DECISION MAKING MODEL FOR THE FRONT-END OF APPAREL INNOVATION

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DECLARATION

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ABSTRACT

A systematic, well-documented approach is absolutely essential in today's context of apparel innovation to manage and implement the activities of the innovation process in the winning goal of developing fashion-forward innovative apparel products. Decision making at the front-end of the innovation process is the most significant aspect of the success of the entire innovation process. As such, decision making in the front-end by incorporating co-creation of value in the Business to Business (B2B) customer context is vital as this is deemed to be the best way to put the company in a strong position in the market with respect to competitiveness and survival. The existing models for decision making in the front-end have limited clarity on what decisions should be made at different stages, how the decisions should be made and what the specific roles of the B2B customers are, in the process of innovation. Though enormous focus and efforts are evident in developing innovative apparel products by the Sri Lankan apparel industry, no standardized procedures have been laid down for the decision making in the apparel innovation process, as revealed from the discussions with the senior managers of the Sri Lankan apparel industry. Thus, this study aims at filling these gaps in the literature and apparel industry practices by developing a model for decision making in the front-end by incorporating 'co-creation of value in the B2B context' to provide a useful guide for the apparel product innovation process.

Initially, three companies in Sri Lanka, who have heavily concentrated on apparel product innovation for the past ten years were studied to identify the type of innovative product offered and the key decisions involved in the front-end of innovation. The findings indicated that 90-95 percent of innovations are incremental in the practical apparel setting in Sri Lanka. The world reputed international apparel brands are directly involved in the manufacturing process as the apparel products are made available to end consumer through apparel brands. Three innovation initiation approaches are practiced by the apparel brands; innovation 'initiated by company for customer', 'initiated by company with customer', and 'initiated by customer'. The key decision gates vary in the three innovation initiation approaches, eight in the first two approaches and seven in the third approach. The inputs from apparel brands and suppliers are also in different forms and in different intensities. The front-end decision making process is controlled by the core competencies and climate of the company and the operational competencies and relationship characteristics of the external actors.

The results obtained in the case studies for two initiation approaches found within incremental apparel product innovation (innovation 'initiated by company' and 'initiated by B2B customer') were re-examined and verified using two concurrent studies: semi-structured interviews and a questionnaire survey. Three individual components (i. decision making process steps, ii. interactive roles of B2B customers, producers, and suppliers, and iii. factors that influence the front-end decision making process) were included in the Meta decision model as they closely interconnect to each other.

The Modified Delphi technique was employed in the process of model validation to verify the Meta decision making model in terms of the levels of clarity of the content, overall reliability, practicality, and appropriateness for the apparel sector. The opinions of experts involved in the validation Modified Delphi study confirmed that the Meta decision making model provides a deeper understanding of what decisions should be made at different stages, the responsible decision makers for each key decision, and how the decisions should be handled systematically at the front-end of apparel innovation. The Meta decision making model could assist apparel producers to improve the quality of design solutions, avoid ineffective solutions, create the best value for customers, and meet the needs of demanding customers.

Key words - apparel, B2B customer, co-creation, decision making, front-end, innovation

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The journey involved in pursuing a doctoral research study, beginning with getting the initial idea, being immersed in the research work for about five years, and then finally writing and completing the thesis can prove to be an arduous, incredibly challenging, and unforgettable educational adventure. The travails of engaging in a doctoral research study while occupied with a full-time job were felt right from the start of my doctoral endeavor. Everything did not go as planned, and not everyone understood the hardships I underwent and the huge amount of effort I invested over a period of more than seven years. But now at the end of the journey, it is a pleasure for me to reflect on the inspiring, character building, and meaningful personal and professional experiences that I acquired while pursuing my ambition.

The subject of my research focused on the activities and decisions at the front-end of apparel product innovation. This called for a great deal of generous support and encouragement from many people in academia, the apparel industry, and my own family. I must acknowledge the advice, assistance, encouragement, and unstinting support given to me by those in my circle while I was learning, researching, and struggling. Now, I take pleasure in conveying my gratitude to them for not only sharing their time and thoughts, wisdom and experiences, but also offering me new perspectives, and sharing my troubles by listening to me when my spirit sagged, and pushing me forward to complete this research successfully.

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LIST OF ABBREVIATIONS

B2B	Business to Business
B2C	Business to Consumer
CAD	Computer Aided Design
C2C	Consumer to Consumer
C2B	Consumer to Business
CEO	Chief Executive Officer
COO	Chief Operating Officer
DGM	Deputy General Manager
IP	Intellectual Property
NDA	Non-Disclosure Agreement
NPD	New Product Development
PD	Product Development
R&D	Research and Development
RQ	Research Question
TRL	Technology Readiness Level

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CHAPTER 1

INTRODUCTION

1.1 Background of the study

1.1.1 Apparel industry

The apparel industry had been characterized as a cottage industry during the pre-industrial era of human history. Gradually, it had shifted from homes to factories where the operations were conducted in relatively simple, unadaptable, and homogeneous environments that worked to the requirements of merchants (Kilduff, 2000). During the industrial revolution, the apparel industry had undergone rapid growth, transforming itself into a globalized industry (Adhikari & Yamamoto, 2007; Glock & Kunz, 2007). The industry was shaped and re-shaped from the late 1950s due to the environmental turbulence and escalation caused by increased fashion consciousness, technical innovations, and the expansion of international trade (Barrie, 2018; Kilduff, 2000). At present, the apparel industry is one of the most internationalized and important sectors of the world economy (Barrie, 2018; McKinsey & Company, 2022). Moreover, it is a dynamic industry focused on design and technology (Albar, 2013; Lou,2020).

Today, the apparel industry serves diverse markets that are split into a number of segments mainly based on price, product quality and specifications, number of pieces (output to the market) and retail activities (Ban, 2020; Barrie,2018; Lou,2020). The apparel industry produces several lines of new products each season (Albar, 2013; Lou,2020). These apparel products span a wide range from low-priced mass market apparel to custom-made couture apparel sold for thousands of dollars per piece (Bruce & Daley, 2006; Lou,2020; Renfrew & Renfrew, 2009). Based on end use and function, the apparel industry produces a wide variety of product categories designed for men, women, children, and infants. These include apparel for casual, formal, sports, maternity, bridal, and other purposes, and uses (Kunz & Garner, 2007).

1.1.2 Challenges of the apparel industry

Difficulties and challenges are inevitable in any manufacturing industry. During the recent past, the apparel industry too has experienced difficulties and challenges, raising doubts about the continued survival and future of the industry due to changing customer needs, environmental turbulence, intensified competition, and technology breakthroughs as illustrated in Figure 1.1 (Barrie, 2019; Bertola & Teunissen, 2018; McKinsey & Company, 2017; Kozlowski, Searcy, & Bardecki , 2016; Parker-Strak, et al.,2020; Sachdeva, Shrivastava, & Chauhan, 2019; Zulch, Koruka, & Borkichei, 2011). This has had a depressing effect on the stakeholders, suggesting a challenging and uncertain future for the apparel industry worldwide.

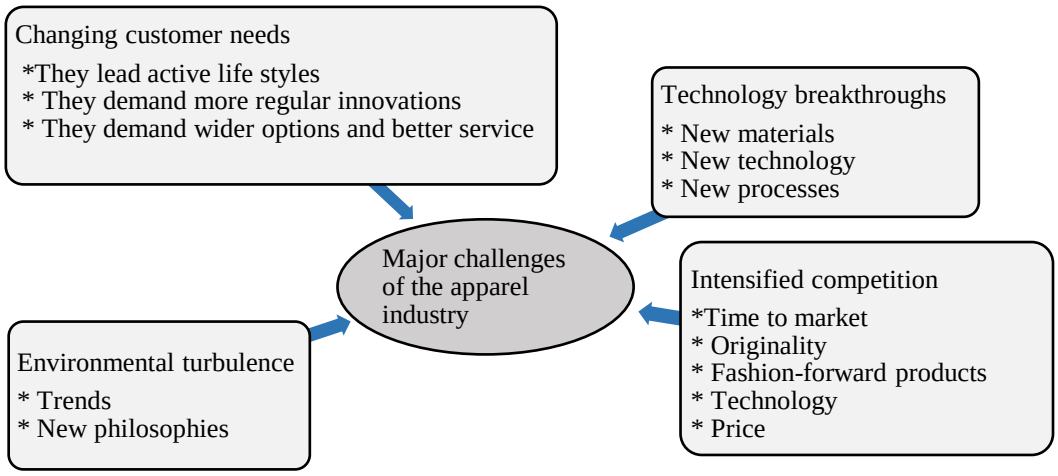


Figure1.1:Major challenges of the apparel industry

Source: (Barrie,2019; Bertola & Teunissen, 2018; McKinsey & Company, 2017; Kozlowski et al., 2016; Parker-Strak, et al.,2020;Sachdeva et al., 2019; Zulch et al.,2011)

Consumers are becoming more aware of their health. There is a growing trend toward more casual and active lifestyles too (McKinsey & Company, 2022; Zulch et al.,2011). Consumers have not only become increasingly sophisticated, demanding wider choice, more frequent innovation, greater exclusivity, and better service, but they also demand more value for money (Bertola & Teunissen, 2018). This trend has led to customers demanding products that satisfy their personal tastes and preferences (Zulch et

al.,2011). In turn, the demands of the present consumer have created markets for new fabrics and apparel that would make available a diverse range of product categories in the market (McKinsey & Company, 2022).

The demand for environmental protection, along with the drive for ethical consumerism, and social compliance, are other major challenges to the apparel industry (Ban, 2020; Barrie,2019; Kozlowski et al., 2016; McKinsey & Company, 2022, Shen, Wang, Lo,& Shum,2012). This forces the apparel manufacturers to rethink how they operate their production practices, and whether the basic raw materials come from transparent, responsible, and green suppliers. Furthermore, social trends such as individualism and the emergence of new subcultures (e.g. afro-punk, hip-hop, ridding, and clubbing) add to the complexity that companies in the apparel sector are already dealing with (McKinsey & Company, 2017).

Besides all these factors, rapidly changing technologies are challenging too. The apparel companies have to keep up with them (McKinsey & Company, 2017; Moretti & Braghini, 2017). Today, the world is changing fast with new innovations and technological advancements in all materials and processes. This forces the apparel companies to either keep up with novel and emerging technologies by adopting the same for their apparel production process and to come up with smart innovative products or else fall by the wayside. The two challenging trends that have emerged recently are the philosophy of 'fast fashion', and 'ultra-fast fashion' (McKinsey & Company, 2017; Parker-Strak, et al., 2020). The major characteristics of these fast fashion trends are shorter product life-cycles, faster production response and distribution, and a greater variety of choices for the customer (McKinsey & Company, 2017; Parker-Strak, et al.,2020). These trends are posing a challenge to the apparel industry.

For more than two decades, apparel brands in developed countries have outsourced their apparel manufacturing to low-cost production regions in developing economies. With the rise of automation in recent years, apparel brands have been driven to relocate manufacturing to a nearby country closer to the end market (near-shoring) or to bring it back to the home country (re-shoring) (De Silva, et al.,2021; Perera,2020; Wijewardhana, et al., 2021). Near-shoring and re-shoring are recent trends in the

apparel value chain that pose a challenge to apparel manufacturers in developing economies.

The above challenges act as push factors calling for new strategies to be implemented to successfully survive in the apparel market.

1.1.3 Apparel innovations to overcome challenges

The concept of 'innovation' has gained popularity as a compulsory requirement that would serve to differentiate and distinguish consumer products (Wecht, 2006). Innovation is an engine of sustainable growth (Rahkoen, 2012). Innovation is a worthwhile source of competitiveness to protect the current market and to expand into new markets by bringing new or greatly improved products (Heuer, 2011; Nicholas, Ledwith, & Perks,2011; Rahkoen, 2012; Rogers, 2003; Trott, 2008; Zeilstra, 2009). Lowering of production costs, improvement of the quality of products, and fast customization of the existing products are all expected to result from successful innovations, thereby providing a competitive advantage to the company (Petetin, Bertoluci & Bocquet, 2010). Thus, innovation can lead to improvements in terms of quality, design, and customization of existing products (Tidd & Bessant, 2013).

According to the above line of reasoning, innovation is an effective strategy to improve the prospects of the apparel sector in today's fast-changing business environment for the survival of a company, competitiveness, and profitability (Albar, 2013; Ban, 2020; Crawford, 2016; Hammedi, van Riel, Allard, & Sasovova, 2011). Therefore, the apparel manufacturers make strong efforts and investments in fashion-forward innovative apparel products while striving to maintain the aesthetic touch of the materials (McKinsey & Company, 2022; Crawford, 2016). As a result, significant apparel product innovations such as regenerated cashmere, electro-conductive textiles, eco-friendly organic materials, recycled synthetic materials, sustainable textiles, and nano-textiles have appeared on the market in the recent past (Henze, 2018). A few examples of apparel product innovations launched on the market are disposable clothing, biomedical clothing, non-wash clothes, seamless garments, body-hugging thermal apparel products, and garments with stitch-free seams (Crawford, 2016; Edelson, 2017).

1.1.4 Importance of decision making in the front-end of apparel product innovation

The process of innovation comprises of three phases; front-end, new product development (NPD) and implementation, as illustrated in Figure 1.2 (Belliveau, Griffin & Somermeyer, 2004; Cooper et al., 2002; Hüsig, Kohn, & Poskela,2005; Nobelius & Trygg, 2002; Smith & Reinertsen, 1991).

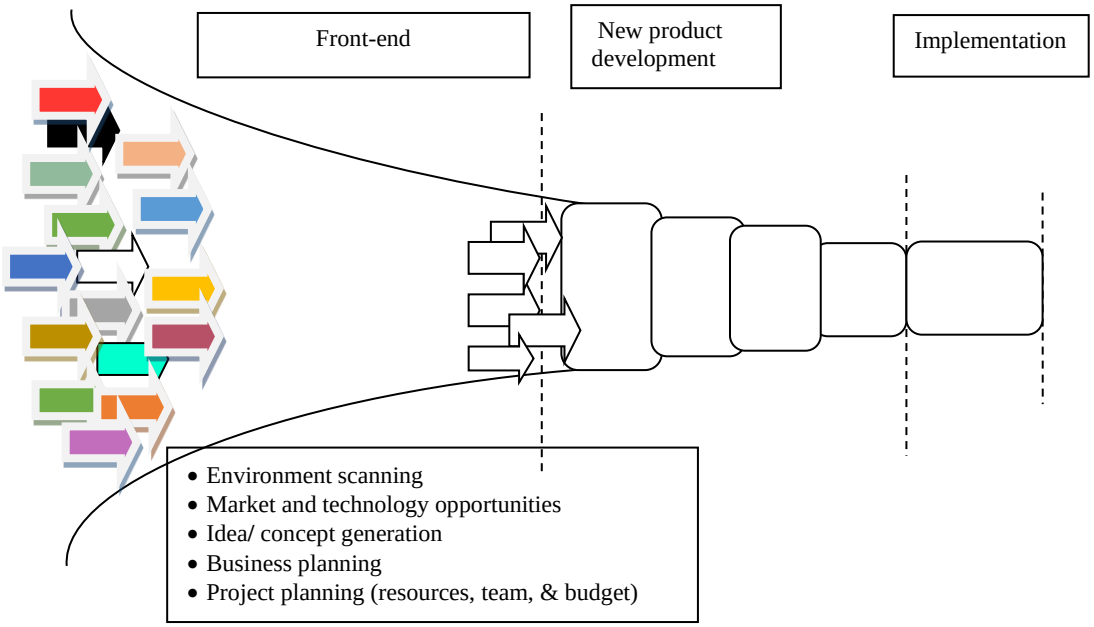


Figure 1.2:Phases of the innovation process

Source : (Belliveau et al., 2004 ; Cooper et al., 2002 ; Hüsig et al.,2005 ; Nobelius & Trygg, 2002; Smith & Reinertsen, 1991)

In order to develop fashion-forward innovative apparel products, implementing efficiently and systematically managing the activities during these three phases of the process of innovation is important (Cooper, 1994; Deppe, Kohn, Paoletti, & Levermann, 2002; de Sousa Mendes & de Toledo, 2011; Koen et al.,2001). Within the three phases of the process of innovation as depicted in Figure1.2, the first stage of the innovation process is the front-end of innovation. The second phase of the innovation process includes the development of selected new product concepts into finished products. Bringing the new innovation to the market is the focus of the third phase. The front-end is the most crucial stage that leads to conceiving novel

technologies, processes, and product improvements, and will determine the success of the innovation process (Williams & Samset,2010). The front-end innovation process starts with activities related to searching for suitable opportunities for innovation by performing environmental scanning on the requirements of the customer, and current product problems in the market. This is followed by idea generation, evaluation and selection, and project/ business planning (Koen et al., 2001; Poskela, 2009; Verworn et al., 2006; Zhang, 2014). During the front-end process activities, critical and far-reaching decisions are made, such as the initial innovation ideas, the best approaches for efficient innovation, financial investment, in-house and external resources, potential markets, and other aspects (Koen et al., 2001; Szutowski, 2019; Williams & Samset, 2010). Thus, Oliveira, Rozenfeld, Phaal, & Probert (2011) describe, the front-end of innovation as,

> "a decision making process in which agreement is reached on the product positioning, primary product features and performance, required technologies and resources, and alignment to product portfolio, among other things" (p.311).

The decision making at the front-end is important to eliminate guesswork, avoid expensive and ineffective solutions and maximize profitability (Almendra & Christiaans,2009; Hyppänen,2013; Samset & Christensen, 2015; Szutowski, 2019). The decision making at the front-end is vital to minimize the product development cycle time, and ultimately enhance the performance of the entire innovation process (Almendra & Christiaans, 2009; Herrmann, Tomczak, & Befurt, 2006; Hyppänen, 2013; Paananen, 2010; Regan, Kincade, & Sheldon,1998; Samset & Christensen, 2015; Szutowski,2019). Nevertheless, assessing one or more of the feasible innovation opportunities, and product concepts, predicting environmental implications, figuring out investment and resource allocations, and making definite decisions at the front-end is a very difficult and challenging task for product manufacturers (Albar, 2013; Jacobs, 2015; Szutowski,2019). This is mainly due to two reasons.

i. The limited access to accurate information is a major cause of uncertainty within the front-end decision making process (Schröder & Jetter, 2003).
ii. Decision to spend and use capital without a promise of return is the other risk faced at the front-end decision making process (Williams & Samset, 2010).

This may lead to highly individualistic front-end decision making approaches based primarily on personal opinions and experience (Albar, 2013; Reid & Brentani, 2004; Szutowski,2019). For avoiding the inherent drawbacks of the front-end, and for exercising some control over the decision making process, a structured decision making approach is beneficial (Cooper, 1994; Khurana & Rosenthal, 1998; Szutowski, 2019).

1.1.5 Importance of co-creating value in the Business to Business (B2B) context in the front-end of apparel product innovation

In present business models, the customer's role has shifted from passive to active and the traditional concept of the 'value created by the firm' (value creation) has shifted to the 'value created with the customer' (co-creating value) (Galvagno & Dalli,2014; Grönroos, 2008; Pathak, et al.,2022). Value co-creation is a joint and collaborative process between the customer and the company (Galvagno & Dalli,2014; Grönroos, 2008; Pathak, et al.,2022) where the expected co-creators of value are 'Business to Customer (B2C), Customer to Business (C2B), Business to Business (B2B), and Customer to Customer (C2C)' (Barrutia et al., 2019; Gummesson & Polese,2009; Saarijarvi, Kannan, & Kuusela, 2013). In a B2C context, the customers are the end consumers who consume the products, whereas in a B2B context, the business customers, buyers, or product brands, who provide insights into market trends and communicate the needs of their own end consumers (Barrutia et al., 2019; Gummesson & Polese, 2009; Pathak, et al.,2022). Co-ideation, co-evaluation, co-designing, and co-developing are examples of currently prevailing business relationship mechanisms for co-creating value in the front-end of the innovation process (Barrutia et al., 2019; Pathak, et al.,2022; Prahalad & Ramaswamy, 2004; Russo-Spena &Mele, 2012).

In the apparel business context, the B2B customers are the buyers or apparel brands who own retail outlets or fashion houses. The apparel brands are the decision makers regarding the specification of fabric, colours, and style details of the final products, and deal with the preferences and needs of their own end consumers (Ariyatum & Holland, 2005; Ban, 2020; Lou,2020; May-Plumlee & Little, 1998). Therefore, active

involvement of the apparel brands (B2B customers) in the front-end of apparel product innovation is valuable to

- absorb knowledge and gain insight about the needs of the customer,
- to determine market potentials,
- minimize market failures,
- reduce uncertainties,
- optimize the product, and
- ultimately improve a company's innovation success rate (Barrutia et al., 2019; Smith 2022).

1.2 Research gaps in academia and industry

In the light of the above reasoning in sections 1.1.4 and 1.1.5, decision making in the front-end incorporating co-creation of value in the B2B context is considered vital. That is due to the fact that this is deemed to be the best way to ensure customer satisfaction, profitability of the manufacturer and apparel brand as well as to put the apparel company in a strong position in the market with respect to competitiveness and for survival.

As per the reports of the Joint Apparel Association (JAAF) of Sri Lanka, the current strategy of the Sri Lankan apparel industry is to offer more value addition through innovation (JAAF,2021). At present, the leading apparel manufacturers in Sri Lanka are heavily involved and invest in innovation. Considering, especially the large investments and risks in innovation, strategies to evaluate the decisions taken at the front-end of innovation are indispensable. Preliminary interviews with the decision makers of the apparel innovation companies in Sri Lanka revealed that no such structured approaches are practiced in making decisions on innovation. The review of literature too revealed the absence of relevant models specifically on apparel product innovation.

An overview of the literature in sections 2.2.2, 2.5.1,and 2.5.2, highlights two research gaps in academia in the area of decision making at the front-end of innovation.

i. Absence of research in general at the front-end of innovation
ii. Absence of research in the apparel context at the front end of innovation

The identified research gaps in industry and academia are explained in sections 1.2.1, 1.2.2 and 1.2.3.

1.2.1 Research gap 1- Absence of research in general

Studies on front-end decision making models are lacking. However, some front-end models evident in the literature, which consist of a number of process activities, depict the decision points in the front-end (Brandtner,2017; Cooper, 1994; Cooper & Sommer,2018; Hüsig et al., 2005; Khurana & Rosenthal, 1998; Orawski, Krollmann, Mörtl, & Lindemann, 2011; Preez, Louw, & Essmann, 2009). Decision gates represent decision points between the process activities where the latest information is assessed, and decisions are taken to move forward to the next activity of the process (Cooper et al., 2002; Cooper & Sommer,2018). Decision gates are essential at each and every process activity to identify the best market opportunities, innovation ideas, and approaches for the success of the front-end process (Szutowski, 2019).

In some front-end models, decision gates between front-end process activities have been introduced (Cooper,1994; Cooper & Sommer,2018; Husig et al., 2005; Orawski et al.,2011; Preez et al.,2009) whereas in some other models, decision gates are found at the end of the front-end (Khurana & Rosenthal, 1998). These models bring limited clarity on how the decisions should be handled, what decisions have to be taken at different stages, and the order of taking decisions in order to achieve success in innovation. A thorough discussion of decision making from a procedural point of view in the front-end of product innovation seems to have gained little attention from academia, and research in this area is still emerging. A detailed view on decision making in the front-end is presented in sections 2.5.2.

The integration of internal as well as external stakeholders is emphasized in some front-end models (Sandmeier, Jamali & Kobe, 2004). The exact roles and responsibilities of the stakeholders are discussed only in a very limited number of studies. Some front-end models considered customer integration (Alas,2011; Cooper & Sommer,2018; Khurana & Rosenthal, 1998; Sandmeier et al.,2004). These models do not specify whether they take into account business to business (B2B) or business to customer (B2C) contexts. Studies on co-creation of value in the B2B context in the

front-end innovation process are lacking, and no clear evidence of studies or models developed on decision making in the front-end incorporating co-creating value in the B2B context in general. The literature on the integration of B2B customers is discussed in section 2.5.3.

1.2.2 Research gap 2 - Absence of research in the apparel context

A number of studies have developed models for apparel product development (Ban, 2020; Gam, Cao, Farr, & Heine,2009; Gaskill, 1992; Han,2012; Lou,2020; May-Plumlee & Little,1998; Moretti & Braghini,2017; Morris, 2011; Parker-Strak et al., 2020 ; Pitimaneeyakul, LaBat, & Delong, 2004; Sinha,2001; Wickett, Gasskill, & Damhorst, 1999). Front-end innovation is the starting point and forms the foundation for future product development activities. However, research of decision making in the front-end of apparel innovation is not evident and there is no clear evidence of models developed on decision making in the front-end of apparel innovation. Few scholars have identified the significance of decision making and have addressed it in the 'apparel product development process' (Lou, 2020; May-Plumlee & Little, 1998; Moretti & Braghini,2017; Pitimaneeyakul et al.,2004; Wickett et al.,1999; Wu & Wu,2011). These models do not sufficiently describe how decisions should be handled, what decisions should be made at different stages and the order in which decisions should be made. Apparel product development by collaborating with customers is suggested in two models (May-Plumlee & Little, 2005; Morris, 2011). However, co-creating value in the B2B context in the front-end apparel innovation is not clearly evident in any of the existing models. The existing models for apparel product development are discussed in section 2.2.2.

1.2.3 Research gap 3 - Industrial practice in the apparel context

The apparel industry in Sri Lanka produces a variety of product categories and reaches the end consumers primarily via high-end international apparel brands (B2B customers). Therefore, currently, the Sri Lankan apparel industry is closely engaged with many world-class international apparel brands, including Nike, Tommy Hilfiger, Intimissimi, Lululemon, Victoria's Secret, GAP, Liz Claiborne, Next, Jones New York, Pink, Triumph, Ann Taylor, Speedo, Abercrombie & Fitch, Land's End, Marks

& Spencer, Boss, Diesel, Calvin Klein, Colombia, Decathlon, H&M, Ralph Lauren, and Sanmar (BOI, 2022; EDB, 2021). Though the Sri Lankan apparel industry was a contract manufacturer a few decades ago, it has since upgraded its operations to become a total solution provider in order to withstand changes in the global apparel industry in terms of consumer demands and new technologies across various applications (BOI, 2022; EDB, 2021; JAAF,2021). In addition, changes in the global apparel industry, particularly technology-driven near-shoring and re-shoring supply chains, have an impact on the Sri Lankan apparel manufacturing sector (De Silva, et al., 2021; Perera,2020; Wijewardhana et al.,2021). Some Sri Lankan manufacturers have already set up their operations in the West (closer to apparel brands). However, prioritizing investment in innovation and skills, as well as improving the efficiency of business processes through automated techniques, have been recognized as essential to withstand the changing technological landscape and to remain competitive (De Silva, et al.,2021; Perera,2020). The Sri Lankan apparel industry is now gradually shifting toward implementing fourth industrial revolution concepts such as 'smarter supply chains,' 'smarter production', and 'smarter products' (Wijewardhana et al.,2021).

In the research interviews with the senior managers in the apparel product development and innovation of Sri Lankan apparel manufacturing companies (Appendix 1-Initial discussions), the importance of competitiveness was highlighted. These senior decision makers have recognized the need to effectively adopt the best practices in the global business environment to offer better value for customers and to successfully survive in the market. These apparel manufacturers have set up a clear strategic vision and growth targets. They have taken up the following initiatives to promote innovation.

- Promote open innovation to encourage all stakeholders, such as companies, customers, suppliers, universities, and ventures, and to flexibly make crossover efforts to create added value
- Invest in research & development
- Recruit educated and experienced personal for innovation team and product development

- Provide training to improve skills, knowledge, and technology know how
- Spend money for the acquisition of machinery, equipment, and technology

In addition, they have devised strategies for cost reduction by minimizing wastage with the aim of enhancing business performance. They currently follow a structured step by step process for their apparel innovation program.

However, the industry relies heavily on past experience in reaching a decision in the front-end phase of innovation. Documentation on the front-end decisions is lacking too, especially on the following important aspects:

- Does not record justifications for the decisions, and the reasoning lying in the background of those decisions.
- No records on dropout innovation opportunities, concepts, or the reasons for dropouts.

Some manufacturers collect information from end consumers, and also work closely with apparel brands (B2B customers) to mitigate risks in their apparel industry operations. Some of the apparel producers make agreements with apparel brands, but no guidelines are available regarding the roles and responsibilities of the apparel brands within the front-end.

Though some innovation opportunities, and concepts are not selected due to their incompatibility with some selected brands (B2B customers), they may be compatible with other brands. Therefore, dropout innovation opportunities, and concepts can be considered further if the company has records of the exact reasons for dropouts.

Decision making in a business environment to innovate with customers requires clearly identified roles and responsibilities of each of the stakeholders, and accurate past performance and information about the customers who involved in the apparel innovation effort. Lack of such information and a structured approach in decision making may lead to irrecoverable damages, causing large financial losses. The model in this research was developed after evaluating the industry requirements and the gaps in the existing models for front-end decision making. The new model will help to improve the quality of the design solutions, avoid ineffective solutions, create the best value for customers, and meet the needs of demanding customers.

The above discussed research gaps in sections 1.2.1, 1.2.2 and 1.2.3 are illustrated in Figure 1.3. Three rectangles indicate the three research gaps and three rectangles in dashed lines provides the details of the research gaps.

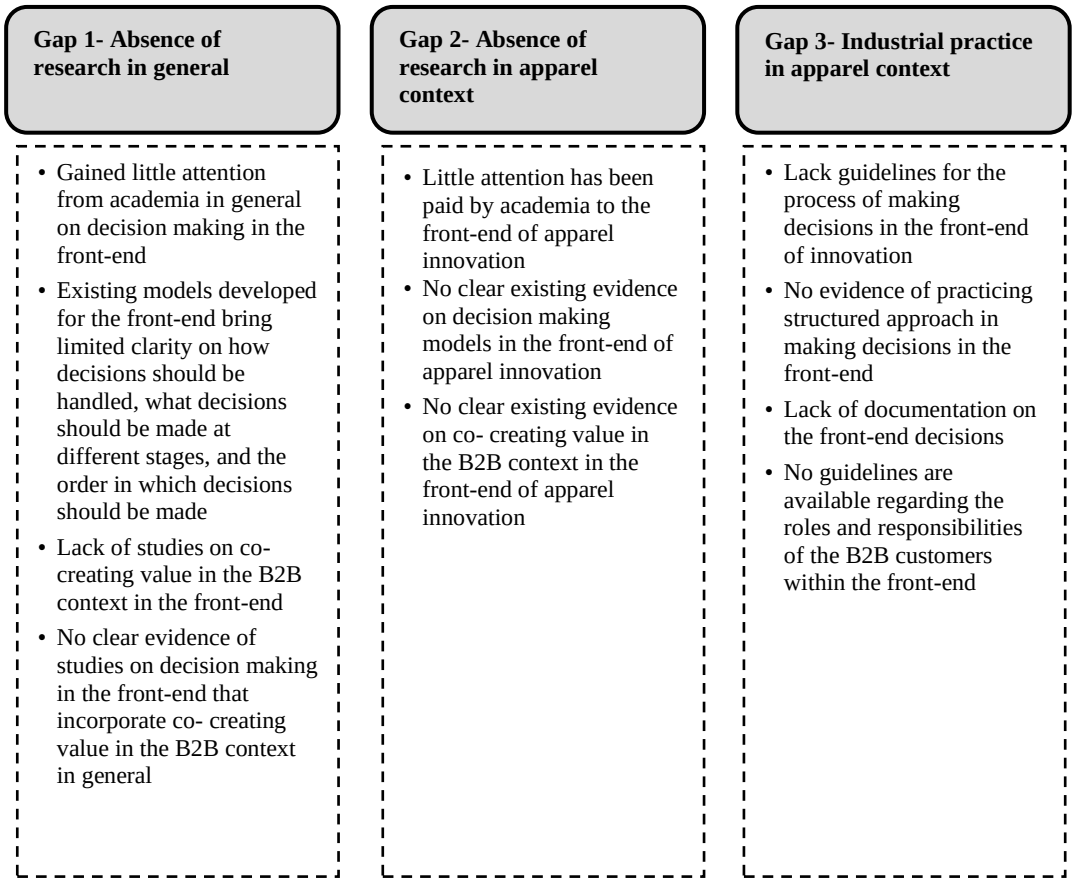


Figure 1.3:Research gaps - Academia and industry

1.3 Aim and objectives of the study

The research gap identified inspires to develop a model for the decision making process. Thus, the aim of the research is to develop a model for the decision making process incorporating 'co-creation of value in the B2B context' in the front-end to provide a useful base in the apparel product innovation process. The model would provide valuable strategic guidance to form a strong foundation for structuring the front-end, and to ensure the effective and smooth running of the front-end, and ultimately lead to an improvement in the success rate of innovation. Thus, this study

will make a significant contribution by filling the gaps identified in the existing literature, and in apparel industry practices.

To achieve the aim of the research, the following objectives are employed.

a. To explore the decision making process within the front-end of apparel product innovation in the current apparel industry setting.
b. To develop a model for the decision making process incorporating 'co-creation of value in the B2B context' in the front-end of apparel product innovation.
c. To verify the proposed model for decision making in the front-end of apparel product innovation

The overarching question can be given as:

How are the decisions made at the front-end of the apparel product innovation process incorporating 'co-creation of value in the B2B context'?

1.4 Structure of the Thesis

This thesis is made up of ten chapters.

Chapter 1 - This chapter discusses the background motivation of the research and highlights the existing research gaps and the main focus of the thesis.

Chapter 2 - The background knowledge necessary to contextualize this research is explored and presented in this chapter. With respect to innovation, decision making, co-creation of value, and front-end processes are reviewed. The existing literature is discussed, and the gaps are highlighted.

Chapter 3 - This chapter explains the logical plan and key elements for making the methodological choices to achieve the main aim and objectives of this study. The research design process follows two phases: developing a decision model and validation of the model.

Chapter 4 - Research questions and the conceptual framework are discussed in this chapter. The conceptual framework is to indicate the causal link between the innovation typologies, the decision process, and the actors within the front-end of the innovation process.

Chapter 5 - The results of the exploratory case studies which constitute the first phase of the model development study are presented. Discussion includes the apparel product innovation typologies, the decision making process, factors that influence the front-end decisions, and actors involved in each innovation typology in the front-end phase of innovation.

Chapter 6 – The results obtained in case studies on the decision making process steps, as well as the interactive roles of suppliers, apparel producers, and B2B customers are discussed for incremental innovation of the two selected scenarios: innovation 'initiated by company' and innovation 'initiated by B2B customer'. The chapter also presents the suggestions made by the senior managers involved in the refinement interviews to further refine the front-end decision making process steps, and the roles of the apparel brands (B2B customers) and suppliers.

Chapter 7 - The results obtained in case studies on the internal and external factors that exert influence on front-end decisions in incremental innovation are re-examined and verified in this chapter. Hypotheses (H_{1a} -H_{4b}) are derived to verify the extent of the influence of external and internal factors on front-end decisions in incremental apparel innovation. The chapter presents the results of the questionnaire survey and the factors that influence decision making are further refined.

Chapter 8 - This chapter presents the Meta decision making model for front-end incremental apparel innovation. The proposed Meta decision making model encompasses three individual components that are interconnected to each other (i. the decision-making process steps, ii. the interactive roles of suppliers, apparel producers, and B2B customers, and iii. the influential factors).

Chapter 9 - This chapter presents the results of the modified Delphi study that was conducted to test the robustness of the Meta decision making model. It investigates experts' agreements and disagreements with the model and identifies the reasons for any non-agreement.

Chapter 10 - Revisiting the existing literature on front-end of innovation, this chapter discusses the findings of the research and proposes guidelines for implementing the

model. The chapter concludes with the contribution of this research study to existing knowledge and practices, and the opportunities for future research.

