# Evaluating and Prioritising Supply Chain Management Strategies in The UK Textile Industry

**By**

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# Candidate Declaration

I hereby declare that:

1. I have not been enrolled for another award of the University, or other academic or professional organisation, whilst undertaking my research degree.

2. None of the material contained in the thesis has been used in any other submission for an academic award.

3. I am aware of and understand the University's policy on plagiarism and certify that this thesis is my own work. The use of all published or of other sources of material consulted has been properly and fully acknowledged.

4. The work undertaken towards the thesis has been conducted in accordance with the SHU Principles of Integrity in Research and the SHU Research Ethics Policy.

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## Published Papers

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## Planned Papers

Saad, S., Komal, S. (2024). Examining the Role of Production and Purchasing Supply Chain Management using PLS-SEM Approach in UK Textile Industry

# Abstract

**Area of PhD:** The textile industry is segregated based on three specified markets: technical textiles, home, and apparel. This study focuses on the textile industry since this industry is highly important and certainly its volume.

**Problem Description:** There is a dearth of supply chain management (SCM) strategies and practices integrated in UK textile industries as managers found it complex to select an appropriate strategy and practice based on the situation and their type of product. Previously, it was noticeable that SCM strategies and practices differ per company's production and purchase policies.

**Methods:** A mixed-method consists of questionnaires of the practitioners and manufacturers and a Analytic Hierarchy Process (AHP) to clarify what SCM approaches are being operated by their firms and, what components led to the adoption of a particular approach and how and why they plan to change the SCM strategy approach.

**Results:** The intense global competition, reduced product life cycle, and increasingly demanding customers shape the current business environment. One of the main aspects of supply chain management is strategic procurement management, which entails both production and purchasing aspects. These strategies assure better utilisation of resources and cost control. The proposed SCM strategy for production and purchasing and its components in the textile industry is provided in the following section. Challenges to reducing the cost while enhancing the service level and promoting sustainable sourcing in the UK are the most important features of the proposed strategy.



**Keywords:** Practices, Production, Purchasing, Strategies, Supply Chain, Textile Industry, UK

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# Nomenclature

| | |
|---|---|
| AHP | Analytic Hierarchy Process |
| ANT | Actor-Network Theory |
| AVE | Average Variance Extracted |
| CR | Composite Reliability |
| CSR | Corporate Social Responsibility |
| DIG | Digitalisation |
| DKS | Development of key supplier |
| EDI | Electronic Data Interchange |
| ERP | Enterprise Resource Planning |
| GP | Green Purchasing |
| GSCM | Green Supply Chain Management |
| IBM | International Business Machines |
| IEC | Internal and external coordination |
| ISS | Information sharing with suppliers |
| JIT | Just-in-time |
| KM | Knowledge Management |
| LTO | Long-term orientation with suppliers |
| MED | Mediator |
| MSDS | Material Supplier Development for Sustainability |
| PI | Purchasing integration |
| PLS-SEM | Partial Least Square Structural Equation Modelling |
| PP | Production and Purchasing |
| RFID | Radio-frequency identification |
| SA | Sensitivity Analysis |
| SBO | Supplier base optimisation |
| SCA | Supplier capability auditing |
| SCM | Supply chain management |
| SDS | Supplier Development for Sustainability |
| SMEs | Small and Medium-Sized Enterprises |
| SPSS | Statistical Package for Social Sciences |
| SSCI | Sustainable Supply Chain Initiative |

| | |
|---|---|
| UK | United Kingdom |
| US | United States |
| VMI | Vendor-managed inventory |

# Chapter One

# Introduction

## 1.1 Background

Over the past three decades, fashion supply chains have observed significant structural changes, which have become augmentatively complicated and globalised. In the late 1990s, high-demanding and affordable style was emerging on the high street. This pattern was led by so-called fast fashion retailers, specifically toward democratised such as H&M and Zara and marked a departure from a period where stylish and well-made clothes were majorly the necessity of wealthy customers (Tungate, 2008; Caro & Martínez-de-Albéniz, 2015). The transformation of the fashion supply chain was supported by such progressions from a manufacturer-push model toward a demand-led pull system, which reflected similar developments in the UK textile industry.

Furthermore, a paradigm shift has been observed in fashion sourcing from domestic production to a greater contribution of offshore production as retailers progressively outsourced their non-core manufacturing activities whereas, frequently retaining an emphasis on their core abilities in the branding, retailing, and design of fashion. According to Castelli and Brun (2010), competition has switched from manufacturing to distribution and retailing in the fashion industry. Recently, additional diversification of the textile industry has appeared with the development of mass prestige and the rise of affordable luxury brands, which include Coach and Michael Kors. In line with these patterns, the shift in fashion e-commerce and escalating consumer approval of e-purchasing of fashion to significant development in the e-commerce sector with retailers such as Boohoo and ASOS providing a diversified variety of trends at low shipping and prices to several countries globally (Perry & Wood, 2018).

The achievement of social and environmental resources has become a debatable issue among these intersecting and complicated patterns to increase outsourcing and internationalisation of the manufacturing function in developing countries (Freise & Seuring, 2015). Sustainability strategies are important for firms' initiatives, specifically for those working in sensitive business realms such as the textile industry with its thorough use of high labour inputs and natural resources. Within the mid-market high-street sector, vertical disintegration and outsourcing is one of the fundamental SCM trends of the production function to a global network of independent subcontractors, often throughout lower labour cost economies (Jana, 2010).

The expansion of free trade followed the reduction of the Multi-Fiber Agreement in 2005, which had administered the global trade in garments and textiles since 1974 by implying quotas on the extent developing countries can ship to developed countries (Goto et al, 2011). The extent of outsourcing associates to the perspectives of retailer on the degree of control that it desires to imply over the supply function and how it observes sourcing throughout the organisation. This differentiation can be related to contractual theory of a firm proposed by Cox's (1996), where a company will retain control of the function by considering sourcing to be a core competence with high asset specificity as compared to the use of third-party specialists. The degree of the relationship with the third-party will relies on the extent of asset specificity, where high asset-related skills will tend to be administered through long- term partnership arrangements (Koprulu & Albayrakoglu, 2007). On the contrary, low asset-related skills will be governed through market-based arrangements of arm's length.

Notably, cost is the major determinant for switching production to developing countries, considering the labour-intensive nature of apparel production and the diversification in labour rates. Textile manufacturing is often unequipped to extensive automation as labour-intensive sewing operations can be found where there is a ready-made available labour source (Sethi, 2018). Labour rates increase and competitive advantage is based on the cost, which switches successively to the upcoming industrialising country where labour rates are even cheaper, because countries are progressively industrialising and economic development is growing. For instance, South Korea, Taiwan, and Hong Kong were the renowned sources of low-cost manufacturing labour. However, they were no longer competitive on an appropriate cost-basis due to rising domestic labour costs in the early-1990s.

Cambodia, Bangladesh, and Myanmar are considered as current locations of low-cost garment manufacturing (Perry & Wood, 2018). Garment manufacturing operations have relocated to cheaper inland regions throughout China as labour rates have increased in coastal areas. The central government of China has responded with a series of policy strategies for supporting firms to support industrial relocation and upgrading in three ways: Go Out, Go West, and Go Up (Zhu & Pickles, 2014). Similarly, some textile firms have changed production for shorter lead-time merchandise to nearby Egypt as costs in Turkey have increased (Tokatli & Kizilgün, 2010). Individual supplier firms or wider economies might respond to this race to the bottom for moving to more technologically or profitably sophisticated skill-intensive and capital economic niches, which is considered industrial upgrading (Tokatli, 2008; Neidik & Gereffi, 2006). On the contrary, possibilities related to the escalating automation development in garment manufacturing and textiles threaten the previous trajectory of industrial

upgrading, enabling firms to manufacture near to their customers and avoid the delays of outsourcing and shipping costs (Hammer & Plugor, 2016).

## 1.2 Problem Statement

The textile industry is specifically divided based on three certain markets: apparel, home, and technical textiles. The core emphasis of this study is on the apparel industry, as it is highly significant and related to its volume. Recently, the apparel industry is classified as one of the largest and oldest export industries being dynamic, global, and complex in charisma (Thakkar et al, 2009). The fashion world might be stylish, glamorous, and sensational, but its unexpected impact on the character is accumulated. From an environmental perspective, the clothes and the textiles can cause excessive disruption (Shirvanimoghaddam et al. 2020).

The apparel industry is considered as a dynamic sector, which is based on facing constant change and great price competition. In the fashion apparel industry, important features of supply chains implement pursuing for low-cost manufacturing possibilities. These possibilities include the rise of e-commerce, the emerging use of quick response, immense change, and rising sourcing offshore (Köksal et al., 2017). Furthermore, the increasing competition from the supermarkets entrance of selling clothes to fast fashion companies refines the buying behaviour process. To this end, a competitive advantage is required to be maintained by supply chain management practices and strategies as it integrates both the aspects of the uncertainties and product associated with it.

## 1.3 Aim and Objectives

There is a lack of SCM strategies and practices in UK textile industries as managers found it complicated to choose an adequate strategy and practice about the situation and their product type. Previously, it should be notable that SCM strategies and practices vary based on the firms with purchasing and production policies. Therefore, this study intends to consider the textile industry and identify SCM strategies and practices integrated with respect to different production and purchasing policies. The following research objectives are developed to achieve the particular aim of this study:

- To carry out a comprehensive literature review of the current knowledge and review the existing practices to establish the gaps in this area of research.
- To identify which SCM strategies and practices are preferred by experts working in textile industries within the UK. The focus will be on the purchasing and production sides of the supply chain. Associated performance measures that concern practitioners will be classified accordingly, and non-value-added practices for the objectives of elimination.
- To develop an initial SCM strategy approach for purchasing and production sides using the outcomes of objective 2.
- To validate the proposed approach developed in objective 3 using questionnaires, which allow fine-tuning of the proposed approach to adapt the practitioners' (academic and industrialist) opinions and judgments. The proposed validated approach will be modelled using AHP to facilitate its implementation.

- To implement the final validated approach developed in objective 4 on two or three organisations and check the applicability of the proposed strategies.
- To test the framework fitting with the data collected using SEM.

### 1.4 Significance of the Research

The supply chain management is effectively considered as an important aspect in establishing a sustainable competitive advantage and become strategically essential when competing in the recent period. Previously, a bulk of SCM research has been carried-out within the fashion apparel industry in the field of fast fashion. Although, 20% of the entire articles is covered by fast fashion as it is based on rapid responsiveness techniques of SCM such as just-in-time, quick response, and agile supply chains.

This study focuses on the specific types of supply chain strategies throughout the UK textile industry as extant literature has either emphasized on the fashion apparel industry or on sub-industry of fast fashion. Therefore, this study is significant based on the three objectives. Firstly, the study is significant for fashion apparel retailers who perform as an intermediary between the manufacturer and the final customer, given the responsiveness of a purchasing department and the purchasing of finished goods. Likewise, this study is quite beneficial for the fashion apparel industry to restructure their own purchasing departments for buying fabrics, materials, and garments. However, a third party is included in this production phase. Lastly, this study is significant for fashion apparel industry for the purchasing or production of all the raw materials important for the garment production as well as their own manufacturing facilities.

## 1.5 Outline of Thesis

This thesis is divided into seven chapters.

This chapter presents background and overview of the thesis. Moreover, this chapter presents aim and objectives to support the background and problem statement. This chapter ends with the significance of the research.

The second chapter provides the review of the literature, followed by a theoretical framework, covering topics from supply chain management strategies to trends in purchasing and retail channel strategies.

The third chapter demonstrates the steps to collect and analyse data followed by methodological underpinnings.

The fourth chapter introduces, the proposed framework, which will be later tested using AHP and PLS-SEM.

The fifth chapter brings together findings and discussion based on AHP.

The sixth chapter brings together the analysis, finding and discussion about PLS-SEM.

The last and final chapter of this thesis summarises the overall thesis followed by limitations, recommendations, and future areas of research.

## 1.6 Conclusion

This chapter has provided a comprehensive background about interest and presented the problems around supply chain management strategies in the UK textile industry. To address these problems, this chapter proposes aim and objectives to showcase what will be achieved in later chapters.

The next chapter (Literature Review) is a theoretical and empirical foundation of previously published papers and theory. This chapter is segregated into different themes covering from SCM in textile industry to outsourcing facilities in apparel sector.

# Chapter Two

# Literature Review

## 2.1 Theoretical Framework

The key trends for the different strategies are described by drawing a conceptual model. The motives for sourcing and locational strategies are influencing factors to recognise those main trends. The trends within the different purchasing and retail channel strategies are influenced apparently by the strategic decision of the production location and make-or-purchase decisions of fashion apparel companies (Kumar, 2005). These trends are also influenced by the firm size and ethnicity, logistical possibilities, and the business strategy of a company. The production might be switched to low wage countries to achieve cost advantages. In addition, the strategic decisions of companies are influenced by the shifting risks to third parties (Köksal et al., 2017). Risk considerations might be decreased by the adoption of sourcing agents or the development of quick response systems to swiftly adapt to changing customer demands. Another important factor is being demand driven to rapidly respond to customer demands by short lead times rather than long-forecast horizons (Hines & McGowan, 2005). It has been observed that monitoring costs cannot be outsourced when it comes to sustainable social responsibility and environmental aspects (Ndubisi & Nygaard, 2018).

The fashion apparel industry is depending on forward integration by executing their own and independent retail shops while brand names are created by fashion apparel retail trade companies. Being market sensitive is considered as an important point by closely observing the customer demands throughout the marketplace (Sanil et al., 2016). It is also observed that new trends are omni- channelled through key trends within fashion apparel retail trade companies from the increasing digitalisation, price,

and the specialisation by product.

## 2.2 Supply Chain Management in Textile Industry

The flow of goods, money, information, and services characterise a supply chain both among and within business entities, which include customers, suppliers, and manufacturers. In addition, all types of organisations involved in warehousing, information processing, materials handling, and transportation are engaged in a supply chain (Robinson & Hsieh, 2016). Throughout the supply chain, manufacturing, inventory management, order processing, production scheduling, procurement, and sourcing are the functions performed. The core objective of supply chain management is to fulfil the demands of customers more efficiently by offering the right product at the right location, on the right time, in the right condition, and in the right quantity (Boström and Micheletti, 2016). The aim of SCM is to achieve time compression, flexible response, unit cost reduction, and waste reduction, as illustrated in Figure 2.1. These objectives have been characterised in several contexts related with SCM to highlight the significance of both inter and intra firm collaboration. As firms seek to reduce waste within the supply chain by mitigating duplication, improving quality, and harmonising operations and systems (Trần, 2017). All entities are competent for operating more efficiently in the supply chain when production and logistics procedures are achieved in less time and thus primary outcome is observed as the mitigated inventories within the system.

Flexible response in order handling includes product variety, order configuration, order size, handling, and several other dimensions that can be achieved in a cost-effective approach using unique requirements of a customer. All these objectives assist to maintain the costs for a given value for the customer at the minimum (Macchion, et al., 2015). SCM achieve an advantage with respect to cost over competitors and customer service. In traditional way, the process of quantifying the efficiency and effectiveness of action is defined as performance management. It plays an important role to monitor the performance, diagnose problems, and improve motivation and communication (Sardar et al., 2016). In addition, the success and potential of management strategies are assisted through performance measurement as well as facilitating the awareness of the situation.

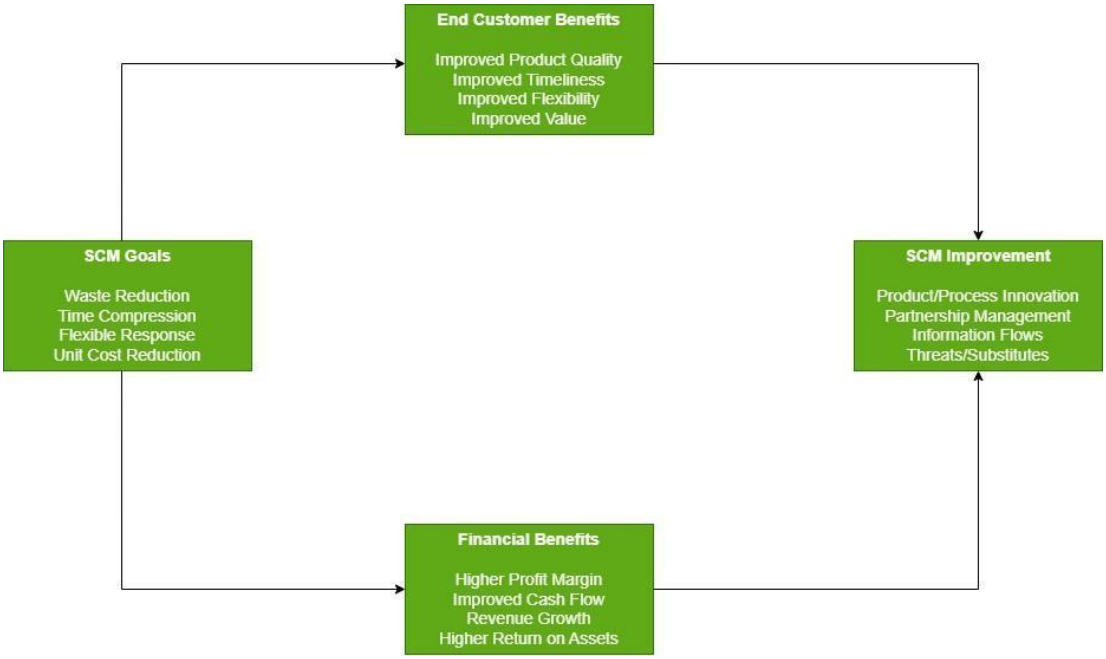


Figure 1.1: SCM Framework

## 2.3 SCM Operations in Textile Industry

The efficiency of a business process is ensured from the support of supply chain management. The adaptation of supply chain is commenced by all industries, specifically by Textiles. It has been observed that a firm must realise social and environmental practices of businesses along with all strategies and decisions of business because of profit maximisation (Angelis-Dimakis et al., 2016). Therefore, both financial and non-financial outcomes are assessed under the objectives of the activities of supply chain members. Textile contributors have commenced to adapt supply chain strategies for sustaining successfully globally such as China, Hong Kong, Pakistan, Turkey, India, Bangladesh, and the US. Across various industries, studies on the supply chain commenced in the early 90's and focused on the significance of textile supply chain management comprehensively with supply chain coordination, leading to competitiveness (Gardetti & Torres, 2017). It is a fact that most significant effects of a company are usually observed regarding its value chain and its operations. Moreover, it upstream the environmental and social effects of its suppliers as well as downstream the effects of its products and services(Nazam et al., 2015).

The social and environmental effects of these business operations are considered by integrating corporate social responsibility throughout fashion supply chains (Ülgen & Forslund, 2015). Environmental issues of pollution and high use of

natural resources, on the one hand, are associated to the textile pipeline and textile waste issues in the consumer disposal of used garments. Moreover, the associated use of water and toxic chemicals at the fabric and processing stage is considered due to the fast fashion with a limited lifespan and the ever-shorter trend cycles and the rise of low quality (Shen et al., 2017). On the other hand, the implications are focused specifically within the social issues, considering the labour-intensive garment manufacturing functions. The three areas can be considered primitively for the social issues of CSR, which include working hours, working conditions, and wages. An important supply chain challenge includes ethical transgressions because fashion industry is a considerable point for worker exploitation, sweatshops, and child labour (Ali & Haseeb, 2019). Precisely, there are substantial challenges to successfully integrate strategies that are both socially responsible and competitive as illustrated from the intense focus on speed and cost reduction in the fashion industry.

### 2.4 SCM Planning in Textile Industry

These aspects include an effective computer-based management information system, a knowledge base of effective practices, a set of optimisation tools, and conceptual paradigm. The most important component in the modern supply chain process is the effective computer-based management information system (Giannakis & Papadopoulos, 2016). Two different kinds of suppliers are categorised usually by retailers. First kind includes a short lead time, more flexibility, and higher cost. In contrast, the second kind includes a long lead time, less flexible, and lower cost. This segmentation assists in planning a strategy with

respect to the basic or fashion goods and type of consumers' demand, which are determined by prediction, variety, changes, production volume, and style variation (Zhelyazkov, 2011). The retailers prefer to work with one of the main suppliers' groups which include the fashion goods and the basic goods.

The relationship of the chain entities as well as their development status for the targeted opportunities is established by a planning-link in the strategic planning process. It guided to design appropriate strategies for the system. These tactics were investigated for their significance to the target opportunities and therefore, the preferences were constructed for those plans. The rating and significance of the plans are established under the prioritisation process, which is beneficial in their integration phase. In addition, this prioritisation phase assists in the allocation of the restricted system resources for achieving the objectives in minimal time.

The impact of inaccurate prediction is minimised through redesigning planning procedures that allow retailers for selecting those alternatives, which result in a faster supply chain and are not culturally or geographically differentiated (Hussain et al., 2012). Consideration emphasises specifically on the association between supply chain management and product management with respect to product range, lean agile, and local overseas. In this regard, cost is one of the important criteria in the planning phase. The aim of the cost criteria is to anticipate and compare the extent of the financial resources required by different strategies (Kumar, 2005). The classification of cost is based on the levels and values of intensity. However, it has been deemed that lower financial resources are required within the planning phase, which lead to higher cost strategies. Another important criterion is the time, which is usually regarded in the implementation phase of the strategic planning (Čiarnienė & Vienažindienė, 2014).

In addition, it is considered along with the intensity values and levels. In this regard, the objective of time aspect is to set the preference of the developed strategies based on the shortest times.

### 2.5 SCM Strategies in Textile Industry

Due to new entrants and innovative strategies emerging from globalisation, the fashion apparel industry has been modifying in the last several years. Fashion apparel companies are being forced by increased imports from low-wage countries with performance standards and similar quality standards to feature alternative strategies for staying competitive (Mudiyanselage & Herath, 2014). In addition, fashion companies are further forced to adjust their value chains based on the wage differences between low-developed and developed countries. In this scenario, important strategic choice in the fashion apparel industry usually considered as the manufacturing or purchase decision is the in-house production versus outsourcing (Martino et al., 2017). Companies can achieve cost advantages and switch components of the risks related with the production as well as associated procedures to third parties while making use of outsourcing. The average costs per working minute are much higher in developed countries specifically UK as compared to the costs in low-wage countries.

