to study and inquire the current role of tech-pack in the progression of sustainable supply chain management.

Figure 7. Conceptual framework
Figure 7 presents the conceptual framework of the current study by adding Higg index as a source of the standard sustainable information in textile and fashion supply chain management. Framework also encourages designers to strengthen tech-pack as efficient tool by specifying standard sustainable requirements for each product. However, current research aims to study tech-pack for its validity and reliability as a communication tool in current practices for the integration of sustainable requirements.
3 Methodology

This chapter aims to describe the methods used to create knowledge around the conceptual framework. The section begins with building a relevant research design by explaining approach and data collection method. However, this chapter aims to answer “how, where, when, who and why” in relation to research purpose, research relevance and research questions. To keep the research inline, sampling method, structuring of telephonic interview questions are further discussed in this chapter to validate the relevance to research topic.

3.1 Research Design and Data collection

The purpose of the study is to analyze if tech-pack contains standard sustainable requirements for the development of sustainable supply chain management, and contributes to previous research by counting tech-pack as a medium for sustainable requirements / knowledge for supply chain to diminish lack of knowledge. According to Eisenhardt, the case study logic is an appropriate methodology for any research to develop theory (Eisenhardt, 1989). Thus, to support the purpose and to answer the research questions of this study, an exploratory approach with qualitative method was adopted. Qualitative methods try to bring generalized models of theory, and it can be done by an analytic induction model, starting by gathering detailed data from key participants in the supply chain through interviews, and finding themes that bring to general theories in sustainable supply chain management that can then be compared with previous literature in the topic. By contrasting findings with previous research, new knowledge can emerge (Bryman, 2012). Siggelkow (2007) advocates that research which is based on inductive approach can be performed with limited number of cases provided that conceptual argumentation is probable. Bryman (2012) research is an interesting explanation of an inductive approach which supported the use of content analysis method for the analysis of data and for the generation of theory. Qualitative method aims to seek the answers of questions of “how, where, when, who and why” with an objective to develop a theory (Leung, 2015). The choice of unit of analysis for this study has a deep connection with research questions because during supply chain practices, selected key respondents receives tech-pack for each product and make necessarily arrangements/modifications in supply chain management.
3.1.1 Case Description

Pakistan is a major beneficiary of the trading opportunities offered by European Union generalized scheme of preferences (GSP). From 1 January 2014 Pakistan benefits from generous tariff preferences aiming to support sustainable development and good governance (European commission, 2017). The European Union being Pakistan’s most important trading partner taking 21.2% of Pakistan’s total exports. In order to keep the purpose and research questions align and conceptual framework in consideration, a buying agency from Pakistan, city Lahore has been selected as a case study because buying agency act as a bridge and coordinator between buyer and supplier. So this was important to conduct the case study on a relevant stakeholder in supply chain management. Buying agency was currently working with six knitwear garment manufacturing companies (suppliers) for the sourcing of textile apparel. By keeping the theoretical framework in consideration, managers and policy makers from buying agency and knitwear garment manufacturers are selected as relevant respondents for data collection. Unit of analysis for the current study are the managers from buying agency and knitwear garment manufacturing because they are the key stakeholders for company’s strategy and policy making decisions. Bryman (2012) supports purposive sampling with reference to the goals of the research, so that units of analysis are selected in terms of criteria that answer the research questions. However, purposive sampling with sequential approach has been conducted as befits the research questions. Buying managers from buying agency and merchandisers, general managers, and quality assurance managers from knitwear garment manufacturers were selected as key stakeholders and respondents for data collection. The Interviewing with purposive sampling with constant comparison was conducted to investigate the current practice of sustainable supply chain development among same competitors and to analyze contribution of tech-pack for development of supply chain management.

Demographical and organizational similarity of companies assist case analysis by selecting content analysis for the analysis of data. To investigate efficiency of tech-pack for sustainable supply chain management that was indeed important to contact small and medium enterprises of same scale to validate the purpose of study.
As per sample selection model figure 8, relevant respondents from small and medium enterprises from Lahore, Pakistan were considered as respondents to investigate the current practices for the communication of sustainable requirements. Figure 6, page 17 from literature review depicts the flow of communication in supply chain management which considerably supports RQ. 1, to investigate how tech-pack communicates sustainable requirements for product development. However, purpose to select buying managers from buying agency is to critically investigate the validity of tech-pack as an effective factor for sustainable supply chain management. Because, buying agents on daily basis communicate with fashion brands and suppliers simultaneously. Vice versa general managers, merchandisers and quality assurance managers from knitwear garment manufacturing companies are equally relevant and reliable for implementation of requirements in supply chain, internal and external communication, supportive culture and collaborative approach.