1.5 Summary of the chapter 1

The introductory chapter discussed the research background for this research. A brief introduction was provided on the challenges of the apparel industry at present due to the changing customer needs, environmental turbulence, intensified competition, and technology breakthroughs. The prominence that must be given to innovation is strongly emphasized as it is a mandatory requirement and an essential strategy to secure competitive power. The importance of 'decision making', and 'co-creating value in the B2B context' in the front-end of innovation was also stressed because the front-end is the most critical stage that will determine the success of the innovation process. The discussion ended by addressing the research gaps that exist in current industrial practices and academia and thereby helping to justify the importance of this research. This was followed by focusing on the main aim of this research study and its sub objectives. The chapter concluded by outlining the structure of the thesis.

CHAPTER 2

LITERATURE REVIEW

This chapter provides an overview of the literature relevant to the study. The chapter discusses the features of innovation at the beginning, and the discussion moves on to characteristics of existing product innovation models in general and in the context of apparel in particular. Discrepancies and limitations of the existing product innovation models, and innovation models for apparel in terms of process stages (activities, and decisions) and the involvement of actors (customers, internal members of producers, and suppliers) are discussed. Next, decision making, and the concomitant creation of value in innovation are reviewed, and the drawbacks of the existing studies are highlighted. A discussion of the characteristics typical to the front - end of innovation, front-end models, front-end decision making, and co-creation of value at the front-end of the B2B context, as well as limitations of the existing studies are included.

2.1 Definition of innovation

Past studies outlining the state of the art have promoted different definitions and concepts of the term 'innovation', which originates from the Latin word 'innovare' (Bessant,2009; Luukkonen,2010).

Buijs (2012) identified provocative pairs of words to describe the differences between normal work (tradition), and innovative work (innovation) as shown in Table 2.1. Žižlavský (2014) describes innovation as,

> "A human-proposed, targeted change relating to products (putting new or significantly improved products into production and placing them on the market), production methods (processes), the organization of work and production that incorporate new organizational solutions of structural importance, and management methods used for the first time at least, as a minimum, by the firm" (Žižlavský, 2014, p. 1287).

Bessant (2009, p.7) supports this by conceptualizing a working definition: 'Innovation = ideas + implementation'. Several definitions have been formulated by different

researchers to describe how they define the term ‘innovation’ as indicated in Table 2.2.

Table 2.1:A few pairs of words to describe innovation

Tradition	Innovation
Exploitation	Exploration
Past & present	Future & more
Routine	New
Incremental	Radical
Obey rules	Change rules
Certainty	Risk
Closed	Open
Dull	Exciting
Straightforward	Schizophrenic
Inside the paradigm	Breaking the paradigm

Source:(Buijs, 2012)

Table 2.2:Definitions or concepts of innovation

Source	Definition or concept
Afuah (2003)	“Use of new knowledge to offer a new product or service that customers want”.
Hislop (2005)	“The deliberate modification or transformation of an organization, or of an organization’s products, services, processes or structures”.
Buijs (2012)	“About coming up with something new, implementing it and successfully introducing it to the marketplace”.
Flint et al. (2005)	“Does not need to be new to the world; if it is merely new in the eyes of the beholder that would suffice”.
Trott (2008)	“Can be said to occur through the interaction of science and technology base (dominated by universities and industry), technological development (dominated by industry), and the needs of the market”.
Hult et al. (2004)	“A way to change the organization in response to external or internal demands or as a proactive attempt to change this environment”.
Katz (2007)	“The successful generation, development and implementation of new and novel ideas, and introduction of new products, processes and/or strategies by a company to enhance current products, processes and/or strategies that would lead to commercial success and possible market leadership by creating value for stakeholders, thus driving economic growth and improving standards of living”.
Bessant (2009)	“Innovation is about human creativity, organized and applied across the organization”.
Perry & Uys (2010)	“A creative activity related to some product development or manufacturing process, or possibly to capital and market creation that is intended to define a path to a common goal”.

Summing up the definitions and concepts of innovation, the most significant terms to denote 'innovation' are 'new or novel', 'significantly improved', 'modifications', 'proactive attempt', and 'creative activity' (Afuah, 2003; Buijs, 2012; Flint et al., 2005; Hislop, 2005; Hult et al., 2004; Katz, 2007; OECD, 2005; Žižlavský, 2014). However, choosing and promoting an appropriate definition of innovation depends on the perspective adopted.

2.1.1 Types of innovation

Innovation can be categorized based on the idea of application, and the fields in which it occurs (Bessant, 2009; Luukkonen, 2010). Trott (2008) promoted seven types of innovation (Table 2.3): product, process, production, organizational, management, commercial or marketing, and service.

Product, process, position, and paradigm (4p's) are the four innovation groups identified by Tidd et al. (2005). On top of these, the literature highlights four main product innovation types that are frequently discussed, and referred to in academia; product, process, marketing, and organization based on the changes associated with the field and direction of the innovation (Baregheh et al., 2009; OECD, 2005).

Table 2.3:Types of innovation

Type of innovation	Example
Product innovation	Develop a new or improved product
Process innovation	Develop a new manufacturing process
Organizational innovation	A new venture division: a new internal communication system
Management innovation	Total Quality Management system (TQM)
Production innovation	New manufacturing systems, Just in time (JIT), quality circles, and new production planning software
Commercial or marketing innovation	New sales approach, and new financial approaches
Service innovation	Innovation within services

Source: (Trott, 2008, p.16)

Product, process, marketing, and organization innovation are briefly discussed below.

2.1.1.1 Product innovation

The product is a complicated blend designed to meet customer needs by utilizing the technological competence of a firm (Danneels, 2002; Sjöberg & Wallgren, 2013). Definitions of product innovations based on different standpoints are presented in Table 2.4.

Table 2.4:Definitions of product innovation

Source	Definition
Herrmann et al. (2006)	"A novel product is clearly different from the previous one".
Garcia & Calantone (2002)	"Product or service that is new or significantly improved."
Wang & Ahmed (2004)	"The novelty and meaningfulness of new products introduced to the market in a timely fashion".
Liao et al. (2007)	"Product innovation refers to the development and introduction of a new product to the market or the modification of an existing product in terms of function, quality, or appearance."
Un et al. (2010)	"Product innovation can refer to the frequent introduction of new and valuable products or significantly modified existing products".
Little (2004)	"Products and services that are meaningfully different from those offered by competitors, through the application of unique knowledge, skills and other tangible resources".

Some of the examples of product innovation are increased digital camera resolution of the i-phone 7, power windows for a car and Global positioning systems (GPS) in transport equipment, a stripped-down Google Glass for a motorcyclist's helmet, smart wireless earbuds, and wireless charging unit serving as a normal light (Baer, 2017; Blewitt, 2018). However, these innovations become 'satisfiers' with time as proposed in the Kano's model (Kano et at., 1984 as cited in Cardona, 2010).

2.1.1.2 Process innovation

The introduction of new production methods, techniques, procedures, and technology to improve the production process is referred to as process innovation (Marais, 2010; Wang & Ahmed, 2004). Process innovation is defined as,

- "New elements introduced into an organization's production or service operations, such as input materials, task specifications, work and

information flow mechanisms, and equipment used to produce a product or render a service with the aim of achieving lower costs and/or higher product quality" (Reichstein & Salter, 2006, p.2).

- "Process innovation is the implementation of substantially new, significantly improved, or more efficient methods of producing, manufacturing, and distributing the organization's market offerings" (Cascio, 2011, p.9).
- "Managing the process of production or distribution methods which are new, improved or developed" (Utkun & Atilgan, 2010)

One of the most prominent examples of process innovation is Henry Ford's invention of the first moving assembly line in the world (Baer, 2017). Installing automation equipment, introducing laser cutting tools, and building mobile sales dashboards are a few examples of process innovation in manufacturing industries (Baer, 2017).

2.1.1.3 Marketing innovation

Marketing innovation is the ability to present a product or service to customers in a very different way (Utkun & Atilgan, 2010). Marketing innovation is defined as,

> "The process of seeking and implementing new and substantially better methods of increasing the value that a customer and an organization derive from current or potential market offers, through customer perceptions or actual experiences that have been triggered by marketing activities" (Cascio, 2011, p.18).

New designs of bottles for body lotion, and first-time use of product placement in movies or television programs are examples of marketing innovation (Baer, 2017).

2.1.1.4 Organizational innovation

Organizational innovation is a combination of process, product, and marketing innovation (Cascio, 2011). It is defined as, "Implementation of a new organizational method in business practices, workplace organization, or external relations" (OECD, 2005 p.46). The main characteristics of organizational innovation are (Utkun & Atilgan, 2010):

- changes in the structure of an organization in a significant way
- application of advanced management and organizational techniques
- application of new or highly modified techniques

2.2 Innovation process

Innovation process is defined as,

> "The way the organization manages the development of inventions into commercial products, services, or processes. The process usually comprises of a set of phases, stages, gates, and rules, defining the order in which the activities are conducted" (Paananen, 2010, p.14).

Basically, three major phases can be identified in the innovation process as illustrated in Figure 2.1; front-end, new product development (NPD), and commercialization (implementation or market launch) (Koen et al., 2001; Poskela, 2009; Zhang, 2014).

Figure 2.1:Phases of the process of innovation

Source : (Koen et al., 2001 ; Poskela, 2009 ; Zhang, 2014)

The front-end of the innovation process starts with activities related to problem identification and requirement analysis, followed by idea generation, evaluation and selection, and project or business planning. The first phase of the innovation process ends with the initial concepts to proceed and develop further (Deppe et al., 2002; de Sousa Mendes & de Toledo, 2011; Koen et al., 2001; Poskela, 2009; Verworn et al., 2006; Williams & Samset, 2010; Zhang, 2014). Developing the selected new product concepts into final products is the key goal of the second phase of the innovation process, which involves product development and manufacturing related activities

(Koen et al., 2001; Poskela, 2009; Verworn et al., 2006; Zhang, 2014). The final phase: commercialization involves bringing the new innovation to the market (Koen et al., 2001; Poskela,2009; Verworn et al., 2006; Zhang, 2014).

The theoretical innovation process models, which represent the structured process (phases, stages, and activities), have been introduced by several researchers for establishing and managing innovation effectively (Koen et al., 2001; Preez et al., 2009; Poskela, 2009; Rothwell, 1994; Zhang, 2014). Theoretical innovation process models have evolved over time from simple linear 'first generation' to more complex 'seventh generation' models as presented in Table 2.5 (Preez et al., 2009).

Table 2.5:Evolution of innovation process models

Generation	Model	Characteristics
1st– 1930's	Technology push	Linear sequential process. Emphasises the importance of R&D and science
2nd-1960's	Market pull	Linear sequential process. Emphasises the importance of marketing, as the market is the source of new ideas for R&D
3rd -1970's	Combined/ Coupling model	Recognizes the interaction between different elements and feedback loops between them. The emphasis is on integrating R&D and marketing
4th -1980's	Interactive model	Combinations of push and pull models. Emphasises on external linkages and integration within the firm
5th-1990's	Network model	Emphasises the importance of knowledge accumulation, external linkages, systems integration, and widespread networking
6th-2000's	Open Innovation	In order to advance the development of new technologies, internal and external ideas as well as internal and external paths to the market are combined
7th– Current	Extended innovation network	Combination of network models and open innovation

Source: (Preez et al., 2009)

The first generation model, known as 'technology push', is a linear process model with sequential positioning of phases from primary research to final sale (Preez et al., 2009; Rothwell, 1994). The first step of the process starts with the identification of evolving trends in technology and science. More focus is given on research & development (R & D) activities, and less attention is paid to the marketplace. With increasing competition, the customer needs were considered in the innovation process. This led

to start the process with the formation of the market, and its needs and the second generation ‘market pull’ linear innovation process model evolved. The third generation process model originated with the combination of the above two models; technology push, and market pull, which contain feedback loops. This ‘coupling model’ is also a linear model that emphasizes functional (R & D, and marketing) interaction. Key individuals of the third generation models are the moving force behind this process model.

Considering the innovation process as consisting of several parallel activities conducted by different functional teams, the fourth generation model was conceived. Horizontal as well as vertical collaboration is emphasized in this model, which is known as the ‘interactive parallel process’ model. The fourth model originated to speed up the innovation process by improving the functional integration. The fifth generation ‘network model’ mainly considered the influence of the external environment, and the network of external and internal actors. It emphasizes knowledge build-up through external linkages, and systems integration through the use of information systems.

Working on the above idea, to speed up the process and to make customized offerings, the sixth generation ‘open innovation’ model was developed. Throughout the whole innovation process, internal as well as external collaboration are emphasized. The sixth generation model encourages the early participation of key stakeholders, including suppliers, and customers. The currently practicing innovation model, the seventh generation model is based on a realistic life cycle process, which integrates various best practice activities and concepts, primarily the concept of open innovation, and network perspectives. However, with the fourth industrial revolution (Industry 4.0 or smart industry), a multitude of technologies will be integrated with the innovation process to come up with commercially viable solutions with which the manufacturing industries will be closely bound up in the future (Moester, 2017; Wijewardhana et al., 2021).

2.2.1 Innovation models

Aligned with the gradual evolution of the innovation process discussed under 2.2 above, a diverse range of innovation, and new product development (NPD) models are found in the literature. The two terms 'product innovation' and 'NPD' are interchangeably used, and consequently 'NPD' is replaced with 'innovation' in literature (Cooper, 2005).

The majority of product innovation or NPD models have been developed by paying attention to procedural perspectives, which represent the main flow of information (stages, actvities, and decisions). However, there are discrepancies even within the process stages, activities, and decision points of the innovation process.

Considering the innovation process as sequential and iterative, the existing models divide the product innovation process into a few stages (Cooper, 1994, 2008, 2014; Cooper & Sommer,2018; Hart & Baker, 1994; Kline & Rosenberg, 1986; Louw et al., 2018; Preez et al., 2009; Szutowski, 2019). The product innovation models generally comprise of five stages (Kline & Rosenberg, 1986). Models with six process stages (Cooper,1994, 2008, 2014; Cooper & Sommer,2018), seven process stages (Louw et al., 2018; Preez et al., 2009; Szutowski, 2019) and eight process stages (Awa, 2010) too have been developed. A recently developed 'customer dominated innovation process model' includes ten activities (Liu, et al., 2019). With the intention of expediting the time to market, concurrent overlapping stages, and activities have been introduced to some innovation models (Büyüközkan & Arsenyan, 2012; Hart & Baker, 1994; Louw et al., 2018; Preez et al., 2009; Szutowski, 2019). Focusing more on responding quickly to changes demanded by the customer, multiple iteration stages, and activities are proposed in product innovation models (Cooper, 2014).

Activities followed by 'go or no go' decision points with feedback loops are included in some NPD models (Cooper, 1994, 2008, 2014; Cooper & Sommer, 2018; Hart & Baker, 1994; Louw et al., 2018; Liu et al., 2019; Preez et al., 2009; Szutowski, 2019). The decision points are not clearly indicated, though the backward (feedback) and forward movements of the process activities are discussed in some other models (Kline & Rosenberg, 1986).

The members of the internal departments who are essential to conduct activities and make decisions is considered in some models (Awa, 2010; Cooper, 1994, 2008, & 2014; Cooper & Sommer,2018; Hart & Baker, 1994; Louw et al., 2018; Preez et al., 2009). The 'multiple spiral model' (Cooper, 2014) and the 'agile stage gate hybrid model' (Cooper & Sommer,2018) considered continuous consumer feedback at each stage of the process to effectively respond to consumer demand. The idea of active involvement of customers is promoted in the theoretical 'customer collaborative product development model' (Awa,2010), the 'enhanced FuGle® innovation process model' (Louw et al., 2018), and the 'customer dominated innovation process model' (Liu et al., 2019). However, the existing innovation models have not discussed how B2B customers and suppliers are involved in each activity and decision of the process.

The existing innovation processes were recapitulated to demonstrate to what extent these models have considered the process stages (activities, and decisions) and the involvement of actors (customers, internal departments of producers, and suppliers) in the innovation process. The findings are summarized as shown in Table 2.6.

Table 2.6:Recapitulating existing product innovation and NPD models

Author/s	Product innovation and NPD model or framework		Process		Involvement of actors		
	Model	Characteristics	Stages/ activitie	Decision points	Internal dept.	Custome	Supplier
Kline & Rosenberg (1986)	Chain-link model	Model considers the interaction of scientific knowledge and new scientific research and identifies five paths of innovation process.	√	X	X	X	X
Cooper (1994)	3rd generation stage gate model	Model consists of six stages. Decision gates are included between the stages.	√	√	Θ	X	X
Hart & Baker (1994)	Multiple convergent PD	Model includes concurrent/ parallel activities, with convergent decision points after completion of the activities. These convergent points are likely to occur several times. Emphasises team working	√	√	√	Θ	X
Cooper (2008)	Next generation stage gate	Model is based on the risks involved in the process. The model consists of five stages. Decision gates are included between the stages. Flexible application of the model is proposed.	√	√	Θ	X	X
Preez et al. (2009)	Fugal innovation process model	Model consists mainly of two phases: front-end and development of seven stages. Gates and filters are in between certain stages. It is driven at the top by the company's strategies, its people and culture, organizational structure, and processes, information, and knowledge.	√	√	√	X	X
Awa (2010)	Theoretical customer collaborative PD	Model consists of four phases and nine process stages. Model considers involvement of designers and users in radical and incremental innovations, irrespective of the industry and other environmental variables.	√	X	√	√	X
Cooper (2014)	Spiral development cycle	Model includes built-in multiple iterations of development that permit experimentation with users. Each spiral consists of four activities. The number of required spirals depends on the type of product to be developed.	√	√	Θ	√	X
Louw et al. (2018)	Enhanced FuGle® innovation process model	Model consists of seven process stages and six quality gates. The components of the model are divided into five areas. The model considers the customer integration, and the flexible application.	√	√	√	√	X
Cooper & Sommer (2018)	Agile stage gate hybrid model	Model integrates elements of both agile and stage gate. Six stages and the post-launch stage. Each stage composed of a series of time-boxed sprints, each lasting about two to four weeks. Gates in between each stage provide vital go/kill decision points.	√	√	Θ	√	X

√ - discussed or considered Θ- discussed or considered to some extent

X - not discussed or considered at all

2.2.2 Innovation models for apparel

Past studies suggest the use of various frameworks and models for apparel product development. These models are briefly discussed below.

Lamb and Kallal (1992) proposed a conceptual framework emphasizing the fulfilling of a variety of customer needs. This framework recommends using varied apparel designs such as ready-to-wear garments, protective apparel, and costume design products. It comprises of six sequential stages that include problem identification as the first stage, followed by preliminary ideas, design refinement, prototype development, evaluation, and implementation as the rest of the stages.

LaBat and Sokolowski, (1999) developed a three-stage design process model for apparel design. This includes three common stages (problem definition & research, creative exploration, and implementation), and ten activities within each stage. This model was promoted as a way of communicating working methods to personnel in the apparel industry, and to university design students.

Regan et al. (1998) introduced a similar model with three stages, and activities by comparing the textile and apparel product development processes with generic product development processes that can be used for any apparel product development. Problem recognition, problem definition, and exploration of problems are the three main process stages of the model.

Based on the activities of two retail stores, Gaskill (1992) introduced a retail product development model focusing on the specialty apparel retailers who carry 100% private label merchandise. The model emphasizes producing market oriented apparel products. The model demonstrates the progression of events in the retail product development process, which comprises three stages: research, line conceptualization, and line visualization, with internal and external variables impacting the process.

Extending the Gaskill's (1992) model, Wickett et al. (1999) proposed an extended retail product development model with a post-adaptation stage. The model paid attention to apparel product feasibility.

Sinha (2001) presented a model named 'the generic fashion design process model' which is a rich model of information on apparel development process and teams. This

model introduced five stages that included research & analysis as the first stage, followed by synthesis, selection, manufacture, and distribution. The key factors of each stage are indicated in this model.

Focusing on the role of aesthetic, social, and historical influences on fashion designers in the apparel industry based in Hong Kong, Han (2012) developed a conceptual fashion design process model having four main stages: investigation, interaction, development, and evaluation.

Chan (2002) presented a conceptual model for intimate apparel design with a clear rationalization of all the bra design aspects, which focuses on providing guidelines for bra designers. This model comprises seven stages. The seven stages are: design goal, orientation, concept development, criteria estimation, design specification, prototyping, and design evaluation.

Pitimaneeyakul et al. (2004) developed a model for knitwear product development by examining the processes used by US sweater firms. The model comprises five stages. Market research, design with cost estimation, presenting computer aided designs (CAD) to customers, sample making, and production line are the five stages of this model. This model paid attention to the interactions of different departments in the work, development activities, and time frames.

Explaining the working relationships between all participants explicitly, Ariyatum and Holland (2005) proposed a conceptual model for smart clothing product development combining the ideas in new product development process and collaborative development. This model supports planning and managing the activities of the front-end of smart clothing development using computer software. The model provides a holistic view on the expected roles and responsibilities as well as the contribution of the participants of the innovation too.

May-Plumlee and Little (1998) proposed a model named 'No-interval coherently phased product development model' based on practices found in the US apparel industry. It is a non-sequential model and almost all the internal departments of a manufacturing organization are involved in the process, and their responsibilities in stages are indicated. Further, the model integrates overlapping stages, and fuzzy gates

that allow for various items within an apparel line to be selectively advanced through previous development phases.

Wu and Wu (2011) developed a model based on a study of Chinese apparel companies named 'Redesigned no-interval coherently phased product development model', extending the May-Plumlee and Little's (1998) concept. The model demonstrates the roles of different divisions and communication between them at each of the five stages.

A reference model for the development of apparel products was put forth by Moretti and Braghini (2017), focusing on apparel companies that create several clothing products for fashion seasons throughout the year. The reference model displays the macro phases (pre- development, development, and post-development) and the micro phases (collection planning, portfolio product planning, market research, concept definition, details, pre-production, product launch, and monitoring the product/ process) while outlining the activities and responsibilities of the departments. Eight decision gates were suggested to screen concepts or goods that ought to advance in the process.

Parker-Strak et al. (2020) developed a 'circular' theoretical process model that extends the concepts of Moretti and Braghini (2017) and May-Plumlee and Little (1998) for online fast fashion retailers who create 'own label' fashion clothing. The central stage of the model is the 'Research, Review, and Planning (RRP)' which impacts on product development decisions and a new stage, manufacturing & studio was introduced. However, the decisions or the decision gates were not clearly indicated and discussed in this model.

In order to manage the time involved in the apparel product development process, Lou (2020) developed a deciphered model based on five case studies, and the literature. The model consists of six different cycles, each of which represents one season of the products. Sequential, concurrent, and stage-gate approaches are used to map out detailed activities, and to suggest decision gates.

Ban (2020) re-evaluated the phases of the product development process, and embedded sustainability concepts in each phase, considering the process as a complex cycle. The core phase of the developed framework for design and development process

is the ‘inspiration and concept development.’ The other four phases are materials sourcing, 3D experiments & prototyping, production sourcing, and product development & presentation. The framework is viewed as a complex radial evolution in which all phases are interconnected, and interdependent on one another. However, the decisions or the decision gates are not clearly indicated in this model.

Summing up the findings on the existing apparel product development models, the following limitations were identified.

The more commonly identified limitations of the existing models are the contradictions within the stages of the models. Some of the existing apparel product development models have dealt in depth with the research, design, design development, and style selection stages. The 'marketing of the product line' stage is included in some other models (Gaskill, 1992; Pitimaneeyakul et al., 2004; Sinha, 2001; Wickett et al., 1999). The pre-production and sourcing stages are integrated into some models (May-Plumlee & Little, 1998; Moretti & Braghini,2017; Morris, 2011; Parker-Strak et al., 2020; Pitimaneeyakul et al.,2004; Wickett et al., 1999). However, three models have scrutinized all the process stages in detail (May-Plumlee & Little, 1998; Moretti & Braghini,2017; Wu & Wu, 2011). Based on the findings, the process stages in a few main existing new apparel product development models are summarized in Figure 2.2.

Evaluation of existing models of apparel product development further with respect to the decisions taken during the development process, revealed that only four models have considered the decision points, and the decisions taken during the development process (Lou,2020; May-Plumlee & Little, 1998; Moretti & Braghini,2017; Wu & Wu,2011). Though Gaskill (1992) and Wickett et al., (1999) discussed the forward and backward movements of decisions, the decision points are not well defined in their models.

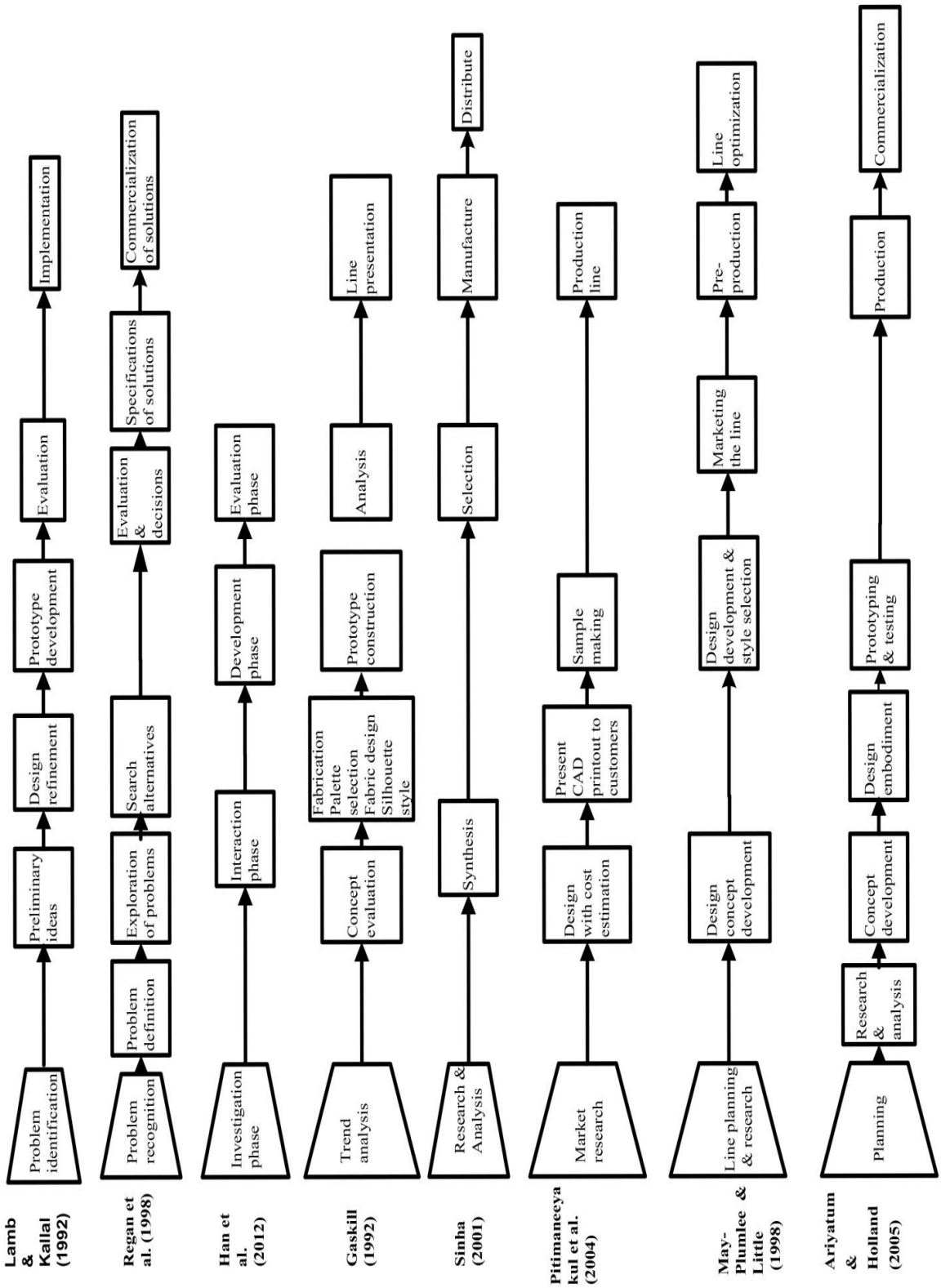


Figure 2.2:Process stages in some existing new apparel product development models

The existing apparel product development models were further reviewed to investigate whether the models have considered the involvement of internal divisions or departments. The members of the internal teams were expected to involve themselves actively in the critical and analytical decision making tasks in three models (Ariyathum et al., 2005; Moretti & Braghini, 2017; Pitimaneeyakul et al., 2004). Few other models have considered the integration of all responsible divisions including their responsibilities, and assigned activities to effectively respond to the requirements of the customer (Moretti & Braghini, 2017; Sinha, 2001; Pitimaneeyakul et al., 2004; Ariyuthum & Holland, 2003).

Evaluating the existing apparel product development models with respect to their vertical integration highlights that an approach towards co-development with fabric suppliers was discussed in the no-interval coherently phased product development model of May-Plumlee and Little (1998). Collaboration with the customer is suggested in two of the models (May-Plumlee & Little, 2006; Morris, 2011). However, these two models do not clearly specify whether they consider business to business (B2B) or business to customer (B2C) contexts. Though several positive measures have been proposed, integration of both suppliers and customers is not discussed in the above two models. However, collaborative design is becoming an emerging avenue which can provide valuable information during the apparel development process that could dramatically influence how apparel and other products are developed (May-Plumlee & Little, 2006).

The characteristics of process stages (activities, and decisions), and the involvement of actors (customers, internal departments of producers, and suppliers) discussed in this section are summarized in Table 2.7.

Table 2.7:Evaluation of the existing apparel product development models

Author/s		Models or framework for the apparel product development	Process		Involvement of actors		
			Stages/ activities	Decision points	Internal dept.	Customer	Supplier
1	Lamb & Kallal (1992)	Conceptual framework	√	X	X	X	X
2	Gaskill (1992)	Retail product development model	√	X	Θ	X	Θ
3	Bailey (1998)	Creative apparel design process model	√	X	X	X	X
4	Regan et al. (1998)	Model aligning with engineering design process theory	√	X	X	X	X
5	May-Plumlee & Little (1998)	No-interval coherently phased product development model	√	√	√	X	Θ
6	LaBat & Sokolowski (1999)	Three – stage design process	√	X	X	X	X
7	Wickett et al. (1999)	Extended (revised) retail product development	√	Θ	Θ	X	Θ
8	Sinha (2001)	Generic fashion design process model	√	X	√	X	X
9	Chan et al. (2002)	Conceptual model of intimate apparel design	√	X	Θ	X	X
10	Pitimaneeyakul et al. (2004)	Knitwear Product development	√	Θ	Θ	X	X
11	Ariyathum et al. (2005)	Smart clothing product development	√	X	√	X	Θ
12	May-Plumlee & Little (2006)	Proactive product development model	√	X	√	Θ	X
13	Gam et al. (2009)	Sustainable C2CAD	√	X	Θ	X	X
14	Wu & Wu (2011)	Redesigned no-interval coherently phased product development model	√	√	√	X	Θ
15	Morris (2011)	Collaborative apparel product development model	√	X	√	Θ	X
16	Han et al.(2012)	Conceptual fashion design process model	√	X	Θ	X	X
17	Moretti & Braghini (2017)	Reference model	√	√	√	X	X
18	Lou (2020)	Deciphered model	√	√	X	X	X

√ - discussed Θ- discussed to some extent X - not discussed at all

2.3 Decision making in innovation

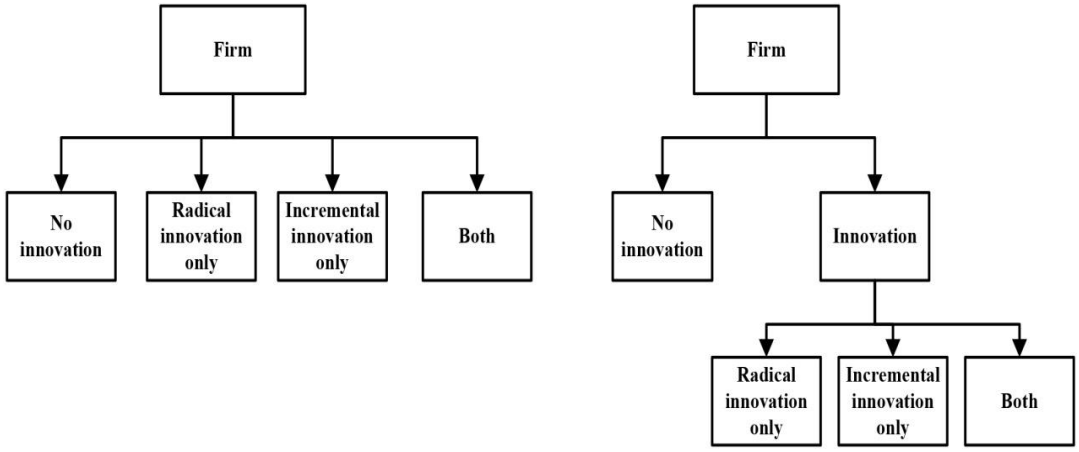
The concepts of innovation and decision making are closely connected to each other (Braga & Braga, 2013; Szutowski,2019) and the innovation process itself is considered as a collection of decisions built into the realization of successful innovation:

- "Innovation processes are seen as collections of decisions that are made in the context of a single innovation project. Those decisions determine the course, and the final success of an innovation project" (Wolbers et al., 2013, p.1).
- "Decision making is an organizational process embedded in each activity that is carried out during innovation in which a common understanding about what is to be done is achieved" (Gutiérrez, 2008, p. 50).

Innovation decisions are important strategic organizational requirements that affect the quality and performance of the new product, lead time, and ultimately the firm's performance, and success (Cooper,1994; McNally & Schmidt, 2011; Szutowski, 2019). Innovation decisions can be defined as,

> "The process through which an individual (or other decision making unit) passes from gaining initial knowledge of an innovation, to forming an attitude toward the innovation, to making a decision to adopt or reject it, to implementation of the new idea, and to confirmation of this decision" (Rogers, 2003, p.20).

Two decision making process approaches found in the literature are: the simultaneous (one-stage) approach, and the sequential (two-stage) approach as shown in Figure 2.3 (Du et al., 2007). In one-stage approach, the decision on whether or not to engage in any innovation as well as the category of innovation is made simultaneously. However, in the sequential two-stage approach, the decision on the category of innovation is made after choosing whether or not to engage in any innovation. The latter is more efficient than the simultaneous approach. Thus, the sequential two-stage approach is the most common innovation decision making process used by researchers (Du et al., 2007).



One-stage Two-stage

Figure 2.3:Decision making process approaches in innovation

Source: (Du et al., 2007)

2.3.1 Decision making models

Decision models are utilized to provide insight into decision making situations and to facilitate decisions for the innovation process (Eriksson, 2009). The innovation models are usually used as decision making models, which represent a way to make decisions (Eriksson, 2009; Szutowski, 2019).

Though decision making in product innovation from a procedural point of view is not a well-developed art, arguably the most popular model is the stage gate model to represent the decision making gates (Cooper, 1994, 2008, & 2014). This model divides the process into distinct stages with decision gates, and describes the supporting practices and systems necessary to confirm smooth operation, as shown in Figure 2.4.

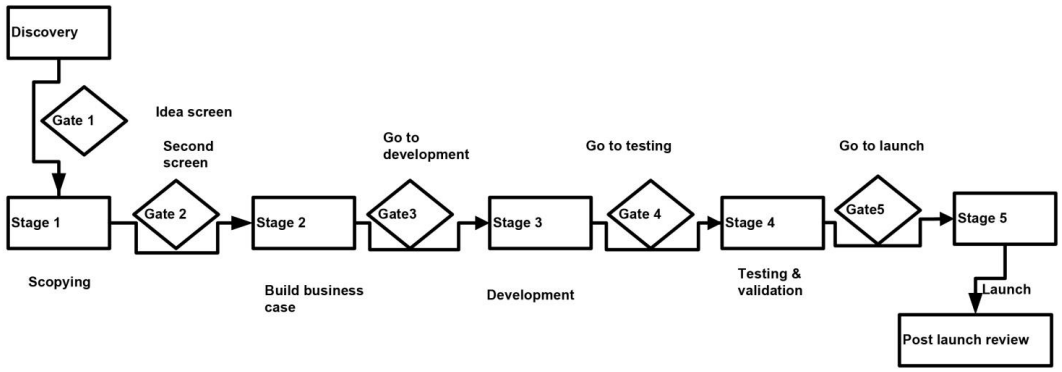


Figure 2.4:Third generation stage gate model

Source: (Cooper, 1994)

Innovation process activities followed by 'go or no go' decision points, with network approach are introduced in the Multiple convergent product development (PD) model (Hart & Baker, 1994). The Fugal innovation process model (Preez et al., 2009), the enhanced FuGle® innovation process model (Louw et al., 2018), and the customer dominated innovation process model (Liu, et al., 2019) too considered 'go or no go' decision points. The multiple convergent PD model is concerned with the cross functional information management, and decision making processes. The Fugal model has distinct stages with decision gates, and filters that includes the idea filter as the first filter, followed by the concept filter, funding gate, launch gate, and exploitation gate (Figure 2.5). These gates and filters are used as decision points between certain activities and stages, as illustrated in Figure 2.5. The enhanced FuGle® innovation process model has seven process stages, and filters are introduced between the stages which are named as quality gates in a similar way to the Fugal model. The customer dominated innovation process model comprises ten activity stages, and seven decision gates that includes company approval, qualified idea review, select candidate ideas, ideas selected to implement, accept offer, development review, and test review.