New product development is the most dependent factor for a creative industry with organisational success and short product life cycles in fashion apparel industry. In addition, the integration of different theories can explain the motives of either selecting for outsourcing or a vertical integration (Lee et al., 2014). The cost reduction focus is the most frequently mentioned motivation for companies for shifting their production to third parties. Companies are searching for the lowest total costs

influenced by the uncertainty, frequency of transactions, and the factors asset specificity, according to the Transactional Cost Economics (Sundström et al., 2016). The Transactional Cost Economics is selected as an option with the lowest total costs of ownership either in-house outsourcing or production in this cost-oriented outsourcing approach (Kovacs and Spens, 2013). Outsourcing is used for adding value to non-core activities of a company in the resource-based view, which concentrates to have imperfectly non- substitutable resources. The company can concentrate on its core internal activities as well as achieve access to expertise outside of the organisation while those non-core- activities are outsourced to experts.

Business practices and technological innovations support the demand driven approach for achieving a highly flexible response to customer needs in the fashion apparel industry. Quick response systems are used to achieve this strategy. It is considered as a speed to market of products, which switch quickly through the delivery cycle and production to retailer, manufacturer, and end consumers from raw materials and component suppliers (Köksal et al., 2017). The use of leagile and agile approaches should be highlighted while considering the need to reduce lead times and achieving a quick response system. The concept of lean manufacturing has been originated in the Toyota Production system. The lean manufacturing focuses on the inclination of production efficiency by reducing waste (Halldórsson et al., 2009).

Local suppliers are preferred to offer an increasing responsiveness when considering the reduction of lead time for quickly responding to customer demands due to distance

advantages. Lower risks can be achieved near sourcing locations while this option might include higher costs. In this regard, in-house production, a mixed strategy, and outsourcing is essential (Diabat et al, 2014). It has been observed that one of these sourcing strategies can be assigned to fast fashion retailers. Other retailers such as Zara and Benetton have in-house manufacturing competencies while fast fashion retailers such as Mango, H&M, and Gap have no manufacturing units for outsourcing (Chan et al., 2017).

In addition, push and pull logistics can be used to differentiate the supply strategy. Clothing is ordered by retail stores for replenishing garments as well as order new collections based on the individual demand of the store when implementing the pull strategy (Herath et al., 2017). On the other hand, vertically integrated companies mostly use the push strategy that possesses the overall responsibility of the supply chain and management (Khan & Rattanawiboonsom, 2019). These firms often push collections from the distribution centre regardless of any present order to the stores directly. The business models are the determinants to decide a specific strategy to be used for a company (Chowdhury, 2017).

These strategies are specifically used by specialised chains such as Mango, Esprit, and Zara in their business models for rapidly increasing their market share (Ashrafuzzaman et al., 2016). Short lead times, continuously renewing their collections, and avoiding warehousing costs are comprised within their company strategies as compared to the replenishing stock. Local procurement and imports are merged to enable them for reducing delivery times to 2 days (Ikram et al., 2018). This strategy allows these companies to provide fashionable clothing. European manufacturing companies have also undergone a restricting process, considering the changing procurement trends.

Competitive advantages are developed, which include quality, shorter lead times, higher productivity, innovation, design, and higher flexibility (Rashid et al., 16).

### 2.5.1 Production Management Models

Different organisational models are applied to identify a movement towards typologies of distributors as compared to the conventional apparel retailers. An organisation can find organisational units that can act as the reference point for an industrial nature's functions within such models. These functions include quality control of fabric, product design, and sourcing of semi-finished textiles (Guercini & Runfola, 2004). Different production management models can be adopted by the distributor to analyse its role in developing the capacity of a retailer for innovation as well as do not coincide with what used to regard as the conventional models. Importantly, quick fashion, planned fashion, and firms with a mixture of both types are usually recognised as several annual collections made possible by time to production and as a function of the time scale involved in production (Jakhar, 2015).

It has been observed that manufacturers of fast fashion tend to assume greater importance of fast fashion, quick fashion, and fashion flashes as compared to its past. Moreover, they can also consider a substantial brand positioning while the planned model was previously associated to branding only (Macchion et al., 2015). A firm considers a generalised tendency by the retailer to change the moment of decision on semi-finished textiles closer to the time of sales in shops for moving the so-called uncoupling point of the supply chain despite different production management models.

Technological alternatives can be achieved to some extent that make it possible to execute with respect to the quick response indications (Wu & Barnes, 2016). In this regard, the layout of the point of sales can be acted by the retailer by making changes to the window display or by setting up the range of sale based on the six seasons as observed in the distribution models of US. In an alternative scenario, the sale range might be set-up for instant planning of two/three-week cycles as observed in the case of the Swedish H&M and the Spanish Zara (Fischer & Pascucci, 2017). Therefore, the development of point of sales ranges deems to be associated to the different models of production management implemented by the distributor.

There are two important implications to the selected production management model as compared to the other one. Firstly, it is important to emphasise the technical aspects as there are close association throughout the production structures between organisational solutions and technical solutions (Silver et al., 2016). Secondly, the adoption of a specific model by the retailer becomes an interesting factor for associating with several organisational structure changes. For instance, the type of organisational set-up will not achieve organisational effectiveness in such a complex framework with such a dynamic competitive structure. In addition, other aspects of corporate management are repressed by the different production typologies (Xie, 2015). Other theoretical contributions also support these observations by investigating the association between new forms of organisation and environmental change in the textile industry.

It is also observed that the organisational system is subdivided into several subsystems due to environmental complexity, each of which specialises in subsystems or portions of the management or environmental configuration (Mehrjoo & Pasek, 2016). The

problem of how the different organisational units can be adequately coordinated is raised with such a situation. In contrast, logistics management problems can hamper the recourse to an extended supply chain. It has been observed that purchasing decisions are usually considered regardless of overall knowledge of the actual costs of different alternatives. On the other hand, a significant impact on revenue can be emphasised with respect to the lost sales and negative economy (Dachs, et al., 2019). The capacity of a retailer to acquire high service levels and gross margins is derived from precision in forecasting demand, which leads to contain unsold stocks to the lowest possible levels. Therefore, the benefit of adopting these models can turn into the reduction in lost sales and merchandising amount, and logistic costs that can derive from selection of a faster local supply chain (Shen et al., 2017).

### 2.5.2 Purchasing Strategies

Purchasing strategies have obtained a vital role in identifying the functions of a clothing retailer. The significance of sourcing is at least characterised to the efforts made for new sources of supplies as well as investigated to identify the major strategic groups of corporate strategy and apparel retail (Mangiaracina et al., 2016). In this regard, two different purchasing strategies can be used to proceed the purchasing requirements to operate apparel firms.

- Purchase of manufacturing services and semi-finished products integrated with the capabilities of a firm.
- Purchase of existing garments manufactured by manufacturers who adopt collections of research and development.

This alternative strategy is a substitute that is concerned with the overall corporate strategy of operators entailed in clothing distribution. Therefore, firms are appeared as genuine retailers in the first group as they operate as pure intermediaries who sell same merchandise categories as they purchase (Wilhelm et al., 2016). In the second group, firms are specifically entailed in retail apparel sales, but they tend to adopt the typical functions of the manufacturing operator, which include purchasing of semi-finished textile and design.

It has been observed that these two purchasing strategies can be observed in several cases as differentiated and identified situations if the firms operating in distribution are examined (Huq et al., 2016). For instance, an activity can be apparently observed as being performed by the supplier, which include designing a piece of apparel in the first case. On the other hand, the customer can perform that activity in the second case. However, several possibilities can be drawn from these conditions (Basheer et al., 2019). These include inclusion of resources made available by the retailing firm and situations in which third party operates for designing the apparel collection suggested by the retailer. In addition, this does not necessarily outdate the purchase of semi-finished textiles if a firm is involved in the purchase of ready-made garments and therefore, it is perfectly observable that retailer can adopt a mixture of both strategies (Basheer et al., 2019). The presence of situations of the possibility of creating a mix between the two alternatives and partial integration of manufacturing functions does not impose that they cannot be conceptually distinguished and identified. A firm can make decisions, if involved in apparel retailing, about the garments purchase considering the patterns of apparel retailing and semi-finished apparel design (Ağan et al., 2016). The extent of vertical integration of the operators who are comprehensively

engaged in apparel retailing is based on the choice of favour in this context, which is affected by the likelihood of increasing geographic diversification of the production or supply chains of the firms. Specific importance in the clothing product sector has been obtained by this phenomenon (Robinson & Hsieh, 2016). The corporate strategy is positioned above the purchasing strategy as it indicates to the level of functional strategies from a conceptual perspective.

### 2.6 Supply Chain Management and Sustainable Competitive Advantage

In theory and practice, being a network including several connections and businesses and managing a supply chain received substantial importance. The effective management of supply chains is identified by researchers as an important success factor in order to develop a competitive advantage. Therefore, the management of supply chains cannot be left to chance anymore due to the increasing attention in effectively managing the supply chains (Huchstedt, 2015).

It is highly important to achieve competitive advantage specifically in the fashion apparel industry. The effective supply chain management is becoming a core focus for strategic management with the consideration to be imitated by competitive companies (Zhelyazkov, 2011). Generally, short-lived differentiation advantages that are quickly and easily created by the fashion apparel industry are eroded by the innovative new styles and imitation, which makes it complex to product such a competitive advantage. The expansion and combination of information and knowledge is a frequent mentioned capability, which results in a competitive advantage (Thakkar et al., 2009).

Due to increasing competition of international companies providing services and products worldwide, companies are experiencing a constantly dynamic nature of supply chain management strategies. In addition, the complexity of managing supply chains is increased by a significant amount of the production, which is outsourced to third companies situated in other countries (Shen et al., 2017). Furthermore, the actual success or failure of a given supply chain management strategy is determined by the final customer. Therefore, it becomes a fundamental rule for the survival in current marketplaces to get the right product at the right time to the customer and at the right price. An increasing competition has been anticipated between supply chain networks rather than companies competing each other (Panhwar, et al., 2017). It is important for fashion apparel industry to include a strategy that fulfils all aspects belong to the products, the marketplaces, and the company.

### 2.7 Trends in Purchasing and Retail Channel Strategies

Fashion apparel companies are using different combinations of retail formats for reaching their final customers, increasing their brand awareness, and exploiting their interaction. Different kinds of formats are used for targeting different customer segments accordingly, which range from mono-brand stores to online shops, flagship-stores, to specialist stores (Basak et al., 2015). It has been observed that the UK fashion apparel market is dominated by the clothing retails and specialist stores. The emergence of retailing is significant as it connects the company owning the retail organisation and the brand in one of the final stages of the supply chain (Barnes & Lea-Greenwood, 2006). The combination of retail channels that are used are also contributed by the overall business strategy of a company. In this regard, a sustained competitive

advantage and customer's loyalty is essentially assured through the company's image and the retail format.

The selected retail format is influenced either by the strategic choice on either outsourcing or in-house production or close-to-market sourcing or off-shore sourcing. In this regard, the fashion apparel retail trade and the fashion apparel industry are the two different strategies in the fashion apparel sector (Chan et al., 2017). Fashion apparel companies are active in the fashion apparel industry based on their designing, selling, and producing aspects to the group of fashion apparel retail trade companies. In current situation, these companies either making use of third part manufacturers by sourcing out supply chain parts or produce their products in own manufacturing facilities (Diabat et al., 2014). On the contrary, companies are selling products directly to the final customer in the fashion apparel retail trade, possessing a medial function between the final customer and the fashion apparel industry.

In the retail trade of fashion apparel products, an increasing number of companies operating make use of forward integration and operating their own and independent retail shops. In contrast, retail trade companies are increasingly using backward integration by manufacturing their own collections (Halldórsson et al., 2009). A comprehensive separation between companies performing in the fashion apparel industry is not possible anymore in most cases. Therefore, companies are either distributing their products internationally or nationally with respect to their own retail channels or a mixture of both opportunities (Kovacs & Spens, 2013). The accessibility of a logistical structure, the activity of competitive companies, intention

to grow in an existing market, entering a new market, and the accessibility of a logistical structure are factors on which the combination of retail formats depend.

The buying patterns and purchasing behaviours of customers are changed by the new mobile devices and growing digitalisation. Online shopping is preferred by an increasing number of customers as compared to going to physical stores located in shopping centres. Specifically, the number of customers is increasing rapidly that are first seeking online for price comparisons and information before purchasing the product offline in a physical store (Lee et al., 2014). A variety of products anywhere and anytime is demanded by the increasing importance of digital customers and trade to reconstruct their supply chains, which face issues related to service requirements and product flows. Retailers identify the increasing demand of the additional development of Omni-channel requirements for competing in this challenging marketplace (Martino et al., 2017).

Within the next few years, omni-channelling will incline substantially to make an adequate product information system for mastering the massive amount of data generated across different channels. In addition, for fulfilling Omni-channel needs, retailers should have to make advantage of their stores. The potential of increasing sales, reducing the need to drastically lower leftover merchandise at the end of season, and out of stock is reduced by needs of satisfied customers. Inventory across the several channels should be increased for assuring that every product is accessible to fulfil both customer experience and profitability.

## 2.8 Outsourcing in Apparel Industry

Outsourcing is an important perspective for many European fashion apparel companies to low-wage cost suppliers in all over the world. The product is designed and purchased by the fabric, whereas the fabric is trimmed by the manufacturer within the clothing firm. The design, marketing, and planning functions of the supply chain are focused by these companies which now owning any manufacturing facilities (Huchstedt, 2015). Outsourcing is characterised as coordinated firms in which the complete value chain is coordinated from the final design to the distribution of final products. Therefore, this category allows fashion companies to make use of third-party manufacturing, including both companies with own stores and no own stores either locally or in offshore production locations (Sanil et al., 2016).

Providing relatively high flexibility is becoming a frequently used practice in the fashion apparel industry while considering the likelihood of switching from low capital investments and great control, outsourcing parts of the production to third party suppliers. Companies might outsource parts of their production due to an increasing number of products, which require a rapid instigation to the market and a greater number of skills and abilities (Hines & McGowan, 2005). However, this variety requires the management of a large network of suppliers resulted from an increasing number of products and a growing volume per product. Companies majorly depend on sourcing agencies to handle their import and export activities as well as their difficulties, which require knowledge and access of existing supplier activities, product technical expertise, and offering a complete logistics and sourcing service with local expertise (Köksal et al., 2017).

In addition, risk is managed effectively as well as improving flexibility by passing responsibilities in the sourcing locations to those intermediaries. However, companies might also reduce prices and decrease lead times as well as cooperating with offshore factories. Moreover, companies are outsourcing offshore with performance standards and similar quality standards to mitigate costs and manage risk effectively in low labour costs (Kumar, 2005). In addition, fashion apparel companies are forced due to lack of domestic suppliers or customers for selecting offshore manufacturing. On the other hand, companies select outsourcing in physical proximities for quickly responding to the demands of the customer. In addition, the challenges of green and sustainable supply chain management activities have received increasing consideration recently to become an important factor such as flexibility, reliability, and quality for outsourcing companies.

### 2.9 Self-Owned Manufacturing Facilities in Apparel Industry

In the present period, the operation of fully owned manufacturing facilities is selected by only a small majority of companies. The flexibility of companies might be limited while taking into consideration the geographical movements, emerging fashion trends, and the response to customer demands while relying on self-owned manufacturing (Mudiyanselage & Herath, 2014). In addition, companies are restricted to comprehensively owning their manufacturing facilities due to maintenance and employment costs throughout quiet periods in the production and fashion cycles. The innovative strategies of fast fashion retailers are frequently cited examples that can be used for strengthening competencies of their own or companies with factories and those

competencies. The New Verticals is another strategy, which is represented by fast fashion companies such as Zara and Benetton (Shen et al. 2017).

There are two aspects that characterise fast fashion companies. Firstly, a highly trend product is designed by closely monitoring preferences of customers as well as demands and characteristics of the industry. Secondly, the domestic or close production locations are attributed by their short production and distribution lead times (Thakkar et al., 2009). Fast fashion retailers have shorter lead times for rapidly covering with trends while being associated to traditional fashion retailers that are forecasted with a production lead time. Quick response systems are offering significant support with the competence to procedure further inventory after achieving updated demand information even though at a higher unit cost as compared to the initial order (Zhelyazkov, 2011). Fast fashion retailers manage to reap further benefits by reducing strategic behaviours due to the placement of a massive number of localised productions, use of advanced shipping methods, and costly local labour.

## 2.10 Research Gap

The objective of this study is to study the determination and application of supply chain strategies and practices in UK textile. The application of supply chain strategies is based on the flexibility, which is demonstrated by Upton (1994) and Duclos et al (2003) as the competence of the purchasing function to react in a timely as well as cost-effective approach to modify requirements of purchased components, with respect to delivery date, mix, and volume. Several examples of the supply chain strategies importance have been found in the literature. For instance, GM and Boeing faced problems regarding the implementation of a production ramp and thus their suppliers cannot manage their

capacity in the 1990s. In similar stance, the achievements of Hong Kong can be imputed to the flexibility of its subcontracting networks as an original equipment manufacturer producer (Ekanayake Mudiyanselage, 2021). The relationship between supply flexibility and sourcing practices has not been adequately explored particularly, the study of supply chain strategies for production and planning is at its infancy stage even though sourcing strategy has been studied substantially (Shukor et al. 2021; Rajesh, 2021). Supply chain strategies cannot be integrated through any diverse approach. The adoption of different strategies indicates the adoption of different sourcing practices (Yang et al., 2021). It is likely to increase flexibility by developing an effective coordination with suppliers in the supply chain integration literature. In alternative scenario, the lack of information or coordination is counterbalanced for firms that buffer stocks. In addition, firms can either rely on e-marketplaces for contacting a wider range of supply sources or intensify the integration of information systems with a few key suppliers (Loro & Mangiaracina, 2022).

Domestic sourcing is used by firms for increasing flexibility with respect to localisation decisions (Arrigo, 2020). In contrast, suppliers can provide a better cost ratio or flexibility owing to lower site costs, accessibility to specific natural resources, lower wages, and less restrictive environmental regulations (Srivastava et al., 2021). Supply chain strategies cannot be increased randomly or by integrating a new approach. In precise, little attention has been given to the analysis of different approaches to increase the application of supply chain strategies and practices so far in the literature (Lim et al., 2021; Zekhnini et al., 2021). Previously, studies have enlightened the evaluation of supply chain flexibility and its influence on the performance and not on the different strategies and practices that firms use for production and planning. Different strategies and practices as set of managerial practices have been majorly used

in supply chain management (Saragih et al., 2020). Thereby, a similar pattern can be used for contrasting subsequent supply chain strategies and practices for production and planning.

The core objective of the SCM is to mitigate the cost and the lead time of the product. The aspects of the supply chain management involve efficient planning and management of logistics, availability of appropriate warehouses for storing goods, availability of improved maritime physical infrastructure, transportation of raw materials, informational sharing of demand, efficient planning and management of logistics, availability of better infrastructure of roads and railways, and highly efficient planning of ports and shipments. These all contribute to reducing the lead time of the value chain and the related cost.

Textile industry is a long chain, which includes complement production, clothing production, and materials production. Therefore, it makes sense for applying supply chain management to textile industry (Monseau et al., 2024). Supply chain management is not merely a new concept but a weakness in textile industry. In contrast, the competence is improved through the edge tool for textile industry. In addition, it is the important stage for textile industry as it progresses and advances its position in global industry chain (Luján-Ornelas et al., 2020). One of the major trends in business is outsourcing that reduce cost and allow firms for concentrating on the core business.

The following questions will be addressed based on these gaps found in the literature.

- Are there any external variables that can demonstrate why firms are driven to a specific strategy?
- How are the sourcing strategies combined to form specific supply chain strategies?

- How do these strategies vary with respect to the level of supply production and planning achieved?

The contribution of this study will be to offer a taxonomy of supply chain strategies and practices in UK textile as well as to compare these strategies with respect to production and purchasing.

## 2.11 Conclusion

Companies are operating in market niches as well as bringing core collections to the market, which include accessories and matching clothes for strengthening the international and national brand image. Companies are more strongly customer-oriented by fast deliveries, instigating an increased number of collections per year, and quickly responding to customer demands. A key component for fashionable products for comparatively short lead times is quick responding integrated forecast system. Fashion apparel companies are increasingly using forward and backward integration for enhancing their control over the last stages of the value chain.

The following chapter presents steps and phases to build the chapter around methodological underpinnings. Moreover, this chapter is fundamentally focusing on the design and process elements of research methodology and how participants will be approached to fulfil the objectives of this research.

# Chapter Three

# Research Methodology

## 3.1 Introduction

The present study focuses on determining the strategies and practices of supply chain in the textile industry of UK. This would help in determining and fulfilling the principles that guide the interactions with upstream supply chain.

## 3.2 Research Design

According to Merriam (2009), exploratory approach is useful in describing and analysing the bounded systems in depth. Exploratory research is defined as a research used to investigate a problem which is not clearly defined. It is conducted to have a better understanding of the existing research problem, but will not provide conclusive results. A total of three companies were selected from the overall UK textile industry. These companies include Marks & Spencer, H&M, and Zara. It is argued that contemporary set of events are described through distinct advantages over different research methods that include surveys, experiments, questionnaires, or open-ended questions (Yin, 2008). Data can be collected from multiple sources in an exploratory study as it provides evidence to data triangulation (Yin, 2018).

The study used a quantitative research design that is data was collected using a quantitative approach. It mainly focuses on processing and understanding the meaning of data. A richly descriptive product is delivered through inductive process that is provided by qualitative analysis (Merriam, 2009). The present study discusses case of three apparel-based companies; therefore, the qualitative method was appropriate in a real-life context to get insights about problems and relevant solutions in the practice of sustainable design.

Quantitative method is commonly used when the knowledge about studies phenomena is robust (Jacobsen & Sandin, 2002). It employs an exploratory approach, rather than a descriptive one. The study is likely to help in describing and developing a framework indicating the performance measure that are included in different supply chains of apparel industry.

### 3.3 Research Process

The process followed in research can either be deductive or inductive approach. Inductive approach involves the search for pattern from observation and the development of explanation whereas deductive approach uses theory for making predictions or explaining a phenomenon. The combination of both approaches that is inductive and deductive is referred to as abduction. This type of approach is used in a situation, where there is an alternate use of research approach (De Toni et al., 1994). It is very difficult to decide whether a piece of research follows deductive, inductive, or abductive approach. Based on the discussion, this research is based on deductive approach as the focus is toward experimental and causal analyses to address the research objectives.

### 3.4 Selection of Sample

The respondents for this study were selected purposefully based on contacts of the researcher. This helped in determining the company that was well-suited for this study along with willingness of the participants to participate in this study. Development of textiles and apparel was included in the case company criteria via global supply chain and getting involved in sustainable design practices. This study used a purposeful

sampling method to recruit participants from three different companies. The collaboration between the researcher and key contacts of three companies helped in identifying the engagement of cross-section of employees in the process of product development and sustainable design in different departments.