### 3.1.2 Data Collection Method

However, aligning the pragmatic approach of purposive sampling with constant comparison, telephonic interviews with open and closed ended questions have been selected for data collection (Eisenhardt, 1989). Current study data collection method leads to keep the purpose of research aligned to answer “how, where, when, who and why”.

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**Figure 8. Sample selection model**
Four key dimensions as shown in figure 9 have been investigated through open and closed ended questions through telephonic interviews. As earlier defined tech-pack as a blueprint for a product development, production and logistics requirements (Sourcemygarments, 2016). Thus, considering tech-pack centric data collection indeed relate the purpose, theory and approach of the current research. Open and closed ended questions in accordance to figure 9 have been asked from relevant samples from buying agency and knitwear apparel manufacturer for data collection. In relation to research questions, questionnaire for interviews was aimed to inquire the current practices by investigating current communication channels for standard sustainable information and current strategies on development of sustainability for both at buying agency and at supplier level.

### 3.2 Ethical Considerations

Researcher intends to consider all the ethical requirements required for the current research for which all the stakeholder’s information has been kept in confidential and owner consent has been properly carried out before utilization of any source for research purpose.
4 Results and Data Analysis

This chapter aims to combine results from the data collected through interviews and formulate a ground for discussion for later chapter. However, data is further categorized to relate methodology with research questions and purpose of this study.

As per Bryman (2012), content analysis is defined as a procedure for the categorization of verbal and behavioral data for the purpose of classification, summarization and tabulation. He further explained that constant comparison allows the researcher constantly to compare phenomena being coded under each category so that a theoretical elaboration of each category can emerge. Data analysis for the current research supports Bryman theory and after collection, data has been categorized in below listed five sections. Data has been collected from 43 respondents (22 Merchandisers, 05 General Managers, 07 Quality assurance managers from knitwear garment manufacturers and 09 buying managers from buying agency). However, data collected from telephonic interviews are analyzed under each relevant category. Data analysis method validates the data collection method and align research methodology with research purpose and research questions.

- Tech-pack
- Sustainability
- Higg Index
- Collaborative strategy
- Lack of Knowledge

4.1 Tech-pack

This section focused on combining the results to analyze how tech-pack communicates sustainable requirements for product development in current practices. However, this section built a foundation from questionnaire for further sections to investigate research purpose and answer research questions.

1. How company receive specifications/requirements for product development?

The purpose of the question was to investigate if company receives product related specifications through any other medium that tech-pack. However, the results show tech-pack as a primary medium for product related specifications both at buying agency and
supplier level. Responses from relevant sample also acknowledge a part of conceptual framework to support tech-pack as a communication tool for product specifications.

2. *Does company follow tech-pack as a source of information for product development?*

The objective of the question was to inquire if company follows tech-pack as a source of information for product development. However, respondents confirmed tech-pack as a source of information. This question also made sufficient ground for the researcher to discuss and analyze if tech-pack performs as source of information for sustainable requirements later in sustainability section.

3. *Do you think tech-pack helps as a blueprint for product development?*

The purpose of this question was to investigate if tech-pack as a tool assist planning the product development for further processes in supply chain. However, stakeholders positively agreed that tech-pack significantly helps product development. Results from this question precisely build another stage to support tech-pack as an efficient tool of communication for product related requirements.

4. *Does tech-pack contain all information for product development?*

The aim of the question was to investigate if tech-pack contain all required information for product development. However, buying managers and merchandisers agreed that tech-pack contains all information but at further into supply chain management general managers and quality assurance managers disagreed and provokes researcher to investigate tech-pack further through open ended questions.

Thus, results and data analysis from this section contributed as first step to investigate tech-pack. However, stakeholders from different levels of supply chain management as respondents supported tech-pack as a strong communication tool to provide sufficient requirements/specifications for product development process. However, interviews further clarified tech-pack as:
“We have hundreds of styles in supply chain, few are at development stage, and some are in production and rest in packing and logistics. Each style has its own requirements for each process, so tech-pack is the only guide we follow for each style. Tech-pack is a consistent and reliable tool to develop and produce efficiently (Merchandiser, ST (Pvt) Ltd)”

Merchandisers shared insight views and practices to highlight the importance of tech-pack for the development of wide range of garment styles with different requirements for product development.