Evaluating the existing literature, it was understood that there is a lack of research on innovation decision making from a procedural point of view (decision points or gates), and especially with respect to the networks of actors involved in innovation decision making (Hauser et al.,2006; Haropoulou, 2013; McNally & Schmidt, 2011).

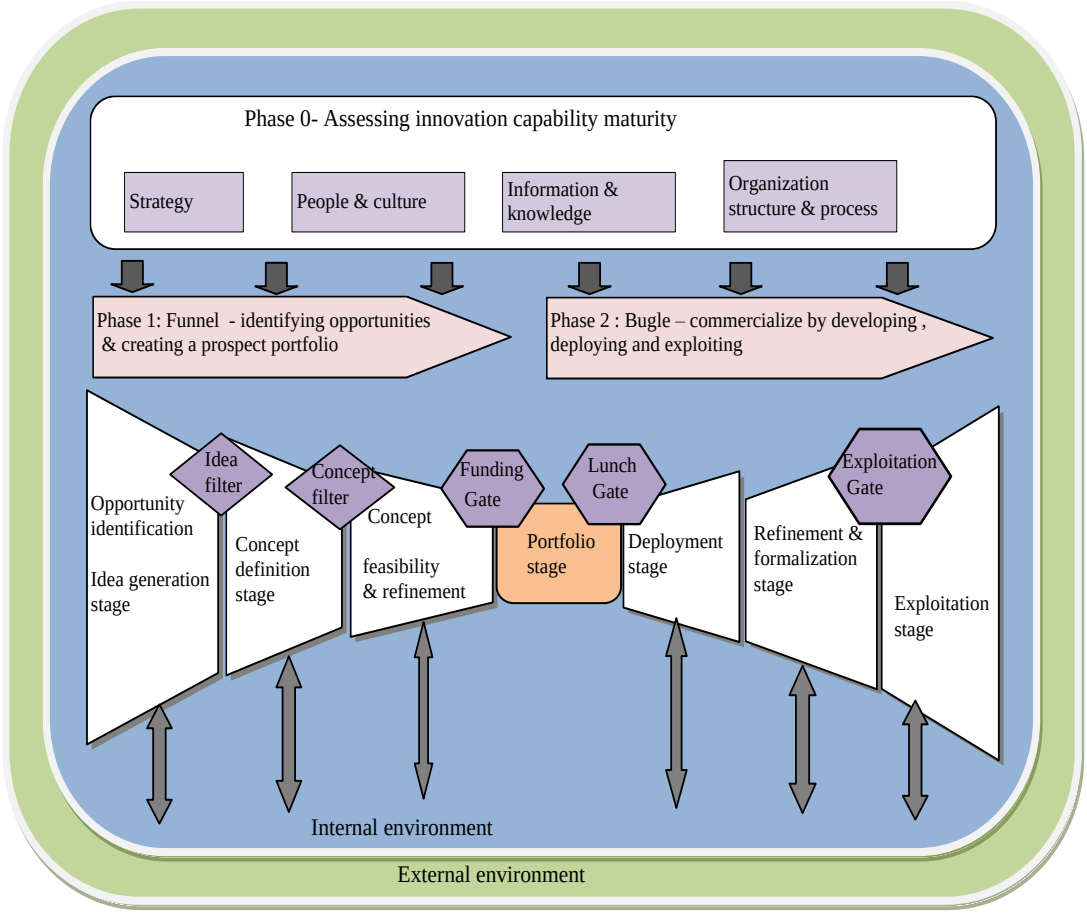


Figure 2.5:Fugal innovation process model

Source: (Preez et al., 2009)

2.4 Co-creation of value in innovation

Interaction with the customer has emerged with the concept of open innovation, and the shift from passive to active customers is being attempted in the business world (Payne et al., 2008). The conventional belief in the 'value created by the firm' (value creation) has shifted to the 'value created with the customer' (co-creating value) where creation of value is a joint, collaborative, and concurrent process between customer and company (Galvagno & Dalli, 2014; Grönroos, 2008; Pathak, et al.,2022).

Saarijarvi et al. (2013) have dismantled the 'value co-creation' idea into its constituent parts, which does much to enhance the understanding of the concept as illustrated in Figure 2.6.

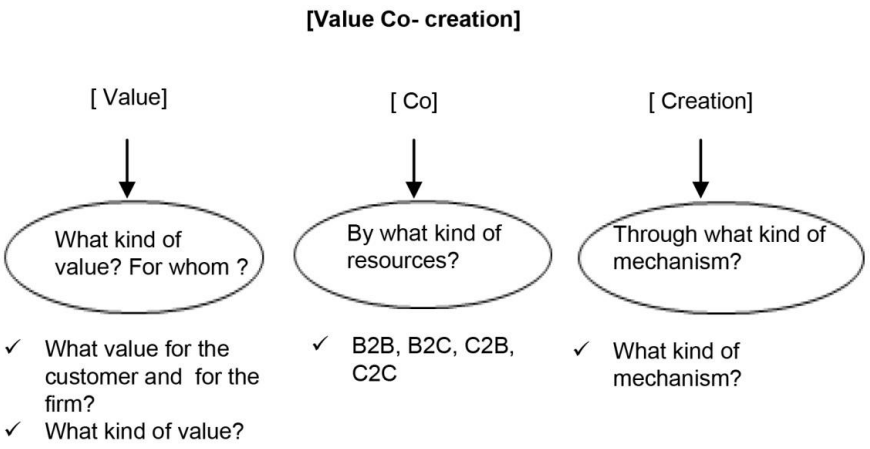


Figure 2.6:Dismantling value co-creation

Source: (Saarijarvi et al., 2013)

'Value' is a subjective term and is defined variously depending on the context (Konhäuser, 2007). 'Value', is described by many researchers in different ways, but having similar thoughts:

> "Value for the customer means that after they have been assisted by a self-service process or a full-service process, they feel much better than before" (Grönroos, 2008, p.303).

With regards to benefits, value is defined as,

> "The customer's overall assessment of the utility of a product (or service) based on perceptions of what is received and what is given" (Zeithaml, 1988, p.14).

It is appropriate to consider both the customer, and the firm to create value.

> "Value resides in the satisfaction and fulfilment of customers' expectations, while at the same time generating wealth for organizations" (Martinez, 2003, p.28).

Based on creating value from the perceptions of both customers and firms the value expectation match model was proposed (Konhäuser, 2007). The value expectation model shown in Figure 2.7 proposes to accomplish value by combining four value perspectives: value to the customer, value from the firm, value to the firm, and value

from the customer. Thus, a single holistic approach has been adopted to optimize the relationship strength (Konhäuser, 2007).

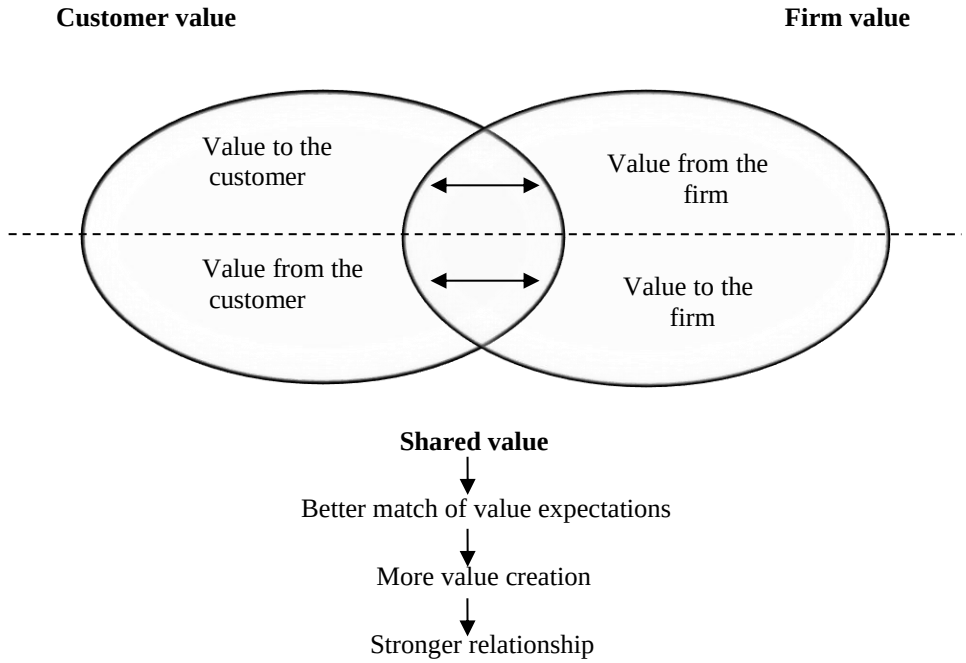


Figure 2.7:Value expectation match model

Source: (Konhäuser, 2007)

The prefix ‘co’ refers to the resources utilized and/or the actors involved in the process of value co–creation (Saarijarvi et al., 2013). The resources used for the joint creation of value, or the expected co-creators of value are B2B, B2C, C2B and C2C (Gummesson & Polese, 2009; Pathak, et al.,2022; Saarijarvi et al., 2013):

- B2B - The manufacturer works with a business firm or product brand to develop marketable products. The business firm or the product brand represents a demand, and preferences derived from end consumer markets. (e.g. - regional manufacturers and retail stores)
- B2C - The manufacturer selects a group of customers to obtain information on needs for new products, and to develop marketable product ideas (e.g.-regional manufacturers and consumers, restaurants, and consumers)
- C2B - Consumer stimulates action by businesses (e.g.- consumers, and retail stores)

- C2C- Represents either organizational customers to organizational customers, or consumers to consumers. (e.g.- online e-commerce (e-bay))

The expected co-creators of value (relationship between Bs and Cs) are presented in Figure 2.8.

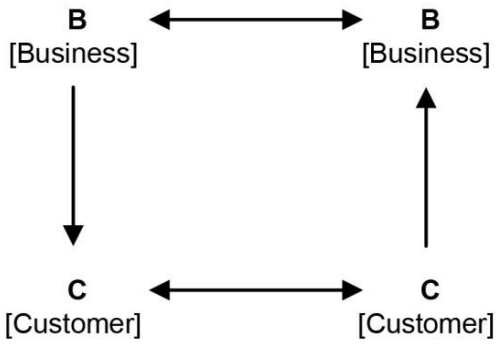


Figure 2.8:Expected co-creators of value

Source: (Gummesson & Polese, 2009)

The term 'creation' refers to the mechanisms that are used to generate new value (Saarijarvi et al., 2013). Interaction, resource integration, and information sharing are common mechanisms of generating value (Pathak, et al.,2022; Saarijarvi et al., 2013; Srivastava et al., 2008). Co-ideation, co-evaluation, co-designing, co-testing, and co-launching are examples of interacting with, collaborating with, and integrating with the resources of customers in different phases of the innovation process (Prahalad & Ramaswamy, 2004; Russo-Spena & Mele, 2012). Figure 2.9 shows the five mechanisms of generating value in innovation.

- Co-ideation - The generation of ideas together. In order to obtain direct, and external voices, the idea generation phase is opened to an external network of actors.
- Co-evaluation - The evaluation of ideas together. Multiple actors are involved in the appraisal of proposals.
- Co-designing - It covers a wide range of practices to bridge the gap between ideas or needs. Many actors are linked.

- Co-testing - The improvement of prototype products is supported before they are marketed. Many actors are linked.
- Co-launching - It relates to the launch of products, and to test the marketability of a product.

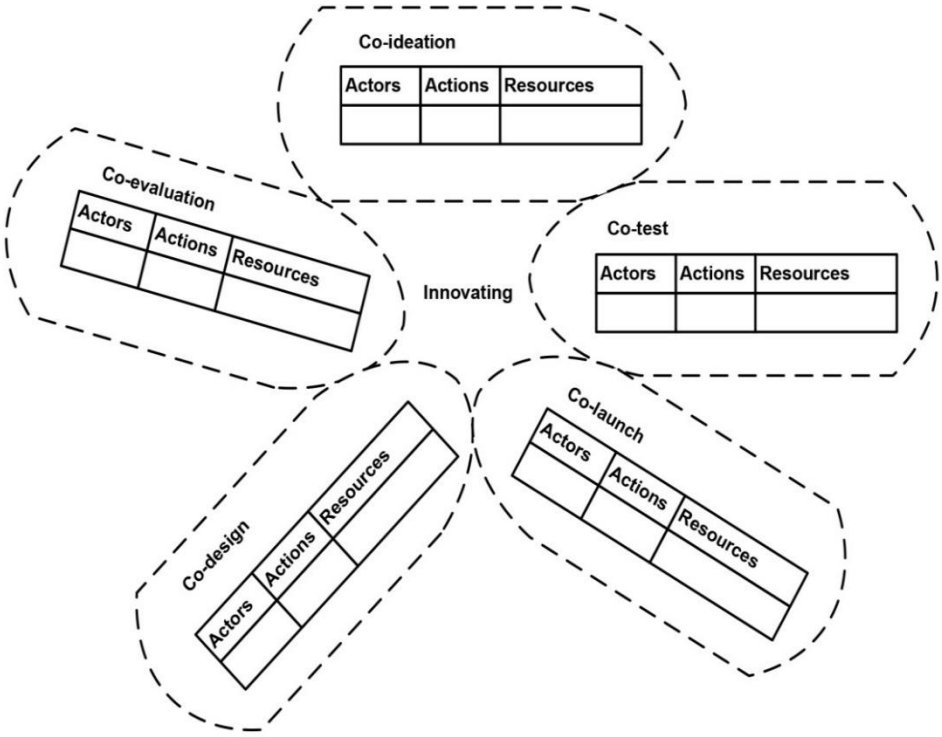


Figure 2.9: Five mechanisms of generating value in innovation

Source: (Russo-Spena & Mele, 2012)

From a practice based point of view, a set of practices used for each phase of the 'co-s' are considered as 'co-creation in innovation' and in innovation 'co' is considered as 'a process of co-creation' (Prahalad & Ramaswamy, 2004; Russo-Spena & Mele, 2012).

In co-creation, customer knowledge and firm knowledge are integrated into all activities of the innovation process (Schweitzer, 2014). The strength of the relationship between firms and their customers as well as the interactive roles of the customers in the innovation process vary due to their characteristics (Barrutia et al., 2019; Budinský,2018).

In a B2B context, firms tend to hold strong ties with their business customers as they are familiar. In addition, business customers possess in-depth knowledge of the technological developments, new markets, and latest trends in the market (Barrutia et al., 2019; Budinský,2018; Smith,2022). Business customers may be highly motivated to contribute knowledge, and representatives of both firms have personal relationships, and have an enthusiasm for new products (Barrutia et al., 2019). Moreover, trust and commitment facilitate the transfer of complex and sensitive knowledge between business customers and the firm (Barrutia et al., 2019; Budinský,2018).

In a B2C context, the ties between a firm, and most customers tend to be weak since the firm has a lot to learn about customers' latent needs, emergent consumer segments, emotional drivers of consumption, and consumption patterns (Barrutia et al., 2019). Due to the high technological complexities involved in innovation, consumers may be unable to provide valuable inputs or evaluate innovation concepts and prototypes because no reference products exist (Barrutia et al., 2019; Budinský,2018). As a result, higher authority in decision making processes within internal development groups (Budinský,2018).

In addition, there are significant differences between B2B and B2C purchasing behavior, purchasing processes, purchasing decisions, and the level of complexity involved (Pathak, et al.,2022). B2B purchasing is commonly viewed as a collaborative effort between manufacturers and buyers to achieve a win-win outcome from the relationship (Barrutia et al., 2019; Budinský,2018; Pathak, et al.,2022; Smith,2022). Therefore, involvement of customers in the product innovation process in the business to customer (B2C) context differs from that in the business to business (B2B) context.

2.5 Front- end of innovation

In the literature, the front-end of innovation is variously known as the first phase or the stage, 'fuzzy front-end', 'early phases of innovation', 'front-end process', 'front-end of new product development' and 'pre-development' (Teza et al., 2015). It is the foundation for successful new product development (Poskela, 2009), the dynamic and iterative beginning phase (Paananen, 2010), a sub-process (Teza et al., 2015), a critical component (Koen et al., 2001), and the most significant action (de Sousa Mendes &

de Toledo, 2011) of the innovation process. Further, it is the cornerstone of an innovative new technology, product, or process improvement where most of the key components of the future innovation are defined (Tea, 2007). The front-end of innovation is defined as,

- "The activities that take place prior to the formal, well-structured New Product and Process Development (NPD) stage" (Koen et al., 2001, p.46).
- "The stage which includes product strategy formulation and communication, opportunity identification and assessment, idea generation, product definition, project planning, and executive review" (Khurana & Rosenthal, 1998, p.57).
- "Identifying opportunities and developing ideas and evolving these ideas into explicit and concrete concepts that are ready to develop even further in the more structured development phase, with the ultimate goal of achieving a successful commercialization" (Loohuis, 2015, p.2).

These definitions are primarily based on the activities taking place within the front-end of innovation (Tayaran, 2011).

2.5.1 Front- end innovation models

A variety of front-end models are evident within the literature; each consists of a number of process activities. Brief introductions of these models are provided below.

Cooper, (1994) introduced a linear model named '3rd generation stage gate model' which included three sequential process stages; discovery as the first stage, followed by scoping and building business case as the rest of the stages. In between these stages, defined decision gates have been introduced which represent decision points. '3rd generation stage gate model' is the most widely applied model due to its simplicity.

Aiming to shorten the time to market by managing the front- end, Reinertsen (1994) proposed the 'Two track front-end model'. The model proposed the normal sequential track as well as concurrent process fast track activities. Normal track comprises of five process stages: classify opportunity, prepare business plan, review business plan,

allocate resources, and begin development. The proposed fast track included concurrent activities.

Considering how the strategy of the organization influences development, Khurana and Rosenthal (1998) introduced the 'New concept development model'. This model mainly considered three phases: pre-phase zero (preliminary opportunity identification), phase zero (product concept creation), and phase 1 (feasibility, and project planning).

Koen et al., (2001) proposed a non-linear and informal process model named as 'New concept development model'. This model considers three building blocks: front-end activities, the engine, and internal as well as external environmental factors. The proposed front activities are opportunity identification, opportunity analysis, idea genesis, idea selection, and concept and technology development. Further, the flow of ideas in an iterative manner between different activities is proposed in this model.

Empirically exploring three different projects, Nobelius & Trygg, (2002) suggested a 'Front- end model' considering the activities performed, task arrangements, relative time duration, and the type of project. The main focus was to provide managerial flexibility in terms of staffing, priorities, and advanced planning of activities in the front-end phase.

Exploring the role of process formalization in the front stages of the innovation process, Husig et al., (2005) proposed a 'Front- end process conceptual model'. The model begins with environmental assessment, followed by an idea generation phase, and a project definition phase. Decision gates are indicated between the activities. This model is a clear structure that represents continuous activities.

A structured, detailed front-end process model named 'Integrated front-end model' was introduced by Sandmeier et al., (2004) taking into account the iterative learning cycles between stakeholders. The model specifically focused on the roles and specific responsibilities assigned to the stakeholders (customers, suppliers, and internal teams). The model consists of three phases. The first phase is market and technology opportunity identification. The second phase is product and business idea

development. The product concept phase and business plan creation are in the third phase.

Alas, (2011) proposed a 'Front- end of innovation process model' by deeply reviewing the literature. The main focus is on the screening and filtering of the most exceptional opportunities to develop, and to commercialize. It discusses the ideation (planned and unplanned) and opportunity management stages in detail, and provides guidance on appropriate tools to proceed in these stages.

Integrating various best practice activities and concepts including open innovation and network identified in the literature, Preez et al., (2009) introduced the 'Fugal innovation process model'. This consists of three stages: the innovation funnel (explore new opportunities, and generating and selecting new ideas and concepts), innovation portfolio (release new innovation projects), and innovation bugle (develop, implement, commercialize, and exploit the new innovation). Decision gates and filters are indicated between stages. The linkage to the external environment in all the stages is emphasized. Further, the strategies of the firm, its culture and people, organizational processes and structure, information, and knowledge are well thought out in this model.

Considering the novelty, the development type of the product, and different information inputs and outputs, Orawski et al. (2011) proposed a merged model named 'Generic front-end process model'. The model discusses two process stages: planning and concept. Decision gates are discussed too. This model is beneficial to handle three different degrees of novelty of product: new product development, the adjustment or adaption design, and the variation design.

Brandtner (2017) proposed a 'strategic front-end of innovation process model' to address the current low performance of strategic level activities. The model was developed based on existing front-end innovation processes in organizational practice. Six key activity groups, and nineteen sub-activities are included in this model.

A 'new fuzzy front-end model' was introduced by Park (2018) after analyzing real world scenarios. The model takes into account the current trends in fuzzy front-end

model improvement, as well as the performance structure and operating mechanism, resulting in more agile fuzzy front-end execution.

Cooper and Sommer (2018) proposed the 'agile stage gate hybrid model' to work across the entire project development process. However, the model provides a detailed view on 'agile front-end' activities, and 'go or no go' decision points. In addition, the model considered the responsibilities of the members of the team, and the 'voice of the customer'.

Summing up the findings on the existing front-end models, the following discrepancies and limitations were identified.

It was exposed that several models have been developed to depict the activities or steps within the process of the front-end. Some models offer a clear view of the process activities occurring in the front-end (Cooper,1994, 2008, 2014; Cooper & Sommer,2018; Delcroix, 2016; Husig et al., 2005; Koen et al., 2001; Khurana & Rosenthal, 1998; Nobelius & Trygg, 2002; Preez et al., 2009) but in some studies, the process activity steps are not indicated (Reid & Brentani, 2004). Some studies have drawn attention to the phases of the front-end when discussing activities.

A prescribed beginning followed by end of process activities that occur sequentially are clear in some models (Cooper, 1994, 2008, & 2014; Cooper & Sommer,2018; Delcroix, 2016; Husig et al., 2005; Khurana & Rosenthal, 1998; Nobelius & Trygg, 2002; Sandmeier et al., 2004; Preez et al., 2009). However, other models do not have a clear prescribed start or end and do not prescribe a specific order (Koen et al., 2001). In order to shorten the time to market, concurrent process activities have been proposed for managing the front-end instead of the sequential process activities in some models (Reinertsen, 1994). Iterative nature of the front-end is considered in few of the models (Koen et al., 2001; Sandmeier et al., 2004).

The decision points between the process activities are not clearly indicated in some models, though the feedback and/ or backward and forward movements of the activities are discussed (Koen et al., 2001; Sandmeier et al., 2004). Though there are no feedback loops, decision making gates are indicated in between each set of activities in some front-end process models (Cooper, 1994; Cooper & Sommer,2018;

Husig et al., 2005). A decision gate at the end of the front phase is proposed before releasing it to NPD in the model of Khurana and Rosenthal (1998).

When discussing the process activities, integration of internal as well as external stakeholders is emphasized in some front-end models (Sandmeier et al., 2004). In a very limited number of studies, the roles, and specific responsibilities are assigned to stakeholders within the front-end process (Sandmeier et al., 2004). It is noted that very little attention has been paid to knowledge integration within the front-end of innovation.

Further, it is argued that these front-end process models ideally consider contextual factors too, as that would help to deal with the following aspects more effectively (Nobelius & Trygg, 2002; Poskela, 2009).

- the degree of complexity, and innovativeness of the product
- nature of markets
- organizational context

The process stages in different models, model characteristics, and the involvement of actors (customers, internal departments of producers, and suppliers) of from-end innovations models are summarized as follows in Table 2.8.

Table 2.8:Evaluation of front- end innovation models

Author/s		Proposed processes or models or framework		Process		Involvement of actors		
		Model	Characteristics	Stages/ activities	Decision points	Internal dept.	Customer	Supplier
1	Cooper (1994)	3rd generation stage gate model	Three stages and gates serving as decision making points between the stages	√	√	X	X	X
2	Reinertsen (1994)	Two track front - end model	Concurrent process activities are proposed to shorten time to market by managing the frontend	√	X	X	X	X
3	Khurana & Rosenthal (1998)	New concept development model	Considers how strategy of the organization influences development	√	√	Θ	√	X
4	Koen et al. (2001)	New concept development model	Considers internal as well as external environmental factors. Does not have a clear prescribed start or end.	√	X	X	X	X
5	Nobelius & Trygg (2002)	Front- end model	The specific sequence and duration of these activities depend on the type of project	√	X	√	Θ	X
6	Husig et al. (2005)	Conceptual front - end process model	No feedback loops but decision making points/ gates are indicated in between activities	√	√	X	X	X
7	Sandmeier et al. (2004)	Integrated front end model	Focus on the role – specific responsibilities assigned to the stakeholders	√	Θ	√	√	√
8	Alas (2011)	Front- end of innovation process model	Organizational structure required to incubate opportunities is considered. Focus is on the screening and filtering of the most exceptional opportunities	√	Θ	√	√	X
9	Preez et al. (2009)	Fugal innovation process model	Gates and filters are in between certain stages	√	√	√	X	X
10	Orawski et al. (2011)	Generic front-end process model	The level of novelty and the development type of the product are integrated	√	√	X	X	X
11	Cooper & Sommer (2018)	Agile front-end	Three stages and decision gates between the stages indicated. The model considered the responsibilities of the members of the team and continuous consumer feedback	√	√	√	Θ	X
12	Brandtner (2017)	Strategic front-end of innovation process model	Six key activity groups and nineteen sub-activities are included. Structural requirements of corporate foresight and strategic issue management concepts are incorporated.	√	Θ	Θ	X	X
13	Park (2018)	New fuzzy front-end model	The model takes into account the current trends in fuzzy front end model improvement, as well as the performance structure and operating mechanism	√	Θ	Θ	X	X

√ - discussed Θ- discussed to some extent X - not discussed at all

2.5.2 Front-end decision making

Front-end itself is described as

> "a decision-making process in which agreement is reached on the product positioning, primary product features and performance, required technologies and resources, and alignment to product portfolio, among other things" (Oliveira et at.,2011, p.311).

Front-end decisions are broad initial assessments which focus on finding the best methods and conceptual ideas to gain greater benefits from intended financial investments, resources, and time to market (Samset & Christensen, 2015). Front-end decisions are useful to prevent costly and unproductive solutions at the early stage of the innovation process (Hyppänen, 2013; Samset & Christensen, 2015). In addition, making decisions efficiently in the front-end of product innovation is important to shorten the product development cycle time, to avoid guess work, to improve the quality of design solutions, and eventually to improve the efficiency of the entire innovation process (Hyppänen, 2013; Samset & Christensen, 2015).

However, the limited availability of reliable information at this early stage has proven to be a major cause of uncertainty in front-end decision making in estimating market potential, assessing technical needs, predicting environmental impacts, and figuring out resource allocations (Schröder & Jetter, 2003). Decisions on spending and using capital without a promise of return are the other uncertainties inherent in front-end decision making (Williams & Samset, 2010).

2.5.2.1 Front - end decision making models

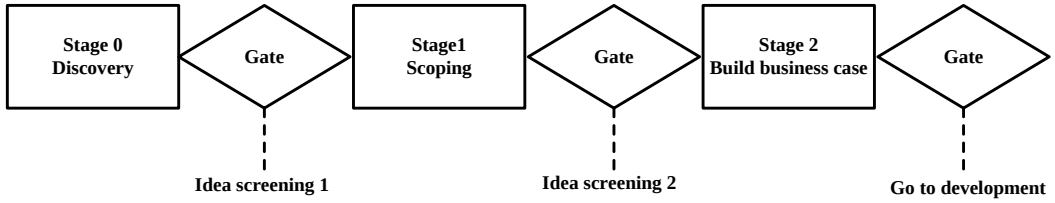
Studies on front-end decision making models are lacking and there is no clear evidence of models developed on decision making at the front-end in general, and the front-end of apparel innovation. However, a number of front-end models have been developed demonstrating the decisions within the process of the front-end (Cooper, 1994; Cooper & Sommer,2018; Hüsig, Kohn, & Poskela, 2005; Khurana & Rosenthal, 1998; Orawski, Krollmann, Mörtl, & Lindemann, 2011; Preez, Louw, & Essmann, 2009). The front-end models with decision gates revealed through literature are summarized in Table 2.9.

Table 2.9: Front -end models with key decisions gates

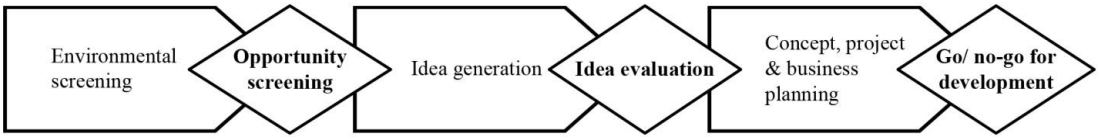
Front - end model	**Front - end activities with key decisions**					
Cooper (1994)	Stage 0 Discovery	Gate 1 Idea screening	Stage 1 Scoping	Gate 2 Second screening	Stage 2 Build business case	Gate 3 Go to development
Preez et al. (2009)	Stage 1 Opportunity Identification/ Idea Generation Stage	Gate 1 Idea filter	Stage 2 Concept definition	Gate 2 Concept filter	Stage 3 Concept feasibility and refinement	Gate 3 Funding gate
Husig et al. (2005)	Phase 1 Environmental screening or opportunity identification	Gate 1 Opportunity screening	Phase 2 Idea generation or Preliminary definition of an idea or concept.	Gate 2 Idea evaluation	Phase 3 Concept project and business planning	Gate 3 Go/ No-go for development
Cooper & Sommer (2018)	Stage 1 Discovery & ideation		Gate 1 Idea sprint	Stage 2 Concept & business case		Gate 2 Concept sprint
Orawski et al. (2011)	Planning stage identification of the general demand, target definition	Gate 1 Innovative enterprise	Concept stage <u>Revolutionary innovation</u> Search field definition, idea finding, idea selection	Gate 2 Innovative idea	project intern pre-development	Gate 3 Innovation technology
			<u>Evolutionary innovation</u> Requirement specification	Requirement specification	concept generation	Concept
			<u>low evolutionary</u> Product and project specifications			Project proposal
Khurana & Rosenthal (1998)	Pre - Phase 0 Preliminary opportunity identification: Idea generation and market & technology analysis and Product & portfolio strategy		Phase 0 Product concept	Phase 1 Feasibility & project scanning		Gate 1 Go/ No-go for development

Cooper (1994) proposed three decision gates for idea screening, second screening, and go/ no go for development in between three process stages. Husig et al., (2005) also indicated three decision gates. However, Khurana and Rosenthal, (1998) suggested

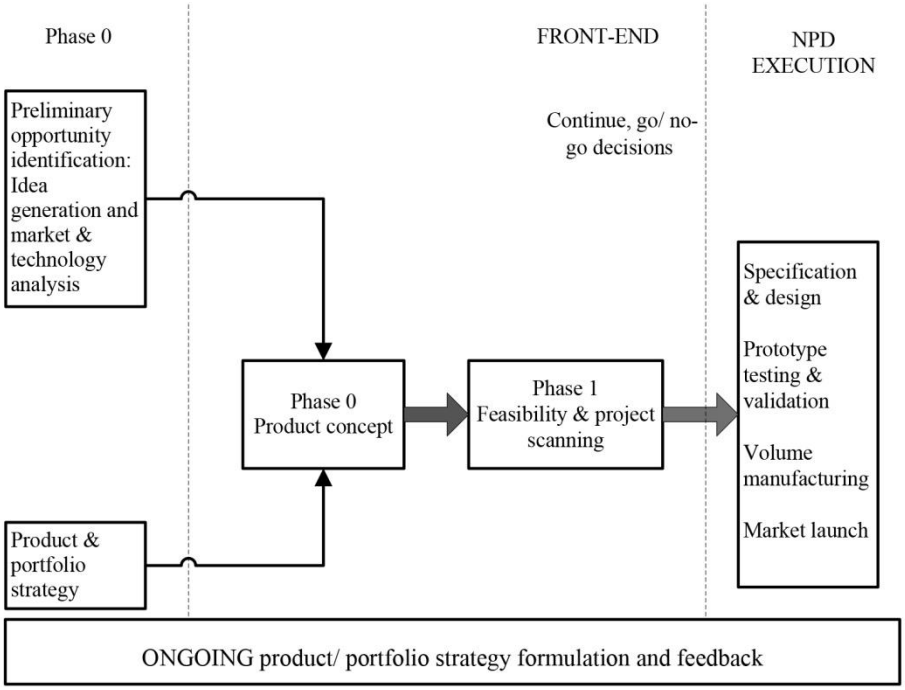
only one decision gate at the end of the front-end: continue go/ no go decision. A few examples of front-end models with decision gates are presented in Figure 2.10.



(Cooper, 1994)



(Husig et al., 2005)



(Khurana & Rosenthal, 1998)

Figure 2.10: A few examples of front-end models with decision gates

However, a detailed discussion of decision making in front-end product innovation from a procedural point of view is not well developed yet in this model, and the matter seems to have gained little attention from academia.

2.5.3 Co-creation of value at the front-end of the Business to Business (B2B) context

The co-creation mainly focuses on the active role of the customer in the innovation process activities, and providing their experiences and competencies (Russo-Spena & Mele, 2012). Active involvement of customers at the front-end of innovation is valuable, and assists to (Coviello & Joseph, 2012; Schweitzer, 2013; Smith, 2022):

- choose the right product features
- optimize the product
- determine market potential
- plan marketing strategies
- reduce market failures
- reduce uncertainties about market
- reduce uncertainties in technical solutions
- help meet actual or potential customers
- improve a company's innovation success rate

In the B2B context, the customers are the buyers or product brands, who deal with the preferences and needs of their own end consumers (Gummesson & Polese, 2009; Pathak, et al.,2022). Basically, B2B customers act as idea generators for the front-end of innovation by providing needs information (Coviello & Joseph, 2012; Schweitzer, 2013; Smith, 2022). In addition, customers can provide solution information too (Schweitzer, 2013), and can be the co-developers who develop products together (Coviello & Joseph, 2012; Smith, 2022).

However, recapitulating the front-end literature, it is understood that value creation, and/ or co-creation of value within a B2B context in the product innovation process have received comparatively little attention from academia in general. Only Sandmeier et al., (2004) emphasized integration of customers in their front-end model, which does not specify whether the customers are consumers or B2B customers.

2.6 Summary of the chapter 2

This chapter provided an overview of product innovation, decision making, and co-creation of value. Further, an overview of the front-end of innovation, front-end models, front-end decision making, and the concomitant creation of value in the front-end of the B2B context are provided.

The findings of the existing theoretical product innovation models emphasize procedural perspectives on activities. Decision points with feedback loops are introduced in certain product innovation models. However, the prominence given to the decision making aspect is minimal in general. Further, the apparel product development models presented in the literature have been developed by focusing on either the activities performed to carry out the product development or the main flow of information. Decision making in the apparel product development process is not properly addressed in any existing model.

The findings on the front-end innovation models highlight that several models have been developed to show the activities and the decisions within the process of the front-end. However, a thorough discussion of decision making from a procedural point of view is not well developed yet. Further, co-creation of value in a B2B context in front-end innovation in manufacturing industries has received comparatively little attention.