### 3.5 Data Collection

It is not easy to determine the application of supply chain strategies and practices in the textile industry because of problems of volatility that hinder the prediction of consumer demands and the fashion trends. The traditional forecasting techniques are not efficient enough for delivering accurate products needed to manage the logistics in fashion market, despite of the recent improvements in this industry. It is possible to reduce the forecasting risk by decreasing the dependency on forecasts through shortened lead time. This is likely to render a better response towards consumer demand. The importance of speed-to-market has increased significantly to cope with the increased demand for fashion variety (Britwistle et al., 2006). The survey was uploaded on the SurveyMonkey platform for collecting data from participants. The questionnaire covered sections related to supply chain optimisation, information sharing with suppliers, long-term orientation with suppliers, purchasing integration, supplier capability auditing, development of key suppliers, internal and external coordination, and digitalisation.

The present study uses AHP and PLS-SEM for conducting quantitative data assessment. Evaluating the suppliers is considered as a complicated process because of the relative difficulty in conceptualising and structuring different evaluation components within the analytical framework (Chan & Chan, 2004). In this process, the nature the factors are quantitative, while others are subjective. There is an increase in

the large number of alternatives as competition in the market increases. A decision-making tool known as AHP decomposes complex problems into multi-level hierarchical structure of criteria, alternatives, objectives, and sub-criteria. Numerous fields have reported on applying AHP in project selection, transportation, manufacturing, conflict resolution, and budget allocation (Wang et al., 2005).

The present study uses AHP and PLS-SEM for conducting quantitative data assessment. Partial least squares structural equation modelling (PLS-SEM) has recently gained increasing attention in research and practice across various disciplines such as management, marketing, information systems, medicine, engineering, psychology, political and environmental sciences. PLS-SEM enables researchers to model and estimate complex cause-effects relationship models with both latent (graphically represented as circles) and observed variables (graphically represented as rectangles). The latent variables embody unobserved (i.e., not directly measurable) phenomena such as perceptions, attitudes, and intentions. The observed variables (e.g., responses on a questionnaire or secondary data) are used to represent the latent variables in a statistical model. PLS-SEM estimates the relationships between the latent variables (i.e., their strengths) and determines how well the model explains the target constructs of interest. The main reasons for the increasing popularity of PLS-SEM are its capability to estimate very complex models and its relaxed data requirements.

In the initial step, a complex problem is broken into sub-problems at different hierarchical levels. It provides a set of attributes that relate to each sub-problem. There is just one element at the top level, that is the goal, while there are several elements at subsequent levels. Comparisons are made between elements in the next higher level, with similar magnitudes. The focus here is choosing the most optimum and best supply

chain considering the case of all three companies considered in this research (M&S, H&M and ZARA). The relevant performance measures were listed at the subsequent levels. There is quantification of all the available choices, which are later converted into weights being used for prioritising a portfolio of alternatives. There is an aggregation of weights of each element at the hierarchical level to reach the next level. The priorities of each pair of criteria can be determined through pairwise comparison that indicate the strength of a single element over the other, considering the higher-level element. A nine-point scaling system is used for prioritising each criterion that helps in quantifying non-economic and intangible factors in hierarchies.

A framework is developed using AHP to cope with multiple criteria that involve intangible and tangible aspects, along with qualitative and quantitative aspects. The three steps involved in this process are listed below.

- Decomposition of complex problems into the hierarchy of different levels of elements.
- Measurement methods to be used for establishing priorities among elements.
- Synthesis of properties of elements for establishing the final decision.

With reference to the present study, the main aim is to select the most optimum of best supply chain strategies and practices. The performance measures at subsequent levels help in listing and quantifying the available choices, which are later converted to weights for prioritising portfolio of ideas. AHP plays an important role in ranking and making decisions in a systematic and rational way. Weighting provides flexibility in the process of taking decisions as it can be changed based on different industries and companies (Chan, 2003). AHP is different from other approaches of decision making

because it is capable of handling intangible as well as tangible attributes, monitoring consistency with which a decision maker makes judgment, and structuring problems in a hierarchical manner for gaining insights into the decision-making process.

The assigning of pairwise comparisons is done based on the nine-point scale as suggested by Saaty (1990). The geometric mean approach is used for combining the individual pairwise comparison matrices for gaining consensus pairwise comparison matrices for the entire team. This approach was used to question the merchandisers in the sourcing office of the three companies. An AHP was used for determining and calculating normalised weights for constructing the model. Designing of this software supports the designing, constructing, and implementing hierarchy to make decision models and solve problems. The first step involves computation of normalised weights for each pairwise comparison matrix, followed by synthesis of solutions for the supplier selection problem. A combination of normalised local priority weights of criteria and sub-criteria from the third phase was used with respect to successive hierarchical levels. This helped in obtaining global composite priority weights for all the sub-criteria at the third level of AHP model.

The difficulty of maintaining consistency in decision-making and the intricacy of the pairwise comparison procedure is two of the AHP drawbacks. AHP calls for a number of pairwise comparisons, which can be challenging to organise and time-consuming when there are a lot of evaluation criteria. Focussing on increasing the explained variance of dependent constructs is a significant drawback of PLS-SEM in comparison to CB-SEM and may result in overfitting, especially in exploratory phases or with complicated models.

### 3.6. Conclusion

The present study has chosen three different companies in the suiting category that

produce apparel and are based in UK. The study would help in getting information related to company's strategies, along with their willingness in building collaborative relation in long-run. The study further adopts competitive priorities, along with the addition of trust in the supplier selection model. Therefore, the study goal was achieved based on the identification of six criteria, including quality, flexibility, trust, cost,

delivery, and digitalisation. The following chapter presents the development of framework and data collection addressing the attributes essential for production and planning. A total of 8 main criteria's and 27 sub-criteria were proposed in the framework.

# Chapter Four

# Development of the proposed SC Strategy Framework

## 4.1 Introduction

Strong international competition, shortened product life and increasingly demanding customers shape the current business environment. One of the main aspects of supply chain management is strategic purchasing management, which deals with both production and purchasing aspects. These methods ensure better utilisation of resources and control of costs. The next section provides a proposed framework supply chain management strategy for manufacturing and procurement of the textile industry and its components. The most important features of the proposed framework are the challenge to reduce costs while improving service levels and promoting sustainable procurement in the UK.

## 4.2 The Proposed SCM Strategy framework for Production and Purchasing

The following seven sections discuss in detail the elements of the proposed production and purchasing supply chain management strategy framework, which is also displayed in Figure 4.1

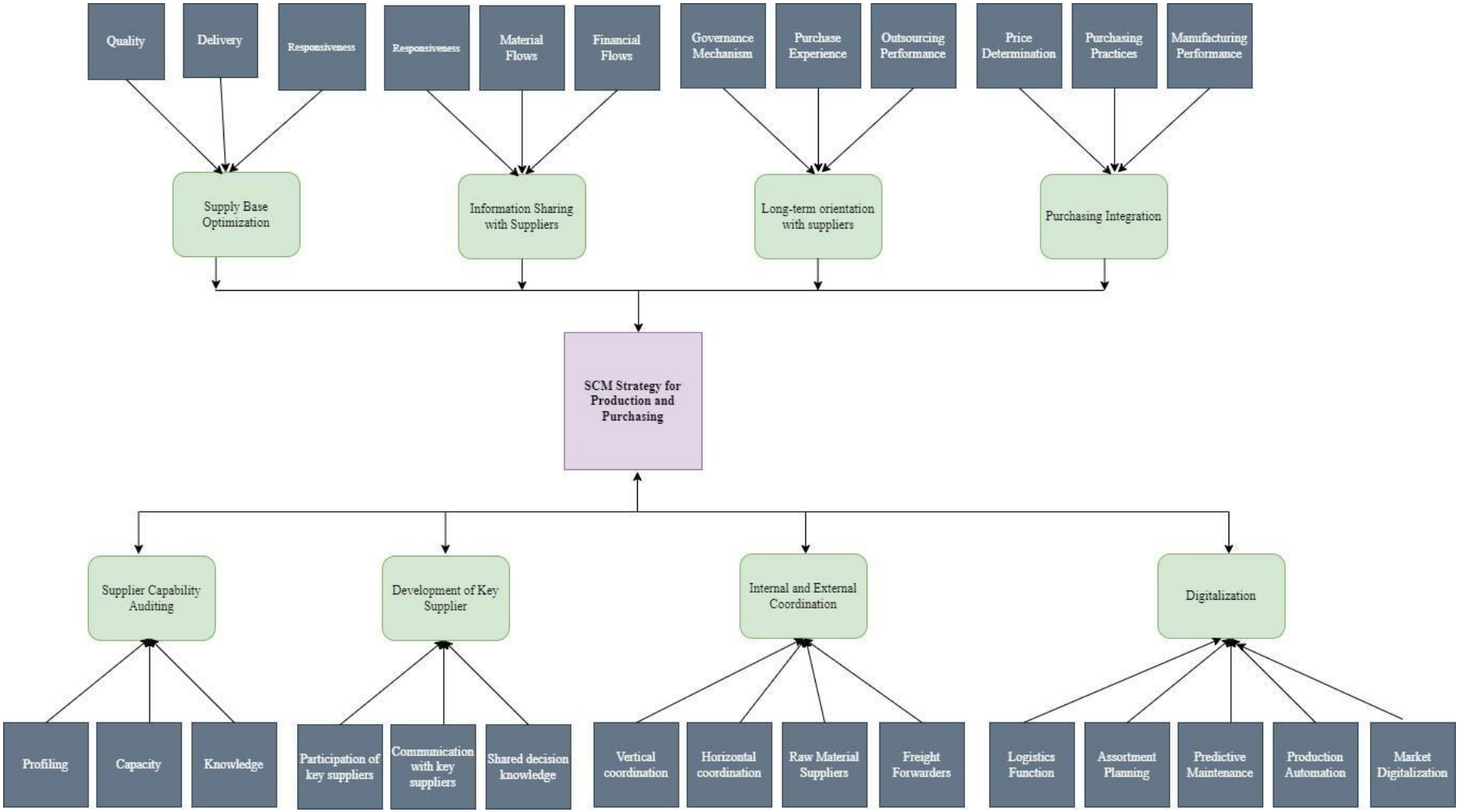


**Figure 4.2:** Conceptual production and purchasing supply chain management strategy Framework

### 4.3 Supply Base Optimisation

#### 4.3.1 Introduction

Supply base optimisation builds procurement leverage and gains cost, delivery, supplier capability, quality, and technology dedication advantages. It provides the foundation for efficient and effective supply management and enables more appropriate procurement practices.

#### 4.3.2 Main Body

Previously, it has been reported that supply base optimisation is associated with a limited number of suppliers, as there are strong similarities in these factors (Franco & Alfonso-Lizarazo, 2020). Three dynamic supply chain models and subsequent optimisation strategies are considered. First, a central order processing system at the manufacturing level of the textile supply chain. Second, a collaborative cloud service platform for optimising the demand-driven textile supply chain; and a new resource sharing platform for optimising the apparel industry to optimise the make-to-order textile supply chain (Zhao, 2010). Recognised supply chain strategies, such as joint decision-making, profit sharing, resource sharing, and information sharing, are incorporated into developing these three collaboration models. Likewise, it has been identified that optimisation heuristics are designed in three models for different objectives.

##### 4.3.2.1 Quality

Quality in supply chain management is the procedure through which firms evaluate, proactively manage, and monitor the quality of processes and products in the supply

chain. It is utilised for creating a more consistent supply chain, improving on-time delivery, and reducing cycle and lead times.

Supply chain collaboration has become an important direction to optimise different elements of supply chain risk management, social responsibility, long-term partnership, and sustainable development (Marvin et al., 2012). At present, each enterprise always has a single supplier, regardless of cooperation or not, forming an independent supply chain structure from the fabric manufacturing level to the clothing manufacturing level (Pal, 2020). Therefore, in practice, supply chain optimisation can be a better way to optimise the textile supply chain. In textile small and medium-sized enterprises (SMEs), increased collaboration can be an innovative strategy that increases flexibility, shortens production cycle times, and increases resource complementarity (Perea-Lopez et al., 2003).

Merge a variety of supply chain collaboration strategies into a dynamic supply chain model, and perform subsequent optimisation heuristics, including resource sharing mechanisms, optimal joint decision-making strategies, and information sharing and information update systems. This helps in identifying the problems of mass customisation, flexible production, and supply chains latest trends (Cai, Choi and Zhang, 2021). The results of this study are expected to provide solutions to the problems of high costs and long lead times in current textile supply chain management models, including traditional make-to-order supply chain models and traditional demand-driven supply chain models. In make-to-order systems, companies must measure demand to account for production and inventory levels, so these systems rely primarily on forecasts, which in many cases are not very accurate (Kaminsky & Kaya, 2009). Demand-driven supply chain is explained as supply chain management that focuses on developing a supply

chain based on demand signals. The main component of a demand-driven supply chain is that it is driven by customer needs (Mendes, 2011). They can further optimise supply chain performance from multiple different elements under different conditions.

#### 4.3.2.2 Delivery

A supply chain involves everything from the delivery of source materials from the supplier to the manufacturer using its eventual delivery to the end user. The supply chain segment encompassed with obtaining the finished product from the manufacturer to the consumer is defined as the distribution channel.

Optimisation studies have emphasised the role of different mechanisms, information sharing metrics, and platforms, including cloud service broker models (Demirkan & Goul, 2013), multi-agent and case-based reasoning (MACE-SCM) systems (Kwon, Im & Lee, 2007), trusted decentralised coordination mechanisms (Lee & Kumara, 2007), and cooperative supply optimisation systems (Sepehri & Fayazbakhsh, 2012). On the other hand, the cloud service broker model was developed by Demirkan & Goul (2013) to provide a collaborative mechanism in a value network that serves as a trusted interface between cloud service providers, enterprises, and other companies. Kwon et al (2007) proposed a multi-agent and case-based system MACE-SCM to facilitate information sharing among supply chain partners in the presence of high uncertainty.

Supplier development is the consideration that helps improve social and economic outcomes and deserves further empirical research. The authors of this article conducted the study in the Indian region. The study covers Indian supply chains by examining the character of supplier development techniques and their impact on supply chain performance. To enhance their economic and social indicators, sourcing companies follow direct and indirect supplier development techniques involving logistics

integration, technology investment, supplier evaluation, and financial support. This finding demonstrates the role of supplier development and its impact on purchasers and suppliers.

Chen et al. (2016) used the expectancy model to examine a supplier development implementation framework. This study was conducted to shed light on important issues related to the Southeast environment and the life cycle of SCM products and practices. The content of this study was explored using content analysis and qualitative methods. The variables involved are program DC and ES. The analysis shows that large buyers suffer reputational damage and small and medium-sized companies have a negative impact on the environment. Buyer pressure can reduce these negative effects.

#### 4.3.2.3 Responsiveness

A responsive supply chain is a kind of supply chain that is competent enough for promptly adapting to changes in demand. This refers to the supply chain that is competent for responding promptly to modifications in market conditions, customer demand, or other factors that might influence the supply chains. By utilising quick replenishment and timely inventory, proximity manufacturing raises service and delivery standards (Sirilertsuwan et al., 2018). To respond to demand, brands can also offer products directly from their manufacturing facilities. After

analysing the reshoring factors, five factors have been identified that help a brand manage inventory-related issues to be responsive to customer demand.

Zimmer et al. (2017) used a quantitative approach and applied it to the German automotive industry to capture social risks in global supply chains. The framework was evaluated using the fuzzy AHP technique. The supply chain risk model can be evaluated with a sensitivity analysis that confirms the final value of the risk. The big difference between social risk and differential risk is the supply chain. Thanks to this technology, different tasks can be prioritised to improve working and living conditions. The result of this study shows that the framework has meaning in different companies and is a useful tool to support social issues in supply chains.

Stakeholders can be seen as active participants in sustainable supply chain management and risk management. Depending on the importance of the role, the material SDS (MSDS) practices of suppliers and supply companies are extensive, repetitive, surgical, and impactful. The project management implications of SDS suggest that, firstly, project managers and supervisors are identified, and secondly, the interests of SDS adherents can be controlled through verifiable supplier performance, network, supply chain traceability, and scope. Due to a lack of access to the latter, the sampling process involved a detailed list of BF units rather than SDS units. The study also explores the

relationships between participants, providers, and BFs that determine the shape of the role.

Sancha et al. (2015) examined the effect of national institutional pressures on the adoption of SSD practices. The results show that according to the results, SSD adoption has a positive effect on SSD adoption has a positive effect on supplier integration. The implementation of Health, Safety, and Environment (HSE) practices does not affect the standard and mandatory pressure. According to the results, SSDs are proactively offered by special capacity companies for competitive reasons.

A review of sustainable supplier management models by Zimmer et al. (2016). To find pressure from different interest groups there is pressure from different interest groups to force their service companies and companies to follow social and environmental reforms. The main result of this study is the increased interest in recent years. Fuzzy analytic network process (ANP) and AHP method for final evaluation and selection of social and quantitative indicators. The result of this study shows that SSM has won in recent years. Supply chains in the past have always been critical, and tier-one suppliers are expected to commit significant environmental and social violations.

### 4.3.3 Summary

Consumer demand can be roughly divided into three segments: basic style, basic fashion, and fashion apparel. Basic clothing has the highest production, moderate demand uncertainty and relatively low prices. Fashion clothing, on the other hand, has the lowest sales and fluctuates in demand but at higher prices. Mass production is a feature of basic categories, while customized products have become a hallmark of

fashion categories. Therefore, apparel companies need to develop appropriate supply strategies based on their own demand segments. While the system has worked effectively over the years, it has become difficult for the company to follow suit when market demand fluctuates. Push-based supply chains accumulate excess inventory (rotating inventory and work in process) as they respond to changing demand. Moreover, since long-term forecasts play an important role, it is difficult to match supply with fluctuating demand. The supply chain also requires larger production runs and is not suitable for short runs.

## 4.4 Information Sharing with Suppliers

### 4.4.1 Introduction

Information sharing with suppliers is a fundamental attribute of supplier relationship management, which intends for optimising the value and performance of the supply chain. Information sharing with suppliers can improve innovation, risk management, collaboration, and operational efficiency between suppliers and buyers.

### 4.4.2 Main Body

#### 4.4.2.1 Responsiveness

In the textile industry, information sharing with suppliers can improve how companies effectively manage strategic alliances, accelerate customer response, and better understand customer requirements for improved cost savings. Information sharing with suppliers plays an important role in developing relationships between suppliers and organisations (Yigitbasioglu, 2010). Real-time information sharing benefits all

stakeholders in the textile supply chain, which is a series of different interconnected stakeholders such as distributors, retailers, suppliers, and manufacturers.

The goal of an efficient supply chain is to provide value to consumers. There are significant physical flows between supply chain actors in terms of information and financial flows, which include finished goods and returns, raw materials and work-in-process inventory (Frazier et al., 2009). Within these entities, management processes require a system to coordinate communication so that they can work effectively. On the other hand, supply chain integration is not an easy process. For large groups, the issue becomes more complicated when the number of people and procedures increases. Furthermore, the concept of sharing has been increasingly built into supply chains over the past decade and has been integrated into many industries (Wu et al., 2014). Sharing resources is the core goal of the sharing economy. Sourcing is defined as the process of leveraging and investing in assets and capabilities with supply chain partners.

On the other hand, resource exchange integration is still at a low level in current supply chain approaches and research. Usually, emphasis is placed on the sharing of intangible resources, including financial sharing and information sharing. These resources have been demonstrated extensively in inter-organisational supply chain collaboration. Physical resource sharing has been addressed through limited supply chain collaboration, which includes platform sharing, transportation sharing, carpooling, and warehousing or inventory sharing in the retail industry (Yu et al., 2001). This can have an indirect positive impact on the supply chain by reducing waste and improving responsiveness and efficiency to help SMEs remain competitive in the apparel industry.

#### 4.4.2.2 Material Flows

Material flow is a supply chain management model that portrays how work moves using a system. It defines the movement of raw materials and elements for work-in-progress inventory and finished goods inventory as a directional approach.

It supports companies in building trust and openness with suppliers to better understand supplier performance. It helps to understand each other better and manage conflicts in relationships effectively. This can reduce transaction costs and create a more cooperative relationship to the benefit of both companies (Cannon, 2014). In SCM methods for production and procurement, integration with the long-term location of suppliers is due to factors that explain the same function.

#### 4.4.2.3 Financial Flows

Financial flows encompass of the money's movement from the customer to supplier. Indeed, the customer pays, and the money travels back to the supplier when the customer receives the product and verifies it. Often, the finances flow the other direction in the form of debt.

The goal of an efficient supply chain is to provide value to consumers. There are significant physical flows between supply chain actors in terms of information and financial flows, which include finished goods and returns, raw materials and work-in-process inventory (Frazier et al., 2009). Furthermore, the concept of sharing has been increasingly built into supply chains over

the past decade and has been integrated into many industries (Wu et al., 2014). Sharing resources is the core goal of the sharing economy. Sourcing is defined as the process of leveraging and investing in assets and capabilities with supply chain partners.

### 4.4.3 Summary

Resource exchange integration is still at a low level in current supply chain approaches and research. Usually, emphasis is placed on the sharing of intangible resources, including financial sharing and information sharing. These resources have been demonstrated extensively in inter-organisational supply chain collaboration. Physical resource sharing has been addressed through limited supply chain collaboration, which includes platform sharing, transportation sharing, carpooling, and warehousing or inventory sharing in the retail industry. Currently, the resource allocation system in the textile industry is used in special situations, such as inappropriate production capacity and fluctuations in market expectations. Additionally, within the organisation, some textile companies integrate resource sharing themselves, sharing resources between different departments and teams. Researchers can expect better resource utilisation by integrating true resource allocation as a common system in the textile industry. This can have an indirect positive impact on the supply chain by reducing waste and improving efficiency to help SMEs remain competitive in the apparel industry.

## 4.5 Purchase Integration

### 4.5.1 Introduction

Purchasing integration is defined as the integration of strategic purchasing goals and practices within the objectives of a firm. Purchasing integration with other business units can enhance quality, collaboration, efficiency, and innovation. By allocating procurement strategies and goals with the overall vision and objectives of the organisation, costs, risks, and waste can be reduced as well as enabled performance and value to increase. The following section is divided into three different sub-criteria: price determination, purchasing practices, and manufacturing performance.

### 4.5.2 Main Body

#### 4.5.2.1 Price Determination

Price determination is the approach of how the demand forces for goods and services as well as the supply of goods and services in a market engage in determining the price. The consumer demand level for a product and the response as well as the supply of producers, play an essential role in determining the price of that product.