“We as a buying agency are like a middle men and to keep the specifications unchanged by our existence in supply chain. Tech-pack is the only efficient tool to communicate all specifications to suppliers (Buying manager, SS buying (Pvt) Ltd)”

At buying agency level, tech-pack is assisting managers to maintain consistency of information flow from buyer to supplier and confirmed tech-pack as an efficient tool for communication of product related requirements.

“Quality assurance department always required right information from start for development, production and logistics of textile products. By having so many garment styles in pipeline we do not see any alternative source of right information. I think tech-pack has always been a great contribution to supply chain management (Quality assurance manager MF (Pvt) Ltd)”

Further to the above confirmations, quality assurance managers also agreed to confirm tech-pack as a high impact communication tool for quality assurance for product, production and logistic requirements in supply chain management.

4.2 Sustainability
This section of results and data analysis is aimed to inquire sustainability from understanding to adoption level. Questions were designed and asked with a relevance sequence to investigate sustainability interpretation in supply chain management and as well at managerial level. However, this section also analyze how tech-pack communicates sustainable requirement and how companies perceive tech-pack as an efficient communication tool for sustainable requirement for product development process.
1. **Is company well aware of global sustainability requirements (Social, economic, environmental)?**

Investigation of sustainability requirements and communication through tech-pack have been initiated by inquiring companies’ awareness at first. This question also supported the research by inquiring the current understanding of stakeholders for global sustainable requirements at different stages of supply chain management. However, results confirmed awareness of global sustainability requirements for Social, economic and environmental impact. Later in this section, key sustainability requirements from supply chain management have been inquired to understand the current priorities and practices of sustainable supply chain management.

2. **What are the key Sustainability requirements from Buyer?**

The aim of previous question linked with current question by inquiring current key areas of sustainability development. However, results show facility as a main area for sustainability integration and few responses confirmed sustainability progression for product also. Further on, this section inquired the current source of communication for sustainability requirement to analyze the gap of the research.

3. **How buyer communicates sustainability requirements for product?**

The current questions carried a significant importance by inquiring the current source of communication for sustainability requirements and contributed as a kick-off for further investigation on tech-pack for sustainability requirements. Results significantly show other sources of communication for sustainability requirements from current supply chain management practices such as through separate compliance department. However, surprisingly few stakeholders from entire sample confirmed tech-pack as a medium of communication for sustainability requirement. The result from this question confirmed that tech-pack in current practices is not a primary tool of communication for sustainability requirements. Further on to this section, the respondents have been asked specifically for tech-pack to investigate if tech-pack communicated sustainability requirements for product
development and that also led the questionnaire to pin research question to investigate its validity.

4. Does tech-pack contain any information related to sustainable development?

In accordance to combine the results of current question, that was necessarily important to inquire and investigate the current practices for sustainable supply chain which earlier in this chapter shown more interest for facility. However, results from current practice of sustainable supply chain management provided moderate responses for tech-pack containing information for sustainable development. Thus, in accordance to purpose of research and respondents, results confirmed tech-pack containing less sustainability requirements for product development in current supply chain management. The current question also provokes and connected further to this section to investigate if tech-pack contributes to development of sustainable supply chain management.

5. Do you think sustainable requirements for design, development, labelling, packaging, production, and logistics can be addressed through tech-pack?

The aim of the current question was to inquire if tech-pack can be a communicating medium for sustainable development. However, respondents confirmed the conceptual framework by approving tech-pack as a medium of communication for development of sustainable supply chain. Even though, respondents from current practices were not sure if tech-pack could be a right medium for communicating sustainability requirements. This section was of great importance to validate the research purpose and answer research questions by confirming current integration of sustainable development for facility. Furthermore, by confirming that tech-pack does not communicate sustainable requirements in current supply chain practices. However, stakeholders conditionally recommended tech-pack as a medium of communication and integrating tool for product sustainability requirements.