Finally, it is apparent that academic research has not yet come up with a suitable decision making process model to fit the needs of the front-end of innovation in the context of apparel innovation. Therefore, a need exists for a comprehensive decision making process model for structuring the front-end to form a strong foundation for efficient apparel product innovation.

CHAPTER 3

RESEARCH DESIGN

A logical plan for making the methodological choices to achieve the aim and objectives of the study is outlined in this chapter. A brief introduction of the research design process is presented at the beginning of the chapter. This is followed by a discussion of the rationale behind the most appropriate procedures and data collection techniques for the research.

3.1 Research design

The research design process of this study follows two phases:

i. The first phase is aimed at developing a decision model
ii. The second phase is dedicated to the validation of the model

The development process of the decision model (phase 1) comprises two steps. At step 1, research questions were formulated, and a conceptual framework was developed to explore the front-end decision making process of apparel product innovation in the current apparel industry setting. The conceptual framework is discussed in Chapter 4 and multiple case studies were applied to explore the front-end decision making process of apparel product innovation. Chapter 5 discusses the results of the multiple case studies.

At step 2 of the decision model development (phase 1), the results obtained in step 1 of the research were re-examined and refined. The focus on developing the front-end decision model was narrowed down to incremental innovation which is prevalent in the apparel industry. Since the objective of the study (section 1.3) was to develop a model incorporating 'co-creation of value in the B2B context', two of the innovation initiation approaches, namely innovation 'initiated by company' and that 'initiated by B2B customer' were considered.

Both qualitative interviews and a quantitative questionnaire survey were employed to re- examine and verify the results obtained in step 1 of the research for incremental innovation and two of the innovation initiation approaches, namely innovation

'initiated by company' and that 'initiated by B2B customer' (Chapters 6 and 7). The Meta decision making model was proposed for the front-end of incremental innovation. Chapter 8 presents the Meta decision making model.

In the second phase of the research, the Modified Delphi technique was applied to validate the refined Meta model and suggest modifications to the model. Figure 3.1 shows the research design process followed in this study.

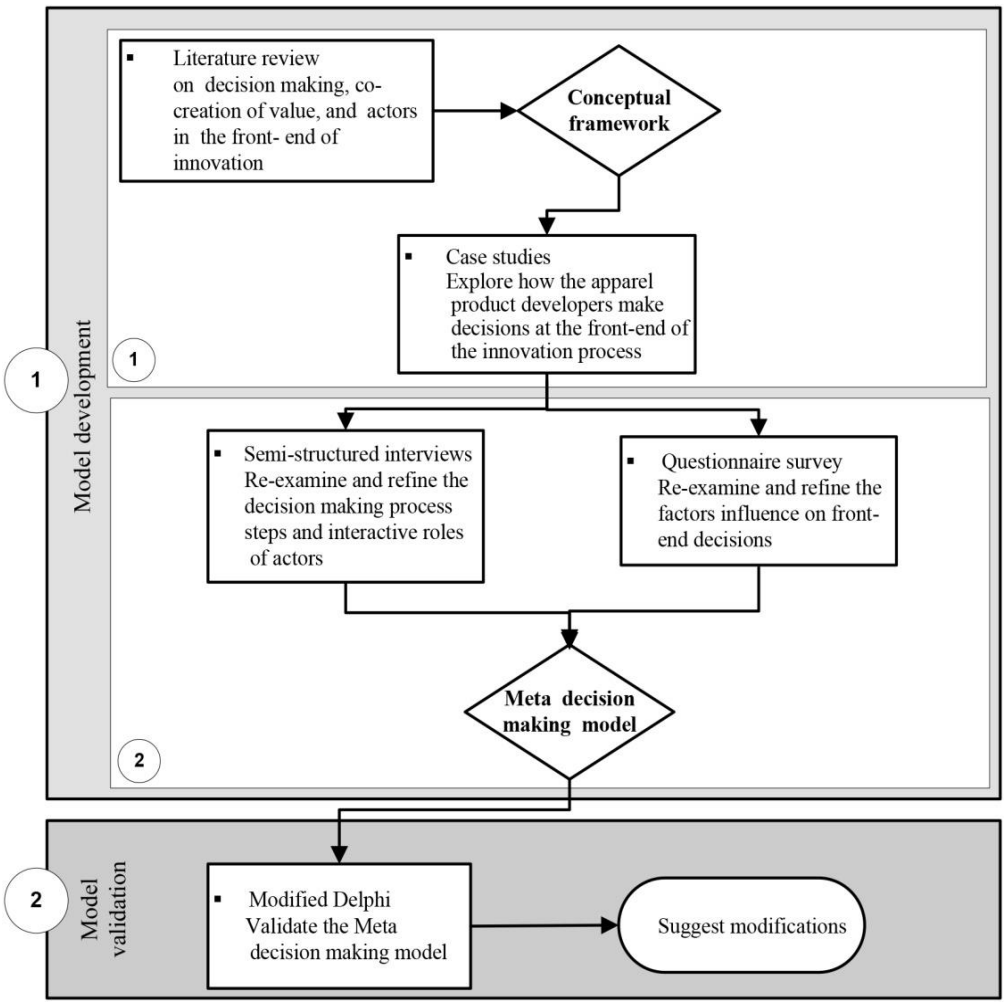


Figure 3.1: Research design process to achieve objectives of the study

3.2 Research design process followed in model development

The rationale behind the methodical choices in research approach, research strategy, and data collection techniques in model development are enunciated in the following sections.

3.2.1 Mixed method research approach for the model development

There are several different approaches to conduct a study. While the main approaches are qualitative and quantitative, the third approach is a combination of quantitative and qualitative (mixed) methods (Bryman & Bell, 2007; Creswell, 2011). The characteristics of the three research approaches are presented in Table 3.1.

Table 3.1:Characteristics of the three research approaches

Qualitative	Mixed	Quantitative
• Emerging methods • Open ended questions • Interview data, Observation data, Document data, Audio visual data • Text and image analysis • Themes, patterns interpretation	• Both pre-determined and emerging methods • Both open and closed questions • Multiple forms of data drawing on all possibilities • Statistical and text analysis • Cross database interpretation	• Pre-determined methods • Instrument based questions • Performance data, Attitude data, Observational data, Census data • Statistical analysis • Statistical interpretation

Source:(Creswell, 2011)

Out of the three approaches, the mixed method approach was the preferred methodological choice for the model development of this research. The mixed method approach is becoming increasingly popular among many academics, and researchers across a wide variety of disciplines, including doctoral level business research (Miller & Marchant, 2009). That is because the mixed method approach is an efficient approach towards answering research questions by removing any biases that might exist in any single research method, and capitalizing on the strength of both qualitative and quantitative approaches (Creswell, 2011).

3.2.2 Research strategies of the model development

As stated in section 3.2.1, the decision model development process of this study comprises two steps.

Step 1 of the model development process was to explore the actual apparel industry setting to understand the everyday activities so as to gain new insight into relationships among decisions and actors on front-end product innovation, leading to the formulation of the following key research question.

How do the apparel product developers arrive at decisions on innovative product offerings at the front-end of the innovation process?

Four sub questions were developed to provide comprehensive answers to the above question (section 4.1).

As the main research question is to understand '*How do the apparel product developers arrive at decisions,'* qualitative methodology (case studies) was applied to step 1 of the model development. Qualitative methodologies are used in business organizations to investigate dynamic, changing phenomena and contexts, and are suitable for studying things in their natural settings (Denzin & Lincoln,2011; Sinkovics et al.,2008). Moreover, qualitative methodologies are ideal for examining the behaviour of a process, as they promote real-life interactions and observations at a greater depth. Further, it helps to collect more data in the field (Creswell, 2011). The results of the qualitative study (case studies) are discussed in Chapter 5.

Step 2 of the model development (phase 1) focused on verifying and refining the results obtained in step 1 for incremental innovation, and two of the innovation initiation approaches, namely innovation 'initiated by company' and that 'initiated by B2B customer'. Step 2 addressed the following three research questions.

a. *What would be the decision process steps in the front-end of incremental apparel product innovation 'initiated by company' and 'initiated by customer'?*
b. *What would be the role of suppliers and B2B customers in the front-end of incremental apparel product innovation 'initiated by company' and 'initiated by customer'?*

c. *Do the organization's climate, its core competencies, customers, and suppliers influence the front-end decisions on incremental apparel product innovation 'initiated by company' and 'initiated by customer'?*

Both qualitative and quantitative methodologies (mixed methods) were employed for step 2 of the model development in this research. Semi-structured interviews were used to answer the two questions: questions a & b (Chapter 6). Hypotheses were derived to verify the influence of factors on front-end decisions and acquire a detailed view on them (question c) and a questionnaire survey was employed (Chapter 7). Since the above two research activities were used to further refine the results of the case studies, this interview was termed as 'refinement interviews' and the questionnaire survey was termed as 'refinement questionnaire'. The mixed method data collection approach works best to address the research questions, provides a fuller picture of the research subject, provides greater insight into the problem, and offers an opportunity to re-examine the results of the case studies in step 1 of the study (Creswell & Clark, 2011; Johnson & Onwuegbuzie, 2004) (Chapter 7).

Figure 3.2 depicts the focus, research questions, sub questions, hypotheses, and research strategies of steps 1 and 2 of the model development.

The Meta decision making model was based on three components (i. decision process steps, ii. interactive roles of B2B customers, apparel producers and suppliers and iii. influential factors) since the decision making process steps cannot exist alone (Szutowski,2019). The Meta decision making model provides an inclusive picture of the decision making process at the front-end. It describes and includes all the constructs needed to make decisions at the front-end. The Meta decision making model is presented in Chapter 8.

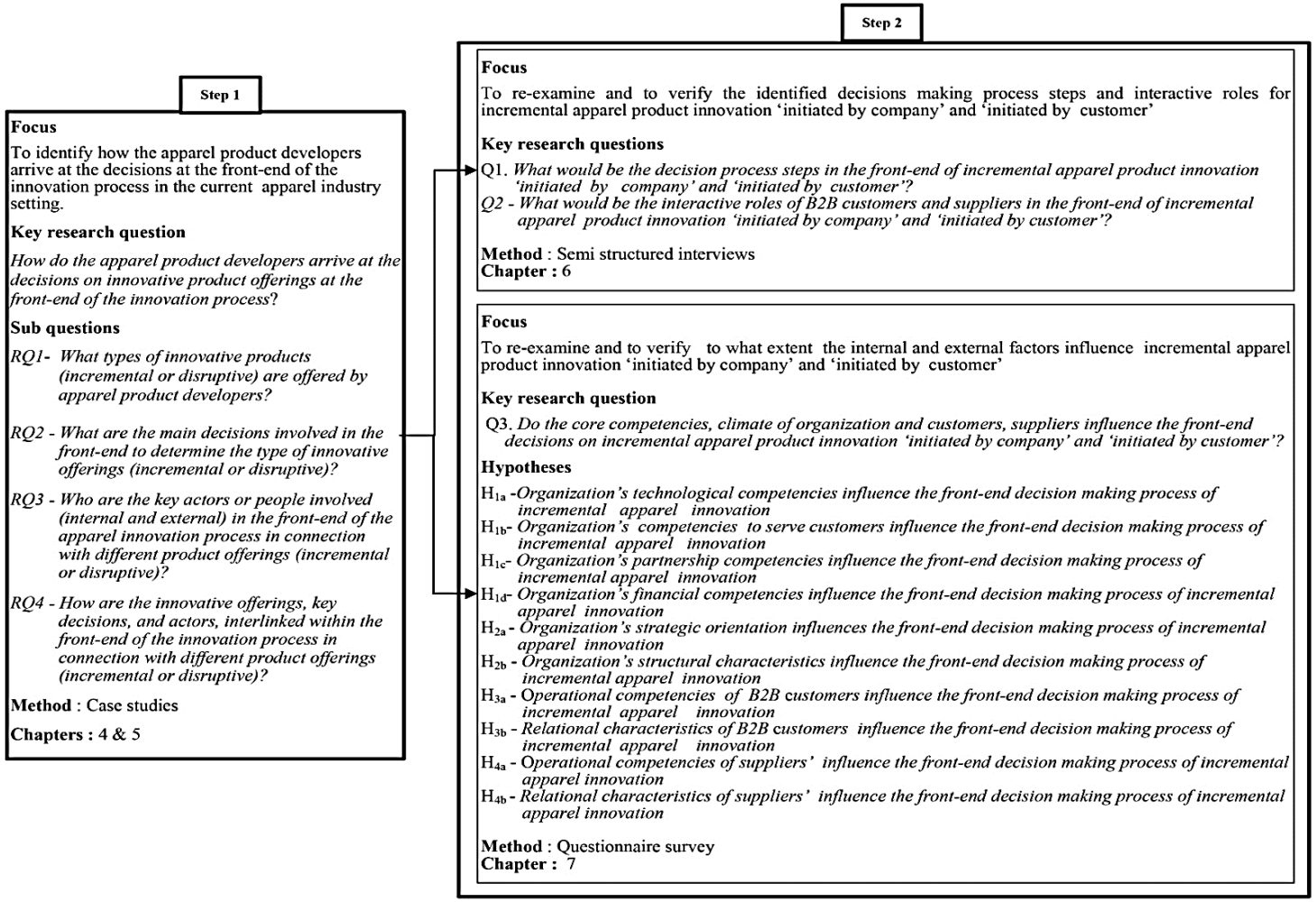


Figure 3.2: Focus, and research questions of steps 1 and 2 of the model development

3.3 Case studies for step 1 of the model development

A qualitative study can be conducted using a variety of research methods: ethnography, grounded theory, experiential research, and case studies (Merriam, 2009; Saunders et al, 2009).

Ethnography is a method of approaching the reality of a social phenomenon. Grounded theory is the systematic discovery of theory from data obtained from social research which is based on continuous data comparison and emphasizes the emergence of theoretical categories solely from evidence (Milles & Huberman, 1994). However, both ethnography, and grounded theory are very time consuming because data collection takes place over a long period of time (Saunders et al, 2009). The researcher did not choose this as an appropriate method of data collection due to time and resource constraints on this study. The experiential research method is a way for the researcher to get closer to the phenomenon and collect more grounded data by actually doing it (Merriam, 2009; Saunders et al, 2009). Considering the difficulty of obtaining permission to stay inside the companies over a period of time, this was not selected as an appropriate method for this research.

Case study promotes close interactions with participants who have faced real-life situations and events (Yin,2009). In the arena of international business and management, case studies are quite often used for several purposes, including theory generation, refutation, testing, refining, prediction, and to make an original contribution to knowledge (Myers, 2009). Moreover, case study is useful for capturing the essence of dynamic business practices and decision making processes, as well as for developing holistic and in-depth understandings (Myers, 2009; Yin,2009). Since this research focused to explore the actual apparel industry setting to understand activities and decisions at the front-end of apparel product innovation in depth, the case study research was selected as the appropriate method for step 1 of the model development.

Either single or multiple cases can be applied to facilitate the research. The main disadvantage of the single case design is the difficulty of generalization, which precludes the building of richer theories (Harling, 2002). The multiple case studies

generally produce robust results that permit generalization (Yin, 2009). In addition, multiple cases allow the researcher to build rich theories through cross case analysis, and provides the opportunity to engage in literal replication (Harling, 2002; Yin, 2009). Therefore, the favoured approach for step 1 of the model development was multiple case study design since it allows to explore, and confirm or refute the activities and key decisions at the front-end.

3.3.1 Process of conducting case studies

A case study is a less structured design process compared to experiments or surveys (Miles & Huberman, 1994). However, in order to provide a systematic approach to the case study, and to ensure the rigor of the research design, five essential requirements have been prescribed by academia: research parameters (research questions, research propositions, and units of analysis), instrument development (case study selection, instrument selection, and the case study protocol), data gathering, data analysis, and reporting case studies (Yin,2009). Based on these specified process stages, the process followed for conducting case studies in this research are discussed further in the following sections.

3.3.1.1 Unit of analysis of the case studies

The unit of analysis is closely related to the research questions underlying the case study research (Yin, 2009). However, for the purpose of comparing the results of the case study, a similar unit of analysis or an entirely different unit can be used (Koners & Goffin, 2007). The unit of analysis for this study was the front-end product innovation process, as shown in Figure 3.3.

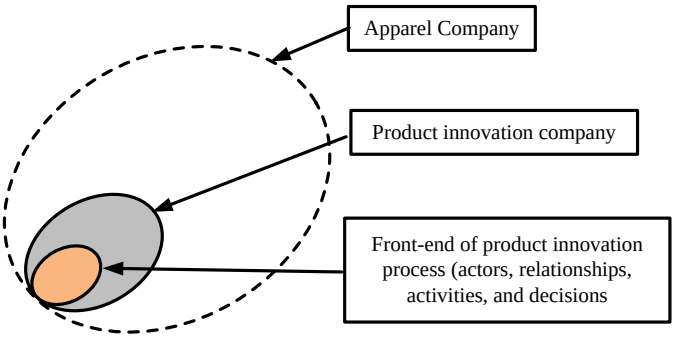


Figure 3.3: Unit of analysis of the case study

3.3.1.2 Selection of the case studies

Choosing the most appropriate sampling technique is crucial in case studies. The purposive sampling technique is often used for case study research depending on the research purpose, questions, propositions, and theoretical context (Miles & Huberman,1994). Choosing the sampling technique requires greater attention since there are other constraints related to accessibility, resources, and time availability, which may also impact on the selection of appropriate cases for the study (Miles & Huberman, 1994; Yin, 2009). Thus, the cases for the research were selected following the purposive sampling technique, based on the following criteria presented in Table 3.2.

Table 3.2:Criteria for case selection

Level of Sampling	Criteria
Case Company	• Must be involved in apparel manufacturing • Must have a culture of engaging in product innovation • Must offer innovative products • Either incremental or disruptive or both of these innovative products need to be provided by a network

The other important element to be considered in multiple case designs is the number of cases to be included, though there are no precise guidelines (Perry, 1998). Generalization is impossible with too few cases, whereas depth of understanding is difficult with too many cases (Harling,2002). However, the number of cases may depend on 'data saturation' or whether no new findings emerge (Creswell, 2011; Yin, 2009). In this case study, three companies were studied till reaching 'data saturation'. Table 3.3 provides a brief overview of the three apparel companies. The details of each company are given in Appendix 2.

Table 3.3:Overview of the three apparel companies selected for the study

Company	Company A	Company B	Company C
Year of operation	1991	2002	1992
Year of commencement of design and product development	2010	2002	2002
Nature of the involvement in innovation	Company actively engages in developing innovative apparels.	Company offers quality products and customer service through innovation.	Company offers unique solutions to its customers with the emphasis on product innovation.
Product portfolio	The company product portfolio is vast which comprises ladies, men's, and children's wear. The company produces active wear, intimates, sleep wear, and casual wear and works closely with several globally recognized brands.	The company manufactures a complete product range of woven and knit, causal, intimates, active and sports garments in women's, men's, and children's wear.	The company is one of the leading suppliers of intimates, activewear, swim wear and ultramodern performance wear. The company partners with global super brands in fashion and style.

3.3.1.3 Data gathering for the case studies

Interviews are one of the most effective data gathering techniques used in case study research (Yin, 2009). The interviews allow the researcher to gather a vast amount of data originating from various situations and roles through a question and answer process (Myer, 2009). In addition, the interviews provide understanding of perceptions of people, meanings, and definitions of situations and the construction of reality (Myer, 2009; Yin,2009). Since this study focuses on exploring the front-end of apparel innovation in depth in the actual apparel industry setting, semi-structured interviews were used for the study. Semi-structured interviews provide the flexibility to ask for secondary sources of archival and documentary evidence for data triangulation and minimization of bias caused by poor interviewee recall (Myer, 2009; Punch, 2005; Saunders et al., 2009; Yin,2009).

A list of themes of questions to be included was mapped into the research questions formulated in Chapter 4 on a conceptual framework. The initial themes were listed as incremental innovation, disruptive innovation, innovation initiation, activities, decisions, internal members, external actors, roles, and responsibilities of actors. The

interview format was prepared with the list of questions (Appendix 3- Case study interview format). Further, the interview questions were moderated based on the responses obtained in interviews with three mangers who are familiar with front-end of innovation. The individuals from the case companies were selected for the interviews based on their familiarity with the front-end innovation, and their active involvement in the process. The details of individuals involved in the case study interviews are provided in Appendix 7. The interviews were conducted on their working premises. Semi-structured interviews were recorded using a mini-disc recorder and transcribed later. Summary sheets were prepared and then turned into words.

Documentation and archival data relevant to the study were also included during the data gathering process to facilitate data triangulation as that would enhance the validity of the research.

3.3.1.4 Data analysis of the case studies

Data gathering and analysis are interrelated processes (Saunders et al.,2009). Qualitative data analysis involves three coexisting flows of activity: data reduction, data display, and drawing conclusions (Miles & Huberman,1994). The process of selecting, focusing, simplifying, abstracting, and transforming the data is known as 'data reduction'. 'Data display' is the second step of qualitative analysis, and this is an organized and compressed assembly of information, which facilitates the drawing of conclusions and action. 'Conclusion drawing, and verification' is the final step in qualitative analysis as some meaningful conclusions have to be drawn (Miles & Huberman, 1994). Since the data for these exploratory case studies was collected from three sources; semi-structured interviews, company documents, and archival records as necessary, the collected data was analyzed using the process of data reduction, data display, and conclusion drawing.

The first stage of data reduction occurred when developing the interview format according to the identified themes and areas of enquiry. The second stage of data reduction occurred when analysing the interview transcripts and other documents. The important data were categorized into themes and presented in Chapter 5 in line with

the research sub objectives formulated in Chapter 4 to provide comprehensive answers to the question: *'How do the apparel product developers arrive at decisions on innovative product offerings at the front-end of the innovation process*?'. The aggregate conclusions were drawn and flow charts, which show the logical sequence of a process or set of activities, and decisions from start to finish, were used to graphically represent the processes.

3.3.1.5 Trustworthiness of the case studies

A number of trustworthiness criteria have been proposed for qualitative research. Credibility (validity) and dependability (reliability) are the two main criteria that are of the greatest concern (Patton, 2002). Research credibility (validity) could be achieved by incorporating one or more of the following validity strategies.

- Triangulate different data sources of information by analysing facts from sources, and using them to justify the findings (Creswell, 2009).
- Use rich and detailed description to convey the findings clearly to give the reader a shared experience (Creswell, 2009).
- Clarify the bias the researcher brings to the study. In order to reduce the bias, staying on the site for a long time, interviewing more than one person, and returning to the site on more than one occasion are recommended (Miles & Huberman, 1994).

The research credibility in these case studies was assured by interviewing five people inside each of the three companies. Further, an interview schedule was defined prior to data collection and by following the standard interview questions. Besides, the interview data was verified by again checking with the interviewees to confirm the interpretations made. In addition, the trustworthiness of this research is ensured by using three sources of data, viz. interviews, documents, and archival data, which allowed for data triangulation.

The stability, accuracy, and precision of measurements are referred to as the dependability (reliability) of research, which indicates the direction for the next investigator to follow and hopefully arrive at the same findings (Tellis, 1997). The procedures followed in designing the case study and collecting the data were clearly

explained and along with that, the format of interview questions and case study protocol are provided, which can be retrieved by any investigator.

3.4 Refinement interviews and questionnaires for the step 2 of the model development

The decision model focused on incremental innovation and two of the innovation initiation approaches, namely innovation 'initiated by company' and that 'initiated by B2B customer' as mentioned in section 3.2.2. It was built by combining the findings of the exploratory case studies and the relevant literature. At step 2 of the model development, the findings of the exploration case studies were verified. Step 2 of the research addressed different types of questions as was mentioned when discussing the selection of research approach in section 3.2.2. Therefore, both qualitative and quantitative data were gathered simultaneously in step 2 of the research. The front-end decision making process and the involvement of suppliers and B2B customers were re-examined using the qualitative interview technique. The quantitative questionnaire survey aimed at detailed, and in depth analysis to verify the extent of the impact of the intended environmental factors on the front-end decision making process. Therefore, they were termed as 'refinement interviews', and 'refinement questionnaire survey'. Figure 3.4 illustrates the process of conducting step 2 of the model development.

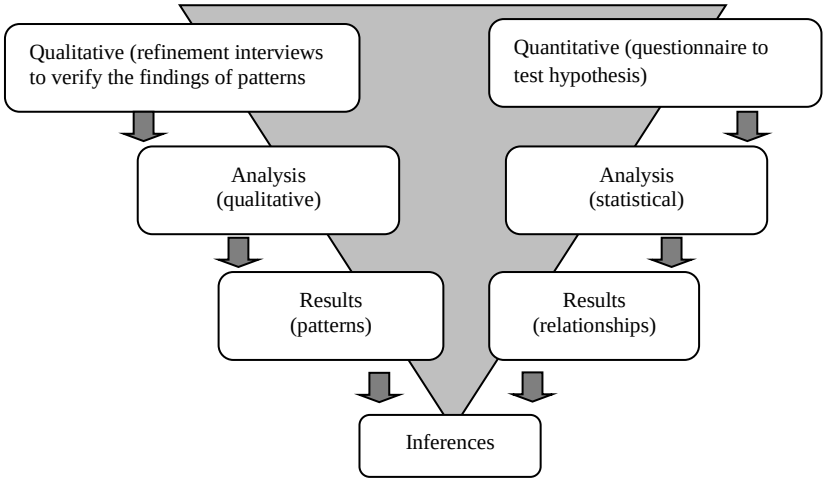


Figure 3.4: Process of conducting step 2 of the model development with refinement interviews and questionnaire

3.4.1 Refinement interviews to re-examine the front-end decision making process and interactive roles

The semi-structured face-to-face interview technique promotes the chance of clarifying doubts, ensures the proper understanding of questions, being able to read non-verbal communication, and improves the reliability of the findings of the first step of research (Saunders et al., 2009). Therefore, a semi-structured face-to-face interview technique was administered in step 2.

The development of the refinement interview format was mainly based on the findings of the case studies of step 1 of the model development in which the main emphasis was on front-end decision making process steps. The visual presentation of the two selected innovation initiation scenarios (the innovation initiated by company, and innovation initiated by B2B customer) helped to carry forward step 2 of the model development. Both of these scenarios were included in the interview format not only to provide a better understanding, but also to facilitate clarifications during interviews, and to ensure a more effective outcome (Appendix 6 - Refinement interview format).

3.4.1.1 Participants for refinement interviews

An important part of the pre-interview routine is the selection of participants for the interviews. Knowledge and experience of the participants within the particular field in which the interview is to be undertaken is very important (Rubin & Rubin, 2011). Usually, the front-end of innovation decisions includes strategy formulation. Therefore, senior managers are often directly involved as they possess substantial knowledge and experience. Thus, the participants for the interviews were selected at the organizational level following the principles of the purposive sampling technique based on the criteria indicated in Table 3.4. The purposive sampling technique provides the opportunity to choose the most suitable members from the population to provide the answers to the research questions (Saunders et al., 2009).

Table 3.4:Selection criteria of the participants for refinement interviews

The participant must be from the apparel manufacturing industry
Participant should hold a senior management position and have the authority to make decisions
Participant should have involved in the front-end of product innovation throughout the activities in one of the following or both scenarios (section 6.1): • Scenario 1- innovation 'initiated by company' (with B2B customer) • Scenario 2- innovation 'initiated by B2B customer' (by B2B customer)

There is no stipulated minimum number of participants recommended for qualitative interviews since this depends on the type of study: phenomenology, or ethnography, or other method, and the concept of 'saturation' (Creswell, 2011). Due to the complexity of analyzing data, small sample sizes are recommended for qualitative interviews, though the choice of sample size is determined subjectively (Stake, 2013). Based on the set criteria, one refinement interview was conducted to check the clarity of the questions, and refine the interview format. Six participants who were not involved in the case studies were chosen from the Sri Lankan apparel companies engaged in innovation. Taking into account the time constraints, six respondents were considered as an adequate number to achieve reliable results at this stage. The purpose of the research was explained to all respondents, and their willingness to participate in the interviews was ascertained. Interactions with the participants of the interviews took place at their respective workplaces with prior permission of the management. A brief overview of the participants of refinement interviews is provided in Table 3.5 and a detailed information is given in Appendix 7.

Table 3.5: Overview of the participants of refinement interviews

Interviewee	01	02	03	04	05	06
Current Job position/role	Open Innovation Entrepreneur	Head of Research & Innovation	Innovation Manager	Chief Executive Officer/ Director	Innovation General Manager	Technical & Innovation Director
Experience in the apparel industry (years)	10	12	15	22	19	25
Experience in apparel innovation (years)	08	08	08	09	09	11

3.4.1.2 Data analysis of refinement interviews

A pilot refinement interview was conducted with a senior manager. Based on the responses, the interview questions were moderated. Respondents were assured of the confidentiality of the information they disclosed. The interviews were tape recorded with their prior permission, and transcribed. Their opinions on the suggestions and modifications for the decision process, and the involvement of suppliers and B2B customers were recorded. The results were analyzed by employing qualitative analysis techniques, which provided the opportunity for further improvement of the developed decision models for the two scenarios stated in Table 3.4 (Miles & Huberman,1994). Since the study used a graphical representation of the process for the selected scenarios, the same graphical representations were further amended and modified, and thereafter, conclusions were drawn.

3.4.1.3 Trustworthiness of refinement interviews

The two main criteria that are of the greatest concern in the trustworthiness of the research are validity and reliability. As mentioned in section 3.3.1.5, implementing one or more strategies could increase the research validity, and reliability.

In these refinement interviews, validity, and reliability were achieved though the following procedures.

- A pilot interview was conducted to check the clarity, and to remove any ambiguity, and the interview format was moderated.
- The interview schedule was defined prior to data collection.
- A professional and friendly approach was adopted throughout the interviews.
- The interview data was verified again by checking, reviewing, and consulting with the interviewees to confirm the interpretations made.
- Procedures followed in designing, conducting, interpreting, and reporting the interviews were explained in this thesis, and the format of interview questions was made accessible (Appendix 9).

3.4.2 Questionnaire survey to re-examine the impact of the environmental factors on front-end decisions

The focus of step 2 of the research was to further examine and verify the influence of internal and external factors on the front-end decisions, as mentioned in section 3.2.2. To acquire a detailed and in depth view, and to verify the extent of the impact of internal and external factors on front-end decisions a questionnaire was administered. The questionnaire is a method for collecting and recording information about a variety of unobservable data (Bhattacherjee, 2012; Saunders et al., 2009). For example,

- To collect realistic information about people and their circumstances
- To gather straightforward information about people's behaviours
- To look at the opinions of a group of people in relation to a particular issue
- To collect 'baseline' information that can then be tracked over time to determine if changes have occurred or if changes are needed
- For remotely collecting data about a population that is too large to observe directly
- To economize in terms of researcher's time, effort, and costs in comparison to most other methods

The questionnaire format of this study consisted of a set of questions based on the findings of the case studies (step 1 of the model development) as discussed in section 3.2.2. The questionnaire was developed seeking the '*interval-level response'* and presented with a 5-point Likert scale ranging from 5 = 'very much' to 1 = 'not at all'

for all the influential factors with clear instructions (Appendix 9 - Refinement questionnaire).

3.4.2.1 Participants for questionnaire survey

Members of an innovation team are often directly involved in the front-end activities. Therefore, the participants for the questionnaire survey were selected at the organizational level based on the criteria indicated in Table 3.6.

Table 3.6: Selection criteria of the participants for questionnaire survey

The participant must be from the apparel manufacturing industry
Participant should be a member of an innovation team
Participant should have involved in the front-end of product innovation throughout the activities in one of the following or both scenarios: • Scenario 1- innovation 'initiated by company' (with B2B customer) • Scenario 2- innovation 'initiated by B2B customer' (by B2B customer)

The number of respondents (sample size) chosen to represent the population is very important for the effectiveness of the results of the questionnaire survey. Determination of sample size mainly depends on five factors (Glasow, 2005), as listed below:

- Desired degree of precision (amount of Type I error -significance level, and confidence intervals)
- Statistical power required (amount of Type II error)
- Ability of the researcher to gain access to the study subjects
- Degree to which the population can be stratified
- Selection of the appropriate units of analysis

Besides, there are several approaches to determine the sample size for a questionnaire survey (Israel, 1992) as indicated below.

- Using a census for small populations
  To achieve the desired level of precision, the entire population may be used as the sample in the case of small populations.
- Imitating a sample size from similar studies

The sample size used is the same as in previous similar studies.

- Using published statistical tables

  Use a sample size with set criteria from published statistical tables.

- Applying formulas to calculate a sample size

  Considering the required precision, confidence, and variability, calculate the necessary sample size.

Two strategies were integrated together in this study to decide the most appropriate sample size. One strategy used a published statistical table (Krejcie & Morgan, 1970) and the other used a formula (Yamane,1967 as cited in Israel, 1992).

$$n = \frac{N}{1 + N(e^2\ )} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

n - the sample size, N - the population size, e- the level of precision

Assuming that the total number of members of the team involved in the front-end is 60, and the level of precision is 0.05 (95% confidence level, e= 0.05), the sample size for the study was determined as 52 respondents within the innovation teams of apparel product developers who are currently engaged in incremental innovation. The questionnaires were hand delivered to each respondent to ensure receipt of the questionnaire.

3.4.2.2 Data analysis of questionnaire survey

A pilot study was conducted to ensure that the questions were clear and easy to answer, but also to fix any questions that participants might have found difficult to comprehend. The questionnaire was sent out to six people actively involved in the innovation process of six different companies as the pilot study. The data of the questionnaires were analyzed using the computer based statistical software program SPSS version 20. The personal information of respondents was analysed item by item, using univariate analysis, which includes descriptive statistics dealing with frequencies, ratios, means, and standard deviations. Spearman's *rho* correlation was employed to analyze the data related to factors in this study. Spearman's *rho* correlation is applied for measuring the strength of the relationship between two variables when the data is comprised of at least one ordinal (rank order) scale, and the

sample size is too small (Elliott & Woodward, 2007). With the use of Spearman's *rho* correlation, the significant individual factors within each main factor relating to front-end decisions in incremental innovation were identified (Appendix 8- Individual factors used to measure each main factor). The impact of the factors on front-end decisions was quantified using linear regression analysis. The hypotheses were tested by means of the Linear regression coefficients and regression estimates.

3.4.2.3 Validity and reliability of questionnaire survey

The two concepts of validity, and reliability are indispensable for a successful survey study as these qualities can testify to its appropriateness, meaningfulness, consistency, and correctness. Lack of validity and reliability may increase the chance of errors in a study (Saunders et al., 2009). Pilot testing, test-retest, and using the statistical tool Cronbach's alpha are common approaches for evaluating the reliability and validity of questionnaires (Saunders et al., 2009). In line with that, and as mentioned in section 3.3.3.2, a pilot questionnaire survey was conducted on six respondents. The reliability of the questionnaire survey was confirmed by Cronbach's alpha coefficient values that exceeded 0.7 (Appendix -10).

3.5 Research process applicable to the model validation

Validation is a process of judging the suitability or fitness of the model or framework to serve its intended purpose (Inglis, 2008). Various validation techniques are proposed in the literature (Inglis, 2008).

- Reviewing the research literature
- Undertaking survey research
- Undertaking empirical research
- Drawing on case studies
- Conducting pilot project
- Delphi method - seeking input from experts

According to Inglis, (2008), by simply 'reviewing the research literature', a framework or a model can be validated since it can assist with the identification of factors and principles, and provide strong evidence of the suitability. 'Undertaking empirical

research' is another validation technique to provide the confirmation of fitness of the framework or the model (Inglis, 2008). A survey is another option which can be done to gather data to assess the appropriateness of a model. According to Inglis, (2008), the model can be practically applied in a work environment while monitoring performance to verify its suitability. Case studies is a practice that is very similar to running a pilot project for model validation (Inglis, 2008; Yin, 2009). Considering the cost involved in the processes, and limited availability of resources and time, the above methods were not selected as the appropriate processes of validation.

The 'Delphi method' was identified as the most appropriate technique to validate and refine the developed Meta decision making model due to four reasons.