Procurement integration links strategic sourcing to a firm's competitive choices. This can increase a company's capacity and improve its performance. Procurement integration is related to the production and procurement practices of the SCM approach as it reflects the same dimensions (Wynstra et al., 2003). Procurement process integration must be implemented throughout the company and between the company and its suppliers. Monczka & Petersen (2008) argue that procurement process integration can be explained as both external and internal integration. All members of the procurement process system work together to help the

company achieve greater profits through efficient procurement and attain internal integration, including finance, operations, quality assurance and purchasing. Currently, external suppliers are integrated into the organisation's external integration (Paulraj et al., 2006). The excellent strategy of the company is to try various methods to become more competitive and get increased profits. They must respond quickly to changes in the market and meet the different needs of different customers. This is an effort that companies need to make. According to Lee et al. (2009), in manufacturing companies, products are made from many raw materials and different elements. Therefore, procurement is an important part of business development.

#### 4.5.2.2 Purchasing Practices

The purchasing process commences when the business identifies that they have a pre-requisite for a service, product, or tool that will improve their operations. Team members can facilitate in identifying requirements as they complete their daily work by informing their supervisors of any issues they experience.

Buyer-seller relationship management is included in procurement process management and requires extensive coordination to ensure supplier performance and achieve customer satisfaction. It was stated that quality, service, and price should be included in the item rating and assessment of supplier performance measurement. Several factors are given corresponding weight, depending on the nature of the product being purchased, competition within the supply industry and the quality required (Schiele, 2010). An overall score can be calculated to easily compare results between different providers. Performance reports are submitted to suppliers on a regular basis. Suppliers

who do not meet delivery and quality standards may lose business or be removed from the approved list.

Competitors are an important external factor that can significantly affect the supply chain strategies of a company. In a competitive market, supply chain management plays a crucial role in enhancing the competitiveness and profitability of a company. First, competitors can affect the supplier relationship of a company. Suppliers may be influenced by a competitor's larger volumes or stronger connections and may prefer to offer them better prices and terms or allocate inventory to them first (Saddikuti et al., 2020). This can cause a shortage of critical components or raw materials for a company, which can disrupt the supply chain, and impact production schedules and, ultimately, customer satisfaction (Benton, 2020). Also, competitors may implement better supply chain strategies, leading to a competitive advantage. For example, suppose a competitor implements a just-in-time inventory system. In that case, they can reduce inventory holding costs and gain a competitive advantage by offering better pricing due to reduced storage costs. A company that fails to respond to such a competitive challenge may lose market share and struggle to compete.

#### 4.5.2.3 Manufacturing Performance

Manufacturing is considered to be an important element in a firm's endeavour to improve firm performance (Sahoo, 2021; Chen et al., 2022). Superior manufacturing performance leads to competitiveness. There are two necessary steps which a firm must undertake to excel in manufacturing. First, the firm must determine what its manufacturing competitive priorities are, and where it stands on these aspects relative to its major competitors. Second, to sustain or improve manufacturing strength,

the firm needs to understand what critical manufacturing practices determine superior manufacturing.

In comparing manufacturing performance, most studies define performance in terms of multiple achievement indicators such as waste reduction, operating efficiency, timely delivery, superior quality, motivated employees, customer satisfaction, etc. However, performance is usually reported for each indicator rather than in a consolidated manner through an aggregate index of performance. In addition, most studies focus on the operating outcomes while overlooking whether the improvement efforts warrant the time and costs devoted to them (Clark & Fujimoto, 1991; Leachman & Hodges, 1993; Silver & Lowe, 1989). On the other hand, in the studies where outputs (operating outcomes) and inputs (improvement efforts) are both considered, performance is usually assessed based on a single output (usually production volume) and limited input items (usually capital and labour). These studies usually employ econometric analysis. In these analyses, nonquantitative achievements which also create superiority in manufacturing, such as quality, on-time delivery, and flexibility are not captured in the measures of performance. Also usually ignored in the inputs are indirect costs, which have increased significantly in manufacturing enterprises due to extensive use of automation, system integration, etc. Clearly, performance based on partial measures falls short in providing a complete description of a firm's overall measure of manufacturing competitiveness.

Performance evaluation generates classes of firms based on performance. This leads naturally to a subsequent question: what factors determine the variations in manufacturing performance among firms? Manufacturing activity is comprised of

many processes, decisions, and actions. Correct choice and effective implementation of critical decisions and actions can enhance a firm's manufacturing capability, which in turn strengthens the competitive status of the firm (Hayes et al.,1988).

The need for an open, inclusive, and neutral procedure in selecting key performance indicators (KPIs) for sustainable manufacturing has been increasing. In the past decade, there has been considerable research in sustainable manufacturing and related measurement methodologies. Haapala et al. thoroughly reviewed concepts, tools, and methods for sustainable manufacturing (Haapala & Prempreeda, 2014).

Duflou et al. (2021) provided a systematic overview of energy and resource efficiency methods and techniques for discrete part manufacturing (Duflou et al.2021). These and similar publications review and analyse methodologies for developing sustainable manufacturing practices from the enterprise level to the process level.

### 4.5.3 Summary

Supply chain companies must adopt flexible and adaptable supply chain strategies to manage the risks associated with political instability. These strategies must be designed to respond quickly to changes in government policies, regulations, and legal environments. Supply chain companies must also focus on risk management and implement measures to deal with the effects of political instability on their supply chain. For example, companies can establish alternative sourcing options, diversify their supplier base, and invest in technology to enhance supply chain visibility and agility.

The supply chain for the fashion industry is highly fragmented, with numerous small and medium-sized businesses participating at different stages of the chain. It may be difficult to adopt sustainable practices because of communication failures, ineffective coordination, and a lack of transparency caused by this fragmentation. However, the fast fashion model, which encourages a quick turn-around of clothing at cheap costs, has resulted in overproduction, overconsumption, and the creation of enormous volumes of trash. As a result, the fashion industry is under pressure to implement more sustainable supply chain strategies, such as waste reduction, improved working conditions, and the procurement of sustainable materials.

## 4.6 Supplier Capability and Auditing

### 4.6.1 Introduction

A supplier capability and audit are an objective and systematic examination of a supplier's performance, policies, and processes for verifying their compliance with the standards, regulations, and requirements. A supplier audit can facilitate in identifying and mitigating risks, strengthening relationship, and improving quality with the suppliers. In this regard, this section is based on three important sub-criteria: capacity, profiling, and knowledge.

### 4.6.2 Main Body

#### 4.6.2.1 Capacity

Capacity in supply chain management is defined as the capability of an entity for generating output over a predetermined period. Supplier capability assessments are important because companies rely on suppliers for product development, which

increases the requirement for supplier performance evaluation. Supplier capabilities enable companies to achieve better business performance and maintain a competitive advantage in design, manufacturing, engineering, testing, and response to product changes and delivery schedule changes (Klassen & Vereecke, 2012). Procurement plans should emphasise the performance capabilities of the textile industry's supply base. In most cases, the textile industry has a variety of potential suppliers with varying costs, production flexibility, and delivery times. In general, lowest cost inventories offer little flexible booking options and delivery times of several weeks and require total production to be spread relatively evenly over the year (Huq et al., 2016). Other responsive suppliers may offer shorter lead times and greater flexibility through production commitments. In addition, different suppliers may be concerned with stocking limited quantities of finished goods and charging fees for delivery.

#### 4.6.2.2 Profiling

A supplier's ability and choice to submit samples and overhead costs to the purchasing company is one of the delivery success factors that must be considered in the supplier selection process. Speed is important when evaluating suppliers with reduced lead times in mind. This includes taking lead time and production time. Furthermore, the on-time delivery rate is one of the most important success factors that can be attractively measured using weekly reports (Pun & Heese, 2014). For each product delivery, the supplier provides a certain amount of shipping data. Delays can result in financial losses and poor sales, as well as shipments of less than the ordered quantity. Timeliness and accuracy of cost accounting are also important. In the textile industry, the ability of suppliers to change order quantities and combine order products is very important.

Furthermore, the supplier's ability to respond quickly to orders is an important criterion in the textile industry because material delivery times are long and the integration of QR systems is often not possible (Tiku & Pecht, 2003). The propensity of suppliers to establish joint ventures or strategic alliances in other countries is another important factor in expanding the supplier base to achieve business and cost advantages.

#### 4.6.2.3 Knowledge

Knowledge is essential for attaining sustainable supply chain management in the fashion sector because it allows stakeholders to match their aims and ambitions with a single goal. Also, the fashion business may benefit from sustainable integration by lowering costs, reducing waste, and increasing consumer happiness (Hassini et al., 2012). Knowledge throughout the supply chain of the fashion sector may be achieved via stakeholder cooperation. For instance, suppliers and manufacturers must work together to guarantee that raw materials are timely and of the proper quality. To guarantee that the correct items are created and supplied to customers in order to satisfy demand, manufacturers must collaborate with merchants. Retailers must collaborate with logistics service providers to guarantee that goods are delivered to customers in an effective and efficient manner. Knowledge is a crucial component of supply chain management that entails coordinating all supply chain operations to make sure that each party cooperates with one another (Ahi & Searcy, 2013).

### 4.6.3 Summary

Suppliers should evaluate the different audit requests they receive and point out any overlaps that require them to conduct such audits to the procurement

organisation/customer. Further attention should be paid to integrating auditing and performance management into all supply chain audit programs to ensure a push towards better standards, rather than a race to the bottom, where companies choose the simplest standards and assume the least responsibility.

## 4.7 Developing of Key Suppliers

### 4.7.1 Introduction

Supplier development is the approach to create a long-term beneficial and mutual relationship with suppliers that fulfils the requirements of both firms. It encompasses of recognising and evaluating supplier capabilities and building a trusting relationship with the supplier community. To assess further contributions of key suppliers, this section is divided into three sub-criteria: participation of key suppliers, communication with key suppliers, and shared decision knowledge.

### 4.7.2 Main Body

#### 4.7.2.1 Participation of Key Suppliers

Suppliers' participation has been considered of significant value and importance in new product development, which are parament for the competitiveness of organisations in a concurrent scenario. Key supplier development helps companies establish effective

relationships with suppliers and also enables companies to respond to environmental changes and market uncertainty and respond quickly to customer needs. Suppliers work with inventory and purchasing management and other relevant departments of the company to ensure that the necessary products are purchased in the timeliest, profitable and efficient manner (Dayet et al., 2013). Procurement is very important for the supply chain, production efficiency and profitability as their important job is to select the qualified suppliers and further analyse the mutual relationship with them.

#### 4.7.2.2 Shared Decision Knowledge

Shared decision-making is a mutual standard process in which a professional works collaboratively with an individual for reaching a decision. Distance and cultural diversity make it difficult for influential organisations to plan and implement comprehensive tactical, operational, and global distributed manufacturing strategies (Kumar et al., 2019). Corporations can attain long-term competition for benefits as well as can enhance their overall efficiency and performance effectively. Product selection and analysis, evaluation of supplier correlations needed to procure products, and achievement plans to align suppliers with product instructions are all ordinary three-step supply management traits (Laari et al., 2018). Environmental safety leadership, employee pressure, and evaluation of potential environmental challenges are all aspects that can lead to a transition in the environmental practices of the organisation. It could be difficult to evaluate the gaps in the corporation that impacted the GSCM programs and relevant performance (Wibowo et al., 2018).

#### 4.7.2.3 Communication with key Suppliers

Communication is important for supply chain success and therefore, is surprisingly, one of the major important areas in need of enhancement.

Due to the fast advancement of innovation or technology and the ease of collecting and using information online, there are some restrictions on the relevance and form of present data (security, competitive advantage, etc.). There might be practical limitations to the sharing of information. However, the actual availability of information is problematic, as accessible information may no longer exist after some time (Badi & Murtagh, 2019). When investigating whether suppliers are using green management systems, obtaining available information is more difficult. Organisations should be aware of the environmental impacts of their procedures and make sure that the procedures and operations of their suppliers are not disturbed in any method (Rebs et al., 2019).

Operations, which encompass the tasks involved in converting inputs into outputs, are a vital component of supply chain management. Operations management is essential for the fashion industry to achieve sustainable supply chain management since it entails controlling the production and delivery of goods and services to satisfy consumer demand while reducing waste and environmental effect (Sarkis et al., 2011).

### 4.7.3 Summary

Adoption of sustainable practices throughout the whole supply chain is necessary for effective operations management in the fashion sector. Manufacturers may, for instance, switch to eco-friendly manufacturing methods like utilising non-toxic colours

or conserving water. Businesses may use sustainable retail strategies, such cutting down on packaging waste or marketing environmentally friendly goods. Logistics companies may use eco-friendly transportation methods, including using electric cars or planning their routes more efficiently, to cut down on emissions.

Using technology to streamline the manufacturing and delivery processes is also essential for effective operations management in the fashion sector. Artificial intelligence and data analytics, for instance, may assist firms in enhancing product quality, reducing waste, and improving production planning. Radio-frequency identification (RFID) is a digital technology that may assist merchants in tracking inventory levels and streamlining stock management. Logistics firms may benefit from using cutting-edge routing and scheduling algorithms to streamline transport routes and save emissions.

## 4.8 Internal and External Coordination

### 4.8.1 Introduction

Internal coordination improves cross-functional communication across the company, enabling the company to improve customer satisfaction and supply chain responsiveness. External coordination is a management function in which different activities are properly coordinated and interconnected in a company. In this regard, this section is divided into three different sub-criteria: raw material suppliers, vertical coordination, horizontal coordination, and freight forwarders.

### 4.8.2 Main Body

#### 4.8.2.1 Raw Material Suppliers

Raw material supplier indicates a company that supplies raw materials to firms that manufacture product packaging.

Coordination is different from communication. Communication involves sharing information to establish a common understanding, while coordination is the activity of organising different people to do things for each other (Joglekar & Rosenthal, 2003). Coordination refers to the integration of all the company's activities with follow-up. To communicate better with the coordination, it is necessary to improve the communication skills and negative ability and creativity. It tries to achieve the organisation's goals. Proper coordination must take place during the garment cycle so that purchased products are delivered on time.

Once the order is confirmed to the factory, the dealer should coordinate with all relevant departments for implementation. Factory vendors use different formats and records to coordinate the smooth running of the entire factory (Zhang, 2008). These formats and documents are created by the buyer or factory dealer because the buyer's dealer needs to provide information from the factory. This type of coordination is called internal coordination.

#### 4.8.2.2 Freight Forwarders

A freight forwarder is a firm regulating in managing cargo on behalf of shippers. Purchasing is a key component of supply chain management, and it entails purchasing the required inputs for manufacturing or resale. In the fashion industry, buying plays a vital part in attaining sustainable supply chain management, since it entails choosing

suppliers that can offer eco-friendly materials, labour practices, and manufacturing processes. Sustainable buying strategies may assist in decreasing waste, limit environmental effect, and boost consumer satisfaction (Liu et al., 2019).

Successful buying in the fashion sector involves the implementation of sustainable sourcing strategies. For instance, producers may acquire materials from vendors who employ sustainable manufacturing processes, such as organic cotton or recycled textiles. Shops may obtain items from suppliers who utilise eco-friendly packaging or promote sustainable fashion products. Logistics providers may purchase transport services from suppliers who employ low-emission cars or optimise transport routes to decrease carbon emissions (Liu et al., 2019).

Technology may also play a major role in encouraging sustainable buying in the fashion sector. For instance, the usage of internet platforms may assist in linking customers with suppliers who adopt sustainable manufacturing techniques. The usage of blockchain technology may assist in tracing the origin and manufacturing processes of raw materials, ensuring that they fulfil sustainability criteria. The application of data analytics may assist in optimising purchase choices, minimising waste and environmental effect (Zhu et al., 2020).

Distribution, which entails moving goods from the producer to the end user, is an essential part of supply chain management. Distribution in the fashion sector is essential to attaining sustainable supply chain management since it entails choosing transportation strategies that may satisfy client demand while minimising environmental effect (Choi & Lee, 2020). Utilizing low emission means of transportation and optimising transit routes are all aspects of sustainable distribution practices in the fashion sector. To lower the volume of transport movements, for

instance, producers and merchants should work together to optimise transport routes. This would cut carbon emissions. Retailers may use technology to properly estimate customer demand, which will cut down on waste and overstocking. To cut carbon emissions, logistics companies might use low-emission transport options like electric or hybrid cars (Choi & Lee, 2020).

Technology significantly impacts the fashion industry's ability to support sustainable distribution. Data analytics, for instance, may be used to improve transport routes, lowering carbon emissions and transportation costs. With the facilitation of the sharing of transport capacity between several producers or shops, the use of digital platforms may also aid in the reduction of waste. The tracking of product movement using blockchain technology may also assist in ensuring that it is done in a morally and sustainably responsible way (Zhu et al., 2020).

#### 4.8.2.3 Vertical and Horizontal Integration

It is an idiom used by advertising experts to explain the efficiency and effectiveness of analysing and improving campaigns and marketing campaigns (Kumar et al., 2019). This is achieved with the assistance of targeted efforts used for aligning the marketing approaches and efforts. Manufacturers can reduce waste, solid waste, and emissions and minimise the use of toxic and endangered materials while enhancing performance and productivity. Environmental management has moved from the organisational domain to the supply chain level. Environmental resource management can be defined as the integration of supply chain content and information flow to meet consumer demand for the manufacturing of green products and services adopting green technology. This paper discusses many GSCM methods, approaches, and issues. The

complexity of supply chain management and the attitude of companies towards environmental management are the main obstacles to implementation. When using GSCM, effort and expense are multiplied. Green supply chain management and subsequent work processes affect not only the performance of green markets but also market performance in other areas.

“Internal” issues are ones that come from within a team or organisation. Lack of available funds was cited as the primary difficulty faced by the researchers themselves during the course of the investigation (Paille et al., 2017). According to Khidir & Zailani (2009), there are two potential forms of costs associated with environmental management in supply chains: transaction costs and direct costs. Researchers have found that a green supply chain has the potential to improve business results (Shah et al., 2019). However, green supply chain management entails higher operational costs, which has hindered its adoption by businesses (Taylor et al., 2018). This is especially true for businesses that have a limited budget and staff.

In addition to the apparent monetary difficulties, shifting an organisation's and its members' perspectives and norms has proven to be a substantial barrier to the broad adoption of GSCM. Attempting to change a company’s founding principles and distinctive characteristics is a formidable challenge (organisational objectives, forms of authority, core technology, and operational and marketing strategy). The importance of top-level management’s foresight and dedication in establishing a new direction for the companies cannot be overstated. Leaders have a responsibility to impress upon their teams the significance of environmental protection. Barriers to GSCM implementation in the sector include a deficiency of resources (technical skills, technology, materials, and processes), knowledge, experience, and standardised environmental control

standards to regulate inside the organisation (Balasubramanian, 2012; Government & Perron, 2014; Jabbour et al., 2017; Khidir & Zailani, 2009; Trigos, 2016).

The number of eco-friendly materials and methods available in the textile sector is relatively minimal. Unfortunately, only a select few items may be deemed completely recyclable and environmentally beneficial (Varnas et al., 2009). Concrete is soon becoming as popular as wood as an environmentally friendly building material. However, due to the cost preference, the adoption of a green product is still in its infancy. Among the external difficulties is the lack of appropriate environmental measures such as education and development programmes, audits of long-term viability, and ISO 14001 certification (Shah et al., 2019). The competitive and volatile nature of the construction sector has also made it difficult for many companies to adopt green supply strategies. The construction business is well-known for its intense competition among firms seeking contracts and for keeping their word on project quality and timing. There is a substantial threat of project delays, suspension, or cancellation due to unforeseen situations or economic concerns, as well as the general unpredictability of building projects (Taylor, 2018).

### 4.8.3 Summary

Internal and external factors worked against GSCM's widespread implementation. The building industry's most significant external challenge is a lack of government assistance. Government support could act as both a motor and a brake in the development of a green supply chain, making the government's involvement in this process equivalent to that of a catalyst. Green project implementation is aided by the

development of relevant standards and policies. Since GSCM necessitates constant communication with several suppliers, many businesses have considered supplier management to be a formidable task. For instance, to qualify as a green supplier, a company's suppliers will need to demonstrate compliance with relevant environmental legislation; this will force them to take responsibility for their actions and demonstrate serious commitment to GSCM.

## 4.9 Digitalisation

### 4.9.1 Introduction

Digital platforms and cutting-edge technology may help businesses manage their supply chains better, increase transparency, and have a smaller negative effect on the environment. The digitalisation of many traditional procurement functions has already begun, with companies using a variety of big data tools and technologies to connect closely with suppliers, enhance procurement, proactively manage supplier risk, facilitate collaboration, and assist in the planning process.

### 4.9.2 Main Body

#### 4.9.2.1 Market Digitalisation

In order to handle supply chain difficulties in the fashion sector, technology is essential. Lack of transparency is one of the major issues facing the fashion industry's supply chain. The fabrication of a single garment often involves several suppliers and manufacturers, making it challenging for businesses to trace the provenance of raw materials and completed goods. Yet, businesses may follow their items from the point of origin to the final customer with the use of blockchain technology. This will assist

in encouraging accountability and transparency and guarantee that goods are produced and moved sustainably and morally (Lu et al., 2020).

Reducing waste is a crucial area where technology may assist in tackling supply chain concerns. Companies may make clothing on-demand by using digital technologies like 3D printing, which lowers the amount of waste produced by unsold inventory. Moreover, the application of data analytics and machine learning may assist businesses in streamlining their manufacturing and inventory management procedures, minimising waste output, and enhancing the supply chain's overall efficiency (Gandhi, 2021). Also, technology may assist businesses in enhancing their labour policies and ensuring that their employees are treated properly. Workers may report problems with their working conditions or pay anonymously using digital platforms like Worker Voice. By doing this, businesses can find and fix any labour problems in their supply chain and guarantee that their employees are treated properly (Lu et al., 2020).

The business goal of a digital supply chain is to reduce costs and increase efficiency through automation, delivering the right products to customers in a reliable and responsive manner. This goal cannot be achieved unless the supply chain is fully integrated, connecting manufacturers, warehouses, customers, logistics and suppliers seamlessly through a central cloud-based control centre (Hagberg et al., 2016). Signals of dominant events in the supply chain can come from anywhere in the network and understand all issues affecting demand or supply, including finished goods, parts, components, and raw materials with this level of integration. Therefore, as customised manufacturing becomes the norm and customers become more demanding, a fully responsive supply chain will have a strong competitive advantage (Loebecke & Picot, 2015).