“I think meaning of sustainability is very wide for supply chain management and then every buyer has their own requirements. Yearly compliance audits for facilities are ongoing practice from last two decades but product development and production processes are still
conventional, few buyers are buying organic materials and also conscious to use eco dyes and that is a true signs for future. General Manager, SK (Pvt) Ltd”

Respondents from upstream manufacturers of textile apparel supply chain shed light on buyer demands for integration of sustainability in supply chain management. There is a moderate agreement for compliance assurances for facility but low agreement on product development requirements. This provides an insight practices at upstream of textile supply chain management.

*Future is sustainability, we as a buying agency trying to integrate and develop factories with sustainability as a competitive advantage. The big change in last 5 years is that buyer attitude is changing from conventional to sustainable. Now they are more conscious about organic and recycled materials, certifications and social issues* (Buying Manager, SS Buying)

Buying agents supported sustainability approach integrated from last 5 years which considerably provided moderate interest towards buying of organic and recycled materials. However, product related sustainable requirements are still not considered primary from current practices.

### 4.3 Higg Index

The aim of this section was to investigate and verify Higg index as an authentic tool for sustainable development from current practices. This section also helped to critically understand the current awareness of upstream stakeholders in terms of lack of knowledge for sustainable supply chain management.

1. *Does company use Higg index (RDM) for product sustainability requirements?*

The aim of the question was to investigate if Higg index is contributing in sustainability development from current practices. Respondents from selected sample unconfirmed use of Higg index in current practices for supply chain management. However, previous results confirmed facility as focused area in current practices. So upstream stakeholders rejected use of any assessment tool for product sustainability requirements, since product they follow tech-pack to follow product development requirements.

2. *Do you think Higg Index is a reliable tool for sustainability development?*
Reliability of Higg index as an assessment tool for the development of product sustainability was the key investigation from research as it holds the part from conceptual framework for the integration of product sustainability requirements. The significant impression from responses supports Higg index as a reliable tool for sustainability development. However, few respondents were not sure because upstream stakeholders do not use Higg index as standard procedure.

However, respondents from current practices rejected use of Higg index for sustainable development but verified Higg index as a reliable tool for sustainable development.

“Higg index for product may not be applicable at supplier level because we only follow buyer requirements. I think it helps designer more, may be they get assistance from this tool (Merchandiser ST (Pvt) Ltd)”

Merchandisers from upstream textile supply chain denied use of Higg Index at manufacturing stage since according to them they follow tech-pack to develop and produce textile apparel.

“We mainly follow facility requirements from Higg index module, for product we always follow buyer requirements from tech-pack and that is all we have for now (Buying Manager, SS buying)”

Buying agency as middle coordinators in supply chain management agreed Higg Index module to follow facility related social issues but for product specifications they confirmed tech-pack as a tool to follow.

4.4 Collaborative Strategy

The aim of the section was to investigate if currently upstream suppliers have any collaborative strategies with buyer for development of sustainability from current practices. Furthermore, if buyer demands continuous growth and development of sustainability. However, the current section also contributed to conceptual framework by inquiring if upstream suppliers support collaborative approach for the development of sustainable supply chain management.

1. Does company have any collaborative strategy with buyer on sustainability development?
The aim of the question was to investigate the current collaborative strategies in terms of sustainability development in supply chain. However, moderate responses confirmed collaborative strategies at buyer supplier level. Results from this questions verified the existence of collaborative strategy among buyer and supplier which supported and validates the following questions.

2. *Does buyer demands continuous development of sustainable supply chain management?*

The aim of this question was to inquire buyer’s priorities for future integration and development of sustainable supply chain management. However, results shown positive agreement of respondents that buyer demands continuous development of sustainable supply chain management. But the previous section indicated facility as a major area for sustainability integration from current practices.

3. *Do you support to adopt tech-pack as external collaborative approach/strategy for development of sustainable supply chain management?*

Results from current question contributes significantly to conceptual framework by confirming use of tech-pack as collaborative strategy for the development of supply chain management. However, responses validates the agreement of using tech-pack as part of collaborative strategies for the development of sustainable supply chain management.

Results from this section certainly advocates external collaborative approaches for the development of supply chain management. Stakeholders from upstream of textile supply chain confirmed continuous requirement and need of sustainability requirement in textile and fashion industry. Finally, the section helped conceptual framework by supporting tech-pack as additive collaborative strategy in current practices.