- The Delphi method is the most widely accepted, adaptable and applied method for model validation in a variety of research areas (Hsu & Sanford, 2007; Inglis, 2008; Nashir et al., 2015; Yousuf, 2007).
- With professional knowledge acquired over a long period of time, a panel of experts can provide many meaningful opinions and suggestions to further develop and refine the model (Hsu & Sanford, 2007; Inglis, 2008).
- It provides an opportunity to acquire a convergence of opinions from experts in the apparel innovation in the arena of international business.
- Time limitations.

The research design process of model validation with the Delphi method is discussed further in detail.

3.5.1 Modified Delphi method for model validation

The Delphi method was originally used in the 1950s by the RAND Corporation on behalf of the United States Air Force to overcome military issues (Hsu & Sanford, 2007). The Delphi method is "a procedure to seek ideas from experts, which is designed to achieve a convergence of suggestions and opinions on a particular real-world problem" (Hsu & Sanford, 2007, p.1). Delphi is a suitable method for developing, identifying, forecasting, and validating research (Hsu & Sanford, 2007; Nashir et al., 2015; Yousuf, 2007). The Delphi method possesses several specific

characteristics (Hsu & Sanford, 2007; Nashir et al., 2015; Yousuf, 2007) as listed below:

- Simple to use
- The experts do not require meeting physically in one meeting
- Performed over a series of rounds – repeated questionnaires/ interviews
- Provides feedback from previous round
- Does not depend on statistical sampling
- Flexibility of applying qualitative, quantitative, or mixed data gathering
- Advanced mathematical skills are not necessary for design, implementation, and analysis

Besides the above characteristics, one of the recognized benefits of conducting 'Delphi' is the possibility of modifying it to suit the circumstances and research questions (Nashir et al., 2015).

In the conventional Delphi method, the subject under discussion is expected to be explored through an open-ended questionnaire, since the study may start with little or no background literature or information (Avella, 2016). However, in the 'Modified Delphi' method, the study can be started with a structured questionnaire. In the Modified Delphi method, the research can be initiated with a various method to identify the initial alternatives for the questions of the researcher and the results are presented to 'experts' for approval (Avella, 2016). The recognized primary benefits of conducting the Modified Delphi method are the possibility of improving and refining the previously developed work further, ability to acquire input from geographically spread individuals, and less time spent on reaching a consensus (Avella, 2016; Nashir et al., 2015). Thus, the 'Modified Delphi' method was chosen as the best technique to validate the Meta decision making model in this study, since it was developed using the findings of the case studies, literature, refinement interviews, and questionnaire survey.

3.5.2 Process of conducting Modified Delphi for model validation

The study design process comprises four main steps: selection of experts, setting up validation rounds, data gathering process, and data analysis (Hsu & Sanford, 2007; Nashir et al., 2015; Yousuf, 2007).

3.5.2.1 Selection of experts for model validation

The most important step is the identification and selection of suitable 'experts' in the field of study to achieve a quality outcome (Hsu & Sanford, 2007). 'Expert' is defined as,

> "A professional who has acquired knowledge and skills through study and practice over the years, in a particular field or subject, to the extent that his or her opinion may be helpful in fact finding, problem solving, or understanding of a situation" (Business Dictionary, n.d.).

Determining the number of 'experts' is an important requirement too (Hsu & Sanford, 2007; Yousuf, 2007). The number is not as important as the quality of the experts (Nashir et al., 2015). The literature highlights that there is no recommended standard statistical sampling technique to decide the number of experts for the Modified Delphi method, though several suggestions on determining the ideal number of experts have been presented in previous research (Avella, 2016; Hsu & Sanford, 2007; Nashir et al., 2015; Yousuf, 2007).

The experts who have practical working experience, and expertise in helping, managing, and advising in the apparel product innovation process were considered as ideal persons for seeking advice on more outward globalized matters in this research study. Consequently,

- those who are actively involved in the innovation process, and contributing to apparel innovations and visiting Sri Lanka time to time as B2B customers from different countries,

  and/ or

- expatriates who are currently working in Sri Lanka as consultants or senior managers and directly involved and contribute to managing innovation,

were decided as suitable experts. The services of such five experts, who each had more than 15 years' experience in apparel innovation were solicited after explaining them the purpose of the study. Their willingness to participate was ascertained. Table 3.7 provides a brief overview of the five experts who involved for model validation. Further details of the five experts are provided in Appendix 13.

Table 3.7: Overview of the experts involved for model validation

Expert	1	2	3	4	5
Current job title/ country of work at present	Chief Executive Officer (SL)	Business Director (SL)	Innovation & Design Director (SL)	Freelance Consultant (UK)	Deputy General Manager (SL)
Experience in the apparel industry (years)	34	22	20	35	28
Experience in the apparel innovation (years)	18	16	17	21	16

3.5.2.2 Data gathering technique for model validation

In this study, the opinions were gathered through structured face-to-face interviews (Appendix 11- Validation interview format). The opinions were mainly expected for the degree of clarity, practicality, usefulness, appropriateness, and overall reliability of the developed front-end decision model on incremental innovation in apparel (Appendix 12- Indicators to evaluate the fitness of the Meta decision model). The questions of the structured interviews were designed seeking two possible responses: yes or no (agree/ disagree). Before proceeding to the validation study, the wording and general appearance of the interview format with the visual presentation of the two scenarios of the front-end decision making process were verified through an interview with an expert.

3.5.2.3 Data analysis technique for model validation

In the Modified Delphi method, both qualitative and quantitative data analysis are applied (Hsu & Sanford, 2007; Nashir et al., 2015; Yousuf,2007). Therefore, the data for model validation of this research study was gathered through structured interviews

and analyzed both quantitatively and qualitatively. The opinions of the experts on the reasons for the agreements or disagreements with the Meta model were analyzed qualitatively, and their proposals for modifications were recorded on each aspect. The agreements or disagreements on the degree of clarity, practicality, usefulness, appropriateness, and overall reliability of the developed front-end Meta decision making model were analysed quantitatively item by item, and using univariate analysis, which involves descriptive statistics dealing with percentages.

3.5.2.4 Validation rounds for model validation

Typically, the Delphi method employs a number of iterations to achieve a final outcome, where each round is taken as the input for the next (Avella, 2016; Hsu & Sanford, 2007; Nashir et al., 2015; Yousuf, 2007). The number may be varied according to the main focus of the study, but generally a small number, such as one or two rounds are sufficient in some studies to reach an agreement when the level of agreement is not increasing any more (Avella, 2016; Hsu & Sanford, 2007). Only one round was conducted in this study to refine the model since the developed decision model was based on a series of iterations (using the findings of the case studies, literature, refinement interviews, and questionnaire survey) (Avella, 2016; Hsu & Sanford, 2007).

3.6 Summary of the chapter 3

This chapter extensively discussed the rationale behind the methodological approaches of two phases of this study. The first phase aimed at developing a decision model, and the second phase was to validate the model.

The mixed method approach was chosen for the model development phase, which involved two steps (phase 1). The first step was to explore the front-end decision making process of apparel innovation in the current apparel industry context. Multiple case studies were selected as appropriate to follow step 1 of the model development. The process for conducting case studies was discussed, and the unit of analysis for the study was identified as the front-end innovation process. The semi-structured interview protocol was chosen as the primary data collection instrument. The brief

details of the three apparel companies in Sri Lanka involved in the study were provided.

At step 2, the focus was to re-examine and verify the findings of the case studies. Step 2 of the research addressed three questions. The semi-structured interview technique was chosen to re-examine the front-end decision-making process, and the involvement of suppliers and B2B customers. The quantitative questionnaire survey was selected to acquire an in depth view, and to verify the extent of the impact of the intended environmental factors on the front-end decision making process. Both refinement interviewing, and questionnaire procedures were discussed.

The second phase of the research focuses to validate the Meta model (phase 2). The Modified Delphi technique was chosen for model validation. The process of conducting Modified Delphi was discussed, and a brief description of five experts was provided. The Chapters that follow discuss the outcome of the research process.

CHAPTER 4

CONCEPTUAL FRAMEWORK

This chapter discusses the conceptual framework which was developed to explore the front-end decision making process of apparel product innovation in the current apparel industry. A conceptual framework describes the main topics to be studied, key constructs, and the assumed relationship between them.

The chapter begins by probing into the key research question for exploration, defining 'innovation product offering', and emphasizing the importance of having a thorough understanding of the front-end decision situations encountered when initiating an innovation. The four sub questions which were framed to answer the key research question are discussed in detail. The first sub question focused on identifying the typology of innovative offerings: incremental, and disruptive. The second question was to identify the key decisions in connection with innovative offerings. The third question focused on identifying the involvement of internal, and external actors, while the fourth question was to understand the relationship between innovative offerings, decisions, and actors. The conceptual framework that illustrates the relationship between the four sub questions is described at the end of the chapter.

4.1 Research questions for exploration of front-end decision making process

Exploring how the apparel product developers arrive at the decisions on innovative product offerings will provide significant insight into front-end decision situations encountered when initiating an innovation. Though there is no universal or specific definition for the term 'innovative product offerings', dismantling the term 'innovative product offerings' into its component parts offers an opportunity to provide a clear and sensible meaning and understanding. A new product that is obviously different from the previous one and/or a modification of the existing one is an 'innovative product' (Herrmann et al., 2006). The latter part of the term 'offering' is defined as "any physical good, service, information, or combination of these that a company can offer to its customers" (Brax, 2005, p.143).

The following key research question was formulated to explore the front-end decision making process of apparel innovation in the current apparel industry setting with the intent of providing a descriptive account of it from a procedural point of view.

How do the apparel product developers arrive at decisions on innovative product offerings at the front-end of the innovation process?

To answer the above question comprehensively, four sub questions were framed.

RQ1 - What types of innovative products (incremental or disruptive) are offered by apparel product developers?

RQ2 - What are the main decisions involved in the front-end to determine the type of innovative offerings (incremental or disruptive)?

RQ3 - Who are the key actors or people involved (internal and external) in the front-end of the apparel innovation process in connection with different product offerings (incremental or disruptive)?

RQ4 - How are the innovative offerings, key decisions, and actors, interlinked within the front-end of the innovation process in connection with different product offerings (incremental or disruptive)?

These research questions are discussed in the following four sub sections with relevant details pertaining to important aspects associated with these four sub questions.

4.1.1 Research question 1

The conceptualization of product innovativeness typologies or offerings was basically based on the degree of novelty, or the newness associated with them. The three dimensions coupled with newness, 'new to whom' (for the market, the customer, industry, or company itself), 'new in what way' (in technology, aesthetic appearance, or function) and 'new to what extent' (minimal/low or high) are the key drivers used to decide the degree of novelty or innovativeness of a product (Herrmann et al., 2006; Johnson, 2007; Moorman & Miner,1997; Roseno, 2005).

Figure 4.1 graphically illustrates the conceptualization of product innovativeness based on the 'new to whom' dimension.

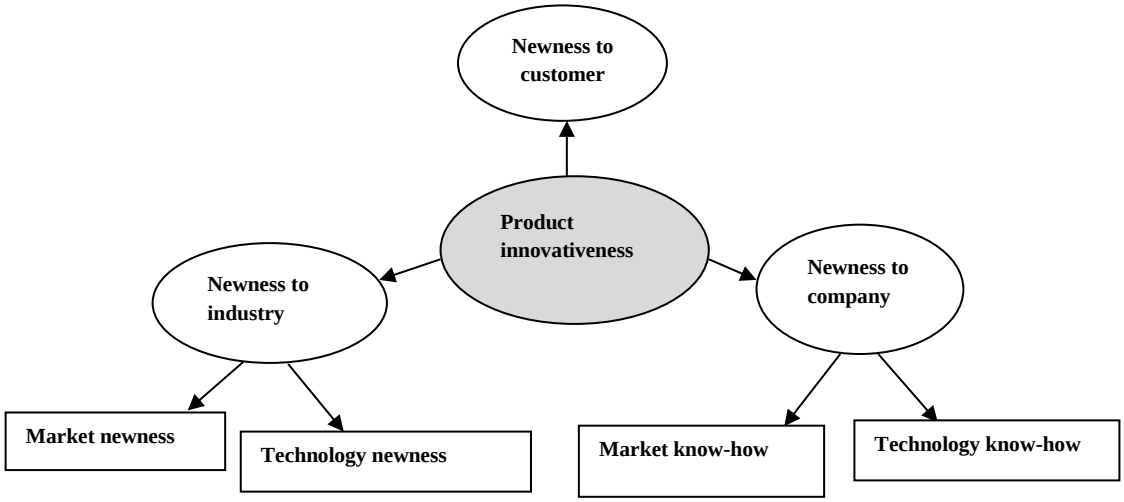


Figure 4.1: Product innovativeness - 'new to whom'

Source:(Garcia & Calantone, 2002)

Accordingly, several product innovation typologies are proposed by previous research: incremental, new-to-the firm, company-related, new-to-the-market, customer-related, market breakthrough, technology breakthrough, really new, new-to-the-world, and radical or disruptive (Garcia & Calantone,2002; Johnson, 2007; Moorman & Miner,1997; Chandy & Tellis, 2000). An overview of the literature highlights two main product innovation typologies most frequently discussed and referred to by academia: incremental, and disruptive. These two main product innovation typologies: incremental and disruptive, are discussed below.

4.1.1.1 Incremental innovation

Several definitions have been formulated by different researchers to describe how they define, and understand the term 'incremental innovation'. Garcia and Calantone (2002, p.123) define incremental innovative products as: "they only provide new features, benefits, or improvements to the existing technology in the existing market." As Tidd and Bessant (2013) infer, "do what we do better" is the meaning of incremental product innovation. According to Rampino (2011), the innovation related to changes in product recognition (change in product's physical appearance) and/ or modification of its usage (adding new features or functions) as compared to the existing products is 'incremental innovation'.

4.1.1.2 Disruptive innovation

There are several alternative definitions, and terms for disruptive innovation, too in the literature. The terms 'discontinuous' and 'radical' are often used to describe disruptive innovation. In general, the definitions emphasize the major changes in the product (Henderson & Clark, 1990; Johnsen et al., 2012; Schillström & Sellman, 2016). As Tidd and Bessant (2013) infer, "do something differently" is the meaning of disruptive innovation. Thus, a disruptive (radical) product innovation is defined as: "an original product that incorporates new technology from the company's perspective, with the potential to create new markets, or drastically change existing markets" (Schillström & Sellman, 2016, p.3). According to Rampino (2011), changes in the emotional and symbolic aspects of a product and/ or variations of a product from its formal archetype are 'disruptive product innovation'. Thus, 'disruptive innovation' is a technological breakthrough resulting in a significant improvement in function and features compared to the archetype, which can create new market and product categories. The i-phone and bag-less vacuum cleaner are some examples of disruptive innovations (Muckersie, 2016). The characteristics of incremental, and disruptive (radical) product innovation are presented in Table 4.1.

Focusing mainly on the two main types of product innovations: incremental, and disruptive, the following research question was formulated.

RQ1 - What types of innovative products (incremental or disruptive) are offered by apparel product developers?

Table 4.1: Characteristics of incremental and disruptive (radical) product innovation

Characteristics	Incremental product innovation	Disruptive (Radical) product innovation
Technology changes	• Minor changes in technology, and product. • Limited impact on technological systems.	• Substantially different technology. • Can create new technological systems or completely new products.
Impact on the market	• Low impact on market. • Low incremental customer benefit.	• High impact on market. • Makes existing products obsolete or unnecessary. • Threatens to destroy existing market. Creates new industry. • High degree of customer benefit. • Can either change the balance of power in the existing market or create a new market that has not existed before.
Risk level	• Low	• High
Outcome for firms	• In case of market niche, firms can realize benefits from incremental innovation relatively easily. • Firms can gain substantially in the long term if they continuously introduce incremental innovations	• The crucial basis for subsequent innovations based on the original innovation. • Successful innovation can make firms grow significantly. • Failed innovation can cause major setbacks. • It can create high return on investments. Can use radical innovation to enter a market.
Requirements	• Less resources and effort are needed.	• More resources and effort are needed.
Impact on environment	• Low impact on global economy, industry, technology, and society.	• High impact on global economy, industry, technology, and society.

Source:(Chaochotechuang, 2016)

4.1.2 Research question 2

The decisions involved in both incremental and radical product innovation originate at the front-end phase of the innovation process when the innovation project is first conceived, and well before the actual implementation (Khurana & Rosenthal, 1998). The front-end decisions embedded in each process activity, such as budget, timeline, resources, and the procedure for each of the categories of innovation, incremental and disruptive, are vital to enhance the performance of the entire innovation process (Khurana & Rosenthal, 1998; Smith & Reinertsen, 1998; Veryzer,1998). In addition, adopting an appropriate management approach suitable for each of the categories of innovation, incremental and disruptive, would be prudent at the very beginning of the innovation process (de Sousa Mendes & de Toledo, 2011). This will overcome the

problems related to product requirements, technology, resources, expertise, and market orientation.

Some researchers have identified certain procedural differences between the two categories of incremental and disruptive at the front-end phase of the innovation process (Veryzer,1998) while most researchers have not distinguished any significant differences between these two categories (Verworn et al.,2008). However, more effort is needed to identify the opportunities and establish suitable technologies during the process to achieve disruptive innovation due to high level of uncertainties (Veryzer, 1998). Further, estimating the market size is difficult during the front-end of disruptive innovation (Verworn et al.,2008). As a result, extra activities need to be carried out in the disruptive innovation process to match the technologies to market opportunities (de Sousa Mendes & de Toledo, 2011; Veryzer, 1998).

However, the extent to which the front-end decisions differ among these incremental and disruptive is not known yet. A deeper understanding of the main decisions to be taken at the front-end, and the differences in front-end activities and decisions for each of the categories of innovation would be helpful to initiate and manage the innovation processes efficiently to develop products, be more successful in the market, and ultimately lead to competitive advantage (Reid & Brentani, 2004;Veryzer,1998). Therefore, it is important to explore the activities and decisions at the front-end to better understand the main decisions involved, and the procedural differences between the two categories; incremental and disruptive, at the front-end phase of the apparel innovation process to provide significant insight. The following research question aims at identifying the key decisions to be made in the front-end of apparel product innovation in connection with different types of product offerings (incremental or disruptive).

RQ2 - What are the main decisions involved in the front-end to determine the type of innovative offerings (incremental or disruptive)?

4.1.3 Research question 3

Recent studies outlined by researchers have reinforced the idea that stakeholder networks, which comprise internal and external stakeholders, serve as enablers of innovation, as presented in Table 4.2.

Table 4.2:Actor network as enabler of innovation

Source	Concept or idea
Hippel (1988)	The concept "sources of innovation" suggests that firms should use external sources also to provide material for their innovation processes.
Johnsen & Ford (2000)	Innovation is increasingly recognized as being the result of the combination of different branches of knowledge and expertise that exist within different organizations.
Rosell & Lakemond (2012)	Innovation is not exclusively a company's internal matter but is increasingly generated in collaboration with external firms.
OECD (2010)	Innovation rarely occurs in isolation; it is a highly interactive and multidisciplinary process that increasingly involves collaboration with a growing and diverse network of stakeholders, institutions, and users.
Johansson & Mollefors (2013)	By integrating the different actors involved in the new product development and innovation process, both information and knowledge can be added to the firms' resources.
Nieto & Santamaria (2007)	The effective management of alliances will reflect better results in terms of degree of novelty in product innovation.

Primarily, the R & D team of a firm is the internal stakeholders (Kahn & Lodi, 2010; Willoughby & Galvin, 2005). Involvement of a multifunctional R & D team at the front-end of innovation is important for communication, mutual understanding, and to build relationships, enhance ideas, and technology transfer between functional groups (Kim & Wilemon,2003).

The major external stakeholders are the customers, the suppliers, the competitors, and various knowledge systems, universities, research institutions, and outside consultants (Kahn & Lodi, 2010; Willoughby & Galvin, 2005). Benefits associated, and the mode of involvement of external stakeholders during the innovation have been discussed in previous studies (Dahan & Hauser, 2002; Ford et al., 1998; Kahn & Lodi, 2010; Kim & Wilemon, 2003; Piller & Ihl, 2009).

Understanding the needs of the customers is important to better match the developed product with their needs, and reduce development time, cost, and market failures (Dahan & Hauser, 2002; Piller & Ihl, 2009). The unmet customer needs can be

identified by getting the customers' involvement in the innovation process either by explicit means or by listening in the domain (Dahan & Hauser, 2002). Three main modes or techniques of customer involvement in the product innovation process are (Dahan & Hauser, 2002; Piller & Ihl, 2009),

- 'To/ for customers' ('listen into') - It is expected to innovate on behalf of the customers using information from various input channels to explore their needs, where the risks, and uncertainties are to be at the highest level. Customer is a 'passive actor' in this mode of involvement.
- 'With customers' ('ask') - Ask customers for input/ participation in innovation or propose different solutions, and explain the same to get their opinion. Customer is involved as a 'facilitator' in this mode of involvement.
- 'By customers' ('build') - Customers are expected to initiate the innovation, and become actively involved and contribute the knowledge to build the product. Customer is involved as a 'collaborative/integrative' partner in this mode of involvement.

The suppliers can provide access to external information that complements the company's internal knowledge base to improve product and process quality, to shorten the development time, and to reduce technological risks (Kahn & Lodi, 2010). Therefore, the suppliers too are important external stakeholders who can work together with the manufacturing organization in the innovation process (Ford et al., 1998; Kahn & Lodi, 2010). Basically, there are three different modes or techniques of suppliers' involvement in innovation (Ford et al., 1998; Kahn & Lodi, 2010).

- 'To the supplier'- The firm is expected to do all the innovation. The product design, and specifications are given to the supplier to procure the materials. This relationship is identified as a transactional relationship.
- 'With the supplier'- The supplier is requested to provide his/her new findings, and special materials to enhance the value of the product, and to increase the cost benefits. This relationship is known as facilitative.
- 'By the supplier'- The supplier is expected to initiate the innovation, and be actively involved to increase the value of the product. Supplier participates as a 'collaborative/integrative' partner in this mode of involvement.

Involvement of external groups such as universities, consultants, research institutes, and other agencies is another important feature in the front-end of innovation (Kim & Wilemon, 2003). Competitors too are important at the front-end of innovation to reduce the level of fuzziness, to explore new markets, and to develop new technologies jointly, to maximize the resources of each group due to mutual exchanges, and to ensure a more efficient outcome for all parties (Kim & Wilemon, 2003).

The involvement of internal and external stakeholders in innovation is illustrated in Figure 4.2 (Kahn & Lodi, 2010). The company is central to the model, and the middle of the model indicates the internal stakeholders (R&D team of a firm). Suppliers, customers, competitors, and other sources (university researchers, and consultants) can all contribute to innovation. They are external stakeholders. The rectangles outside depict external stakeholders. The arrows show the flow of information and knowledge. The techniques or modes of customer and supplier involvement (by, with, and to) are indicated.

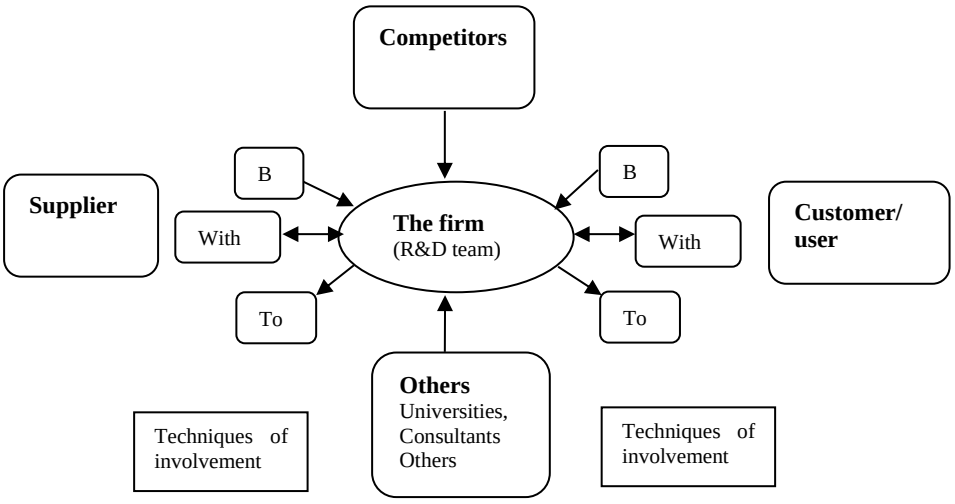


Figure 4.2:Stakeholders or actors involved in innovation

Source: (Kahn & Lodi, 2010)

However, the involvement of internal and external actors in the activities and decisions at the front-end of innovation for incremental and disruptive typologies is not known yet. Thus, it is important to explore the network structure aspects of front-end innovation in order to understand the differences and similarities across the network structure that may vary with the different innovative offerings in the apparel context.

The following research question was proposed to explore the network structure at the front-end for innovative offerings.

RQ3 - Who are the key actors or people involved (internal and external) in the front-end of the apparel innovation process in connection with different product offerings (incremental or disruptive)?

4.1.4 Research question 4

The previous research questions deal with the nature of innovative offerings, (incremental and disruptive), key decisions involved, and the structure of the actor network during the front-end respectively, which are closely related and intertwined to collectively address the main question of the research. In order to understand the linkages across the areas that enable the firms to offer innovative products to the apparel market, the following research question was formulated. The answer should support understanding the demands imposed by the innovative offerings in the structure, and relationships of the network and decision making process at the front-end of innovation:

RQ4 - How are the innovative offerings, key decisions, and actors, interlinked within the front-end of the innovation process in connection with different product offerings (incremental or disruptive)?

In line with the understanding that the innovative offerings (incremental and disruptive), key decisions involved, and the structure of the actor network during the front-end are interlinked, the following conceptual framework (Figure 4.3) was developed for illustrating these linkages.

4.2. Conceptual framework

A conceptual framework is the researcher's own portrayal of the problem, setting out the focus, content of the research and boundaries of the work (Miles & Huberman, 1994). A definitive statement for it is "a conceptual framework explains, either graphically or in narrative form, the main things to be studied, the key factors, constructs or variables, and the presumed relationships among them" (Miles & Huberman, 1994, p.18).

The conceptual framework that provides the structure for the whole study can be based mainly on relevant literature or on the integration of literature and personal experience (Miles & Huberman,1994; Tamene, 2016). The latter method was employed for this research to develop the conceptual framework. In light of the research questions presented in the above sections, the conceptual framework of the explorative part of the study is graphically illustrated in Figure 4.3.

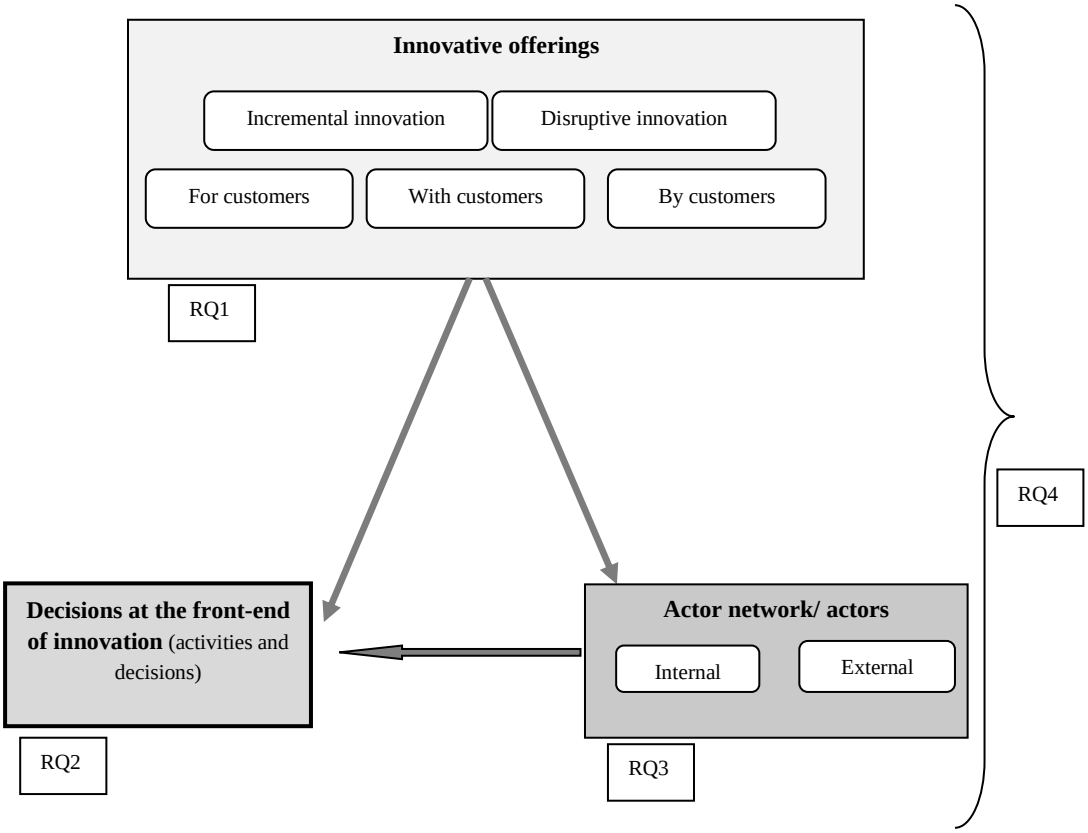


Figure 4.3: Conceptual framework for the exploration

The rectangles and the brackets in Figure 3.3 show the respective areas for each research question (*RQ1-RQ4).* The arrows in between the rectangles in the framework refer to the link between innovative offerings, decisions, and actor networks or actors. In addition, the relevant areas for each research question are indicated. Research question 1 refers to the area indicated by the innovative offerings, research question 2 refers to the key decisions, and research question 3 refers to the actor network area. Research question 4 encompasses the entire framework, since research question 4 is aimed at understanding the relationship between the innovative offerings (incremental

and disruptive), key decisions involved, and the structure of the actor network during the front-end of innovation.

For the innovative offering area (*RQ1),* two types of offerings are considered: incremental, and disruptive. In addition, based on the modes of customer involvement, three categories of innovative offerings are taken into consideration: for B2B customers, with B2B customers, and by B2B customers. This research considers only the B2B context because apparel manufacturers reach end consumers via apparel brands (B2B customers), who make decisions on fabrications, colour, and style details (section 1.1.5). In addition, the objective of the study (section 1.3) was to develop a model incorporating 'co-creation of value in the B2B context'. As discussed in section 2.4, B2B purchasing is commonly viewed as a collaborative effort between manufacturers and buyers to achieve a win-win outcome from the relationship. For the key decision area *(RQ2),* the activities and decisions are considered within the front-end of innovation. For the actor network structure (*RQ3),* two main actors: internal team (company staff members) and external partners (B2B customers, and suppliers) are considered. For research question 4 *(RQ4),* it is necessary to first identify the above three areas of inquiry which lead to the explication of relationships among them.

4.3 Summary of the chapter 4

The conceptual framework for this research was based on both the relevant literature, and the researcher's personal knowledge to explore the front-end decision making process of the apparel product innovation in the current apparel industry. The term 'innovative product offering' was described dismantling into two parts: 'innovative products' and 'offerings'. The formulated key research question was *"How do the apparel product developers arrive at decisions on innovative product offerings at front-end of the innovation process*?". Four sub questions were framed to answer the key research question. The first sub-question sought to identify the typology of innovative offerings provided by the apparel product developers. This was focused mainly on two types of innovation: incremental, and disruptive. The second sub question was to identify the key decisions and activities within the front-end of

innovation in connection with innovative offerings. Identifying the role of internal and external actors in the front-end of innovation was the third sub question. Members of the company were regarded as internal actors, whereas B2B customers and suppliers were regarded as external actors. The fourth sub question sought to understand the connection between innovative offerings, decisions, and actors.

This conceptual framework was the cornerstone for developing a decision making model in the front-end of apparel product innovation. The researcher explored this conceptual framework within the actual apparel industry setting in Sri Lanka, and the findings are presented in Chapter 5.

CHAPTER 5

EXPLORATION OF THE FRONT-END DECISION MAKING PROCESS

Exploratory case studies were conducted to identify how the apparel product developers make decisions at the front-end of the innovation process, as the main research question formulated in section 4.1 was to explore and identify '*how the apparel product developers arrive at decisions'*. Case studies promote close interactions with participants who have experienced real-life situations, capture the essence of dynamic business practices, and develop comprehensive and in-depth understandings.

Three apparel companies engaged in apparel product innovation in Sri Lanka were studied (Appendix 6 - Companies studied) which were selected based on four criteria (must be involved in apparel manufacturing, must have a culture of engaging in product innovation, must offer innovative products, and the innovative products need to be provided by a network). As stated in section 3.3.1.1, the unit of analysis for these case studies was the front-end product innovation process (activities, decisions, actors, and interactive relationships). With prior identified themes, the data of case studies were collected mainly through semi-structured interviews as mentioned in section 3.3.1.3 (Appendix 3 - Case study interview format). Five individuals who are actively involved in innovation activities, and hold senior management positions in each company were interviewed at the organizational level (Appendix 7 - Case study data base). Documentation (profiles, process charts, relationship documents, and meeting minutes) were also referred with the intention of gathering more information. The data collected from the three companies was analyzed in detail via keywords, and common pattern identification, and organized around the priori identified themes. The organized data within each theme was categorized again under sub-themes (Appendix 5 -Case study results). Conclusions were drawn to address the research questions formulated in section 4.1. The findings of the exploratory study across three companies are presented in this chapter in line with the order of the research questions formulated in Chapter 4 on conceptual framework development.

5.1 Types of innovative offerings in apparel

The first objective of the exploratory case studies was to identify and understand the nature of the innovation provided by apparel manufacturers, and the formulated research question in section 4.1.1 was

RQ1 - What types of innovative products (incremental or disruptive) are offered by apparel product developers?

As revealed from the three apparel manufacturing companies, the apparel products made in Sri Lanka reach to end consumers through apparel brands. These apparel brands are owned by world reputed international companies. The importance of focusing on value-added innovative apparel products has been realized by Sri Lankan apparel manufacturers to successfully survive in the market by fulfilling the demands of apparel brands. The Director of Company A (Case study interviewee a- 1) affirmed the above by stating that,

> *"In Sri Lanka, we do not have direct competitors. We are not selling our products directly to consumers. We are working with apparel brands to reach the global market. But nowadays, apparel brands are demanding. Because they have competitors, and they need to focus on their end consumers' preferences. Brands are very concerned about innovative ideas to stay competitive in the market. At the moment, we are working with 12 world recognized apparel brands. Therefore, we need to first satisfy our brands by providing value-added innovative products."*

Further, it was revealed through the findings of the case study interviews, Sri Lankan apparel manufacturers are working for incremental product innovations. The Innovation Manager of Company C (Case study interviewee c-1) expressed his thoughts on incremental product innovations,

> *"In practice, I would say about 90-95% are small moderations for the existing products or upgrading the functionality, and appearance of the product. This is practically easy, and the risk is less. Within a considerable time period, we can come up with good solutions".*

It confirmed that incremental innovations are being made to upgrade and enhance both the aesthetic (physical appearance) and functional (utility, and operation of the products) values of the product categories.

As per the findings of the case study interviews, Sri Lankan apparel manufacturers are working on disruptive product innovations too. The Innovation Director of Company C (Case study interviewee c-2) expressed his view on this.

> *"We are working on achieving significant improvement in the functions of the products. We incorporate novel methods, techniques, and technologies into the apparel industry, and we borrow technologies from different fields, and disciplines too".*

It confirmed that the disruptive apparel product innovations focus on enhancing the functional aspects of the products, most of which incorporate the evolving technologies in the apparel industry and allied industries.

Sri Lankan apparel manufacturers work hand in hand with apparel brands (B2B customers) from the beginning of their innovation process. The Chief Operating Officer of Company B (Case study interviewee b-1) stated:

> *"As everyone knows, the end consumer is the king. But without apparel brands, it is very difficult to reach end consumers in a country like Sri Lanka. The global market's competition is high. We sell our products through reputed apparel brands. We have to work with them from the very beginning".*

Therefore, the incremental and disruptive innovation were further analysed with respect to the mode of B2B customer involvement. In exploring the mode of customer involvement, three modes identified in section 4.1.3 and 4.2 were considered: 'for B2B customers', 'with B2B customers', and 'by B2B customers. In innovation 'for B2B customers', the company initiates the innovation on behalf of the customers. Though the company initiates the innovation 'with B2B customers', the customers are involved in the innovation process. In innovation 'by B2B customers', customers initiate the innovation (Dahan & Hauser, 2002; Piller & Ihl, 2009). Organizing, and categorizing the keywords under the above three sub-themes during data analysis of case study interviews, the mode of customer involvement was identified at the front-

end of apparel innovation. The findings show that the type of innovations practiced by these companies are aligned with the three categories identified in section 4.1.3 and 4.2: 'for customers', 'with B2B customers' and 'by B2B customers'. All three categories of innovation were identified in the incremental innovation. In the disruptive innovation, only 'with B2B customers' category was identified.