Various cloud-based collaboration platforms and business networks are emerging that are like social networks and enable companies to communicate in depth and quickly with supply chain stakeholders (Rudolf et al., 2019). These platforms have become significantly more advanced than previous business networks, including SAP's Ariba, which focuses on matching demand and supply for certain products. Recently, all online participants can exchange information about inventory, production and transportation capacity, demand and provide near-real-time feedback on changes such as potential bottlenecks and demand growth (De-Pablos-Heredero, 2020). In fact, this level of integration allows companies to jointly plan operational scenarios through a set of figures over time and estimate possible trade-offs between different variables, including fill rates, margins, costs, capacity, and delivery (Kaplanidou, 2018). All collaborative processes are integrated by workflow and can be precisely modelled to provide reliable and quick information about when the finished product will be delivered to the customer.

By implementing data throughout the supply chain, in real time and often without human intervention, lead times can be significantly reduced, and product and inventory management can be optimised (Åkers, 2018). Rapid information exchange increases supply chain agility, while enabling closer integration with customers through superior service, a compelling customer experience, and an efficient supply chain platform. In the digital ecosystem of the supply chain, effective management and integration of raw material suppliers is an important factor (Dressler, 2015). As supply chains become increasingly automated, this will reduce costs and increase the speed of delivery within the supply chain.

Digitalisation is an important aspect in the contemporary era. It may possibly be driving a new industrial revolution. It further facilitates prompt and dramatic process innovation. It provides reduced manufacturing costs and better flexibility. Several companies are proactively integrating new digital technology because of these potentials. Firms often lack expertise regarding new digital technologies, their merits, and drawbacks.

Digitalisation is essential for contemporary businesses, both public and private, as digitalisation has changed our lives, meaning that numerous businesses have not yet been competent enough to familiarise to it (Küchler, 2019). The core reason for this in an organisation is the paucity of knowledge or trained staff that allows them to comprehend how to deal with this shift. Despite progress in numerous public administration services, the likelihood of digital adaptation lacks evidence (Waltersmann et al., 2019). Private firms' digital landscape is constantly changing, emphasising how private firms try to explore ground-breaking digital solutions in the social, economic, and political spheres and how this changes the decision-making procedure (Akpan & Ibidunni, 2021).

Currently, there is a growing need for organisational change to change the approach private firms view knowledge transformation strategies for addressing societal needs or effectively enhancing services through digitalisation (Starzynska & Klembalska, 2021). Familiarising and anticipating such modifications are extremely vital for policy makers, private firms' managers, design, integrate or assess digital private firms' decisions (Aladyshkin et al., 2019). Three advantages of knowledge transformation in digitalisation are defined: to increase the capacity of private firms, to improve the quality of private firm's services and to promote the healthy development of private

firms (Williams et al., 2021). Therefore, this acknowledges the view that the success of digital governance largely relies on knowledge transfer. Since public and private businesses need to use their knowledge more intelligently and efficiently, knowledge transfer has become a priority (Döring et al., 2021).

#### 4.9.2.2 Assortment Planning

Assortment planning is implied to the set of decisions for products carried in each store at each point in time (Kök et al., 2009). The target of assortment planning optimisation is to determine an assortment that maximizes sales or gross subject to various constraints, such as a limited budget for purchase of products, limited shelf space for displaying products, and a variety of multiple constraints such as a desire to have at least two vendors for each type of product (Flamand et al., 2018).

Assortment, shelf-space allocation, inventory management, and supplier selection are among the most important decisions in retailing.

Assortment planning (AP), inventory management, and shelf-space allocation are the most basic duties in retailing. Retailers must decide on the set of products to carry in their assortment, the amount of inventory to stock for each product, and the amount of shelf-space dedicated to each product. Some variables such as sales or total revenue is maximised under a limited purchasing budget, limited holding space, limited space for displaying the products, and other miscellaneous constraints like having at least two suppliers for each product (Kok AG et al.,2008). Of course, retailer should periodically revise their assortment because of the season change, the introduction of new products, the change in consumer taste, etc.

According to Sajadi (2012) product category management (PCM) plays a pivotal role in today's large stores. PCM manages to answer questions such as assortment planning (AP) and shelf space allocation (SSA). AP problem seeks to determine a list of products and suppliers, while SSA problem tries to design the layout of the selected products in the available shelf space. These problems aim to maximise the retailer sales under different constraints, such as limited purchasing budget, limited space of classes for displaying the products, and having at least a certain number of suppliers (Sajadi., 2022).

#### 4.9.2.3 Logistics Function

Inventory management is a critical internal factor that can significantly impact a supply chain's success. To avoid tying up capital and driving up expenses, efficient inventory management ensures that just enough stock is always on hand to satisfy consumer demand (Shukor et al., 2020). Inventory control is essential in managing the flow of goods in a supply chain. A supply chain that is not well-managed may result in inventory shortages or excesses, which can lead to lost sales and financial losses. A company that runs out of inventory may need more to meet customer demand, while excess inventory ties up valuable capital and can lead to high storage costs.

Companies can adopt different inventory management techniques to optimise their supply chains. For example, companies can use just-in-time (JIT) inventory management to minimise inventory holding costs while ensuring that the right amount of inventory is available at the right time. JIT inventory management involves scheduling the delivery of merchandise just in time for production, thereby minimising inventory levels (Benton, 2020). Another technique that companies can use is vendor-

managed inventory (VMI), where the supplier is responsible for monitoring their clients' inventory levels. In this case, the supplier monitors the customer's inventory levels and delivers inventory when needed, thereby reducing the inventory holding costs of the customer.

#### 4.9.2.4 Predictive Maintenance

Advancement in the industrial progress has significantly increased the operational efficiency of manufacturing industries to accelerate their production capacity in a more precise and spontaneous manner. However, as the market changes from being manufacturer driven to customer driven, concepts such as just-in-time (JIT) manufacturing and the "lean" concept emerge (Yuliansyah et al., 2019; Hu et al., 2019; Liu et al., 2020). Regardless of the kind of manufacturing technique adopted by the organization – JIT, lean, or other – the fundamental question that arises is whether the manufacturing system in place can ensure seamless production to meet market demand. The most suitable answer to this question is always an effective, sustainable maintenance strategy.

A maintenance strategy is described as synchronising an administrative and technical process that ensures the manufacturing system of an industry is intact. However, a dilemma always exists in the selection of ample maintenance practice. Hence, it is reasonable to deduce that the primary challenge in the selection of a maintenance strategy should focus on the gaps between theory and sustainable practice (Yunusa-Kaltungo & Labib, 2020). A study by Aghaee et al. (2020) indicates that the maintenance cost of the industry alone reaches up to 15 -17% of the production cost. By realizing the significance of maintenance practices, numerous maintenance

strategies and approaches were formulated and implemented over the years. Predictive maintenance (PdM) practice is a technique in which advanced technologies are used to measure the level of deterioration and to predict the remaining useful life (RUL) of a component or system. The same technique also indicates when the system needs maintenance (Kirubakaran & Ilangkumaran, 2015; Lei & Sandborn, 2016).

Various barriers potentially hamper the implementation and adoption of SPM practices. These barriers include management's attitudes towards maintenance practice, financial shortages, lack of skilled technicians, and shortages of computerized technology (Kirubakaran & Ilangkumaran, 2016; Maktoubian & Ansari, 2019). Furthermore, identified barriers require different approaches depending on the strategies and capabilities of industrial management. From the above information, industrial management should realize the significance of maintenance practices and they should select the best management practice as they keep the long-term vision in mind. Although there are some earlier studies on the selection of maintenance practices, they are restricted by prioritizing the barriers alone (Pancholi & Bhatt, 2018; Ighravwe & Oke, 2019; Massaro et al., 2019). Work is very scant on developing countries perspectives. Poor prioritization will only convey partial knowledge and the importance of barriers.

#### 4.9.2.5 Production Automation

Discussions around 3D printing also revealed technical impediments. 3D printing was cited as a good option for prototyping, sample development and product customization, but is currently associated with various limitations. It was noted that the technology is not yet suitable for high volume production and that it is not currently compatible with

a wide range of materials. A source from a multi-brand conglomerate indicated that the company has not yet used 3D printing at scale in factories. Still, several respondents suggested that they expect greater use of 3D printing in future as the technology continues to evolve. The perception of technological impediments shared among interviewees suggest that estimates focusing on the task composition of occupations alone overestimate the occupational disruption posed by automation. Studies cited earlier portend a vast displacement of apparel manufacturing workers based on the routine, repetitive, nature of sewing. Yet evidence from key informants interviewed suggest these assessments overstate such risk considering practical issues faced at the shop floor. As noted among several interviewees, the caveat remains that it is difficult to anticipate technological developments beyond the near future.

Automation may be inhibited by high costs. A respondent from the supply chain management company asserted that some of the technologies being adopted now, such as RFID technology, have been around for more than a decade, but only recently prices have decreased enough to justify adoption in labour-intensive industries. In addition, as asserted by a respondent from one of the sports corporations, automating production lines would require substituting multiple machines, with cost-benefit analyses that include not only acquisition costs, but everything from installation through to decommission. A source from a multi-brand fashion company predicted that large capital investments in an industry with low margins are likely to hinder widespread automation in the next five years. A respondent from this company reported that manufacturers in their supply chain are, instead, striving to achieve greater efficiency with the existing equipment through better management and processes. But even these process-based attempts at leaner manufacturing are restricted to a handful of larger

supplier firms which have the resources to do so. It was also noted that suppliers may have difficulties financing investments. A respondent from the supply chain management company stated that many smaller and medium enterprises in Asia do not have credit records which can be used to access financing. This source argued that the lack of credit records constrains the use of existing technologies, such as automated cutting, which are expensive to purchase, install, and fix.

### 4.9.3 Summary

Technology has enabled companies to improve their decision-making. With the availability of big data, companies can analyse vast amounts of data to make informed decisions about their supply chain strategies. Data analytics tools can provide insights into demand patterns, supplier performance, and inventory levels. This information can help companies to optimise their supply chain, reduce costs, and improve efficiency. For example, companies can use demand forecasting tools to predict future demand and adjust their inventory levels accordingly.

However, there are also some challenges associated with the integration of technology in supply chain management. One of the biggest challenges is the cost of implementing and maintaining technology systems. These costs can be significant, and small businesses may need more financial resources to invest in these systems. Another challenge is the need for skilled personnel to manage and operate these systems. These systems may be used to their full potential with adequate training, leading to reduced efficiency and effectiveness.

## 4.10 Conclusion

As a result, the fashion industry is under pressure to implement more sustainable supply chain strategies, such as waste reduction, improved working conditions, and the procurement of sustainable materials. The supply chain for the fashion industry is highly fragmented, with numerous small and medium-sized businesses participating at different stages of the chain. It may be difficult to adopt sustainable practices because of communication failures, ineffective coordination, and a lack of transparency caused by this fragmentation. However, the fast fashion model, which encourages a quick turn-around of clothing at cheap costs, has resulted in overproduction, overconsumption, and the creation of enormous volumes of trash.

The next chapter follows chapter 3 and 4 to validate the proposed framework using AHP software and sensitivity analyses. The core purpose of validating the proposed framework is to evaluate the benchmarking of criteria introduced based on different decision-making criteria.

# Chapter Five

# Data Collection, Implementation of the Proposed Framework, Validation, Results and Sensitivity Analysis

## 5.1 Introduction

This chapter presents the analysis of data collected. As pointed out earlier, the proposed framework is validated via a comprehensive questionnaire administered by practitioners from each of the specified companies using the Analytical Hierarchy Process (AHP), which could flexibly combine quantitative and qualitative methods. The impact of purchasing and production strategy as main criteria, with many sub-criteria associated with each main criterion are also considered.

The online survey was distributed to achieve the aim of this study, which is to support organisations in managing purchasing and production strategies. This research collects data from three textile companies in the UK, including H&M, Marks & Spencer, and Zara. The outcomes shape the new structure of the production and purchasing strategies in the following pages.

## 5.2 Data Collection

In April 2020, the researcher of this thesis commenced collecting data despite the spread of the global Covid-19 pandemic, which affected everyday life: borders were closed, and international students returned to their home countries. Despite the unforeseen wide-ranging consequences of the pandemic, the researcher pursued her research non-stop to achieve this study goals. Replacing the data collection system and analysis was challenging. Nevertheless, the researcher succeeded by using Expert Choice Software. The data collected from 253 participants working at H&M (n = 53), Marks &

Spencer (n = 108), and Zara (n = 92) was reviewed for completeness and accuracy. It underwent several stages of pre-analysis, such as error checking and data screening. The data was coded and fed into AHP software to measure the importance of competing objectives. A dedicated tool and proven mathematical techniques enable the researcher to obtain the best decision to reach a goal. Hence, using comparison AHP to develop a framework will be explained further in the following sections.

### 5.3 Implementation of the proposed Purchasing and Production SC Strategies framework using AHP

As discussed in Chapter Three, AHP is one of the most popular multi-criteria decision- making methods for assessing the AHP method. Furthermore, structuring and analysing a series of simple hierarchies pair-wise comparison matrices (Wind & Saaty, 1980). It also uses judgments of decision-makers to form the decomposition of problem complexity into an order (Kahraman, 2020), appraise and support the decision, and consider various criteria by prioritising all available decision alternatives (Mahmoudi *et al.*, 2020). Besides, the process of structuring a hierarchy involves: (*a*) stating a goal,

(*b*) arranging criteria, and (*c*) adding sub-criteria. A problem's hierarchy structure could enable researchers to understand the interactions amongst elements and their impacts on the entire system. As can be seen in Figure 5.1, the proposed AHP framework has been developed using the Expert Choice Software.

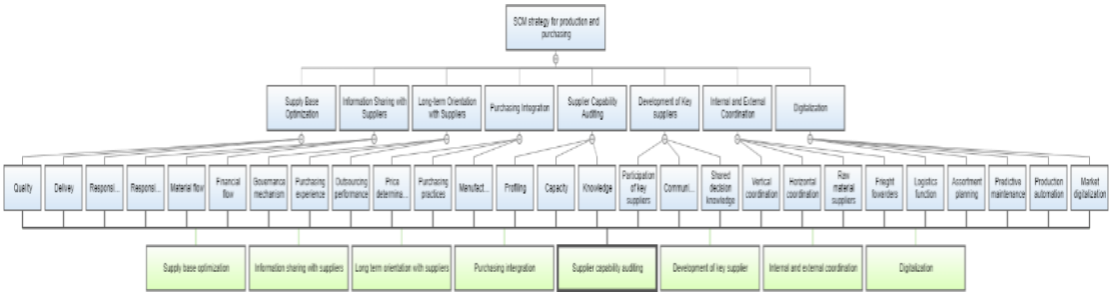


**Figure 5.1:** The proposed Production and Purchasing strategies AHP framework.

## 5.4 Validation of the proposed framework

The proposed framework must be validated to confirm its contents. This was carried out within the questionnaire by asking questions related to production and purchasing criteria and sub-criteria at each level of the proposed framework, including the importance of each criterion and sub-criterion and whether it is necessary to be included in the proposed framework.

Figure 5.2 represents the relative importance of the criteria and sub-criteria, as can be seen, digitalisation stood first with 22.49% importance, followed by the “development of key suppliers”, “supply base optimisation”, “internal and external coordination”, “purchasing integration” and “Information sharing with suppliers” with 14.44%, 12.48%, 12.36%, 11.05%, 9.72% and 9.23% respectively. The results revealed that the “long-term orientation with suppliers” was the least criterion, with 8.22%.

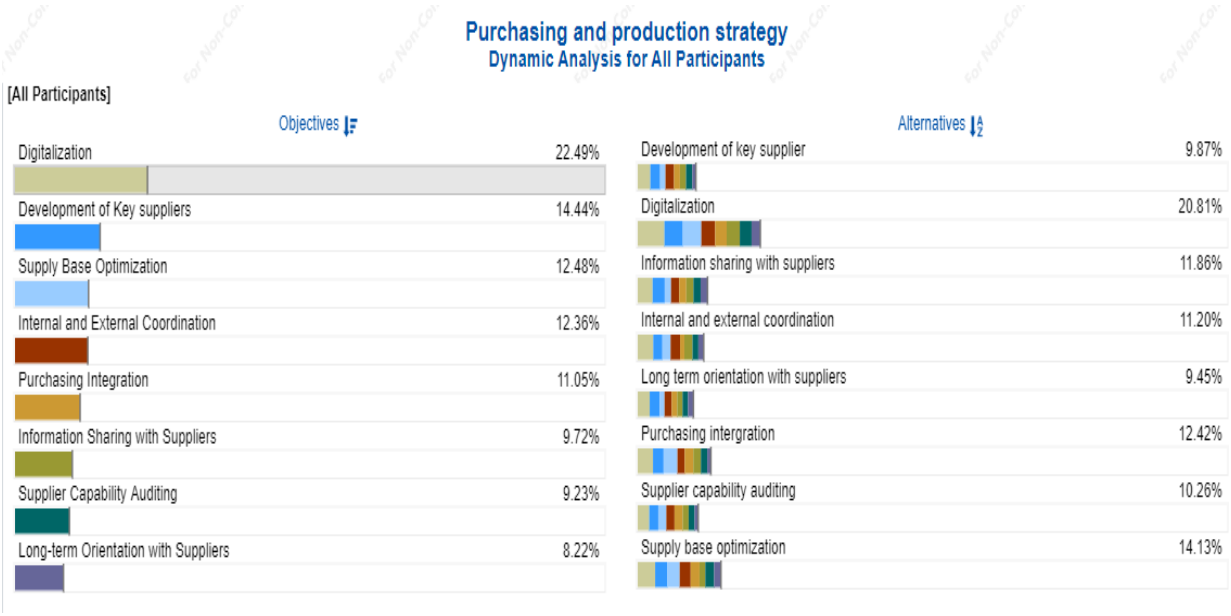


**Figure 5.2:** Results analysis of the data collected from the three companies.

### 5.5 Sensitivity Analysis

Sensitivity Analysis (SA) definition varies according to its application to practice. The consensus concludes that SA is a science that studies and quantifies the impact of each input parameter on the outputs via the circulation of uncertainties (Pang *et al.*, 2020). There are three most popular ways to analyse criteria sensitivity (Chen, *et al.*, 2010) explicitly:

*i)* Firstly, changing criteria values.

*ii)* Secondly, changing the relative importance of criteria.

*iii)* Thirdly, changing criteria weights.

This study will examine different scenarios and observe changing the weighted criteria on the alternative ranking. Expert Choice software will be used to carry out the necessary analysis. Implementing sensitivity analysis is crucial to ensure the reliability of the final decision through the investigation of different scenarios and observation of

the impact of changing the priority of the criteria on the alternative ranking system. On the other hand, sensitivity graphs present helpful performance, dynamic, gradient, and head-to-head analysis. Furthermore, expert choice offers flexibility to try to change the main objectives' priorities (production and purchasing strategy) on the graphs (*on the Left Y-axis*) and to see how the sub-criteria priorities change as a result (*on the Right Y-axis*).

Therefore, the input data is slightly modified to observe the effect on the outcomes to implement sensitivity analysis. If the ranking does not change, then the results are considered stable, and the uncertainty in the participant's opinion within the percentage of changes in the input data does not affect the final output. Otherwise, the impact should be considered when concluding the study. In this study, a dynamic sensitivity analysis was selected to discover the effect of the different weight alternatives allocated to the main criteria under investigation: purchasing and production strategy.

### 5.6 Pilot Sensitivity analysis

The following figure shows the sensitivity performance of all variables considering the sensitivity on their benchmarks. The pilot sensitivity analysis is performed to determine the differences after applying increment in the three criteria by 5%, 10%, and 15%, respectively. Figure 5.3 represents the actual base model, showing the values and sensitivities in actual presence, without making any changes.

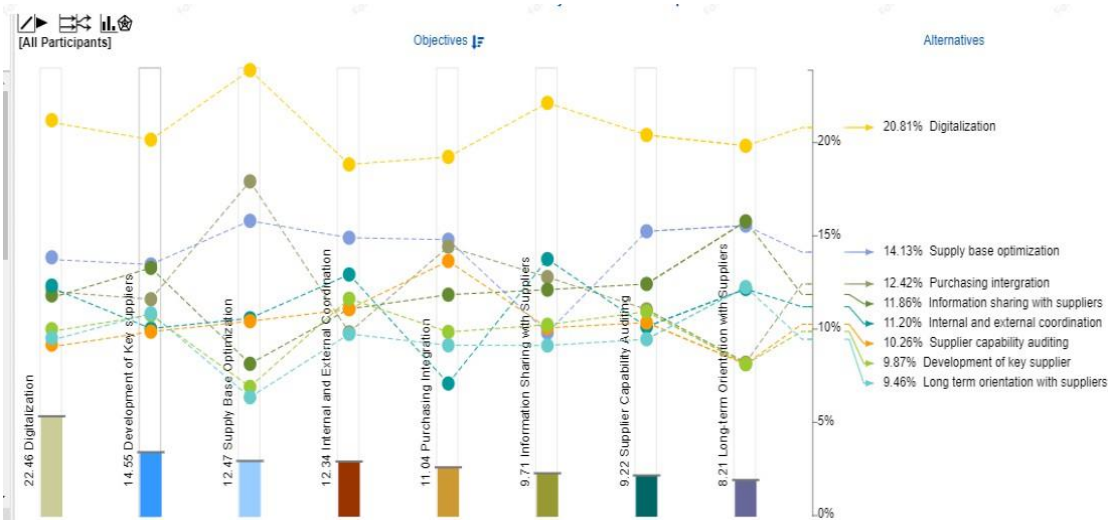


Figure 5.3: Sensitivity Analysis

### 5.6.1 Digitalisation

#### 5.6.1.1. 5% increase

The first change was made in the digitalisation. With the increase in digitalisation up to 5%, supply base optimisation shows a change of 14.13%, purchasing integration shows a change of 11.86%, internal and external coordination shows a change of 11.20%, supplier capacity auditing shows a change of 10.26%, development of key supplier shows a change of 9.87%, and long-term orientation with supplier shows a change of 9.46%, as seen in Figure 5.4.