*For us product development, production, quality, finishing and logistics all stages required collaborative approach. Textile supply chain is very demanding, fast fashion requires quick response and that can only be achieved through collaborative approach. Compliance audits are always conducted through collaborative approach. “General Manager SK (Pvt) Ltd)”*
General Managers from upstream companies in textile supply chain declared it very demanding and also shed light on fast fashion and quick responses to accommodate shorter lead times. Quick responses for fast fashion business models requires collaborative strategies at supply chain level. For sustainability, responses confirmed compliance audits for facility as collaborative strategy to address social requirements.

“Buyer always demands sustainability, so we have several developments plan on sustainability to reach till 2020. Product is also one of that, but it depends what specifications are given. We produce what we asked for (Merchandiser WZ (Pvt) Ltd)”

4.5 Lack of Knowledge

The purpose of this section was to critically investigate tech-pack as source of information for current supply chain management. Further to inquire stakeholders for agreement to use tech-pack to communicate sustainability information. The section itself contributed to answer research question to investigate tech-pack as an enabling factor to diminish lack of knowledge for sustainable supply chain management.

1. Does tech-pack helps as a source of knowledge for product development, production and logistics requirements?

The question was aimed to inquire tech-pack not only as communication tool but also as a source of information to reduce lack of knowledge for supply chain management. However, significant responses from stakeholders proved tech-pack as an authentic source of information for existing supply chain management.

2. Would you support standard sustainability requirements to be specified on tech-pack?

The aim of this question was to inquire upstream stakeholders consent and take a poll to help and contribute in conceptual framework. However, respondents supported the conceptual framework of utilizing tech-pack for sustainable requirements for the development of sustainable supply chain management.
3. Do you think tech-pack with sustainable requirements can help developing sustainable supply chain?

Previous questions from this section shown positive results for tech-pack as a significant tool for source of information, also stakeholders acknowledged conceptual frame work of using sustainable requirements to be specified on tech-pack. However, current question was aimed to inquire if tech-pack could contribute in development of sustainable supply chain management. Moderate responses confirmed conceptual framework by supporting tech-pack to use for the development of sustainable supply chain management. However, very few respondents were not sure if theory would contribute in development of sustainable supply chain management.

This section provided importance of tech-pack as a source of information from current practices which turned significantly positive responses from stakeholders. Further on, results from this section helped research question two by providing a positive poll to use tech-pack to communicate sustainability requirements across supply chain.

“Tech-pack has always been a source of information, this is nearly impossible to develop and produce hundreds’ of styles without tech-pack. Merchandiser AK (Pvt) Ltd”

This chapter supported research by categorizing the purpose and conceptual framework into relevant elements and data has been collected by combining these elements through questionnaire for interviews and then separate them again to analyze results. However, purposive sampling and categorization of elements helped theoretical elaboration of each category to emerge. For brief understanding of results and data analysis from each category, results are further categorized as “current practices” and “future recommendation” and shown under for each category. These two categories depict attitudes from current strategies for the development of sustainable supply chain. However, the main focus was to align conceptual framework and purpose to inquire for future attitudes of stakeholders for the development of sustainable supply chain management.
Thus, results shown above precisely confirmed current strategies for integration of sustainability for facility and the main sources from current practices are through compliance department and e-mails. However, buyer and supplier are in agreement for the continuous development of sustainable supply chain management and encourage tech-pack to take a step ahead by adding sustainable requirements for product through further integration and to minimize the impact on social, economic and environment. Results also certainly assessed tech-pack as current source of information and that shown positive results. However, from current practices stakeholders are not sure if tech-pack can help as an enabling factor to diminish lack of knowledge.
5 Discussion

This chapter aims to discuss research questions in light of results and findings under each category from previous chapter. However, selected research methodology validates results and align purpose, research questions and conceptual framework for further discussion.

To answer the first question, the questionnaire was designed in sequential approach to collect relevant results under each category presented in previous chapter both for current practices and for future recommendations. There were two dimension of this research question. First, to make a wider ground to authenticate from current practices if tech-pack is an efficient tool of communication for product specifications which has been observed positive responses. Second, to investigate how tech-pack communicates standard sustainable requirements as a tool of communication in supply chain management. However, this has been found through data collection that from current practices tech-pack poorly communicates sustainability requirements for product development. Respondents significantly pin the variation of sustainable requirements for each product. The findings from the current research encourage Higg index as a source for standard sustainability requirements to enhance the efficiency of tech-pack for sustainable supply chain management. Preparation of tech-pack with Higg index standard requirements will communicate and integrate sustainability for each product at each stage of product development, production and logistics. However, findings from the research brought awareness for designers and product developers to integrate sustainability efficiently through tech-pack. Furthermore, findings from current research also contributes to previous research by emerging tech-pack as a source of information and perform as an enabler to diminish external barrier for the development of sustainable supply chain management.