As per the findings of the case study, Company C is working for both incremental and disruptive product innovations and only incremental innovations are being carried out by Company A and B. Company A is working on two categories of innovative offerings 'for customers', and 'with B2B customers. However, both Company B and C produce all three categories in the incremental innovation. The innovations offered by the three case study companies are presented in Table 5.1. Column 1 shows the three apparel companies studied. The innovative offerings; incremental and disruptive, are presented in the other two columns. Inside each innovative offering, the three categories of innovation with respect to the mode of B2B customer involvement; 'for customers', 'with B2B customers' and 'by B2B customers' are indicated.

Table 5.1: Innovative products offered by the apparel product developers

Company	**Incremental innovation**			**Disruptive innovation**		
	For customers	With B2B customers	By B2B customers	For customers	With B2B customers	By B2B customers
A	√	√				
B	√	√	√			
C	√	√	√		√	

5.2 Key decisions involved in the front-end

The second objective of the exploratory case studies was to identify the key decisions made at the front-end with respect to innovative product offerings, as per the formulated research question in section 4.1.2.

RQ2 - What are the main decisions involved in the front-end to determine the type of innovative offerings (incremental or disruptive)?

In exploring the decisions in this study, two major activity phases of the front-end were considered, viz. preliminary strategy identification phase, and concept development phase (Cooper, 1994; Hüsig et al., 2005; Khurana & Rosenthal, 1998; Orawski, et al., 2011; Preez, et al., 2009). The first activity phase occurred just before commencing the actual innovation process, and the next activity phase occurred while refining the 'concepts' for further development. These are described below.

- 'Phase 1 of innovation' ('preliminary strategy identification' phase).
  Suitable innovation opportunities (ideas) are identified prior to the start of the actual innovation process during phase 1 of the front-end of apparel product innovation (Cooper,1994; Husig et al., 2005; Khurana & Rosenthal, 1998; Orawski, et al., 2011; Preez et al., 2009). In this study, this 'phase 1 of innovation' is named as the 'preliminary strategy identification' phase in line with the meaning of 'innovation strategy' as defined by Hervas- Oliver, et al., (2021):

  > "The strategic choices made by firms for the innovation process in the sense of developing certain routines or capabilities to innovate" (Hervas-Oliver et al.,2021).

- 'Phase 2 of innovation' ('concept development' phase).
  In this phase, it is expected to screen out the product ideas and refine the ideas that do work by applying technological solutions. In addition, decisions are made on the most appropriate product concepts that should be further developed to meet the changing customer requirements. In this study, phase 2 is named as the 'concept development' phase, considering the connotations of 'concept' as defined by Koen et al. (2002):

  > "A concept has a well-defined form, including both a written, and visual description that includes its primary features, and customer benefits combined with a broad understanding of the technology needed" (Koen et al.,2002, p.7).

An overview of the literature in section 2.5.3 indicates that the decisions within the process of the front- end are depicted in the existing front-end models (Cooper, 1994;

Cooper & Sommer,2018; Hüsig et al., 2005; Khurana & Rosenthal, 1998; Orawski, et al., 2011; Preez, et al., 2009). Decision gates are the decision points between the activities of the process. Three decision gates are proposed in some models (Cooper, 1994; Cooper & Sommer,2018; Husig et al., 2005; Orawski et al.,2011; Preezet al., 2009) and one decision gate was suggested in one model (Khurana & Rosenthal, 1998). In these models, a detailed discussion on how the decision making process should be organized, and what are the key decisions in two activity phases of front-end product innovation is not demonstrated separately.

In this study, how the apparel product developers arrive at the decisions were explored for the two activity phases of the front-end separately with the intent of providing a detailed view on front-end decision situations encountered when initiating an innovation. In exploring the front-end decisions, case study interviews were analysed via identifying key words. Categorizing and organizing keywords under themes, the front-end activities operated by companies were identified. As pronounced by Mintzberg et al. (1976), each decision begins with the onset of awareness about a problem or an opportunity in the front-end of a process. Hence, the activities at the initial stage of the decision making process include information gathering. This is followed by an evaluation stage, which leads to the final decision as illustrated in Figure 5.1.

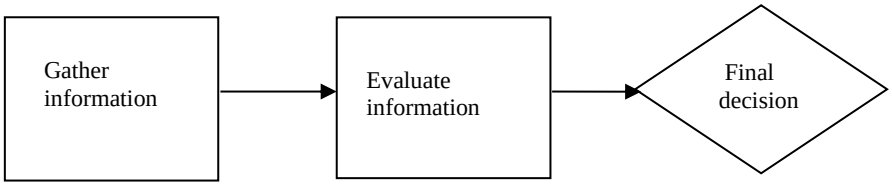


Figure 5.1: Front-end decision making process

Source: (adapted from Mintzberg et al., 1976)

In addition, by organizing keywords under a few main themes (decisions) and categorizing them under sub-themes during data analysis of case study interviews, key decision making gates were identified. The identified key decision making gates of the two activity phases within the front-end of the apparel product innovation process: ‘preliminary strategy identification’ phase, and ‘concept development’ phase is discussed in the following sections.

5.2.1 Decisions in the preliminary strategy identification phase (phase 1 of the front-end of innovation)

The decision gates of the preliminary strategy identification activity phase are not clearly defined in the existing front-end models. The first decision gate in the preliminary strategy identification in different models is given different names: idea screening, opportunity screening, idea filter, and innovative enterprise (Cooper, 1994; Cooper & Sommer, 2018; Husig et al., 2005; Orawski et al.,2011; Preez et al., 2009). Though other decision gates in the middle of the model are different, all models agree on the decision at the end of the front-end phase; go-no-go decision.

By analyzing the case study interviews, five key decision gates were identified for the preliminary strategy identification phase of the front-end of apparel product innovation for both incremental and disruptive innovation. These five decision gates are

- Gate 1 - decision on 'initial innovation opportunities (ideas)'
- Gate 2 - decision on 'suitable innovation opportunities (ideas) to be proceeded with, and apparel brands'
- Gate 3 - decision on 'resources and budget'
- Gate 4 - decision on 'appropriate practices to be implemented'
- Gate 5 - decision on 'network actors'

These five decision gates are discussed in detail in the following sections.

5.2.1.1 Gate 1 - decision on 'initial innovation opportunities(ideas)'

The first decision gate is concerned with activities that are similar to those in the published models that have been developed to depict the activities and decisions occurring within the process of the front-end (Cooper, 1994; Cooper & Sommer, 2018; Husig et al., 2005; Orawski et al.,2011; Preez et al., 2009).

The apparel products closely link with people's daily lives. As indicated in section 1.1.2, customer needs and expectations continuously vary with the heavy use of social media interactions. Apparel companies must flexibly react to changes. Therefore, real time information is gathered on market direction, consumer behaviour trends, potential

markets, evolving technological developments, and increasing environmental concerns. As per the Director of Company A (Case study interviewee a- 1),

> *"We start our process by collecting information on market direction, consumer behaviour trends, evolving technological developments, and environmental concerns. Then, we roughly assess them to check whether they are compatible, whether we can offer new values to customers, and what the benefits for company. We use a checklist."*

This collated real time information is evaluated by the apparel companies against the appropriateness for the company (compatibility/ strategic alignment), new values to the customer, and values to the company in order to identify the initial innovation opportunities (ideas). A checklist is a facilitative technique in their current practice to evaluate the external drivers, and innovation opportunities, and select the possible innovation opportunities to proceed within these case study companies. A checklist is one of the good techniques for evaluating opportunities for new ventures (Bakouros, 2000; Koen et al., 2014; Rebernik & Bradač, 2008). However, voting, rough screening by criteria, and evaluation matrix are also applicable techniques (Bakouros, 2000; Cooper, 1998; Dornberger & Suvelza, 2012; Koen, et al,2002; Miller,2013; Okudan &Tauhid,2008; Rebernik & Bradač, 2008). Consequently, in 'decision gate 1', decisions are taken on innovation opportunities (ideas). However, the existing front-end models do not clearly demonstrate the evaluation mechanisms, including the criteria for the first decision gate.

As stated in section 5.1, Sri Lankan apparel manufacturers have been working with apparel brands (B2B customers) from the outset of their innovation, as apparel products manufactured in Sri Lanka are made available to end-users through apparel brands. Therefore, the 'B2B customers' initiate the innovation. However, the initiation of innovation 'by B2B customers' was not considered in the published front-end models with decision gates (Cooper, 1994; Cooper & Sommer, 2018; Husig et al., 2005; Orawski et al.,2011; Preez et al., 2009).

As per the findings of the case studies, in the initiation of innovation 'by B2B customer', the decision making process begins with the current problems (unmet and

under-met needs) and expected solutions requested by the B2B customer on behalf of the end consumer. As per the Technology Entrepreneur of Company C (Case study interviewee c-3):

> "*Customers know their end consumers much better than us, having stayed for long periods in business. Their requested solutions for problems provide very useful input. These solutions are effective platforms to start an innovation, and to differentiate our offerings, because the uncertainty, and risk are much less.*"

Market direction, and consumer behaviour trends, and evolving technological developments (latest technologies, techniques, and materials) are also currently used as supplementary information. This information is evaluated against compatibility, benefits to the company as well as benefits to the customer to identify the opportunities for innovation. Thus, 'innovation opportunities (ideas) related to customer requirements' are decided at gate 1.

5.2.1.2 Gate 2 - decision on 'suitable opportunities (ideas) to be proceeded with and targeted apparel brands'

This decision gate is not established in any existing front-end models evident in the literature, where innovation opportunities, and targeted brands are decided. That may be due to the fact that some existing models developed to depict the decisions were proposed based on the state of the art literature review (Husig et al., 2005; Orawski et al.,2011). One existing model developed to depict the decisions was tested in the insurance industry (Preez et al., 2009).

Identifying the exact needs of the end consumer is extremely important to avoid risks in innovation decisions. Therefore, at this decision gate, the innovation opportunities identified at gate 1 are reviewed further to identify which of them would be attractive in the market, commercially viable, and marketable through an apparel brand or brands (B2B customers). The Innovation Director of Company C (Case study interviewee c-2) confirmed this by saying,

> *"We are not working on all of the available opportunities. No point in working and wasting our time and money if the market is not big enough to justify those.*

If there are any legal obstacles, it will not be possible to sell and make a profit at the end. So, we try to carefully figure out and identify the ideas that we can sell in the market."

Thus, the activity starts with collecting information on customer attributes such as sizes of the target market segments, buying power of the consumers, market share, estimated growth rate, and season calendar. This information is collected with the help of market survey companies, social media (YouTube, blogs, and Twitter), key targeted customers (B2B), key retailers as well as from the data and knowledge base of the company. As revealed from case studies, the collated information is evaluated against; readiness of the apparel brands to accept new ideas, reputation of apparel brands within the market, readiness to inter-firm collaboration, and alignment to the seasonal calendar using a checklist. Checklist, rough screening by criteria, scoring, and evaluation matrix are applicable techniques to arrive at 'go or no go' decisions in academia too (Bakouros, 2000; Cooper, 1998; Dornberger & Suvelza, 2012; Koen, et al,2002; Miller,2013; Okudan & Tauhid,2008; Rebernik & Bradač, 2008). The 'suitable innovation opportunities to be proceeded with' and targeted apparel brands are decided at 'decision gate 2'.

5.2.1.3 Gate 3 - decision on 'resources and budget'

As per the findings of the case studies, at decision gate 3, the resources are chosen in order to realize the already identified opportunities (ideas) effectively as they are part of the entire process of innovation. The existing front-end models do not clearly demonstrate how, and when the resources and budget are decided.

At decision gate 3, information on internal and external resources (machinery**,** technologies, and techniques, novel fabrics**,** materials, technological know-how, and areas of skills to be acquired) is gathered. The information is collected from the experience of the company (data and knowledge base), trade fairs and exhibitions, trade journals, and from specialists (in apparel and textiles). At present, the collated information on resources is evaluated mainly against compatibility, and rewards to the company using a checklist to decide the resources. Then, a monetary analysis (payback period, and expected net income or profit) is also evaluated to ensure the

cost of implementation and maintenance. Consequently, at 'decision gate 3' key internal and external resources (machinery, and materials), the initial projected budget, and the innovation typology (incremental, and disruptive) to be pursued further are decided.

5.2.1.4 Gate 4 - decision on 'appropriate practices to be implemented'

Once the apparel company decides to proceed with the promising ideas for innovation, and the requirements of resources, the company has to decide the appropriate practices. Identifying good practices and options for innovation is important for the implementation, and smooth running of the innovation process. This decision gate is not established in the existing front-end models evident in the literature.

According to the Chief Operating Officer of Company B (Case study interviewee b-1),

> "*We are searching for good innovation practices, and new trends in the business world, and like the methods some market reputed brands use. We may learn how they implement innovation and run their business….*".

It indicates that this activity originated through collated information on evolving business practices, and good and best practices in the apparel industry, and other industries for innovation. This information is gathered from the World Wide Web, published success stories of other companies, trade journal articles, and by consulting experts in the business, marketing, and product development fields. The Chief Operating Officer of company B (Case study interviewee b-1) confirmed the above by stating as follows.

> "*Recently we got some consultants from……We learned about good innovation practices, and new trends in the business world. They have explained the methods that market reputed brands practice, and how they implement innovation, and run their business….*"

As per the findings of the case studies, in the innovation 'for customer' and 'with customer' categories, the identified practices are evaluated against the compatibility, accessibility, and rewards to company. In the 'by customer' category of innovation,

rewards to customers as well as the B2B customer's preferences are also considered. A checklist is the facilitating instrument used at present to evaluate the identified practices, and select the most appropriate and possible practices to be implemented in the company. Based on the above evaluation, 'decision gate 4' is used to make decisions on initial appropriate innovation practices to be implemented for an effective innovation process.

5.2.1.5 Gate 5 - decision on 'network actors'

The apparel manufacturing companies acquire raw materials and techniques to develop the innovation idea as described in section 5.2.1.3. Once the apparel company decides the resources, the suitable suppliers who have the capacity to efficiently join the innovation process are identified. The capabilities of the suppliers in terms of high-tech material manufacturing methods and processes, and the ability to employ a variety of technologies are evaluated. Therefore, at decision gate 5, the information on potential basic raw material suppliers, manufacturing partners (material developers**,** technology providers, and customers), and technology know-how providers (R&D centres**,** universities, special institutes, and training providers) is collected. As per the Director of Company A (Case study interviewee a- 1),

> *"We need to acquire materials, and techniques. Maybe new yarns, fabrics, or advanced technology, software, and machinery, etc. We need to make sure we get them on board to develop innovative apparels or to upgrade our current processes or systems".*

This information is collected through trade fairs and exhibitions, experience of the company (database and knowledge base), and by consulting specialists in apparel and textiles as well as professional social networks.

As per the findings of the case studies, in both innovation models, 'by customer' and 'with customer', the information on network actors is assessed against their compatibility with the company, readiness or maturity, value to the company, and relational closeness. The compatibility with 'B2B' customers as well as the feasibility of proceeding with initially identified 'potential innovation solutions' are considered in innovation 'by customer'. The above evaluation is carried out with the use of an

evaluation checklist at present practice, which includes qualitative criteria (relationship qualities, and competence). However, scoring as well as evaluation matrices are also good techniques that can be applied for detailed evaluation (Bakouros, 2000; Dornberger & Suvelza, 2012; Koen, et al., 2002; Okudan & Tauhid, 2008; Rebernik & Bradač, 2008). The collaboration with the actors, or 'the network actors' is decided in this 'decision gate 5'.

This decision gate is not evident in the existing front-end models.

5.2.1.6 Outcomes of the preliminary strategy identification phase

Identifying potential innovation opportunities (ideas), internal and external resources, applicable innovation practices, potential external partners, as well as budget are the main outcomes of the preliminary strategy identification phase. The decisions are taken by the senior managers (CEO, COO, Directors, and/ or Head of divisions including head of innovation) together with any other members assigned to the team by the company. If the apparel producer decides to work with suppliers, respective networking companies are requested to nominate members for the team. Similarly, if the apparel producer decides to work with B2B customers, the members are nominated by the latter.

The five key decision making gates in the first phase for two scenarios ('for customer', and 'with customer') with respective information and evaluation criteria are illustrated in Figure 5.2. The updated information which is the input discussed in sections 5.2.1.1 to 5.2.1.5 at each step of the process is indicated in the bottom rectangles. The middle rectangles show the criteria used to evaluate each bundle of information. Diamonds show the final decisions, and the decision gate numbers are displayed in small circles.

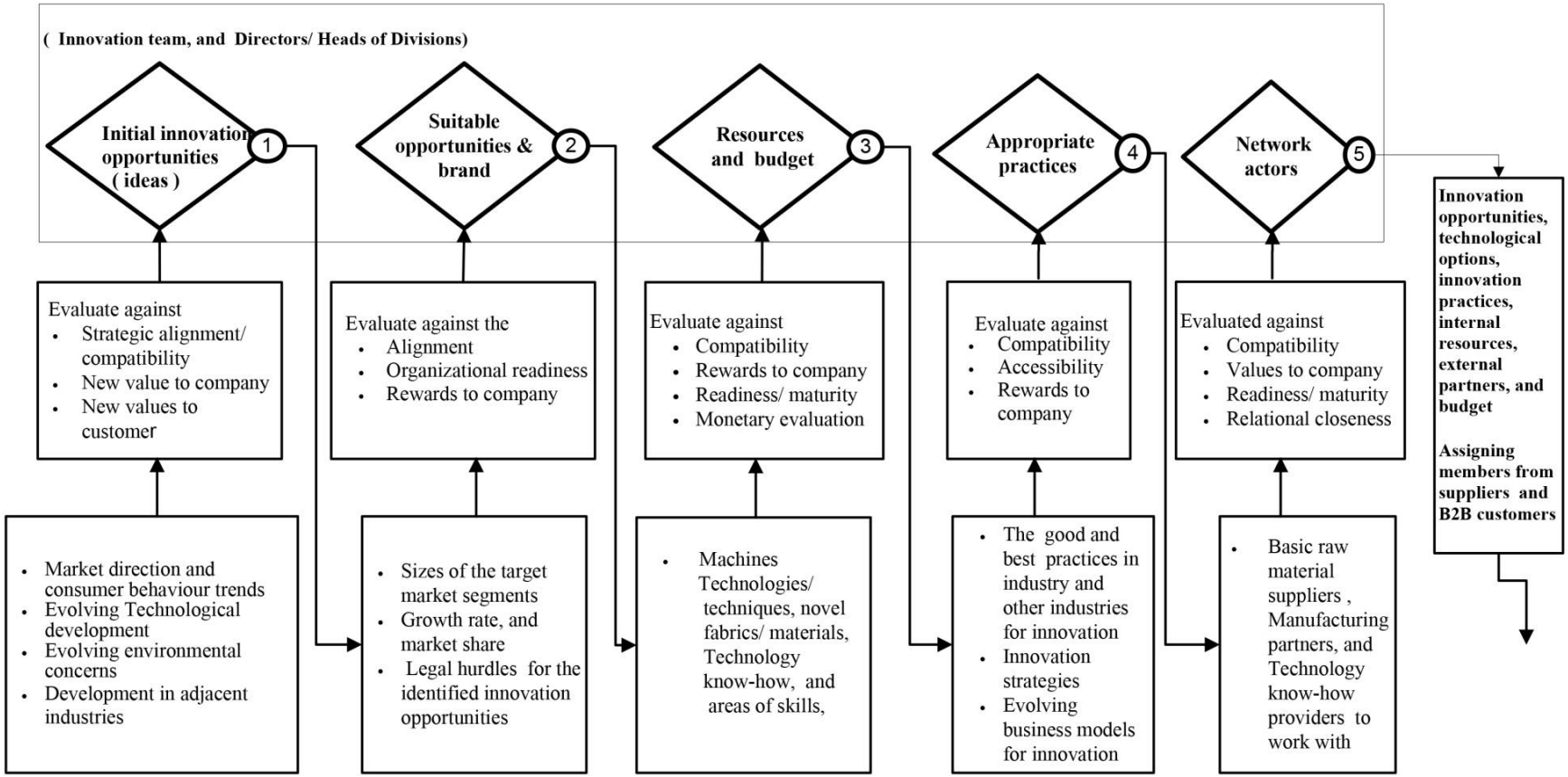


Figure 5.2: Five key decision making gates in the preliminary strategy identification phase

5.2.2 Decisions in the concept development phase (phase 2 of the front -end of innovation)

Though the decision gates of the concept development activity phase are not clearly defined in the existing front-end models, some suggested models introduce a decision gate termed as, 'go to development' (Cooper, 1994; Cooper & Sommer,2018; Husig et al., 2005; Khurana & Rosenthal, 1998). Another front-end model emphasized the importance of concept feasibility, and refinement (Preez et al., 2009).

In exploring the front-end decisions in the concept development phase, case study interviews were analyzed in detail via identified keywords. Further, the keywords were organized under the main decisions. Three approaches were identified.

i. Though the apparel products made in Sri Lanka reach to end consumers through apparel brands, the requirements of the end consumers need to be met. In order to develop innovative products that offer superior value to end consumers, the true needs of the end consumer have to be identified. Therefore, identifying the true needs of the customer is the first process activity to verify the already identified innovation ideas (related to targeted apparel brands) in gate 2 and innovation solutions.

ii. A variety of techniques, textures, structures, and features which suit apparel products are essential to develop the innovation idea. Therefore, the first process activity is identifying a variety of developments to verify the already identified technologies and materials in gate 3.

iii. Two process activities run concurrently to accelerate the innovation process, and to identify potential technological and aesthetic solutions to improve consumer satisfaction. The one process activity is identifying true customer needs in order to refine the previously identified innovation ideas in gate 2, and to decide on innovation solutions. The other process activity is identifying new developments (techniques, textures, structures, and features) to refine the technologies and materials that have already been identified in gate 3, and to decide technical solutions.

The case study interviews were further analysed in detail under three decision approaches; need based, technology based, and combination. Corresponding key decision making gates were identified for the three decision approaches. The identified decisions through case studies related to need based, technology based and combination (need and technology based) in concept development activity phase for both incremental and disruptive innovation are discussed further in the sub sections below.

5.2.2.1 Need based approach

The first process activity of need based approach focuses to further confirm the already identified innovation ideas in 'gate 2' of phase one of the front-end of innovation (section 5.2.2.2). By analyzing the case study interviews, three key decision gates were identified for need based approach that is evident in incremental innovation as 'for customer' offerings.

i. Decision on potential solutions to be generated (from innovation ideas related to targeted end consumer requirements)
ii. Decision on suitable feasibility studies to be executed
iii. Decision on final concepts to be proceeded with

5.2.2.2 Technology based approach

Though the technologies and materials are identified at gate 3 of phase one of the front-end of innovation (section 5.2.1.3), finding a variety of techniques, textures, structures, and features that can be generated from them is essential to practically achieve the innovative solutions. Therefore, the first process activity of technology based approach focuses on further refining the already identified technologies and materials in gate 3 to effectively respond to the identified ideas in gate 2 (section 5.2.2.2) of phase one at the front-end of innovation.

The analysis of the case study interviews identified three main decision gates for technology based approach, which are evident in both incremental, and disruptive innovation.

i. Decision on most applicable developments to be generated (from technologies, and materials identified at gate 3)
ii. Decision on suitable feasibility studies to be executed
iii. Decision on final concepts to be proceeded with

5.2.2.3 Technology and need based approach

By analyzing the case study interviews, four key decision gates were identified for technology, and need based approach in which two decisions; on potential solutions, and most applicable developments to be generated, are taken simultaneously. This speeds up the innovation process, and identifies potential technological and aesthetic solutions to enhance the satisfaction of the end consumer.

i. Decision on potential solutions to be generated (from innovation ideas related to targeted end consumer requirements).
ii. Decision on most applicable developments to be generated (from technologies, and materials identified at gate 3)
iii. Decision on suitable feasibility studies to be executed
iv. Decision on final concepts to be proceeded with

The findings of the case studies indicate that the last two decisions; decisions on acceptable feasibility studies, and decisions on final concepts are common to all three approaches.

Based on the three identified approaches and decision making gates, gate numbers for each decision gate for three decision approaches in the 'concept development' phase were assigned for easy understanding. The decision gate numbering was a continuation from previous section 5.2.1 (gate1- gate 5). As mentioned in section 5.2.2.3, two decisions; on potential solutions, and decision on most the applicable developments to be generated are taken simultaneously not only to speed up the innovation process, but also to identify potential technological and aesthetic solutions to enhance the satisfaction of the end consumer. Therefore, decisions on potential solutions to be generated, and the decision on most applicable developments to be generated are named as gate 6A and gate 6B. Since the last two decisions, decisions on acceptable feasibility studies, and decisions on final concepts are common to the

three identified approaches they are named as gate 7 and gate 8, respectively.

The corresponding decision gates for the three approaches (need based, technology based, and need and technology based) in the 'concept development' phase for incremental and disruptive innovation are indicated in Table 5.2. Column 1 of Table 5.2 shows the nature of the innovation provided by apparel manufacturers; incremental and disruptive innovations, and categories of innovation with respect to the mode of B2B customer involvement. The key decision gates evident in the concept development phase are indicated too.

Table 5.2:Decision gates for the three approaches in the 'concept development' phase

					Decision approaches		
					Need based	Technology based	Need and technology based
Innovative Offerings	Incremental	For customers/ consumers			√	√	√
		With B2B customers				√	√
		By B2B customers (customer requested)				√	√
	Disruptive	With B2B customers				√	√
Decision gates in the concept development phase	Decision on potential solutions to be generated (from innovation ideas related to targeted end consumer requirements).		Gate 6	Gate 6A	√		√
	Decision on most applicable developments to be generated (from technologies**,** and materials identified at gate3)			Gate 6B		√	√
	Decision on suitable feasibility studies to be executed		Gate 7		√	√	√
	Decision on final concepts to be proceeded with or developed further		Gate 8		√	√	√

These decision gates for the three decision approaches are further discussed in detail below.

5.2.2.4 Gate 6A - decision on potential solutions to be generated

The Design Manager of Company B (Case study interviewee b-2) expressed his thoughts on this activity.

> *"At the beginning, we are roughly screening the solutions, but we need to do more work. We have to think of the functional, ergonomic, and aesthetic aspects of the products. So, we have to identify, and implement the exact technical solutions required to meet the customers' demands".*

The decision gate 6A is to identify exactly the true needs or requirements (final attributes), verify, and refine the already identified innovation ideas (related to targeted apparel brands) in gate 2, and identify potential solutions that can be generated. This is to enhance the satisfaction of the end consumer. Thus, additional information on specific unmet, and under-met needs and requirements (functional, ergonomic, and aesthetic aspects, materials, price, etc.) of the current and potential customers is collected.

As per the findings of the case studies, this information is collected by the apparel producer through feedback gathering from current customers (B2B), retail visits and social media (YouTube, blogs, and Twitter). Through brainstorming, the potential solutions are worked out. Then, the solutions are evaluated against values to B2B customers, values to end consumers, and values to company to determine whether the identified market gap can be filled. This is carried out using a checklist based on qualitative criteria. Subsequently, at 'decision gate 6A' potential solutions to be generated (from innovation ideas related to targeted end consumer requirements) are decided. These decisions are taken by the assigned innovation team in consultation with the senior managers who are involved in the strategy identification phase.

Preez et al.,'s (2009) front-end model emphasized the importance of translation of the requirements of the customer into specific product features, and proposed a decision gate called 'requirement specification'. However, the model did not clearly illustrate the evaluation mechanisms including the criteria for this decision gate.

5.2.2.5 Gate 6B - decision on the most applicable developments to be generated

The decision gate 6B is to further refine the already identified technologies and materials in gate 3 by identifying variety of developments that can be generated to effectively respond to the identified ideas in gate 2. The Technology Entrepreneur of Company C (Case study interviewee c -3) confirmed this by saying,

> *"We do thorough research on the identified technologies, and materials. They may be used in apparel or may be in other industries, and electronics. We try to find out the variety of developments we can generate from those. That may be seam types, surface decorations, and compression to identify whether we can use it for our developments. In our recent idea on functional improvement of ……., we studied the ……. and identified the most applicable development we can incorporate into our product.*"

Presently, the required information is gathered by referring to trade journals, visiting trade fairs and exhibitions, watching futuristic movies, and communicating with suppliers and other organizations (Case study interviewee a-2, a-4, b-2, b-4, c-1, & c-3). In academia too, the same is accepted as good sources, and techniques to collect information on new developments in materials, techniques, and technologies (Ruiz & Maier, 2016).

The information gathered is evaluated against the compatibility (appropriateness for innovation ideas, and manageability with the allocated budget) and manufacturability. A checklist is the main technique used in evaluation. At decision gate 6B, the most applicable developments to be generated to realize the innovation potential of the available or new products are decided. This decision was also taken by the assigned innovation team in consultation with the team of senior managers involved in the strategy identification phase.

A decision gate on the 'most applicable solutions to be generated' is not established in any of the existing front-end models. However, this decision provides an opportunity to carefully consider the technological solutions that can be generated to effectively respond to constantly changing consumer requirements, and enhance product features to satisfy them.

5.2.2.6 Gate 7- decision on suitable feasibility studies to be executed

The identified potential solutions (appearances / features) at gate 6A have to be practically tested using the identified technologies, and materials developments at gate 6B. Therefore, the next important activity is working out a detailed concept realization feasibility study plan. This activity is important to ensure effective utilization of the resources allocated in the previous phase in specific exploration within the targeted time frame. The Design Head of Company A (Case study interviewee a-2) stated that,

> *"We need to select a good combination of materials, techniques, and technologies for the experiments based on the applicable developments that can be generated from them. That is to execute potential solutions. This is important. Then we have to think about the budget, and the time frame. After that, we have to go for the most doable experiments or the feasibility studies".*

The information for gate 7 flows through gates 6A, and 6B. The information sources are existing documents on identified solutions and applicable development, and the information gathered during previous stages (in respect of ideas, customers, technologies, materials, and processes). These concept realization feasibility studies are evaluated with respect to processing time, and material utilization in order to identify the most suitable combination of materials, techniques, and technologies. Subsequently, the most appropriate realization feasibility studies are selected. This decision is made at decision gate 7. A checklist facilitates the evaluation of the realization feasibility studies in present practice.

The assigned members of the innovation team together with the team of senior managers act as the main decision makers. As per the findings, not only the suppliers but also the B2B customers may be invited to make comments on the selection of appropriate technologies, materials, and processes.

Though this decision gate is important to speed up the experimentation process, it is not established in any existing front-end decision making models.

5.2.2.7 Gate 8- decision on final concepts to proceed with

The concept feasibility studies listed at gate 7 are practically experimented to verify, evaluate, and identify the final concepts. As per the findings of the case studies, preparing mock-ups is one of the widely used techniques practiced by the apparel industry for concept realization. The Innovation Director of Company C (Case study interviewee c-2) confirmed this by saying, "*We do a lot of experiments to ensure the technologies and materials, and we do mock-ups*". In addition, other basic techniques used for the concept realization (feasibility studies) are sketched using software tools (CAD, CorelDraw, and design tools), using hand sketching, and using photographs or images, and simulators.

At present, suppliers may also be engaged in these feasibility studies, depending on the mode of collaboration with them already decided (Case study interviewee, a-2, a-4, b-2, b-3,c-1, & c-3). The outcomes of the initial experimental studies are evaluated against the company viewpoint (compatibility, financial benefits, and viability) and customers' viewpoint (benefits). At present, a checklist facilitates evaluating this product idea for feasibility. Decision on final concepts to be developed further is taken at 'decision gate 8'.

As per the findings of the case study interviews, due to the trial and error nature inherent in feasibility studies, whenever the team is not convinced about the outcome, the previous step will be revisited to recheck the alternatives, re-work, and refine the idea. The Innovation Manager of Company C (Case study interviewee c-1) confirmed the above by stating as follows.

> *"....in our initial innovation review meetings, we carefully evaluate the preferences, and demands of the customers…..... in the final review meeting, they may pick a handful of ideas. Then we have to drop most of our potential ideas. If we cannot select ideas for further development, we again go back to our previous feasibility studies plan, and do the experiments again"*

The feasibility study is a repetitive process that is conducted with multiple evaluations of the concepts until arriving at what appears to be the most promising course of action. This is an important characteristic of this stage of the overall project, as per the

findings of the case study interviews. The decision is also taken by the assigned innovation team in concurrence with the senior managers at gate 8. As indicated earlier, at decision gate 7, suppliers and customers may be invited for comments and consent on the selection of appropriate final concepts to develop further.

Through the decision gate, 'go to development' has been identified in the existing front-end models as the final decision at the front-end of product innovation (Cooper, 1994; Cooper & Sommer,2018; Husig et al., 2005; Khurana & Rosenthal, 1998), the process activities, and evaluation mechanisms including the criteria have not been clearly demonstrated.

5.2.2.8 Outcome of the final concept development feasibility phase

As per the findings of the case studies, the outcome of the innovation 'for customer' is the final concept developed for several different product categories. The outcome would be the concepts accepted by customers for the innovation 'with B2B customer' and 'by B2B customer'. Alas (2011) also summed up the outcome of the front-end as a clear product concept, general knowledge, and an understanding of the concept.

5.2.3 Factors affecting the front-end decision making

The relationship between the environmental factors (internal and external) and front-end decisions was not included in the conceptual framework in Chapter 4, and a research question was not formulated. However, environmental factors (internal, and external) were identified as essential to consider, as per the findings of the case studies, since the decision making at the front-end of apparel innovation, both incremental and disruptive offerings, is controlled by many different factors. Literature in section 2.5.1 highlights that internal and external environmental factors are considered in one front-end model (Koen et al., 2001). In the case studies of this research, the internal and external factors of the organization that influence initiation decisions were also explored.

The findings of the case studies show that the strategic vision of the organization towards innovation is one of the key factors which influence the front-end decisions. Besides, internal strategies to acquire new knowledge, new ideas, as well as policies

on external partnerships are key internal factors that influence initiation decisions on innovation. The Innovation Director of Company C (Case study interviewee c-2), also affirmed the above by stating that,

> "*Some companies really want to continue innovation because of their company vision. But with their internal strategies or the policies, they are reluctant to reveal the ideas to others. According to my experience, there are limitations, but if we do not open to acquire new knowledge or share our knowledge, and resources we cannot go for successful innovation*".

As revealed through the case study interviews, the internal factors of the organization such as, financial capability for allocating budget for research & development are also highly challenging; yet these cannot be overlooked to initiate an innovation. According to the Innovation Director of Company C (Case study interviewee c-2),

> "*I feel we are the only apparel manufacturing group in Sri Lanka willing to spend money, and patiently wait for 4-5 years to get results. Our top people believe innovation is essential to move forward. Most companies do not have the capacity to invest. Even the ones that have the capacity, they don't take the risk.*"

Past research also acknowledged financial resources as a key requirement for arranging other resources (Brinckmann et al., 2011; Hottenrott & Peters, 2012).