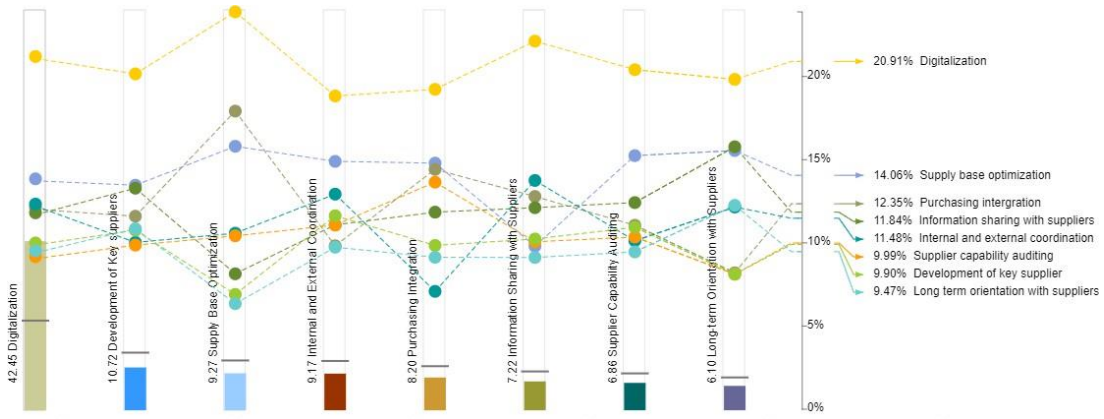


Figure 5.4: 5% increase in Digitalisation

### 5.6.1.2 10% increase

With the increase in digitalisation up to 10%, supply base optimisation shows a change of 14.06%, purchasing integration shows a change of 12.35%, internal and external coordination shows a change of 11.48%, supplier capacity auditing shows a change of 9.99%, development of key supplier shows a change of 9.90%, and long-term orientation with supplier shows a change of 9.47%. These can be noticed in Figure 5.5.

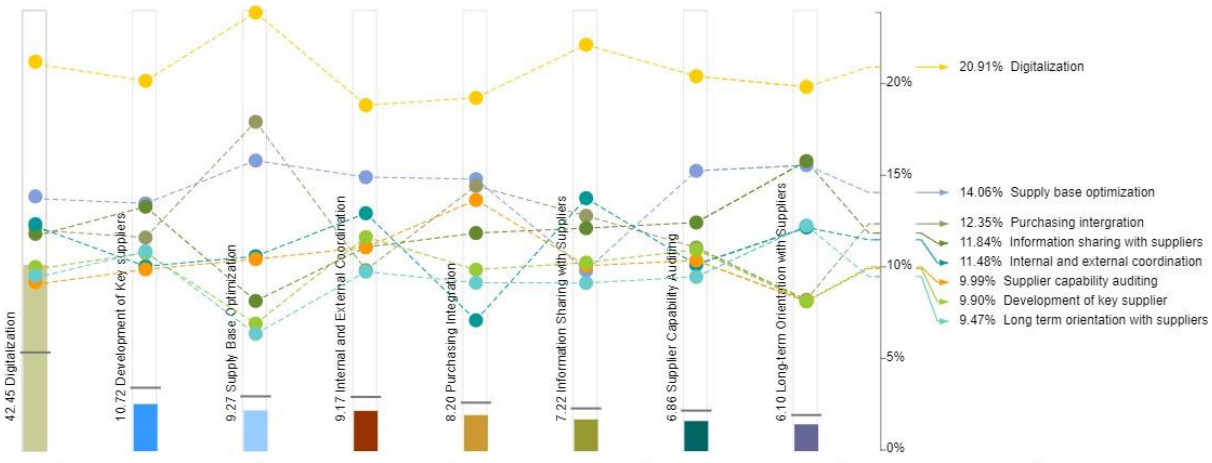


Figure 5.5: 10% increase in Digitalisation

### 5.6.1.3 15% increase

With the increase in digitalisation up to 15%, supply base optimisation shows a change of 13.98%, purchasing integration shows a change of 12.27%, internal and external coordination shows a change of 11.79%, supplier capacity auditing shows a change of 9.94%, development of key supplier shows a change of 9.69%, and long-term orientation with supplier shows a change of 9.49%. In this regard, supply base

optimisation showed better ranking as compared to other factors at 15% increase. See Figure 5.6.

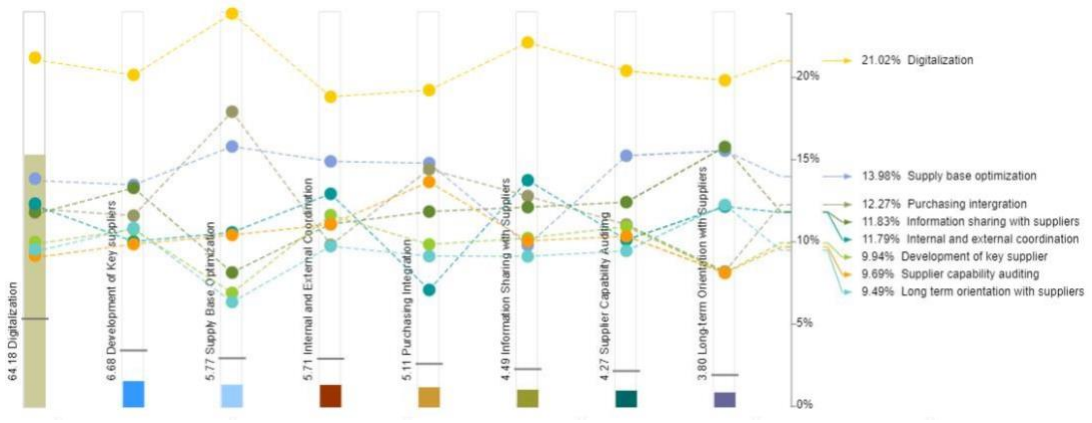


Figure 5.6: 15% increase in Digitalisation

#### 5.6.1.4 Summary

The changes in different factors were observed with respect to digitalisation in sensitivity analysis. From the findings, it has been observed that changes were observed in each variation (5%, 10%, and 15%) in other criteria's whereas the marginal changes were noted in the following criteria: development of key supplier, supplier capability auditing, and long-term orientation with suppliers. Supply base optimisation and purchasing integration showed changes in all three variations. But it has been seen that there is no change in the ranking up to 15% increase of Digitalisation.

### 5.6.2 Development of Key Suppliers

#### 5.6.2.1 5% Increase

The second change was made in the development of key suppliers. With the increase in the development of key suppliers up to 5%, supply base optimisation shows a change

of 14.05%, purchasing integration shows a change of 12.02%, internal and external coordination shows a change of 11.97%, supplier capacity auditing shows a change of 10.21%, digitalisation shows a change of 20.73%, and long-term orientation with supplier shows a change of 9.52%. See Figure 5.7.

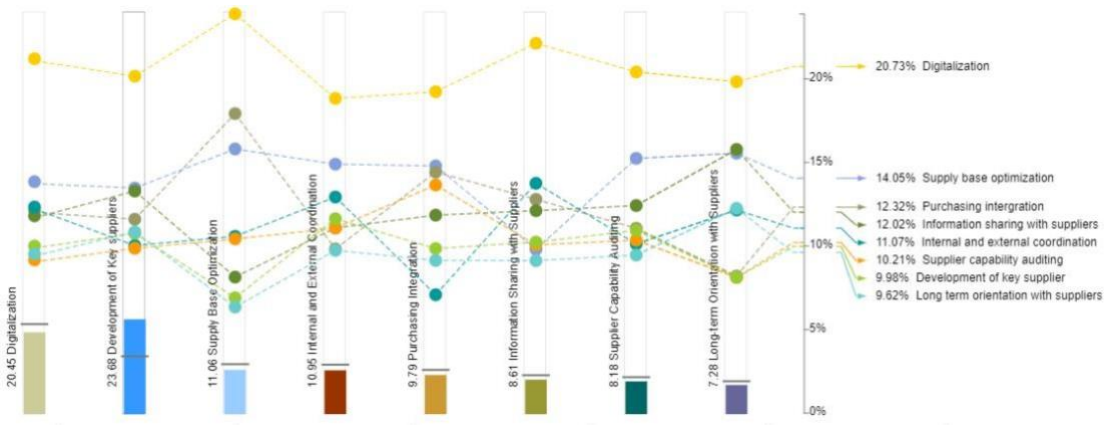


**Figure 5.7:** 5% increase in development of key suppliers

### 5.6.2.2 10% increase

With the increase in development of key suppliers up to 10%, supply base optimisation shows a change of 13.92%, purchasing integration shows a change of 12.31%, internal and external coordination shows a change of 10.83%, supplier capacity auditing shows a change of 10.13%, digitalisation shows a change of 20.61%, and long-term orientation with supplier shows a change of 9.89%. These are clearly demonstrated in Figure 5.8.

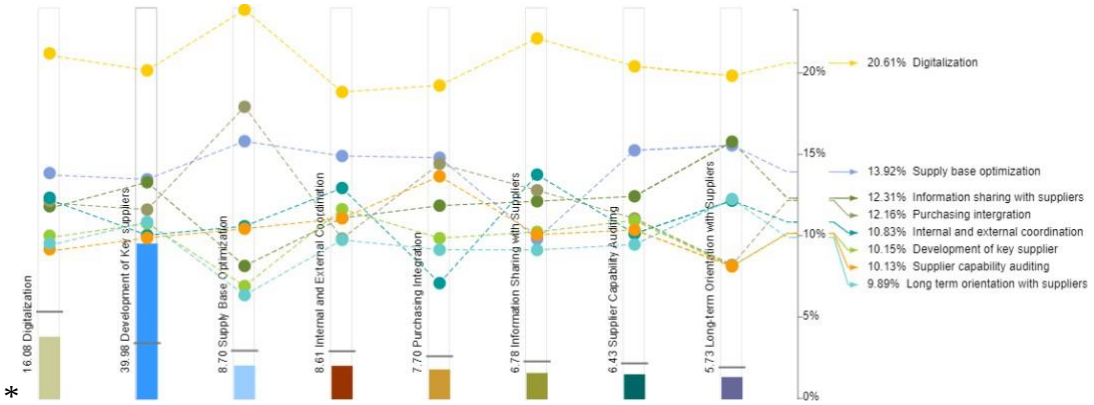


**Figure 5.8:** 10% increase in development of key suppliers

### 5.6.2.3 15% increase

The results of this increase are presented in Figure 5.9. As can be see, when the development of key suppliers increased to 15%, supply base optimisation shows a change of 13.73%, purchasing integration shows a change of 11.93%, internal and external coordination shows a change of 10.50%, supplier capacity auditing shows a change of 10.02%, digitalisation shows a change of 20.42%, and long-term orientation with supplier shows a change of 10.28%.

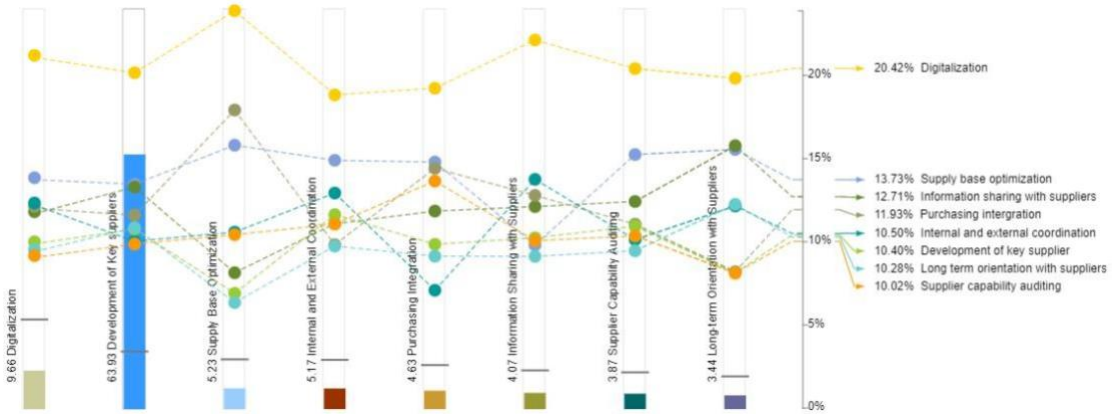


**Figure 5.9:** 15% increase in development of key suppliers

### 5.6.3 Supply Chain Optimisation

#### 5.6.3.1 5% increase

The third change was made in the "supply base optimisation" and the results are shown in Figure 5.10. With the increase in supply base optimisation up to 5%, development of key suppliers shows a change of 9.54%, purchasing integration shows a change of 13.02%, internal and external coordination shows a change of 11.05%, supplier capacity auditing shows a change of 10.40%, digitalisation shows a change of 21.09%, and long-term orientation with supplier shows a change of 9.10%.

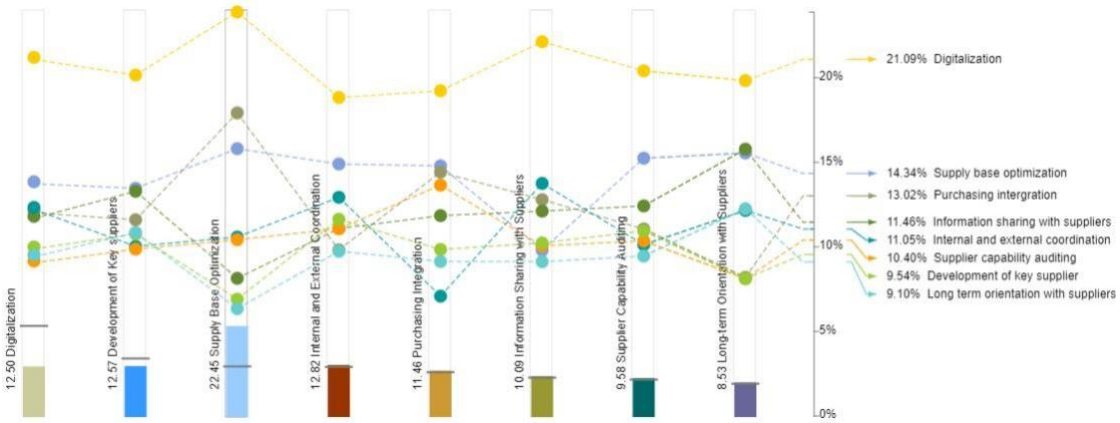


**Figure 5.10:** 5% increase in supply base optimisation

#### 5.6.3.2 10% increase

With the increase in supply base optimisation up to 10%, the development of key suppliers shows a change of 8.81%, purchasing integration shows a change of 14.38%, internal and external coordination shows a change of 10.92%, supplier capacity auditing shows a change of 10.41%, digitalisation shows a change of 21.87%, and long-term orientation with supplier shows a change of 8.33%. See Figure 5.11.

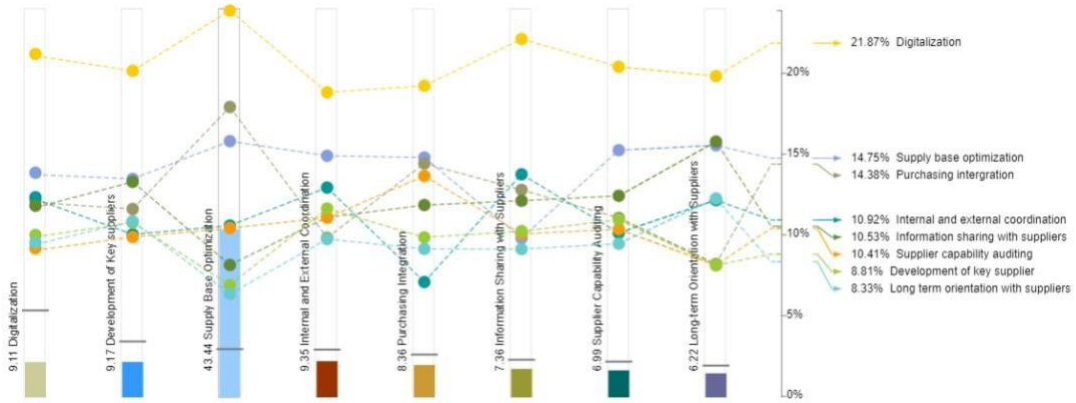


**Figure 5.11:** 10% increase in supply base optimisation

### 5.6.3.3 15% increase

With the increase in supply base optimisation up to 15%, development of key supplier shows a change of 8.08%, purchasing integration shows a change of 15.74%, internal and external coordination shows a change of 10.79%, supplier capacity auditing shows a change of 10.41%, digitalisation shows a change of 22.64%, and long-term orientation with supplier shows a change of 7.57%. Figure 5.12 demonstrates these changes.

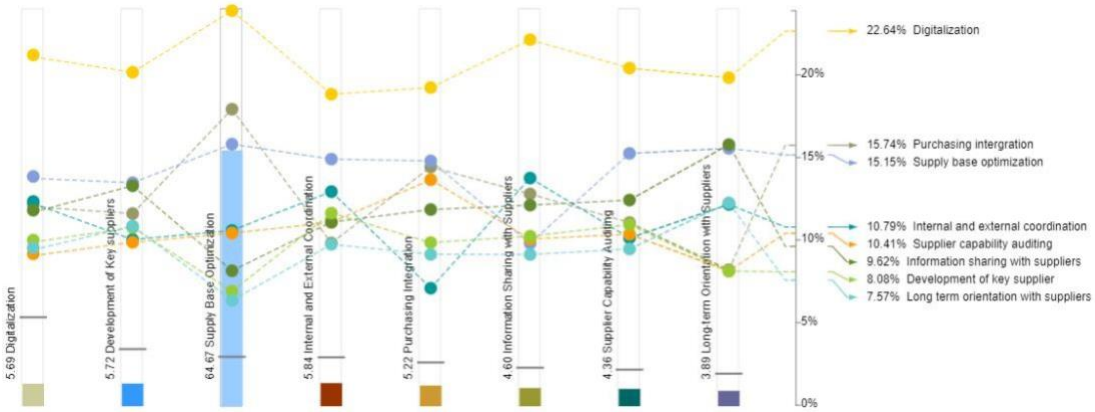


**Figure 5.12:** 15% increase in supply base optimisation

### 5.6.3.4 Summary

The changes in different factors were observed in sensitivity analysis with respect to the development of key suppliers. From the findings, it has been observed that changes were observed in each variation (5%, 10%, and 15%) in other criteria, whereas the marginal changes were noted in the following criteria: internal and external coordination, supplier capability auditing, and long-term orientation with suppliers. Information sharing with suppliers and supply base optimisation showed prominent changes in all three variations.

## 5.7 Pilot Sensitivity Analysis

The following figure 5.13 shows the sensitivity performance of all criteria (5%, 10%, 15%) considering the sensitivity on their benchmarks. The pilot sensitivity analysis is performed to determine the differences after applying decrement in the three criteria by 5%, 10%, and 15%, respectively. Figure 5.15 is the actual base model, showing the values and sensitivities in actual presence, without making any changes.

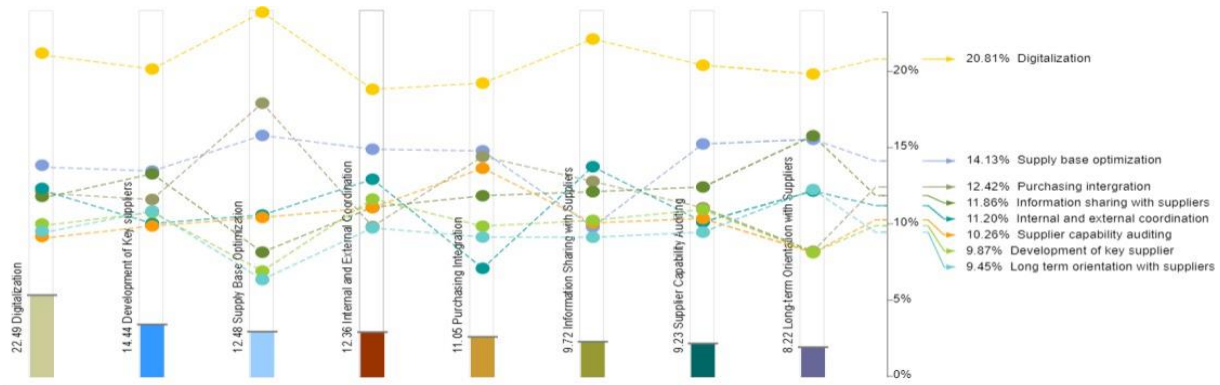


Figure 5.13: Pilot Sensitivity Analysis

### 5.7.1 Digitalisation

#### 5.7.1.1 5% Decrease

Figure 5.14 is based on a 5% decrement in the digitalisation factor to determine the differences made in other criteria and compared with the actual base model. From the findings, it can be said that there are very slight changes in the sensitivities of other constructs compared to the actual base model.

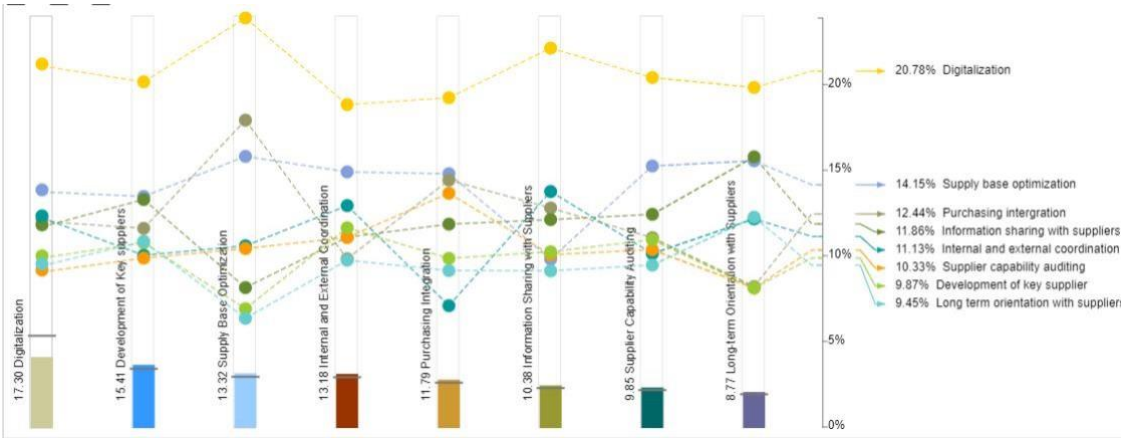


Figure 5.14: 5% decrease in digitalisation

#### 5.7.1.2 10% Decrease

Considering the changes after making a 10% decrement, it has been observed that there were slight to marginal changes in the sensitivities of other criteria with the findings after a 5% decrement. When compared with the actual base model, it has been observed that at least .04% changes were made in every other criterion, see Figure 5.15.