Higg index aims assessment of product for its impact on environment. It assists designers to design the product by choosing the right materials and trims, manufacturing requirements, care & repair, end of use and quality to compare their impact on environment. Findings from the data collection encourages that, by specifying the sustainable materials and trims, sustainable cutting methods, dyeing methods and chemicals, sustainable choices for after care and repair, end use and quality requirements can force product developers to procure the required specifications. As earlier discussed tech-pack represents each textile product in supply chain management. So specifying the right sustainable requirements for each product will force and encourage product
developers to practice sustainability at each stage of supply chain management. By doing this each product will carry its own sustainable standard requirements through tech-pack and buying agents and suppliers would have to follow the requirements for procurement and development purposes.

As discussed earlier each tech-pack carries requirements for each product. Designers can compare the sustainable choices from Higg index and specify according to purpose. However, by adding this practice as standard operating procedure during designing phase will certainly standardize the sustainable requirements for rest of the upstream supply chain. Collaborative strategy towards development of sustainable supply chain management also requires standards to follow, so by standardizing the sustainable requirements for each product will force buying agents and suppliers to adopt sustainable approaches. Findings from the current research motivate stakeholders, through modifying current supply chain practices can help in implementation of standard sustainable requirements.

Results have shown buying agents and supplier agreement to accept tech-pack as a source of information as it describes product related requirements. Sourcing of new materials, buying of sustainable trims and accessories, practicing sustainable methods for cutting to reduce waste, requirement of eco-dyes are all examples on information and knowledge for buying agents and suppliers. According to respondents, tech-pack restricts supplier to develop each product according to the provided product specifications and by standardizing product specifications with sustainable requirements will eventually pressurize suppliers to make necessarily arrangements and procurements for each product. However, by standardizing the Higg index sustainable requirements through tech-pack also diminish external barriers such as lack of knowledge for the development of SSCM. Proposed conceptual model will provide sufficient knowledge of sustainability to suppliers for each product to follow and implement at each stage of supply chain. However, standardization of sustainable requirements will act as internal enablers for organizations to introduce practices such as increase of employer involvement to modify supply chain practices, by creating an internal strategic approach to reach standard sustainable requirements, and through training employees to reach the sustainable requirements with quality assurance.

Standardization of sustainable requirements and by regularizing the practice at organizational level and at each stage of supply chain will contribute efficiently for the development of sustainable supply chain management. However, this model requires
alliance of all stakeholders from supply chain management, horizontally at organizational and managerial level and vertically to product processes and technical level. By practicing standard sustainable requirements through tech-pack, this will certainly create a shift from conventional approaches to sustainable approaches in current supply chain practices. Upstream suppliers through collaborative strategy can also modify current supply chain by developing sub-suppliers for buying sustainable materials and trims, by using efficient and latest cutting methods to reduce wastages, through buying eco-dyes and by less use of water and toxic chemicals and for assuring quality of product. All these required modifications in supply chain will lead to develop sustainable supply management in textile and fashion industry.
6 Conclusions

This chapter concludes this research study by describing the importance of various dimensions such as tech-pack as efficient tool for conventional product development practices, sustainability as a promising strategy at buyer supplier level and acknowledgement of Higg index as a reliable tool for sustainability requirement. However, the research observed distinctive difference between current practices and future recommendations.

From current practices, upstream stakeholders confirmed poor communication of sustainable requirements through tech-pack due to variation in sustainability requirements. However, the development of a sustainable supply chain at collaborative strategical level has shown progression for facility but precisely not for product development. It has been observed that upstream suppliers are well aware of the global sustainability requirements to reduce the social, economic and environmental impact. Further to the findings, upstream stakeholders acknowledge the role of tech-pack as an efficient tool of communication but encourage standard source of information for sustainable requirements by accepting Higg index as a reliable source.