Another factor that needs much attention in decision making is the availability of resources (technological and logistic facilities) within the organization or the capability of acquiring the facilities from other stakeholders (Case study interviewee a-2, b-2, b-5, c-3, & c-4). This includes plant and machinery, and operational abilities. If the company is not able to undertake the innovation alone, then collaboration with external partners is considered. The Fabric sourcing & Technical Manager (Case study interviewee a-3) affirmed the above by stating,

> *"We don't have our own textile plant; we need fabrics for garments. So, we need to acquire new yarns, fabrics, and other materials, or techniques and, may be, with highly advanced software. We need to make sure to get them on board to develop innovative apparels or to upgrade our current systems."*

Preference is given to external partners who have a record of good relationship in the past (commitment, trust, and communication) where relationship characteristics are seen as the foundation for quality of the relationship between actors (Perho, 2015; Woo & Ennew, 2004). Further, companies prefer to work with external partners who have knowledge, capabilities, and facilities in plants, and experience (Case study interviewee b-2, c-3, & c-4). In past literature too, operational capabilities are found as one of the main drivers of collaboration with external actors due to their potential to outspread support (Azadegan & Dooley, 2010). Experience gained from previous projects is very useful according to the Design Head of Company A (Case study interviewee a-2),

> "*We have information about most of the suppliers in our database, so we know their capabilities through reviewing their past performances. We have grouped our suppliers as those who are reliable, those who come up with innovative ideas, and those who are cost effective, flexible, and easy to communicate with and negotiate with*."

As revealed by the case study interviews, Intellectual property (IP) protection agreement between the collaborating parties is one of the important prerequisites to avoid future disputes. Effective communication between both parties really matters in all these relationships (Case study interviewee b-2, c-1, & c-4).

The findings of the case study interviews show that another important internal organizational factor influencing the front-end decisions is the authority given to team members to make decisions and take risks in the innovation process. Past research also acknowledged the above as influential for innovation (Forrester, 2000; Lotti et al., 2006). Moreover, the team members should be encouraged to freely discuss, and express their ideas, and justify their decisions in review meetings (Case study interviewee a-1, b-1, & c-2). Freedom to debate and discuss new ideas is identified as influential for innovation (Miesing, 2006). This would help to make effective decisions with no fear of failure. The Chief Operating Officer of Company B (Case study interviewee b-1) confirmed this by stating that,

"*They have the right, and freedom to arrive at decisions on their findings with no fear of failure. But the final decisions are taken at the review meetings. However, young designers or team members need guidance to make decisions. Even the interns are given the opportunity to sit in at buyer's meetings to learn about customer expectations, that is what they are looking for. Before embarking on innovation, they should understand who the customers are, and to which kind of markets they are catering for*."

However, the organization's support, encouragement, and commitment are also factors that influence the decisions taken by the team. The Design Manager of Company B (Case study interviewee b-2) affirmed the above, stating that,

"*Our management allows, and supports us to do experiments, and product developments. I can say that as I have been here for the last 4-5 years. They are very supportive as that is the company's strategy. They know where they are going. But the results are slow, and steady*."

Based on the above findings, the influential factors related to front-end decisions identified in these case studies can be categorized mainly under internal, and external factors and under the following subheadings based on their characteristics.

- Internal factors
    a. Core competencies - Organization's core competencies are considered as the organizational capabilities and resources (Godbout, 2000; Torkkeli & Tuominen, 2002).
    b. Climate - Organization climate is considered as the overall "tone" or "work atmosphere" of an organization (Thakare et al.,2014)
- External factors (suppliers, customers, and other organizations)
    a. Competencies - The distinct capabilities, knowledge, and resources of the actors are identified as competencies (Jap,1999).
    b. Relationship characteristics - The elements of the relationship quality are identified as relationship characteristics (Ulaga & Eggert, 2006).

Figure 5.3 illustrates the influential factors related to front-end decisions. The internal factors are indicated in one rectangle, and the other rectangle illustrates the external

factors. Two separate rectangles with dashed lines inside the internal factors illustrate the influence of the organization's core competencies and climate. The influence of competencies and relational characteristics of external actors are indicated in two separate rectangles with dashed lines inside the external factors.

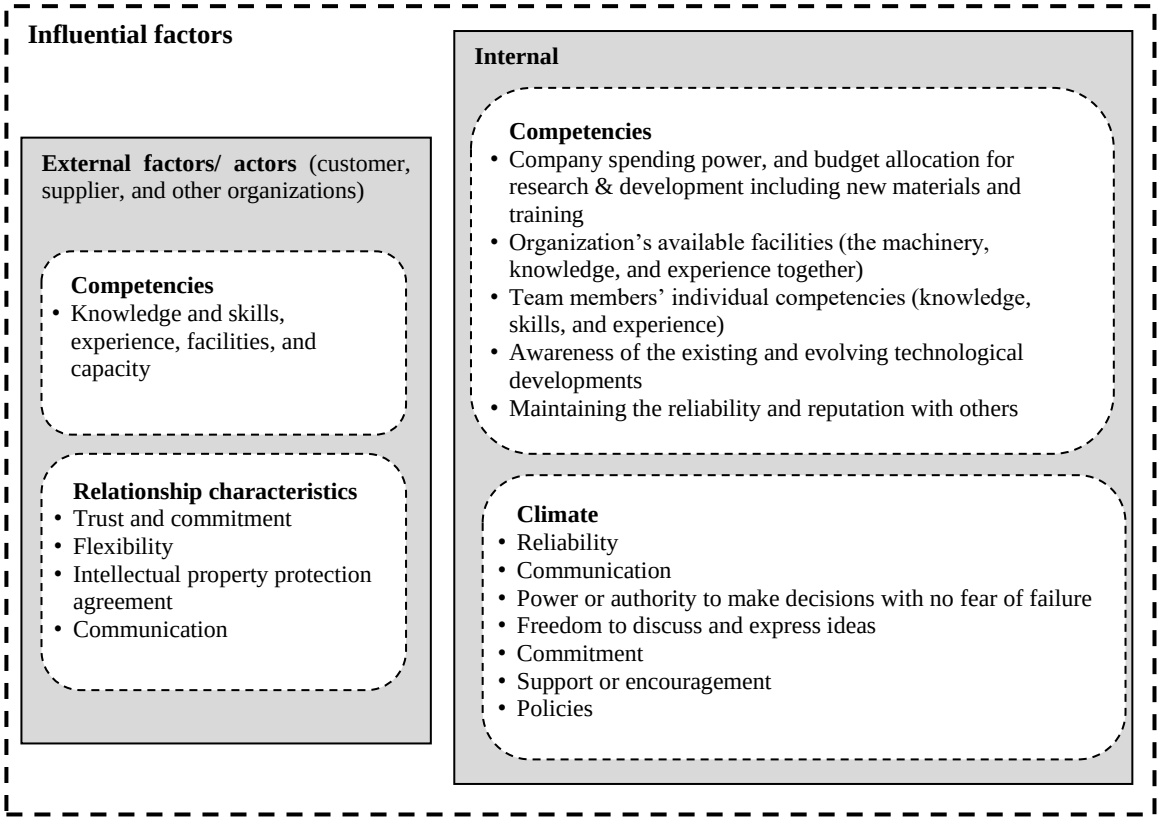


Figure 5.3:Influential factors governing front-end decisions

5.3 Actors (internal & external) involved in the front-end

The third objective of the exploratory case studies was to identify the key internal, and external people involved in the front-end innovative product offerings. The third research question formulated in section 4.1.3 was

RQ3 - Who are the key actors or people involved (internal and external) in the front-end of the apparel innovation process in connection with different product offerings (incremental or disruptive)?

An overview of the literature in section 2.5.1 highlights that integration of both internal as well as external actors is emphasized in one front-end model (Sandmeier et al., 2004). However, a detailed discussion of the roles and responsibilities of the actors within the two activity phases of front-end product innovation is not demonstrated separately in this model or in any other existing model. Due to the procedural differences in the two activity phases of the front-end, the range of knowledge, skills and information required may vary. Therefore, a deeper understanding of the different modes of involvement of internal and external stakeholders in the two activity phases of the front-end will be helpful to initiate and manage the apparel innovation processes efficiently.

In the case studies of this research, how the internal and external actors involved in the two activity phases of front-end were explored separately to provide a detailed view on interactive roles of the external, and internal actors when initiating an apparel product innovation. The interactive roles were identified via organizing keywords under the main theme (actors), and categorizing them again under sub- themes during data analysis of case study interviews.

5.3.1 Internal team in the front-end

Internal multifunctional teams are essential elements in successful innovation since they can generate a diversity of ideas, and implement them too (Zeilstra, 2009). The findings of the case study interviews highlighted that a team should be in place to start an innovation, and they are directly involved in activities at the front-end. Each of the innovation teams in the front-end of apparel innovation case study companies have 5-7 members including the Director and Head of innovation. The team size varies from company to company with the scale of the project, allocated budget, and resources. Previous literature does not specify an absolute number size, though there are a lot of assumptions on team size (Ahmad, 2013; Barczak, 2010; Hoegl, 2005). However, smaller teams are better to maintain trust, participation, and efficiency (Barczak, 2010; Hoegl,2005).

The team members in the case study companies have different competencies; specialize in diverse fields such as textiles and apparel, electrical and electronics,

chemical, mechanical, marketing and finance. Some are graduates, and some hold doctoral qualifications. Roles are assigned to them based on the competencies they bring to the team, and they are designated as business entrepreneurs, technical entrepreneurs, and financial entrepreneurs. The Innovation Manager of Company C (Case study interviewee c-1) stated that

> *"In our team, we have one business entrepreneur, one financial entrepreneur, and three technical entrepreneurs. At least one business entrepreneur, one financial entrepreneur, and one technical entrepreneur should be in a team to carry out the essential basics. They should work out the market viability, financial viability, and manufacturing or technological viability of the innovation idea."*

The above statement confirms that the team comprises at least one member with business and marketing competencies and one member with financial competencies. The number of members with technological competencies varies, and 3-5 members with technical competencies are assigned to the team. The top management is also involved in decision making in strategy identification as well as in concept development phases. The involvement of the top management also varies from company to company. The CEO, COO, Directors and/ or Heads of divisions (innovation, marketing, and finance) are the key people involved in the decision making during strategy identification at the front-end in all three companies.

As a whole, the findings of the case studies suggest that a team with 5-7 members with unique competencies, which are absolutely essential for task completion in the front-end is ideal for successfully running the apparel product innovation process.

5.3.2 Suppliers in the front-end

The suppliers in the front-end decision making process are the basic raw material providers, material developers, and technology providers. The involvement of these supplier categories is very important for an effective innovation decision. The findings of the case study interviews highlighted that the level of involvement of suppliers varies with the type of expected innovation (incremental or disruptive), material (resource) requirement, the technology readiness level for the innovation typology,

and past experience in working with the suppliers. The apparel companies invite the suppliers to provide newly developed materials and technology know-how for the front-end of innovation in which the suppliers act as information providers (Case study interviewee a-2, a-3, b-2, b-5, c-3,& c-4). Providing information, and acting as a source of the information is one of the roles of the suppliers (Lau et al., 2010; Lehtimäki et al, 2012; Hippel,1988). In addition, suppliers come up with their own new ideas for materials and techniques to initiate apparel innovation. The innovation team explores the possibility of acquiring that material and technology ideas from the suppliers. If suppliers are not willing to sell their idea, the mode of working with them has to be decided. According to the Innovation Director of Company C (Case study interviewee c-2)

> *"If they are willing to sell their idea, we try to come to an agreement on our deal. We pay for the innovation, and take the ownership / IP (Intellectual Property) on that. If suppliers are not willing to do so, we have to work out how to deal with them. May be with a non-disclosure agreement, may be a shared IP agreement between the company, and the material supplier, or may be a collaboration".*

Suppliers are actively involved in initial experiments, feasibility studies, and selection of technologies, materials, and final ideas for further improvements during the concept development phase. In most occasions, the suppliers act as co-developers during the front-end of apparel product innovation, acting with mutual understanding, and trust (Case study interviewee b-2, c-3, & c-4). Acting as a co-developer is one of the roles the suppliers can play in innovation (Lau et al., 2010). However, in innovation 'for customers' and 'with customers', apparel manufacturers have the freedom to decide and work with the suppliers based on their competencies and experience. The Fabric sourcing & Technical Manager of Company A (Case study interviewee a-3) confirmed the above as follows:

> " *We know the capabilities of most of our suppliers, having worked with them for years. We know the suppliers who are coming forward with innovative ideas, their capacities, and their reliability. We have to work hand in hand, as one party cannot expect to dominate. Everyone knows that they have to work*

together. As we need to work for the common objective, always there has to be mutual trust between the parties."

In the 'by customer' mode of innovation, the apparel developer can propose his supplier preference. However, more often, the companies will have to work with the B2B customer nominated suppliers, since the customers are concerned about trust as well as brand recognition. The Technical Director of Company C (Case study interviewee c-4) stated that,

"*Customers always try to keep their brand recognition. They have their own reliable parties to work with. Like us, they have their own trusted material, and technology developers and suppliers. Innovation is a very competitive proposition, and all parties have to get together for innovation to succeed; so, it is important to maintain trust throughout the process*."

5.3.3 Customers in the front-end

The findings of the case study interviews discussed in section 5.2 show that for incremental innovation in the 'for customer' mode, the B2B customer is not physically integrated into the activities and decision stages. However, the information concerning the expectations of selected B2B customers, and their end consumers are considered during the front-end of innovation. The Director of Company A (Case study interviewee a-1) affirmed the above by saying,

"*We, at the preliminary stage consider 2 or 3 customers to determine what they expect from us. After working with them for a couple of years, we know what they are looking for, and whether they like to buy innovative ideas and try them out. If we simply innovate without targeting particular customers, at the end, we have been wasting our time and money as there are no business results*."

Only after finalizing the ideas, the targeted customers are invited to review and provide feedback on innovative ideas at the front-end of incremental apparel innovation for the 'for customer' mode. This would enable the selection of a suitable idea to be passed on to further developments. Since the information obtained from the customer is used and the customer acts as a source of information, the B2B customer can be

considered as a facilitator for the front-end of apparel innovation (Case study interviewee b-2, b-4, c-1,& c-5).

In incremental apparel product innovation in the 'with customer' mode, only one customer is chosen at the starting point, and is invited to review and provide feedback during the middle of the concept development phase. That B2B customer is involved in the decision making at the concept development stage, and acts as a reviewer during the front-end of apparel innovation (Case study interviewee b-2, b-4, & c-1). Since the front-end innovation process begins with the collated idea of a specific customer who is invited to review and give feedback, the B2B customer can be considered as a facilitator as well as a reviewer (Case study interviewee b-2, b-4, & c-1). The customer's participation in the innovation as a reviewer is acknowledged in literature too (Joseph & Coviello,2012). However, the level of involvement of the customer is basically decided during the preliminary strategy identification phase. The positive as well as the negative impacts of this approach are affirmed by the Technical Director of Company C (Case study interviewee c-4) as follows:

> *"....in these review meetings, they pick 2 or3 ideas. Then we experiment with their consent and make the final decisions together with the customer before releasing to the development. This practice saves time and money. But sometimes they are more demanding, and then we have to drop most of our potential ideas*."

In incremental apparel innovation, in the 'by customer' mode, the customer acts as an initiator of the innovation idea, and becomes involved in decision making in the concept development phase (Case study interviewee b-1, b-2, c-1, c-2, & c-4). Past studies too have suggested customers' role as an 'active initiator' in innovation (Joseph & Coviello,2012). Further, the customer considered as a co-developer of the front-end of innovation may share knowledge between each other (Case study interviewee b-2, c-1, c-2, c-3, & c-4). The B2B customer is actively involved in the decision making in the concept development phase in the 'by customer' mode.

Based on the above findings, the involvement of B2B customers, and suppliers in different activities at the front-end of incremental innovative apparel product offerings is illustrated as follows in Table 5.3.

Column 1 shows the two major activity phases within the front-end of the apparel product innovation process. The key actors involved (internal and external) in the front-end are presented in column 2. The other three columns present the three categories of innovation with respect to the mode of B2B customer involvement: 'for customers', 'with B2B customers' and 'by B2B customers. The identified interactive roles of the internal and external actors within the three categories of innovation are presented to provide a clear understanding of their differences and similarities across the different innovative offerings in the apparel context.

5.3.4 Other organizations (know-how providers) in the front-end

Another important factor in the front-end decision making is the relationship between apparel companies and other know-how providers (research organizations including universities). Only Company C has built up a close relationship with a private research organization in Sri Lanka in recent times, and the Technical Director of Company C (Case study interviewee c-4) spoke about this: "*we are closely working with Organization X for our new innovations; they are also new to Sri Lanka*."

Table 5.3: Involvement of B2B customers and suppliers in the front-end

Phases	Actors		For customers	With customers	By customers (Customer requested)
Strategy identification phase	Company		• Initiator • Financier		• Facilitator • Financier
	External actors	Suppliers	• Facilitator (Facilitate providing information) • Initiator (Innovation is initiated by providing new developments)		• Facilitator
		Customers (B2B)	• Facilitator • Source of information		• Initiator (Innovation is initiated by providing end consumer requirements, & expectations)
Concept development phase	Company		• Developer		
	External actors	Suppliers	• Facilitator (Facilitate for the concept development providing the newly developed materials and technology knowhow) • Co-developer (Involve actively for the selection of technologies/ materials and final ideas for further improvements and engage in hands-on developments)		
		Customers (B2B)	• No involvement	• Facilitator (Facilitate for the concept development stage providing end consumer requirements and feedback for the existing products) • Reviewer (Review and provide feedback for final ideas/ concepts for different product categories for further improvements)	• Co-developer (Involve actively all the stages in concept developments together with the company and engage in hands-on developments)

5.4 Relationships between innovation, the actors, and decisions in the front-end

The fourth objective of the exploratory case studies was to identify the relationship across the key decisions, key internal and external people involved in the front-end innovative product offerings and the research question was

RQ4 - How are the innovative offerings, key decisions, and actors, interlinked within the front-end of the innovation process in connection with different product offerings (incremental or disruptive)?

The apparel product developer offers both incremental and disruptive innovations (section 5.1). Mainly, three categories of innovation were evident in the incremental offerings: 'for customers', 'with B2B customers' and 'by B2B customers. As per the case study findings discussed in section 5.2.1, the preliminary strategy identification activity phase consists of five main decision stages (gate 1-5). The number of decisions making gate changes in the concept development activity phase is based on three approaches; need based, technology based and need, and technology (combination) based. Concept development activity phase consists of three main decision gates in the need based approach (gates 6A, 7, and 8) and the technology based approach (gates 6B, 7, and 8). There are four decision gates for need and technology based approach (gates 6A, 6B, 7, and 8). For these front-end innovation decisions, and for both incremental and disruptive innovations, the organization's internal factors (competencies & climate) as well as external factors related to outside actors (suppliers' and customers' competencies and relationship characteristics) were influential, as per the findings discussed in section 5.2.5. The relationship between the apparel organization and B2B customers changes with the different innovative offerings (section 5.2.6). The mode of relationship between the apparel organization and supplier does not change with the type of innovation. These roles basically depend on the company's level of familiarity with technology. The level of involvement is decided at the preliminary strategy identification activity phase.

The relationships between the type of innovation, key decisions, and interactive roles of actors within the front-end of apparel can be presented as shown in Table 5. 4. The table shows the nature of the innovation provided by apparel manufacturers; incremental and disruptive innovations and categories of innovation with respect to the mode of B2B customer involvement. The key decision gates evident in the two phases are indicated. The identified interactive roles of actors are also mentioned. If a relationship exists between the type of innovation, key decisions, and interactive roles of actors, it is indicated using a check mark (√).

Table 5.4: Relationships between the key decisions, and interactive roles of actors within the front-end of apparel innovation

Type of innovation		Key decisions				Actor network (interactive roles)											
		Strategy identification phase	Concept development phase			Internal - interactive roles				Supplier - interactive roles			Customer - interactive roles				
			Decision approaches														
		5 decision gates (gate 1,2,3,4, &5)	Need based - 3 decision gates (gate 6A, 7, &8)	Technology based 3 decision gates (gate 6B, 7, &8)	Need and technology based 3 decision gates (gate 6A, 6B, 7, &8)	Initiator	Financier	Developer	Facilitator	Facilitator	Initiator	Co-developer	No involvement	Facilitator	Reviewer	Initiator	Co-developer
Incremental innovation	For customers	√	√	√	√	√	√	√		√	√	√	√	√			
	With B2B customers	√		√	√	√	√	√		√	√	√		√	√		
	By B2B customers	√		√	√		√	√	√	√		√		√	√	√	√
Disruptive innovation	With B2B customers	√		√	√	√	√	√		√	√	√	√	√	√		

5.5 Summary of the chapter 5

In this chapter, the findings of the exploratory case studies conducted to identify how apparel product developers arrive at the decisions at the front-end of the apparel product innovation process were discussed.

Sri Lankan apparel manufacturers are working on both incremental and disruptive apparel product innovations. The decisions were explored for the two activity phases of the front-end separately: preliminary strategy identification phase, and concept development phase. Five main decision gates were identified in the preliminary strategy identification phase.

- Gate 1 - decision on 'initial innovation opportunities (ideas)'
- Gate 2 - decision on 'suitable innovation opportunities (ideas) to be proceeded with, and apparel brands'
- Gate 3 - decision on 'resources and budget'
- Gate 4 - decision on 'appropriate practices to be implemented'
- Gate 5 - decision on 'network actors'

There are three different decision approaches within the concept development phase of the front - end; need based, technology based and need, and technology based. The number of decisions making gates changes in the concept development activity phase based on three approaches.

- Three main decision gates in the need based approach
- Three main decision gates in the technology based approach
- Four decision gates in need and technology based approach in which two decisions are taken simultaneously

Five main decision gates within the preliminary strategy identification phase, and three different decision approaches within the concept development phase of the front - end were presented in detail.

Besides, the different modes of involvement of the B2B customer and the supplier and differences in their inputs and involvement in the front-end were identified in actual apparel industry practice.

In addition, the environmental factors (internal and external) that influence front-end decisions were also identified. However, the extent to which these factors differ for incremental and disruptive apparel innovation was not identified. The relationship of the internal and external factors, and front-end decisions were not included in the conceptual framework developed to identify the relationship between innovative offerings, key decisions, and actors at the front-end in Chapter 4.

The findings of the exploratory case studies provide significant insight into the front-end decision situations when initiating an apparel product innovation process. The recognized relationship between the decisions, actors, and influential factors within the front-end of apparel innovation practice through case studies will facilitate ensure effective and smooth running and to get better and effective results from the front-end. Therefore, the relationship between innovative offerings, key decisions, influential factors, and actors in the front-end will be used in the forthcoming Chapters for subsequently developing the decision making model.

CHAPTER 6

VERIFICATION OF THE DECISION MAKING PROCESS STEPS AND INTERACTIVE ROLES

This chapter re-examines and verifies the results obtained in case studies (step 1 of model development) on the decision making process steps, as well as the interactive roles of suppliers, apparel producers, and B2B customers for incremental innovation of the two selected scenarios: innovation 'initiated by company' and innovation 'initiated by B2B customer.'

The focus of the decision making model was narrowed down to incremental innovative offerings, which are prevalent in the apparel industry. As the main focus of the study stated in section 1.3, the decision model incorporates the concept of 'co-creation of value in the B2B context'. Two approaches to innovation initiation were considered: innovation 'initiated by company' and innovation 'initiated by B2B customer'. Both information and knowledge of the customer are expected to be utilized for the innovation process in the 'co-creation of value'. The focus of the decision model is discussed in section 6.1.

The chapter discusses the decision making process steps and the interactive roles of suppliers, apparel producers, and B2B customers for incremental innovation of the two selected scenarios: innovation 'initiated by company' and innovation 'initiated by B2B customer' based on mainly the findings of the exploration case studies described in Chapter 5 (step 1 of the model development) and the relevant literature (sections 6.2 and 6.4). The chapter addresses the following two questions.

a. *What would be the decision process steps in the front-end of incremental apparel product innovation 'initiated by company' and 'initiated by customer'?*
b. *What would be the role of suppliers and B2B customers in the front-end of incremental apparel product innovation 'initiated by company' and 'initiated by customer'?*

Interviews were conducted to re- examine and verify the front-end decision making process steps and interactive roles of the two selected scenarios: innovation 'initiated

by company' and innovation 'initiated by B2B customer'. Since the interviews were used to further refine the findings of the case studies, this interview was termed as 'refinement interviews'. The format of the refinement interviews is presented in Appendix 6. The verification process was carried out by interviewing six managers who held senior management positions and were not involved in the case studies of the exploratory study but actively engaged throughout the front-end of apparel innovation activities. The senior managers involved in the refinement interviews are well experienced in the area, and successfully run the innovation process in their companies. Appendix 7 presents the details of the respondents, and the results of the refinement interviews. Conclusions were drawn to address the research questions formulated. The chapter also presents the suggestions made by the senior managers involved in the refinement interviews on the decision making process steps in section 6.3 and the interactive roles of B2B customers, apparel producers and suppliers in section 6.5.

6.1 Decision making model focus

The findings of the case study interviews in section 5.1 confirmed that incremental innovations are carried out to enhance both the aesthetic and functional values of product categories. Further, the apparel producers of Sri Lanka must satisfy the expectations of the apparel brands since they sell their products through apparel brands (Case study interviewee a- 1). Apparel brands are concerned about innovative products to reach the market within a shorter time frame than their competitors. The Chief Operating Officer of Company B (Case study interviewee b-1) stated:

> "*Apparel brands are demanding new ideas within a shorter period. Apparel brands want to be the first in the marketplace. The time is very tight for us as manufacturers to work on innovative ideas*".

As a result, in the actual apparel industry setting in Sri Lanka, 90-95% of innovations are incremental (Case study interviewee c-1). Therefore, the focus on the front-end decision making model was narrowed down to incremental innovative offerings.

In addition, past studies have also highlighted the wide application and benefits of incremental innovation.

- Incremental innovation is the most widespread type of innovation found in practice (Aleixo & Tenera, 2009; Paananen,2010).
- Incremental innovation is often associated with continuous improvements where new concepts are applied vigorously to existing products (Garcia & Calantine, 2002; Paananen, 2010).
- When changes are small, the market is already familiar to the producer, the level of risk is low or moderate in the case of incremental innovation (Aleixo & Tenera, 2009).
- Within the incremental innovation process, estimating the business potential is easier (Aleixo & Tenera, 2009; Garcia & Calantine, 2002), the timeline is shorter (typically 2-3 years' time lag), and therefore, the concepts can be executed faster, since the necessary information can be gathered quickly (Garcia & Calantine, 2002).
- A steady flow of incremental innovation is vital for businesses competing in a technologically mature market (Paananen, 2010).

As per the findings of the case studies described in sections 5.2.1 and 5.2.6, three innovation initiation approaches were evident in apparel product innovation. In the first approach, the apparel producer initiates the innovation on behalf of the customer. In the second approach, the apparel producer initiates the innovation and asks the Business to Business (B2B) customer for input. In the third approach, the B2B customer set the groundwork for the innovation by taking on a role as an active initiator and involves for the front-end activities and decision making in the concept development phase. Since the customer does not physically integrate in the first approach, the knowledge of the customer cannot be utilized for the front-end activities. Therefore, two innovation initiation approaches were selected for the model considering the active involvement of B2B customers. That is because in 'co-creation of value', both information and knowledge of the customer is expected to be utilized for the innovation process (Saarijarvi et al., 2013; Srivastava et al., 2008). Based on the above all, and the research study aim, the following two innovation process approaches, or scenarios were considered for the study.

- Scenario 1- innovation 'initiated by company' (with B2B customer)

The apparel producer initiates the innovation process. The B2B customers are involved on the front-end providing information, proposing solutions, and giving feedback for final concepts.

- Scenario 2- innovation 'initiated by B2B customer' (by B2B customer)
  The B2B customer sets the groundwork for innovation with the unmet and under-met needs of the potential end consumer, and is actively involved in the process.

The decision making process steps and the interactive roles of suppliers, apparel producers, and B2B customers, which were discussed in Chapter 5 are further discussed below, focusing on the front-end of incremental apparel product innovation 'initiated by company' and 'initiated by B2B customer' and the suggestions made by the senior managers involved in the refinement interviews are presented.

6.2 Decision making process steps in the front-end of incremental apparel innovation

As per the case studies discussed in section 5.2, five decision gates were identified under the preliminary strategy identification activity phase. During the concept development phase, three approaches were identified as need based, technology based, and combination (technology and need) based approaches (section 5.2.2). As per the findings of the case study interviews in sections 5.1 and 5.2, the function, and aesthetic value of the products are expected to improve in apparel innovation. Therefore, the needs of the customers, and a variety of developments that can be generated from technologies, materials and assembly techniques are explored together. The findings of the case studies confirmed that technology and need based approach is utilized in the actual apparel industry setting in Sri Lanka. Therefore, need based and technological based approach was considered in the concept development phase. Further, past studies too emphasize the features of technology and need based approach.

- Technology and need based approach emphasize the interaction between technological capabilities and customer needs, thus stimulating the development of new markets (Brem & Voigt, 2009).

- It is a proven fact that successful products and services depend on the targeted combination of ‘market pull’ and ‘technology push’ activities (Brem & Voigt, 2009).

As per the case studies discussed in section 5.2, four decision gates were identified under the need and technology based approach.

The decision gates (gates 1- 8) discussed in section 5.2 were identified purely based on exploration case studies. In this chapter, these steps are verified and further refined by integrating the work of previous researchers, where applicable, as the decision model focuses on incremental innovation and two of the innovation initiation approaches, namely innovation ‘initiated by company’ and that ‘initiated by B2B customer’. Therefore, the following research question was formulated to re-examine and to verify these identified decisions making process steps at the front-end of incremental apparel product innovation.

Q1. *What would be the decision process steps in the front-end of incremental apparel product innovation ‘initiated by company’ and ‘initiated by customer’?*

The activities of the decision making process follow three steps (Figure 5.4 in section 5.2). As the first step, updated information must be gathered at each step of the process. Then, information is refined by evaluating against already existing knowledge aspects to be considered to arrive at the final decision. At the third step, final decisions are taken.

Thus, evaluation matrices are proposed for the evaluation of information to reach out to decisions in this study under each decision gate. The decision matrices are presented for each decision gate from section 6.2.1.1 to section 6.2.2. This evaluation matrix visualizes the factors to be considered under each decision gate, and indicates the position of the company against each factor towards innovation of the identified ideas (Bakouros, 2000; Dornberger & Suvelza, 2012; Okudan & Tauhid, 2008 ; Rebernik & Bradač, 2008). The evaluation matrix provides insight to the final decision and is used in many companies in idea selection (Koen, et al, ,2002).

The decision making process steps in the front-end of incremental apparel innovation under the above research question are discussed for scenario 1 (innovation initiated by company) and scenario 2 (innovation initiated by B2B customer) separately.

6.2.1 Decision making process steps - Scenario 1 (innovation initiated by company)

6.2.1.1 Gate 1 - decision on 'initial innovation opportunities'

The potential innovation opportunities are identified at decision gate 1 as discussed in section 5.2.1.1. These potential innovation opportunities are determined by studying the specific market and related industry, customer needs, and current and emerging technologies. These timely factors continuously vary. Therefore, updated information on these factors must be gathered to develop the knowledge to arrive at the final decision. The identified factors were stated in Chapter 5. They are verified and further refined by revisiting the work of the previous research. Column 1 of Table 6.1 presents the factors. The related research activities (the case study interviews and /or the literature) in determining these factors are presented in column 2 of Table 6.1.

Table 6.1: Factors that determine innovation opportunities at gate 1and the research activity from which these factors were identified – *scenario1*

Factors/ Information	Research activity
Market direction, and consumer behaviour trends	Ahmad, 2010; Case study interviewee a-1, a-2, b-1, b-2, c-1, & c-2 (Appendix 5)
Evolving Technological development	
Evolving environmental concerns	Case study interviewee b-1, b-2, & c-1 (Appendix 5)
Development in adjacent industries	Ahmad, 2010; Case study interviewee c-1, & c-2 (Appendix 5)
Unmet & under met customer needs	Ahmad, 2010; Cooper,2014

The literature sources and the case study interviews of this research stated under the 'research activity column' in Table 6.1 report the factors determining innovation opportunities, while Table 6.2 reports the sources from which the updated information can be found. The related research activities (case studies and/or the citation of the

previous work) in determining these sources of information are also presented in Table 6.2 (column 2).

Table 6.2:Sources of information to identify the factors for gate 1and the research activity that depicted these sources of information – *scenario1*

Sources for Information	Research activity
Feedback gathering from current B2B customers	Case study interviewee b-1, b-2, c-1, & c-2 (Appendix 5)
Market survey companies	Ahmad, 2010; Case study interviewee a-1, a-2, b-1, b-2, c-1, & c-2 (Appendix 5)
Retail visits	
Social media (You tube, blogs, twitter, user forums, and expert blogs)	Case study interviewee a-2, b-1, b-2, c-1, & c-2 (Appendix 5); Roberts & Piller, 2016
World wide web	Case study interviewee a-2, b-2, c-1, c-2, c-4 (Appendix 5); Roberts & Piller, 2016
Trade journals	Ahmad, 2010; Case study interviewee a-2, b-1, b-2, c-1, & c-2 (Appendix 5); Roberts &Piller, 2016
Trade fairs & exhibitions	Ahmad, 2010; Case study interviewee a-2, b-1, b-2, c-1, & c-2 (Appendix 5)
Trade magazines	
Conferences	Case study interviewee b-1, b-2, c-1, & c-2 (Appendix 5)
Industry forums	Case study interviewee a-2, b-1, b-2, c-1, & c-2 (Appendix 5)

Evaluation matrix for gate 1- scenario1

The identified factors in Table 6.1 must be evaluated in order to identify potential innovation opportunities. Each of the factors listed in column 1 of Table 6.1 is evaluated against the criterion listed in Table 6.3. The factors for the evaluation criterion, and the respective sources which caused determining these research decisions for the evaluation criterion are presented in Table 6.3.

Table 6.3: Factors for evaluation criterion for reaching decision at gate 1 and the research activity from which the factors for evaluation criterion identified –*scenario1*

Factors for evaluation criterion		**Research Activity**
Strategic alignment	Align with the context (current / future situation)	Case study interviewee a-1, a-2, b-1, b-2, c-1, & c-2 (Appendix 5); Stevanović et al., 2012
New values to company	Enable to overcome the competitors/ competition	Kirova,2009; Stevanović et al.,2012
	Enable to explore new customers	Case study interviewee a-1, a-2, b-1, b-2, c-1, & c-2 (Appendix 5); Kirova,2009
	Enable to offer new values to existing customers	
	Enable to acquire new technical knowledge or skills	Case study interviewee a-2, b-2, c-1, & c-2 (Appendix 5); Stevanović et al.,2012
	Will enhance impact of the company	Stevanović et al.,2012
Attention to environment issues	Ecology and recyclability	Case study interviewee b-1, &b-2 (Appendix 5); Stevanović et al.,2012
	Water consumption / reduce waste	Case study interviewee b-2 (Appendix 5)
	Material usage / prevent waste	

The matrix to evaluate the initial innovation opportunities is presented in Table 6.4. Marks are assigned for each of the factors identified (column 1 of Table 6.1) against each of the criteria presented in column 1 of Table 6.3. For each of the factors presented in Table 6.1, there may have several innovation opportunities as shown as 1,2,3, & 4 in the evaluation matrix for gate 1(Table 6.4). For example, under market direction and consumer behaviour trends, there are 1-4 innovation opportunities which were identified from the sources presented in Table 6.2. For example, multipurpose or multifunctional garments may be under met or unmet customer needs, where there may have several innovation opportunities in line with sustainable garments, well ness, and smart clothing (Case study interviewee a-2, b-1,& c-2; McKinsey & Company, 2017). Scores are assigned for each of the factors in the columns of the evaluation matrix (Table 6.4) considering the relationship to the factors of the evaluation criteria (column 1 of Table 6.4). At this stage, only an answer of yes/no (1 or 0) is assigned; 1, if a relationship exits and 0, if no relationship exists. The innovation opportunities which have obtained higher scores at this stage, are considered as potential innovation opportunities.

Table 6.4: Evaluation matrix for gate 1 to decide the innovation opportunities – *scenario1*

Factors (from Table 6.1) / Factors for evaluation criteria at gate 1	Market direction and consumer behaviour trends				Evolving Technological development			Evolving environmental concerns			Development in adjacent industries			Unmet & under met customer needs			
	1	2	3	4	1	2	3	1	2	3	1	2	3	1	2	3	4
Align with the context (current / future situation)	1/0																
Enable to overcome the competitors/ competition																	
Enable to explore new customers																	
Enable to offer new values to existing customers																	
Enable to acquire new technical knowledge or skills																	
Will enhance impact of the company																	
Ecology and recyclability																	
Water consumption / reduce waste																	
Material usage / prevent waste																	
Total																	

The process of identifying potential innovation opportunities described in the section 6.2.1.1 is graphically represented in the flow chart in Figure 6.1.