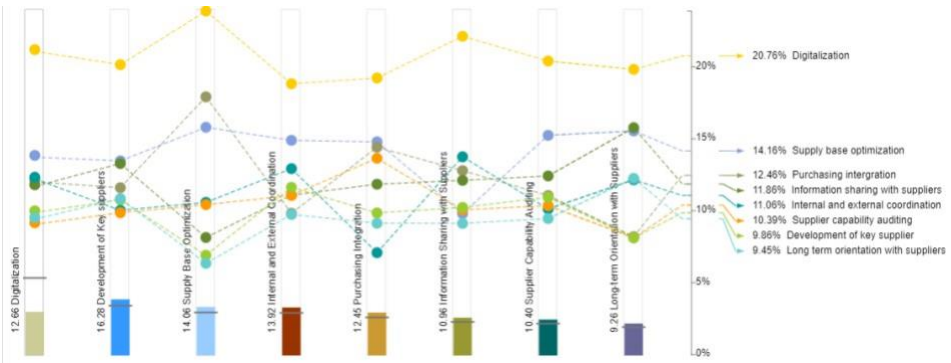


Figure 5.15: 10% increase in digitalisation

### 5.7.1.3 15% Decrease

Considering the changes after making a 15% decrement, it has been observed that there were slight changes in the weights of the other criteria under investigation by at least 0.01%, which is very small in comparison to the base model, see Figure 5.16.

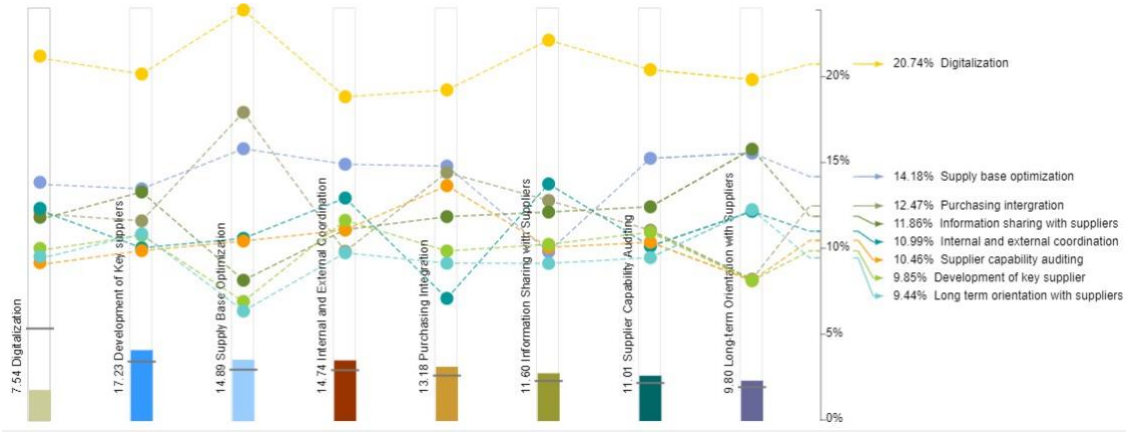


Figure 5.16: 15% decrease in digitalisation

## 5.7.2 Development of Key Suppliers

### 5.7.2.1 5% Decrease

Figure 5.17 shows a 5% decrement in the development of key suppliers' factor to determine the differences made in other criteria and compared with the actual base model. From the findings, it can be said that there is a very slight change (0.04%) in the other criteria compared to the actual base model.

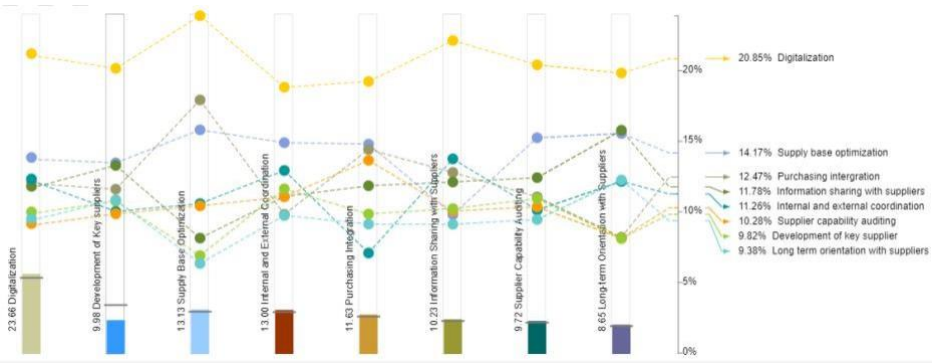


**Figure 5.17:** 5% decrease in the development of key suppliers

### 5.7.2.2 10% Decrease

Considering the changes after making a 10% decrement, it has been observed that there were slight to marginal changes in the rank of the other criteria with the findings after 5% decrement. When compared with the actual base model, it has been observed that at least 0.07% of changes were recorded in every other criterion. See Figure 5.18.

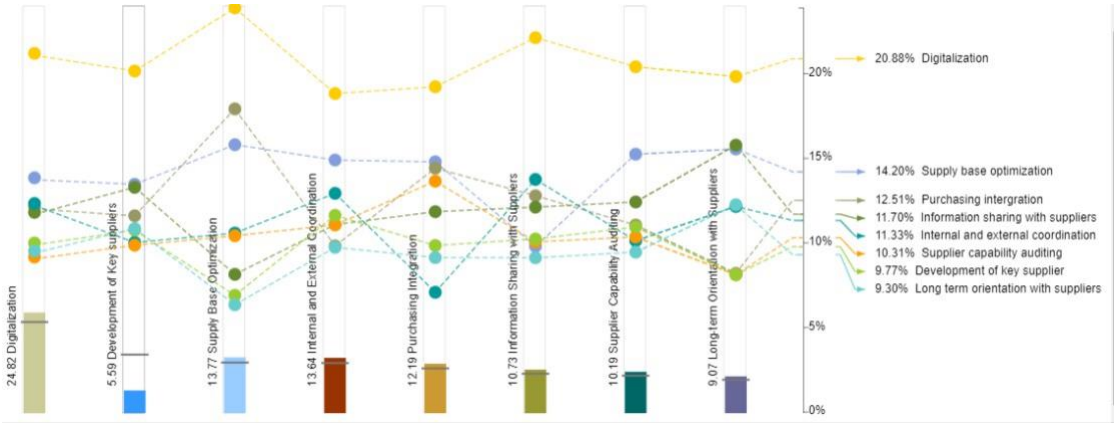


**Figure 5.18:** 10% decrease in development of key suppliers

### 5.7.2.3 15% Decrease

A 15% decrease in the development of the key suppliers led to a small change of 0.11% in the rest of the criteria as shown in Figure 5.19.

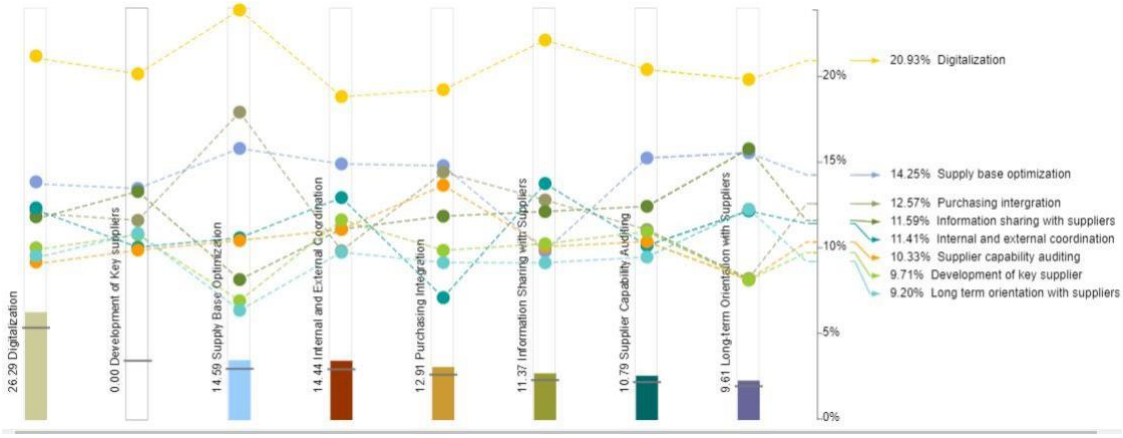


**Figure 5.19:** 15% decrease in the development of key suppliers

### 5.7.3 Supply base optimisation

Figure 5.20 is based on a 5% decrement in the supply base optimisation factor to determine the differences made in other criteria and compared with the actual base model. From the findings, it can be said that there is very marginal change (0.12%) in the other criteria ranking compared to the actual base model.

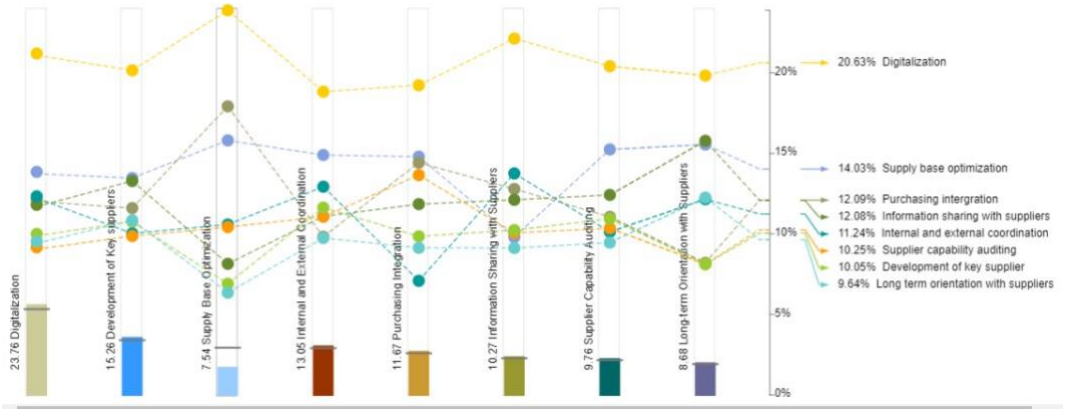


Figure 5.20: 5% decrease in supply base optimisation

#### 5.7.3.1 10% Decrease

Considering the changes after making 10% decrement, it has been observed that there were slight to marginal changes in the other criteria ranking with the findings after 5% decrement. When compared with the actual base model, it has been observed that at least 0.12% of changes were made in every other criterion as presented in Figure 5.21.

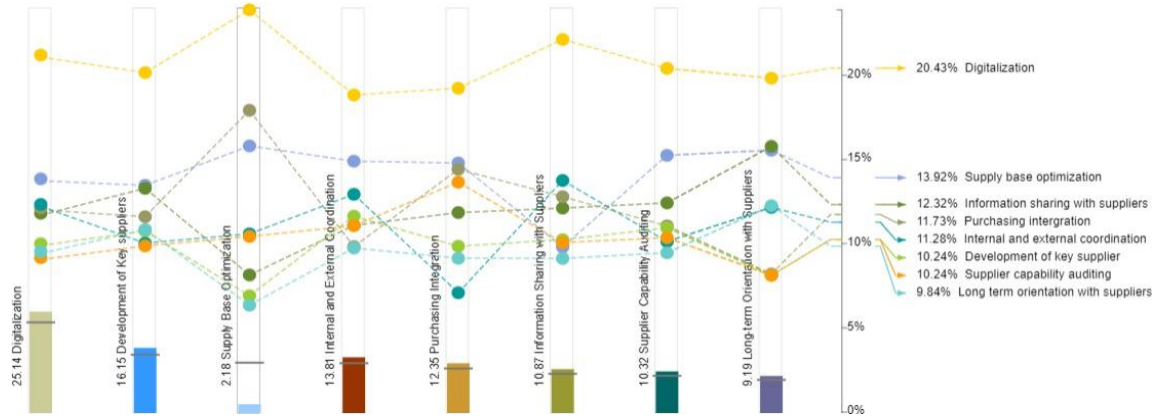


**Figure 5.21:** 10% decrease in supply base optimisation

#### 5.7.3.2 Summary

The changes in different factors were observed with respect to supply base optimisation in the sensitivity analysis caried out. From the findings, it has been observed that changes were recorded in each variation either increment or decrement (5%, 10%, and 15%) in other criteria whereas the marginal changes were noted in the following criteria: “internal and external coordination”, “supplier capability auditing”, “development of key suppliers”, and long-term orientation with suppliers. Purchasing integration and supply base optimisation showed prominent changes in all three criteria.

## 5.8 Conclusion

The proposed framework has been validated using a comprehensive questionnaire administered by practitioners. The impact of purchasing and production strategy as main criteria, with many sub-criteria associated with each main criterion, were measured at 5%, 10%, and 15%. The upcoming chapter provides a detailed testing of the proposed framework fitness using the Structured Equation Modelling (SEM).

# Chapter Six
# Testing the fitness of the proposed framework using the Structural Equation Modelling (SEM)

## 6.1 Introduction

This chapter aims to test the fitness of the proposed framework using SEM approach. The statistical analysis is based on regression modelling and path analysis, where the collected data from the questionnaire is tested, undertaking reliability measures and other relevant statistical measures.

## 6.2. SEM Background

Structural equation modelling (SEM) is a multivariate statistical technique that is utilised for analysing structural relationships. This technique is a merger of multiple regression analysis and factor analysis. It is also utilised for analysing structural relationships between latent constructs and measured variables. This technique is recommended by the researcher since it measures the interrelated and multiple reliance in a single analysis. Exogenous and endogenous variables are two types of variables. Dependent variables are equivalent to endogenous variables, whereas exogenous variables are equivalent to independent variables.

## 6.3. SEM Steps

In this research, data was gathered through an online questionnaires survey for pilot testing to test the reliability of the instrument using IBM SPSS 22. Figure 6.1 shows the steps that helps in computing Partial Least Squares Structured Equation Model

(PLS SEM). The results of pilot testing highlighted that all the variables have value of Cronbach's Alpha above 0.7 (Hair et al., 2014). After performing data screening, the Smart PLS SEM technique is used to analyse further findings.

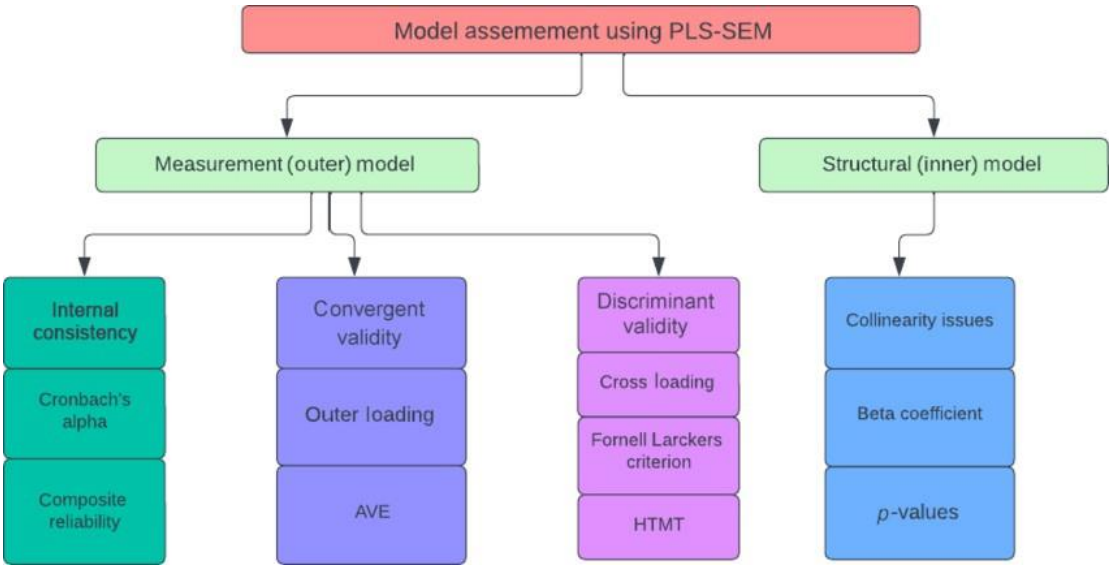


Figure 6.1: Steps to compute PLS-SEM

### 6.4. Pilot Study

To examine the reliability of survey questionnaire, IBM SPSS 22 was used. Reliability analysis is the statistical procedure which enables to analyse the consistency of the survey questionnaire, for which the researcher has used Cronbach's alpha's value. The value of Cronbach's alpha highlights the consistency of the entire scale, which should be greater than 0.7 (Hu & Bentler, 1999; Hair et al., 2014). In this way, the Pilot study is considered as the pathway to conduct the main study, which tends to be performed on a small sample of data; therefore, in this research, 54 responses are used to identify either the collected data is consistent or reliable for the study. Cronbach's alpha's value elaborates on the consistency of the data collected. The liability result is shown in Table 6.1, in which as can be seen all the values of Cronbach's Alpha are greater than 0.7 for all variables.

**Table 6.1:** Reliability Analysis

| Variable | No of items | Cronbach alpha* |
|---|---|---|
| Supplier base optimisation | 4 | 0.914 |
| Information sharing with suppliers | 4 | 0.9 |
| Long-term orientation with suppliers | 3 | 0.875 |
| Purchasing integration | 3 | 0.916 |
| Supplier capability auditing | 3 | 0.907 |
| Development of key supplier | 3 | 0.755 |
| Internal and external coordination | 3 | 0.886 |
| Digitalisation | 3 | 0.816 |

** anything > 0.7 is significant*

### 6.5. Data Screening

After collecting the desirable outcomes of the reliability test, which is more than 0.7, the data was further collected from 253 respondents for data screening. Data screening was carried out using IBM SPSS 22. Data screening technique was used to analyse and improve the quality of data through multiple steps of testing, rectifying the errors in data and identify missing values and outliers, both univariate as well as multivariate. To ensure data screening initially "Missing Data Values Analysis" technique was used, in which missing values were replaced by the series mean value which highlights that there was no missing value in this data.

According to Byrne (2016), extreme values on a solitary variable are recognised as univariate outliers, though extreme values on more than one variable are known as multivariate outliers. Similarly, Z-scores are projected for univariate outliers for which

the benchmark value should be between -3.29 and +3.29, that specific sample is known as univariate outlier (Reza & Ruhi, 2015). In this research, 33 univariate outliers were recognised and deleted from the data. The critical values of Chi-square distribution have been compared with the calculation of "Mahala Nobis Distance Test" through which the number of standard deviations from the mean can be measured. The threshold value must be 0.001 to identify multivariate outliers (Tabachnick & Fidell, 2007). Multivariate outliers are recognised when the critical value is less than 0.001. After performing data screening, the research further proceeds towards Smart PLS SEM for data analysis.

Based on Table 6.2, 65.2% of the participants were male, whereas 34.8% of the participants were female. Moreover, 28.9% of the participants were 36-40 years old, followed by 31-35 years old (25.7%), 25-30 years old (22.5%), and 41-45 years old (11%), and 46-50 years old (7.9%). Out of 253 participants, 51.8% of the participants had a Bachelor degree whereas 35.6% of the participants have a Master degree. Lastly, 34.4% of the participants have 1-5 years of experience, followed by 6-10 years of experience (28.1%).

**Table 6.2:** Demographics

| **Variable** | | **Frequency** | **Percentage** |
|---|---|---|---|
| Gender | | | |
| | Male | 165 | 65.2 |
| | Female | 88 | 34.8 |
| Age | | | |
| | 25-30 | 57 | 22.5 |
| | 31-35 | 65 | 25.7 |
| | 36-40 | 73 | 28.9 |
| | 41-45 | 28 | 11.0 |

| | | | |
|---|---|---|---|
| | 46-50 | 20 | 7.9 |
| Qualification | | | |
| | Bachelors | 131 | 51.8 |
| | Masters | 90 | 35.6 |
| | PhD or research | 32 | 12.6 |
| Work experience | | | |
| | 1-5 years | 87 | 34.4 |
| | 6-10 years | 71 | 28.1 |
| | 11-15 years | 54 | 21.3 |
| | 16-20 years | 41 | 16.2 |

### 6.6 Measurement Model

After the identification of demographic profile of respondents, the measurement model technique was used through Smart PLS SEM. Measurement model is a technique that highlights the factor loadings of the items. It also enables the researcher to analyse the results of indicator reliability, internal consistency, convergent validity as well as discriminant validity with three different measures.

### 6.7 Indicator Reliability (Outer loading)

Indicator reliability was examined by observing the values of outer loading. According to Hair et al. (2014), indicator reliability reports the appropriate correspondence among item's measurements which must be above 0.7 as per criteria. In this research, the results confirmed that all the outer loading was above 0.7, hence the indicator reliability is achieved that has been taken from the appropriate sample size representing the actual population of the research.

### 6.8 Internal Consistency (Compose Reliability)

After accessing the indicator reliability internal reliability was also evaluated. This enables the researcher to know about the inter-correlation of observed indicators. Internal reliability can be measured by two different techniques Cronbach's alpha and composite reliability (Hair et al., 2014). In this research, internal reliability is evaluated through composite reliability (CR) because it a better indicator to access the indicator reliability of the construct in contrast with Cronbach's alpha. According to Hair et al. (2014) the value of composite reliability must be above 0.7 to meet the necessity which are fulfilled in this research as per criteria.

### 6.9 Convergent Validity (Average variance extracted)

After accessing internal consistency, convergent validity was calculated by for the purpose of evaluating reflective indicators. For convergent validity, the outer loading and average variance extracted (AVE) of each item is above 0.70 and 0.50, respectively (Hair et al., 2014). According to the criteria discussed above, the results of this research are defensible.

### 6.10 Discriminant Validity

Discriminant validity can be highlighted through the square root of average variance extracted for each of the variables (Fornell & Larker, 1981). According to Hair et al., (2014), for discriminant credibility the square root of AVE of every single criterion must be higher than the value of correspondences with other criteria. There are three techniques through which discriminant validity can be accessed. As per we used two

of them for effective results, namely: Fornell & Larker (1981) criterion and Cross Loadings and are explained in the following two sub-sections.

### 6.10.1 Fornell and Larker Criterion

To access the discriminant validity Fornell and Larker (1981) is the first technique in which the value of first variable should be greater than the values of other constructs in its entire row to ensure the discriminant validity. Table 6.3 shows the Fornell-Larker Criterion and the values in the table have proved the discriminant validity.

**Table 6.3:** Fornell-Larker Criterion

| | **SBO** | **ISS** | **LTO** | **PI** | **SCA** | **DKS** | **IEC** | **DIG** | **SBO** |
|---|---|---|---|---|---|---|---|---|---|
| SBO | 0.902 | | | | | | | | |
| OL | 0.820 | 0.894 | | | | | | | |
| LTO | 0.795 | 0.785 | 0.918 | | | | | | |
| PI | 0.817 | 0.748 | 0.765 | 0.857 | | | | | |
| SCA | 0.705 | 0.641 | 0.668 | 0.775 | 0.856 | | | | |
| DKS | 0.797 | 0.824 | 0.764 | 0.723 | 0.619 | 0.926 | | | |
| IEC | 0.768 | 0.772 | 0.780 | 0.759 | 0.633 | 0.741 | 0.892 | | |
| DIG | 0.795 | 0.809 | 0.786 | 0.778 | 0.696 | 0.805 | 0.822 | 0.877 | |
| SBO | 0.770 | 0.730 | 0.794 | 0.767 | 0.723 | 0.692 | 0.717 | 0.757 | 0.824 |
| | | | | | | | | | |

### 6.10.2 Cross Loadings

After evaluating Fornell and Larker Criterion, another technique of discriminant validity is examined, which is most substantial, known as cross loadings. In this technique, the loadings of all the items of the latent variables must be above the values

of other variables (Hair et al., 2011). Table 6.4 shows the table of cross loadings outcomes of this research, and those values of this criterion has also fulfilled the discriminant validity. For example: latent variables are the variables presented on the left side of the table (SBO_1, SBO_2 etc.)