Current research methodology design revealed another dimension by taking a consent from upstream stakeholders to validate the conceptual framework. As findings show, they supported tech-pack as an efficient tool for integration of standard sustainable requirements for product. So the results from the research encourage designers and product developers to add Higg index sustainable requirements in tech-pack and use this efficient tool for routine and consistent integration of sustainability. According to interviewed upstream stakeholders, through collaborative approach tech-pack can perform efficiently in near future with no cost addition and with high positive impact on development of SSCM. Current research also contributes to previous research by providing standardize sustainable communication tool to diminish the lack of knowledge for development of textile and fashion supply chain management.

6.1 Contribution

The current study contributes significantly in research field by revealing another dimension for the development of sustainable supply chain management. Previous researches were mainly focused on organizational restructuring by studying different business models. However, current study introduced an efficient roadmap for the designers and product
developers to regularize the implementation of sustainability requirements for each textile product. Through collaborative strategy textile and fashion industry can expedite the process of sustainability progression by using the current study communication model.

6.2 Recommendations
Current research presented “current practices” and “future recommendations” from upstream suppliers for the progressive integration of sustainability at each stage of the supply chain. However, currently supply chain strategies acknowledge tech-pack as a moderate communication tool for standard sustainability requirements. Conceptual framework also provides an opportunity for the textile and fashion industry to expedite integration of standard sustainable requirements by adopting Higg index and tech-pack as a standard operating procedure. Results and analysis from current research also revealed more areas for future researches such as studying designers’ attitudes to use tech-pack as integrated tool for sustainable requirement. Future research can also study tech-pack designing and development process by underpinning each specification for development, production and logistics.
7 References


Sustainable apparel coalition (2015), Higg Index, Available from: http://www.apparelcoalition.org/higgindex (10th July 2016)


## Tech-pack Sample

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## Appendix 1b Tech-pack Sample

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### Vendor Notes

Supplier - Product Manager Correspondence (NAME, DATE, NOTE)

### Vendor Pre-Classification Notes

AGENT/VENDOR PRE-CLASSIFICATION NOTES
(For Multi-Piece Style: Identify Piece Percentages)
(Appendix 2a) Telephonic Interview Questions

Closed ended Questions:
- What is the operational profile of company?
- Which buyers company is currently manufacturing/sourcing for?
- What are the key sustainability requirements from buyer?
- How company receive specifications/requirements for product development?
- Does tech-pack contain all information for product development?
- Does company follow tech-pack as a source of information for product development?
- Do you think tech-pack helps as a blue print for product development?
- Does tech-pack helps as a source of knowledge for product development, production and logistics?
- Does company have any collaborative strategy with buyer on sustainability development?
- Is company well aware of global sustainability requirements (Social, economic, environmental)?
- Does buyer demands continuous development of sustainable supply chain management?
- How buyer communicates sustainability requirements for product?
- Does company use Higg Index (RDM) for product sustainability requirements?
- Do you think Higg index is a reliable tool for sustainable development?
- Does tech-pack contain any information related to sustainable development?
- Do you think sustainable requirements for design, development, labelling, packaging, production requirements and logistics can be addressed through tech-pack?
- Would you support sustainability requirements to be specified on tech-pack?
- Do you think tech-pack with sustainable requirements can help developing sustainable supply chain?
- Do you support to adopt tech-pack as external collaborative approach/strategy for development of sustainable supply chain management?
Open ended Questions:

- How do you define tech-pack from your work practice?
- How do you define sustainability from your work practice?
- Which sustainable area the company is progressing more, facility or product?
- Do you use Higg index to assess sustainability of product, if not then why?
- Specifically which product related sustainability requirements are mostly specified on tech-pack?
- Would you follow tech-pack if it contains sustainability requirements for product?
- How often buyer discuss sustainability issues at collaborative strategic level?
Dear All,

My name is Ahsan Shafiq, I am a student of Master in Fashion Management at University of Boars, Sweden. I am required to undertake a research that examines issue relating to Textile management and Textile supply chain.

As a master degree student, I have chosen the research area in Textile Apparel industry to analyze the importance of tech-pack for the efficient and effective transmission of product material sustainability requirement through entire supply chain. For the matter, students are intended to contact relevant industry to get a feedback on research topic. So this is my pleasure to get an approval for holding a telephonic interview. This will help my current research to collect reliable results.

Thanking in anticipation

Ahsan Shafiq
Dear Respondents,

Thanks for accepting my application to help me by holding telephonic interviews. Interview will be constituted of open and closed ended questions. I hope this will take short time but surely contributes a lot to research.

Thanking in anticipation

Ahsan Shafiq