**Table 6.4:** Cross Loadings

| | **SBO** | **ISS** | **LTO** | **PI** | **SCA** | **DKS** | **IEC** | **DIG** |
|---|---|---|---|---|---|---|---|---|
| SBO_1 | 0.915 | 0.743 | 0.736 | 0.731 | 0.638 | 0.697 | 0.694 | 0.712 |
| SBO2_1 | 0.914 | 0.768 | 0.713 | 0.708 | 0.604 | 0.729 | 0.700 | 0.711 |
| SBO3_1 | 0.878 | 0.707 | 0.701 | 0.772 | 0.667 | 0.732 | 0.683 | 0.728 |
| ISS1_1 | 0.721 | 0.897 | 0.717 | 0.671 | 0.561 | 0.721 | 0.716 | 0.746 |
| ISS2_1 | 0.769 | 0.904 | 0.717 | 0.699 | 0.615 | 0.733 | 0.724 | 0.732 |
| ISS3_1 | 0.709 | 0.882 | 0.671 | 0.635 | 0.544 | 0.758 | 0.630 | 0.693 |
| LTO1_1 | 0.737 | 0.732 | 0.923 | 0.691 | 0.609 | 0.730 | 0.708 | 0.741 |
| LTO2_1 | 0.740 | 0.758 | 0.915 | 0.730 | 0.618 | 0.721 | 0.752 | 0.728 |
| LTO3_1 | 0.711 | 0.671 | 0.918 | 0.685 | 0.614 | 0.652 | 0.687 | 0.696 |
| PI1_1 | 0.815 | 0.733 | 0.738 | 0.894 | 0.608 | 0.724 | 0.753 | 0.739 |
| PI2_1 | 0.720 | 0.686 | 0.695 | 0.885 | 0.656 | 0.647 | 0.686 | 0.708 |
| PI3_1 | 0.537 | 0.474 | 0.508 | 0.788 | 0.760 | 0.460 | 0.484 | 0.530 |

### 6.11 Path Analysis

Path analysis was generated by the bootstrapping method through smart PLS SEM. In this technique, path coefficients will highlight whether the association among the variables is positive or negative.

Here, beta refers to path coefficient, which is a standardised regression coefficient that portrays the direct effect of an independent variable on a dependent variable in the path model.

Smart PLS can generate T-statistics for significance testing of both the inner and outer model using a procedure called bootstrapping. In this procedure, many subsamples (e.g., 5000) are taken from the original sample with replacement to give bootstrap standard errors, which in turn gives approximate T-values for significance testing of the structural path. The Bootstrap result approximates the normality of data. Using a two-tailed t-test with a significance level of 5%, the path coefficient will be significant if the T-statistics is more than 1.96.

**Table 6.5:** Path analysis

| | **Beta** | **T Statistics (\|O/STDEV\|)** | **p-values*** | **Result** |
|---|---|---|---|---|
| SBO →PP | 0.204 | 2.357 | 0.01 | Significant |
| ISS → PP | 0.474 | 7.401 | 0.00 | Significant |
| LTO→ PP | 0.457 | 7.217 | 0.00 | Significant |
| PI→ PP | 0.171 | 2.534 | 0.01 | Significant |
| SCA→ PP | 0.236 | 3.645 | 0.00 | Significant |
| DKS→ PP | 0.081 | 1.621 | 0.05 | Insignificant |
| IEC→ PP | 0.235 | 3.676 | 0.00 | Significant |
| DIG→ PP | 0.159 | 1.658 | 0.05 | Insignificant |

If P-Values <= 0.05, the element is significant.

A mediated moderation then exists if this moderator effect is applied to an indirect path from the independent variables to the dependent variable via a mediator (MED). So,

there is an indirect effect, the strength of which depends on the moderator, and therefore, the strength of the overall effect depends on the moderator. Figure 6.2 shows mediation-moderation analysis:

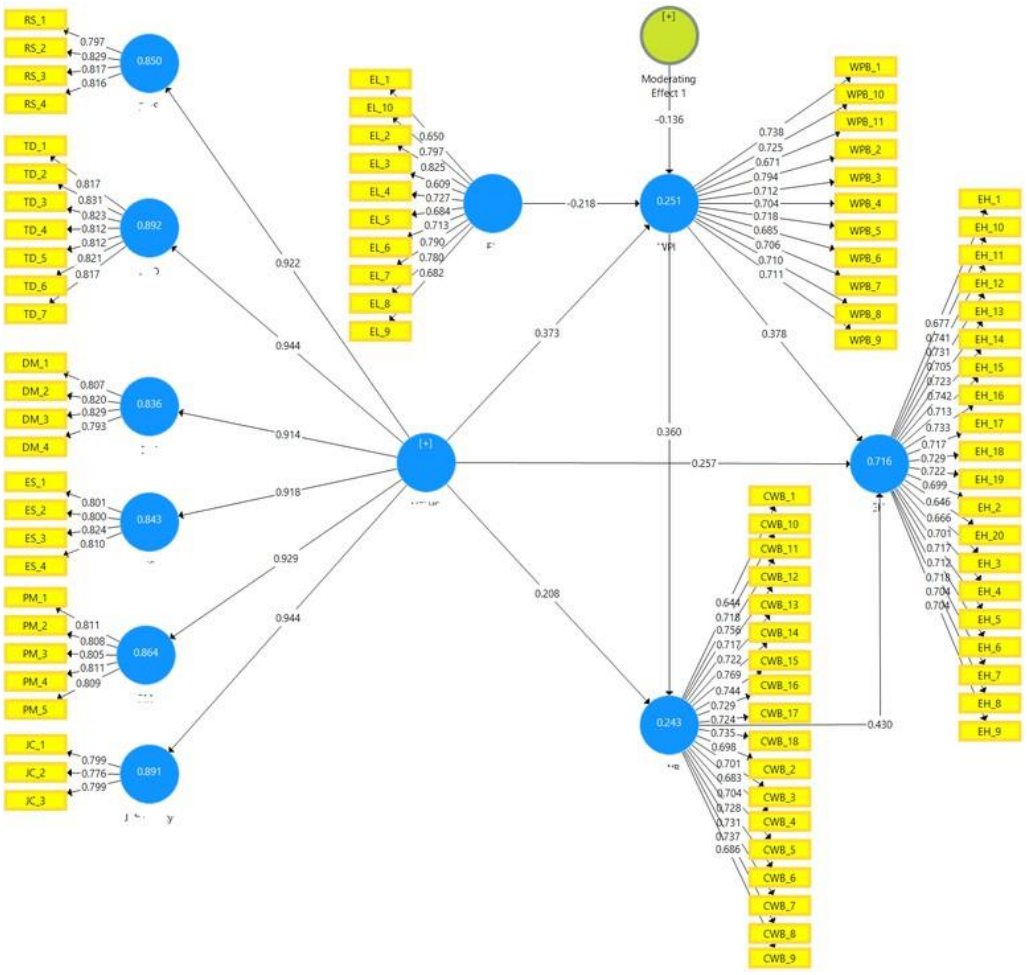


**Figure 6.2:** Mediation-Moderation Graph

Path analysis graph is used to estimate a system of equations considering all variables. Unlike regression models, path models can contain multiple dependent variables (regression model systems). In SmartPLS, variables for path models can be included as discrete constructs. When a variable is based on multiple indicators, they are assigned equal weight to obtain a construct score. In principle, models are only made for the structure between the observed variables (or equally weighted structures) with or

without control variables. This type of model is usually used when one or more variables are supposed to mediate the relationship between two other variables (mediation model). At the same time, it is possible to model the mediation of mediation. The variables on the right side of the graph represent dependent variable whereas the all the variables on the left side of the graph are independent variables. The values inside the blue circles represent overall coefficient value of a single independent variables whereas the values mentioned on the arrow following yellow boxes, represent coefficient values of respective item for each variable. All the variables were provided pseudonym acronyms by software but followed actual framework and alignment to show cause-and-effect analysis. From the findings, it was very much clear that there was a sufficient and positive effect of all independent variables on the dependent variable. However, mediating, and moderating variables showed minimal effect on the relationship between independent and dependent variables.

***Explanation on a special note***

The findings have shown a statistically significant impact of supplier base optimisation, supplier capability auditing, supplier development for sustainability, long-term orientation, and information sharing with suppliers on production and purchasing with a coefficient value of (0.850), (0.892), (0.836), (0.843), (0.864), and (0.891).

The findings have shown a statistically significant moderating variable (digitalisation) on the relationship between independent variables (supplier base optimisation, supplier capability auditing, supplier development for sustainability, long-term orientation, and information sharing with suppliers) and dependent variable (production and purchasing) with coefficient values of (-0.136 and 0.251).

The findings have shown a statistically significant mediating variable (internal and external coordination) on the relationship between independent variables (supplier base optimisation, supplier capability auditing, supplier development for sustainability, long-term orientation, and information sharing with suppliers) and dependent variable (production and purchasing) with coefficient values of (0.360 and 0.243).

In the table 6.5, the linkage was highlighted in a way that whether they are impacting significantly or insignificantly. In this table the researcher also considers T values, which must be above 1.96 as per criteria and P values to identify the significant and insignificant impact. If the impact is significant here P values must be less than 0.05 similarly if the P value of the study is more than 0.05 then the hypotheses have an insignificant impact on this study's variables to be an important element to pursue this research.

In addition to checking collinearity, there can be a detailed discussion of the model's $f^2$ effect size which shows how much an exogenous latent variable contributes to an endogenous latent variable's $R^2$ value. In simple terms, effect size assesses the magnitude or strength of the relationship between the latent variables. Such discussion can be important because effect size helps researchers to assess the overall contribution of a research study. The researcher should not only indicate whether the relationship between variables is significant or not, but also report the effect size between these variables.

In this research, the samples values were created from the actual data which was used to produce the framework. In the table of analysis (See table 6.6), it is observed that review quality has an insignificant effect on perceived usefulness ($\beta$=0.766 t>1.96,

p>0.05). But supply base optimisation, purchasing integration, development of the key suppliers, and digitalisation have similar significant and direct effect i.e. (β=0.204 t>1.96, p<0.05), (β=0.171 t>1.96, p<0.05), (β=0.081 t>1.96, p<0.05) (β=0.159 t>1.96, p<0.05) (β=0.227 t>1.96, p<0.05) and (β=0.117 t>1.96, p<0.05) respectively.

**Table 6.6:** R-Square

| | **R Square** | **R Square Adjusted** | **$Q^2$ (=1-SSE/SSO)** |
|---|---|---|---|
| Supplier base optimisation | 0.592 | 0.591 | 0.478 |
| Information sharing with suppliers | 0.736 | 0.730 | 0.610 |
| Long-term orientation with suppliers | 0.736 | 0.734 | 0.625 |
| Purchasing integration | 0.713 | 0.710 | 0.474 |

SSE = squared prediction error, SSO = squared observations

Another tool to observe variance is R square which is also known as coefficient of determination. According to Hair et al. (2014), R square enables the researcher to identify accuracy predicting power of a model. The standard value of the coefficient of determination (R2) with respect to ROT is 0.75, 0.50, and 0.25 (Henseler et al., 2009). According to Hair et al., (2011), endogenous variables disclose logical applicability when the value of Q square is more than zero.

### 6.12 Conclusion

The validation of the proposed framework through feedback from the questionnaires drawn from the three companies was crucial for the research methodology. The responses could be used to confirm its usefulness to industry professionals. Partial least

squares structural equation modelling (PLS-SEM) is a modern multivariate analysis technique with a demonstrated ability to estimate theoretically established cause-effect relationship models. This technique has been increasingly adopted in management research over the last two decades. Adopting PLS-SEM technique appears to be a timely and valuable endeavour. Results show that application of PLS-SEM, research design, model development, and model evaluation are discussed in detail. Most importantly the usage of PLS-SEM proof the validity of the proposed framework and its criteria and sub-criteria. The upcoming chapter will be the overall conclusion of the research, recommendations, and limitations of the research.

# Chapter Seven

# Conclusions, Recommendations, Contribution to Knowledge, Limitations and Future Work

## 7.1 Introduction

This chapter presents an overall conclusion, recommendations, contribution to knowledge, and limitations based on the data analysed. This chapter has further covered the recommendations for future studies.

## 7.2 Conclusion

In conclusion, the supply chain for the fashion sector is intricate and presents substantial sustainability difficulties. The four pillars of supply chain management — integration, operations, buying, and distribution — may be used by businesses to overcome these obstacles and advance sustainability in their supply chains. Also, businesses may use technology to manage their supply chains better, increase transparency, save waste, and boost labour standards. Companies may encourage ethical and sustainable fashion production and consumption, helping to create a more sustainable future for the fashion industry, by using digital platforms like blockchain, 3D printing, data analytics, and machine learning. Based on objective 2 of this thesis, companies in the fashion sector must understand how their supply chains affect the environment, society, and economy and take the required steps to lessen the repercussions.

Based on objective 3, fashion apparel firms identify an upcoming threat from new entrants of foreign retail chains, which are progressively due to the rising

internationalisation. Based on Objective 4, production and purchasing strategy was crucial as primary criteria for accomplishing the goal of the future framework. This progression is posing a great challenge while being relied on the fashion apparel industry, specifically for fashion apparel retailers. Retail trade companies are making efforts for increasing their speed by long-term and close associations with the fashion apparel industry to compete with fast fashion companies. In addition, backward integration is used in a comparatively small number of retail trade companies to speed up their reaction time as well as strengthen their own market position. Generally, the benefits to create own brands by a backward integration are merely appropriate for comparatively large as well as financially strong fashion apparel retail trade companies. Based on Objective 5, the implementation of sustainable elements throughout all supply chain activities has also been considered as being substantially important. To be precise, this element is complicated to accomplish for retail trade companies while being relied on the fashion apparel retail trade. Parts of the supply chain activities would be clearer, which consequently affects the extent of sustainable supply chain activities, while using backward integration. In addition, better opportunities for fashion apparel companies can be created by increasing the possibilities of digitalisation. Retailers identify an increasing demand of omnichannel achievements for competing in this challenging marketplace.

The cross-channel shopping and fulfilment, digitalisation will seek to accelerate substantially throughout the next few years. In this regard, the customer satisfaction is highly affected by their perception of an integration between both offline and online digitalisation platforms. Further innovative technologies might support purchasing

decisions using digitalisation. A greater specialisation by product and price is identified throughout large organisations experts.

Generally, firms in the fashion apparel industry are selecting for strategic outsourcing for reducing costs as well as increasing their flexibility. Outsourcing allows companies for producing cost-efficiently, which not being relied upon to produce in their own manufacturing possesses on full capacity. Such possessions are implementing high product varieties, which makes the full operation of their own manufacturing facilities approximately impossible in most cases. Accordingly, firms are looking for the best suppliers, which can deliver each product at the best-price quality ratio. Therefore, outsourcing provides low capital investments for identifying the production and a high degree of flexibility for rapidly switching to different suppliers.

By concluding, the focus of top performing fashion apparel firms has shifted from an internal towards an external orientation. In addition, they have switched from an appropriately cost-centric approach to create value for growing their business as well as developing a value driven network. In fact, all the extents of this value-adding elements should be targeted based on their individual segments.

In order to validate the proposed approach in objective 3, a survey questionnaire was prepared, and data were analysed using AHP and SEM models. There was substantial evidence from the three companies participating in the research that purchasing and production strategies play equally significant roles in successful innovation, identification, and delivery. The results shows that the digitalisation criterion such as Industry 4.0 is the topmost required of the three companies. Long-term orientation with suppliers and Information sharing with suppliers were the most influential in assisting digitalisation.

Based on Objective 6, the applicability and the validity of the proposed framework were confirmed through the implementation of SEM approach. Three main supporting elements should be considered in both practice and theory for creating value. Firstly, a product should be created with a comparatively high-price quality ratio. Secondly, sustainable elements should be implemented along almost all supply chain activities. Thirdly, the use of an online market is considered as an important element. The online market has a major growth potential and still many well-recognised brands merely have a comparatively low market share in digitalisation. This shows that both the supply chain executives and business executives throughout fashion and lifestyle brands for addressing robust solutions to hold the digitalisation and develop the business of a company in a profitable way.

### 7.3 Recommendations

Sophisticated technology and high thought laboratories have been introduced in the production process, which brought new dimension in the purchasing, procuring, storing, and maintaining supplies and inventories. The improved transportation and communication as well as competitors' threat has made the issue more challenging and competitive. Thus, the usage and need for supply chain management are increasing dramatically. Further, global competitions require the companies' continuous response to the customer with new products and replacing those that become obsolete. For these reasons, companies are combating finding new suppliers and building strong and long-term relationships with them. Hence, managers must be very rational, logical, and sensitive in designing and implementing proper supply chain management in order to fight and compete against competitors and attain organisational goals. Before selecting

a supplier, a firm must decide whether it will use single sourcing or will have multiple suppliers from which to source the product. Single sourcing is used to guarantee the supplier sufficient business when the supplier must make a significant buyer-specific investment. Once suppliers have been selected, contracts must be structured between the buyer and each supplier. Supply chains can influence demand by using pricing and other forms of promotion. Marketing and sales often make the promotion and pricing decisions, and they typically make them with the objective of maximising revenue. Pricing decisions based on revenue considerations often result in a decrease in overall profitability.

Regarding the criteria for the inventory, there are two ways to maintain responsiveness. The first is to maintain a certain inventory, and the second is to bring in products straight from the manufacturer according to requirements. Reshoring of manufacturing supports proper inventory maintenance by synchronising demand and production. Collaboration with local suppliers can help brands get more products directly from manufacturers while reducing the need to manage inventory.

Long-term orientation and strategies for achieving common goals allow supply chain networks to operate almost effortlessly like vertically integrated companies, while ignoring the barriers of sunk costs, organisational rigidity, and lock-in. Closer business relationships are necessary to maximise the effectiveness and efficiency of the material flows within the supply chain, especially in terms of inventory availability and delivery time, especially for textile products (Polo Redondo and Cambra Fierro, 2005). As a result, major retailers have streamlined their global supply networks to reduce costs and establish closer partnerships with fewer preferred suppliers. On a supply-side basis, downsizing allows buyers to establish long-term relationships with secondary suppliers

and improves supplier performance and capabilities, thus bringing benefits to both companies (Su, 2013; Starmanns, 2017).

It has been stated that strategic sourcing is the process by which purchasing managers gain different perspectives on the external and internal environments, which leads to changes in existing practices and making effective decisions. This perspective can be forward-looking as it allows the purchasing manager to develop backward and forward-looking skills while determining where his purchasing strategy stands and what strategies should be developed to achieve the company's vision without having to repeat the purchasing manager's mistakes in the past (Foerst et al., 2013). Procurement integration allows buyers to develop a keen awareness of changes in the external environment, work on weak signals, build strength, and procurement perception will be the result of communication between different functions, build partnerships and deal with supplier network procurement problems.

To deal with the effects of competitors on supply chain strategies, companies need to be aware of their competitive environment and engage in continuous improvement in their supply chain management practices. For example, they may implement lean supply chain management practices or collaborative initiatives to reduce costs, shorten lead times, and enhance supply chain performance.

The internal and external factors can have a significant effect on the success of a supply chain. Internal factors such as inventory management, technology, supplier relationships, and procurement strategies, while external factors such as economic conditions, political instability, environmental factors, and competitors can affect supply chain strategies. Supply chain companies should focus on innovation, inventory control, and risk management to improve their operations and consider implementing

the recommendations provided in this paper. By doing so, supply chain companies can improve their efficiency, reduce costs, and ensure a steady supply of goods and services to their customers.

It has been observed that even with better suppliers and quality sourcing, the supply chain cannot compete effectively in the overall market environment. Due to the need to keep pace with the challenges of increasing globalisation, effective ethical behaviour is now a key factor in achieving profitability in manufacturing (Handfield et al., 2006). Trusted and reliable suppliers are important factors in effective inventory and procurement management and in working closely with suppliers to coordinate buyer and supplier operations to improve profitability and productivity.

The production and purchasing model in this study emphasises that it is initially linked to product design units, marketing operations, external design, warehouses, and quality control to improve production profits. The best place to start in supply and procurement management is to identify and manage better suppliers. The key elements of design are the basis of producing quality products and providing the best service. Ensuring the marketability of services and products, improving the quality and quantity of services and products, and managing warehouses to maintain the basic quality of economic order are important to the profitability of production.

### 7.4 Contribution to the Knowledge

The following points are considered based on the analyses of data collected from the participants who are identified to make contributions to knowledge and to exchange services in their industries:

1. Developing the production and purchasing framework: Through this, innovative solutions can be provided by focusing on the digital transformation and adopting the digital technologies in the 21st -century.

2. The usage of the Analytic Hierarchy Process (AHP) in the supply chain management: As can be seen, AHP provided a very practical research method which allowed for the analysis of the data collected, the validation of the proposed framework and also for carrying out the sensitivity analysis procedures, which are crucial to understanding the model behaviour and its limitations; Besides, measuring the inconsistency ratio of the participants' contribution toward building the proposed framework.

3. The involvement of the three companies: The contribution of these three companies (Marks and Spencer, H&M and ZARA) recruited a large sample size of 253 participants from these companies, which added to the credibility of the proposed framework.

### 7.5 Limitations and Future Work

The current research will be limited to the comparison of the digital and traditional modes of the supply chain, particularly in the textile industry. There will be a focus on comparisons of traditional and digital supply chain models to make comparisons. Comparisons will help assess why companies opt for a digital supply chain. There will be the measurement of gaps to see the difference between the present situation and the desired state. The future research should discuss how the improvement of the supply chain in terms of digitalisation can help textile companies to attain supply chain objectives.

Although the researcher of this thesis and the supervisory team are experts in the supply chain management field, out of which the proposed strategies were recommended, however, as for future work, these need to be validated through more involvement of different companies and brands.

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## Appendix and survey

Development of a framework for production and purchasing SCM strategies in UK textile

Survey (surveymonkey.com)