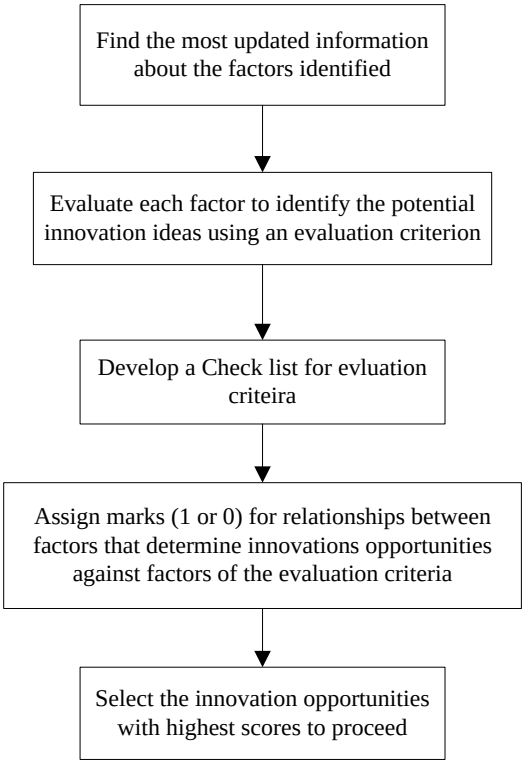


Figure 6.1:Process of identifying potential innovation opportunities

Apparels manufactured in Sri Lanka directly reaching the end consumer does not normally happen. However, at decision gate 1, a specific customer is not focused on. That is due to the fact that if initial innovation opportunities are considered with a specific customer, the chance of missing valuable innovation opportunities may be high. The customer or apparel brand is finalized in decision gate 2. The procedure for the selection of the customer brand is discussed in section 6.2.1.2.

6.2.1.2 Gate 2 - decision on 'suitable innovation opportunities and apparel brand'

The initial innovation opportunities identified at decision gate 1 are evaluated at gate 2 to ensure commercialization or marketability with suitable potential apparel brands (section 5.2.1.2). Therefore, at decision gate 2, targeted apparel brands are considered, and the identified innovation opportunities at gate 1 are evaluated against the targeted apparel brands.

The apparel brands cater to different market segments with a range of product categories. However, apparel brands have to offer value-added innovative apparel to

be competitive in their existing markets. Therefore, some brands are eagerly waiting to grab sellable new concepts to offer new values to existing customers as well as to explore new customers. The Innovation Manager of Company C (Case study interviewee c-3) stated this as

> "We *know with our experience, what type of products the brands are looking for. The apparel brands are eagerly waiting to grab sellable concepts to offer value-added products to their consumers, for which the apparel brands will pay for the new concepts at early stage, and will buy products".*

Some brands are interested in inter - firm collaborations with apparel producers for innovations to maintain or increase their share within the market (Case study interviewee a-1, a-2, b-1, b-2, c-1, & c-2). Therefore, the decision gate 2 is to determine the apparel brands against the identified opportunities at gate 1 and to decide on suitable opportunities too.

Column 1 of Table 6.5 presents the customer attributes (factors) that determine the apparel brand for identified innovation opportunities at gate 1. The related research activity (case studies and/or the previous work) are presented in column 2 of Table 6.5.

Table 6.5: Factors that determine the apparel brands at gate 2 and the research activity from which these factors were identified-*scenario1*

Information on customer attributes	Research activity
Sizes of the target market	Case study interviewee a-1, a-2, b-1, b-2, c-1, & c-2 (Appendix 5); Cooper,1998 ; Dahan, 1998
Market segments	
Market share	
Growth rate	
Season calendar	Case study interviewee a-1, a-2, b-1, b-2, c-1, & c-2 (Appendix 5)

Some of the information about the B2B customer is based on existing customer rating data, if available with the company. However, to verify the existing information on apparel brands, and to gain more knowledge, the information sources listed in column

1 of Table 6.6 are used. These sources of information listed in Table 6.6 were revealed in the case study interviews and found from literature as presented in column 2.

Table 6.6: Sources of information to identify the factors for gate 2 and the research activity that depicted these sources of information – *scenario1*

Sources of Information	Research activity
Experience of the company (data and knowledge base)	Case study interviewee a-1, a-2, b-1, b-2, c-1, & c-2 (Appendix 5)
Market survey companies	Dahan, 1998; Stevanović et al.,2012
Key targeted customers (B2B)	Case study interviewee b-1, b-2, c-1, & c-2 (Appendix 5)
Industry experts	Dahan, 1998
Published and statistical materials such as industry reports	Dahan, 1998

Evaluation matrix for gate 2- scenario1

Initial innovation opportunities are identified at decision gate 1, and the apparel brands are evaluated against the criteria listed in column 1 of Table 6.7.

Table 6.7: Factors for evaluation criterion for reaching decision at gate 2 and the research activity from which the factors for evaluation criterion identified – *scenario1*

Factors for evaluation criterion	Research activity
Sizes of the target market segments	Case study interviewee a-1, a-2, b-1, b-2, c-1, & c-2 (Appendix 5); Cooper,1998; Stevanović et al.,2012
Market share	
Growth rate	
Align to the expected time / season calendar	Case study interviewee a-1, a-2, b-1, b-2, c-1, & c-2 (Appendix 5)
Reputation within the market	Case study interviewee a-1, a-2, b-1, b-2, c-1, & c-2 (Appendix 5), Cooper,1998; Stevanović et al.,2012
Readiness to accept new ideas	Case study interviewee b-1, b-2, c-1, & c-2 (Appendix 5)
Readiness for inter firm collaboration	Case study interviewee a-1, a-2, b-1, b-2, c-1, & c-2 (Appendix 5)
Closeness of relationship	
Accessibility/ approachability	

The initial innovation opportunities identified at decision gate 1 are further examined to identify commercially viable innovation opportunities with apparel brands (B2B

customers). The matrix to finalize apparel brands and the innovation opportunities is presented in Table 6.8.

Table 6.8: Evaluation matrix for gate 2 to decide apparel brands – *scenario1*

Factors (from Table 6.5 and gate 1) / Factors for evaluation criteria at gate 2		Innovation opportunities identified at gate 1				
		1	2	3	4	5
Apparel brand 1	Sizes of the target market segment, / market share, and growth rate					
	Align to the expected time / season calendar					
	Reputation within the market					
	Readiness to accept new ideas					
	Readiness for inter firm collaboration					
	Closeness of relationship					
Total score						
Apparel brand 2	Sizes of the target market segment, / market share, and growth rate					
	Align to the expected time / season calendar					
	Reputation within the market					
	Readiness to accept new ideas					
	Readiness for inter firm collaboration					
	Closeness of relationship					
	Accessibility/ approachability					
Total score						

At this stage, numerical values are assigned to each of the factors in the columns of the evaluation matrix (Table 6.8) to indicate the strength of the relationship between the desirability of the innovation opportunities and the targeted apparel brands. The indication of the strength of the relationship facilitates meaningful comparison to arrive at the final decision (Binz & Reichle, 2005; Burge, 2006). Therefore, a value scale ranging from 3 to 0 is assigned (3-highly desirable, medium desirable, little desirable, and 0-not desirable) (Burge, 2006). The higher scored innovation opportunities are considered as suitable opportunities to proceed with. Further, the apparel brands that obtained higher scores for the suitable opportunities are selected as the B2B customers to offer the innovation (concept or product) and work with them. This decision facilitates to minimize the wasteful efforts of innovation.

6.2.1.3 Gate 3 – decision on 'resources and budget'

The third decision gate is to identify and select the appropriate key resources to realize the already finalized opportunities (ideas) at gate 2 and to allocate the initial budget, as discussed in section 5.2.1.3. The identified factors determining the resources and budget were stated in Chapter 5. Column 1 of Table 6.9 presents the factors related to the decision on resources. The research activity from which these factors were identified is presented in column 2 of Table 6.9.

Table 6.9: Factors that determine the resources at gate 3 and the research activity from which these factors were identified – *scenario1*

Factor to determine the resource and budget		**Research activity**
Internal and external sources	Machineries (technologies/ techniques)	Case study interviewee a-2, a-3, b-1, b-2, c-1,c-2, &c-4 (Appendix 5)
	Novel fabrics/ materials	
	Technology know-how	
	Areas of skills	

The state-of-the–art machinery, technologies, and materials change with time. The most updated information on these factors can be found from the sources of information listed in Table 6.10. These sources of information listed in column 1 of Table 6.10 were revealed during the case study interviews, and found from literature as presented in column 2 of Table 6.10.

Table 6.10: Sources of information to identify the factors for gate 3 and the research activity that depicted these sources of information – *scenario1*

Sources of Information	**Research activity**
Experience of the company (data and knowledge base)	Case study interviewee a-2, a-3, b-1, b-2, c-1, c-2, & c-4 (Appendix 5)
Trade fairs and exhibitions	Case study interviewee a-3, c-2, & c-4 (Appendix 5); Ruiz & Maier, 2016
Trade journals	Case study interviewee a-3, c-1, c-2, & c-4 (Appendix 5); Ruiz & Maier, 2016.
Specialists in apparel and textiles	Case study interviewee a-3, c-1, c-2, & c-4 (Appendix 5)
Structured industrial directories	Ruiz & Maier, 2016

Evaluation matrix for gate 3- scenario1

The criterion for evaluating each of the factors in Table 6.9 to arrive at decision gate 3 is presented in column 1 of Table 6.11. The factors in the evaluation criteria are found from literature and case study interviews as shown in column 2 of Table 6.11.

Table 6.11: Factors for evaluation criterion for reaching decision at gate 3 and the research activity from which the factors for evaluation criterion identified – *scenario1*

Factors for evaluation criterion		**Research activity**
Compatibility	Appropriateness to proceed ahead with the potential ideas (gate 2)	Bandarian, 2007; Case study interviewee a-2, a-3, b-1, c-1, c-2, & c-4 (Appendix 5)
Rewards to company	Will be able to overcome technical uncertainty / manufacturing difficulties, and market uncertainty	Ruiz & Maier, 2016 ; Shen, et al., 2010
Monetary evaluation criteria	Cost of implementing / purchasing resources (technologies, and machineries)	Case study interviewee a-2, b-1, c-1, c-2, & c-4 (Appendix 5); Ruiz & Maier, 2016
	Cost of operation and maintenance of resources (technologies, and machineries)	Case study interviewee a-2, a-3, b-1, c-1, c-2, & c-4 (Appendix 5); Hong & Shin, 2012
	Payback period of resources (Technologies, and machineries)	Hong & Shin, 2012
	Expected profit margin	Bandarian, 2007; Hong & Shin, 2012

The matrix presented in Table 6.12 is to decide the resources. Each of the factors presented in column 1 of Table 6.9 may have several options, shown as 1,2,3,&4 in Table 6.12. Hot air seam sealing, 3 D printing, lacer decorations, 3D knitting, and flatbed interlock are a few examples of the variety of current state-of-the-art machinery and technologies (CBI, 2019; Fibre to Fashion, n.d.) which can be found from the sources presented in column 1 of Table 6.10.

Table 6.12: Evaluation matrix for gate 3 to decide resources – *scenario1*

Factors (from Table 6.9) / Factors for evaluation criteria at gate 3	Machineries / technologies/ techniques				Basic raw materials					Technology know-how					Areas of skills			
	1	2	3	4	1	2	3	4	5	1	2	3	4	5	1	2	3	4
Appropriateness to proceed ahead with the innovation opportunities (gate 2)																		
Will be able to overcome technical uncertainty (Manufacturing difficulties)																		
Will be able to overcome market uncertainty																		
Total score																		

Numerical values are assigned to illustrate the strength of the relationship in evaluating each of the factors identified (column 1 of Table 6.9) against each of the criteria presented in column 1 of Table 6.11. A value scale ranging from 3 to 0 is assigned (3-highly essential, medium essential, little essential, and 0-not essential). The resources which have obtained higher scores are considered as essential internal and external sources (machinery, and technologies or techniques, novel fabrics and materials, technology know-how, and areas of skills) are to be used for innovation.

The company should check the availability of resources within the premises, revisiting their data and knowledge base. For example, if the selected technology is lacer decorations, the company should know whether the technology is available within the premises. If the resources are not available within the premises, the company will have to acquire the resources externally. The information related to the selected resources needs to be revisited to identify the details on cost of implementation, cost of purchasing and cost of operation and maintenance. Then the initial budget is calculated. Column 1 of Table 6.13 shows the information related to the monetary values of the resources and the other columns show the selected resources. Each of the resources may have several preferences as shown in the evaluation matrix (Table

6.12). Hot air seam sealing, 3 D printing, and lacer decorations are a few examples of the identified variety of machineries and technologies.

Table 6.13: Budget estimation – *scenario1*

Cost of resources (Table 6.9) / Cost factors	Machineries / technologies/ techniques			Basic raw materials			Technology know-how		Areas of skills	
	1	2	3	1	2	3	1	2	1	2
Cost of implementing / purchasing resources (Technologies, and machineries)										
Payback period (technologies, and machineries)										
Cost of operation and maintenance										
Total estimated cost										

The process of identifying the appropriate key resources and allocating initial budget is graphically represented in the flow chart in Figure 6.2.

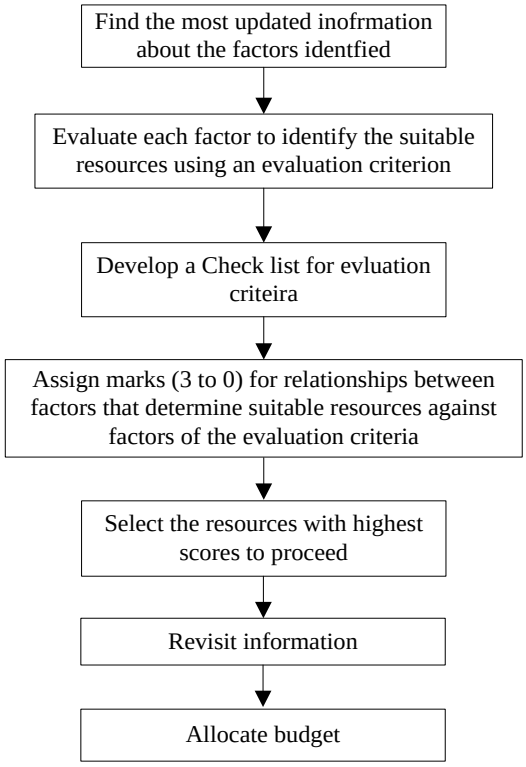


Figure 6.2: Process of identifying the appropriate key resources and allocating initial budget

6.2.1.4 Gate 4 - decision on 'initial appropriate practices to be implemented'

As discussed in section 5.2.1.4, at decision gate 4, appropriate innovation practices to be implemented are decided to realize the already finalized opportunities at gate 2. The updated information on good practices in industry and other industries for innovation must be gathered to select and employ the most appropriate good practices (Case study interviewee b-1, c-1, & c-2). A few examples of good practices for innovation are collaboration, cross-functional multi-disciplinary teams, networking, and crowd funding (Fortuin, 2006; Pathak et al, 2016). Column 1 of Table 6.14 presents the sources from which good practices can be identified. The related research activities (case studies and/or the citation of the previous work) in determining these sources of information are presented in column 2 of Table 6.14.

Table 6.14: Sources of information to identify the factors for gate 4 and the research activity that depicted these sources of information – *scenario1*

Sources of information	Research activity
World wide web articles, and online data base	Case study interviewee a-2, b-1, b-2, c-1, & c-2 (Appendix 5); Tuckwood, et al, 2014
Trade journals	Tuckwood, et al, 2014
Experts	Case study interviewee a-1, b-1, & c-2 (Appendix 5); Tuckwood, et al, 2014
Published available success stories of other companies	Pathak, et al, 2016 ; Tuckwood, et al, 2014
Network with other organizations to determine successful practices	

Evaluation matrix for gate 4- scenario1

The good practices in industry and other industries for innovation must be compatible, and must give rewards to the apparel company. Therefore, these good practices are evaluated against the criteria listed in Table 6.15. The factors for the evaluation criteria were identified from case study interviews, and from the published literature (Table 6.15).

Table 6.15: Factors for evaluation criterion for reaching decision at gate 4 and the research activity from which the factors for evaluation criterion identified – *scenario1*

Factors for evaluation criterion		**Research activity**
Compatibility	Appropriateness to proceed ahead with the potential ideas (gate 2)	Case study interviewee a-2, b-1, b-2, c-1, & c-2 (Appendix 5)
	Can manage with the identified resource (gate 3)	Case study interviewee a-2, b-1, b-2, c-1, & c-2(Appendix 5); Tuckwood, et al, 2014
	Align with the allocated budget (gate 3)	Case study interviewee a-2, b-1, b-2, c-1, & c-2 (Appendix 5)
Accessibility	Information available on implementation process steps & priorities	Case study interviewee a-2, b-1, b-2, c-1, & c-2(Appendix 5); Tuckwood, et al, 2014
	Easy to adopt and implement to reach the target	Tuckwood, et al, 2014
	Flexible, user friendly & convenient	Pathak, et al, 2016
	Simple to understand the requirements for implementation & maintenance	Case study interviewee b-1, b-2, c-1, & c-2 (Appendix 5)
	Evidence available of effective / successful implementations	Case study interviewee a-2, b-1, b-2, c-1, & c-2 (Appendix 5); Pathak, et al, 2016
Rewards to company	Possibility to reduce time frame	Pathak, et al, 2016
	Enable to acquire new knowledge or skill sets	Pathak, et al, 2016 ; Tuckwood, et al, 2014

The matrix to evaluate the appropriate practice to be implemented to realize the already finalized opportunities is presented in Table 6.16. Scores are assigned for each of the factors in the columns of the evaluation matrix (Table 6.16) considering the relationship to the factors of the evaluation criteria (column 1 of Table 6.16). In order to indicate the applicability of practices to realize the innovation, and to prioritize appropriate practices, numerical values ranging from 3 to 0 are assigned (3-highly applicable, medium applicable, little applicable, and 0-not applicable). Practices that scored higher total marks are considered appropriate practices to be implemented for innovation.

Table 6.16: Evaluation matrix for gate 4 to decide appropriate practices – *scenario1*

Factors / Factors for evaluation criteria at gate 4	Best practices				
	1	2	3	4	5
Appropriateness to proceed ahead with the potential ideas (gate 2)					
Can manage with the identified resource (gate 3)					
Align with the allocated budget (gate 3)					
Information available on implementation process steps & priorities					
Easy to adopt and implement to reach the target					
Flexible, user friendly& convenient					
Simple to understand the requirements for implementation & maintenance					
Evidence available of effective / successful implementations					
Possibility to reduce time frame					
Enable to acquire new knowledge or skill sets					
Total score					

6.2.1.7 *Gate 5 – decision on 'network actors'*

The fifth decision gate is to decide the potential basic raw material suppliers, manufacturing partners, and technology know-how providers to effectively realize the already identified opportunities (discussed in section 5.2.1.5). Column 1 of Table 6.17 presents the factors related to the decisions of network actors. The research activities that revealed these factors are presented in column 2.

Table 6.17: Factors that determine the network actors at gate 5 and the research activity from which these factors were identified – *scenario1*

Factor to determine the network actors	**Research activity**
Basic raw material suppliers	Case study interviewee a-1, a-2, a-3, b-1, b-2, b-5, c-1, c-2, & c-4 (Appendix 5); Emden et al., 2006; Renirie, 2008 ; Ruiz & Maier, 2016
Manufacturing partners (material developers, technology providers, & customers),	
Technology know-how providers (R& D centres, Universities/ special institutes, & Training providers)	

The information on the factors presented in column 1 of Table 6.17 can be identified from the sources listed in column 1 of Table 6.18. The related research activities (case

studies and/or previous work) in determining these sources of information are presented in Table 6.18 (column 2).

Table 6.18: Sources of information to identify the factors for gate 5 and the research activity that depicted these sources of information – *scenario1*

Sources of Information	Research activity
Experience of the company (data & knowledge base)	Case study interviewee a-1, a-2, a-3, b-1, b-2, c-1, c-2, & c-4 (Appendix 5); Ruiz & Maier, 2016
Trade journals	Case study interviewee a-3, b-5, c-1, c-2, & c-4 (Appendix 5)
Trade fairs and exhibitions	Case study interviewee a-3, b-5, & c-4 (Appendix 5)
Specialists in apparel and textiles	
Professional social networks	Ruiz & Maier, 2016
Structured industrial directories	
Specialized databases	

Evaluation matrix for gate 5- scenario1

The evaluation of the factors listed in Table 6.17 is necessary to identify potential basic raw material suppliers, manufacturing partners, and technology know-how providers to work with. Each of the factors listed in column 1 of Table 6.17 is evaluated against the criterion listed in Table 6.19.

Table 6.19: Factors for evaluation criterion for reaching decision at gate 5 and the research activity from which the factors for evaluation criterion evolved – *scenario1*

Factors for evaluation criterion		**Research activity**
Compatibility	Appropriateness to proceed with the initial potential ideas (gate2)	Case study interviewee a-1, a-2, a-3, b-1, b-2, b-5, c-1, c-2, & c-4 (Appendix 5)
	Appropriateness to proceed with the identified resource requirements (gate 3)	Case study interviewee a-1, a-2, a-3, b-1, b-2, b-5, c-1, c-2, & c-4 (Appendix 5); Emden et al., 2006; Renirie, 2008
	Appropriateness to proceed with the identified innovation practices (gate4)	Case study interviewee a-1, a-2, a-3, b-1, b-2, b-5, c-1, c-2, & c-4 (Appendix 5)
Rewards to company	Ability to overcome technical uncertainty/ manufacturing difficulties	Case study interviewee a-1, a-2, a-3, b-1, b-2, b-5, c-1, c-2, & c-4 (Appendix 5); Ruiz & Maier, 2016
	Ability to overcome financial difficulties	Emden et al., 2006 ; Renirie, 2008; Ruiz & Maier, 2016
	Enable to acquire new knowledge and skills	Case study interviewee a-1, a-2, a-3, b-1, b-2, b-5, c-1, c-2, & c-4 (Appendix 5); Ruiz & Maier, 2016
	Enable to build effective network relationships	Case study interviewee a-1, a-2, a-3, b-1, b-2, b-5, c-1,c-2, & c-4 (Appendix 5); Emden et al., 2006; Renirie, 2008 ; Ruiz & Maier, 2016
	Enable to overcome Legal hurdles	Emden et al., 2006; Renirie, 2008
Readiness / maturity	Integration readiness / open to acquire and share new knowledge and skills	Case study interviewee a-1, a-2, a-3, b-1, b-2, b-5, c-1, c-2, & c-4 (Appendix 5)
	Systems and processes readiness /ready for changes	
Relational closeness	Reputation	Case study interviewee a-1, a-2, a-3, b-1, b-2, b-5, c-1, c-2, &c-4 (Appendix 5); Renirie, 2008; Ruiz & Maier, 2016
	Experience (knowledge and skills)	Case study interviewee a-1, a-2, a-3, b-1, b-2, b-5, c-1,c-2, & c-4 (Appendix 5); Emden et al., 2006; Renirie, 2008 ; Ruiz & Maier, 2016
	The partners' position within the industry	Case study interviewee a-1, a-2, a-3, b-1, b-2, b-5, c-1, c-2, & c-4 (Appendix 5); Renirie, 2008
	Financial position of the partner	Ruiz & Maier, 2016
	Past records	Case study interviewee a-1, a-2, a-3, b-1, b-2, b-5, c-1, c-2, & c-4 (Appendix 5)
	Geographical Closeness	
	Enthusiasm for the inter-firm collaboration	

The matrix for evaluating the raw material suppliers, manufacturing partners, and technology know-how providers is presented in Table 6.20.

Table 6.20: Evaluation matrix for gate 5 to decide network actors – *scenario1*

Factors (from Table 6.17) / Factors for evaluation criteria at gate 5	Basic fabric suppliers			Manufacturing partners (material developers, and technology providers)			Technology know-how providers, R& D centres, Universities/ special institutes/ and Training providers			
	1	2	3	1	2	3	1	2	3	4
Appropriateness to proceed ahead with the initial potential ideas (gate2)										
Appropriateness to proceed ahead with the identified resource requirements (gate 3)										
Appropriateness to proceed ahead with the identified innovation practices (gate4)										
Align with the context										
Ability to overcome technical uncertainty/ manufacturing difficulties										
Ability to overcome financial difficulties										
Enable to acquire new knowledge and skills										
Enable to build effective network relationships										
Enable to overcome Legal hurdles										
Integration readiness / open to acquire and share new knowledge and skills										
Systems and processes readiness /ready for changes										
Reputation										
Experience (knowledge and skills)										
The partners position within the industry										
Financial position of the partner										
Past records										
Geographical Closeness										
Enthusiasm for the inter-firm collaboration										
Total score										

Each of the factors presented in Table 6.17 may have several preferences, shown as 1,2, & 3 in the evaluation matrix for gate 5 (Table 6.20). For example, suppliers of knitted fabrics, fibre glass fabrics, recycled fabrics, and technical textiles are a few examples of the variety of basic fabric suppliers (Case study interviewee a-3, b-5, c-

4; Fibre to Fashion, n.d.). In order to arrive at a final decision on suitable actors, numerical values are assigned to indicate the extent of relationship between each of the factors identified (column 1 of Table 6.17) and each of the criteria presented in column 1 of Table 6.19. The values range from 3 to 0 (3-highly appropriate, medium appropriate, less appropriate, and 0-not appropriate). The suppliers who scored the higher totals are selected as the suitable actors.

6.2.1.6 Outcome of the 'strategy identification phase'

The outcome of the preliminary strategy identification activity phase is the summary of the decisions at gate1-gate 5. The summary of these decisions (gate1-gate 5) can be provided by an 'initial innovation project canvas' (Dornberger & Suvelza, 2012).

Figure 6.3 illustrates the initial innovation project canvas. The first part (left hand side) provides an understanding of the innovation intention, which includes opportunities, selected apparel brands to offer innovation, and impact (value) to customer and company. The second part (right hand side) is intended to provide insight into decisions within the strategy identification activity phase need to implement to realize the finalized opportunities (gate 3 - gate 5). This includes the decisions on resources, innovation practice, external partners and allocated initial budget. For example, if the innovation opportunities are sustainable garments, and wellness, the 'initial project canvas' indicates, what are the apparel brands, what are the expected value to customer and company, what type of machinery and materials to be utilized, who are the suppliers, and what is the initial budget. 'Initial innovation project canvas' can be used as a visual communication tool to the company and to the outside stakeholders (Dornberger & Suvelza, 2012).

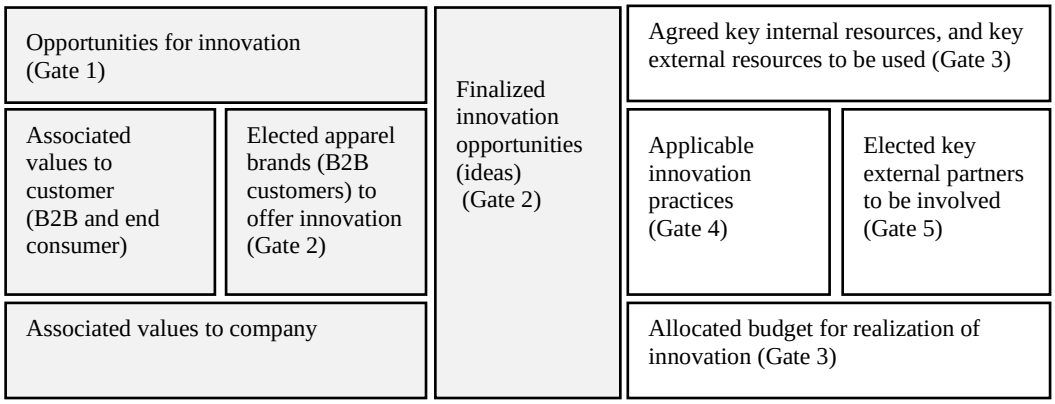


Figure 6.3: Initial innovation project canvas– *scenario1*

The activities and the decisions within the preliminary strategy identification phase, are in Figure 6.4. Gate numbers are indicated in small circles. The bottom rectangles depict the updated information at each step of the process. The criteria used to evaluate each bundle of information gathered are indicated in the middle rectangles. The final decisions are shown in diamonds. The rectangle at the top of the diagram outside the final decisions shows the responsible actors for the decision making. The outcome of the strategy identification phase is shown in the rectangle at the end of the process.

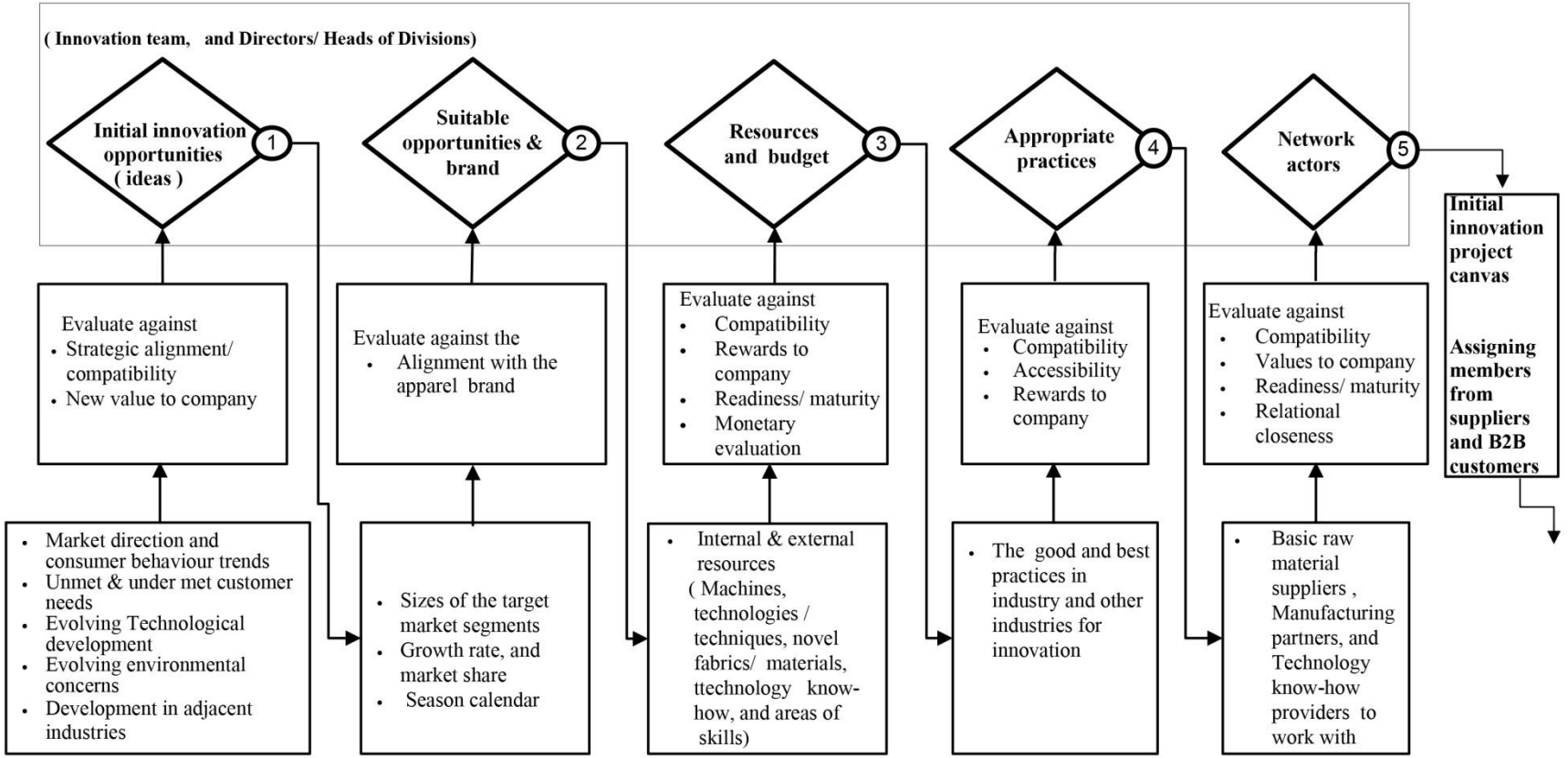


Figure 6.4: Activities and the decisions in the preliminary strategy identification phase- *scenario1*

6.2.1.7 Gate 6A – decision on potential solutions

At decision gate 6A, already finalized innovation opportunities (ideas) at gate 2 are further refined by evaluating them against the product features that may enhance the value and satisfaction of the end consumers of the selected apparel brand (discussed in section 5.2.2.4). Since the requirements of the end consumers continuously vary, updated information must be gathered to refine the innovation ideas, and identify the potential solutions. Column 1 of Table 6.21 presents the sources from which updated information on end consumers can be found. The related research activities in determining these sources of information are also presented in column 2 of Table 6.21.

Table 6.21: Sources of information to identify the factors for gate 6A and the research activity that depicted these sources of information – *scenario1*

Sources of information	Research activity
B2B customer and end consumer feedback	Case study interviewee a-2, a-4, b-2, b-4, & c-1 (Appendix 5); Koen et al. ,2013
Retail visits	Ahmad, 2010; Case study interviewee a-2, b-4, & c-5 (Appendix 5)
Social media (YouTube, blogs, and Twitter).	Case study interviewee a-4, b-2, & c-5 (Appendix 5); Roberts & Piller, 2016

Evaluation matrix for gate 6A- scenario1

The potential solutions generated from innovation opportunities (ideas) finalized at gate 2 are worked out through brainstorming. At this point, end consumer requirements are highly considered. For example, if the selected opportunity at gate 2 is multi- functional, the potential solutions are convertible, adjustable, easily transformed, or user-friendly garments with various colours, prints, lengths, and features (Case study interviewee a-4, b-2, c-1, &c-5). These potential solutions are evaluated against the criteria listed in Table 6.22.

Table 6.22: Factors for evaluation criterion for reaching decision at gate 6A and the research activity from which the factors for evaluation criterion identified – *scenario1*

Factors for evaluation criterion		**Research Activity**
Values to B2B customer	The potential to create a new market	Ahmad, 2010; Cooper,2014; Case study interviewee c-1, & c-5 (Appendix 5)
	Enhance end consumer loyalty	Case study interviewee a-2, b-2, b-4, c-1, & c-5 (Appendix 5)
Values to company	Enhance B2B customer relationship & loyalty	Cooper,2014; Case study interviewee a-2, a-4, b-2, b-4, & c-1 (Appendix 5)
	Enable the company to explore new skills	
New values to end consumer	Offer functional benefits	Ahmad, 2010; Cooper,2014; Case study interviewee b-2 (Appendix 5)
	Offer Expressive benefits	Ahmad, 2010; Cooper,2014; Case study interviewee b-1, b-2, c-1, & c-2(Appendix 5); Kirova,2009
	Offer aesthetic benefits	Ahmad, 2010; Cooper,2014; Case study interviewee a-2, b-1, b-2, & c-1(Appendix 5)

Table 6.23 is the evaluation matrix to identify the strength of relationship between the variety of potential solutions and the criterion listed in Table 6.22 and to finalize the innovation solutions. Each of the opportunities at gate 2 may have several potential solutions. Convertible, adjustable, and easily transformed are a few examples of the potential solutions for multi- functional garments.

Table 6.23: Evaluation matrix for gate 6A to finalize potential solutions - *scenario1*

Finalized innovation ideas at gate 2 / Factors for evaluation criteria at gate 6A	Finalized innovation idea 1 at gate 2				Finalized innovation idea 2 at gate 2		
	Solution1	Solution2	Solution3	Solution4	Solution1	Solution2	Solution3
Potential to create a new market							
Enhance end consumer loyalty							
Enhance customer relationship & loyalty							
Enable the company to explore new skills							
Offer functional benefits							
Offer Expressive benefits							
Offer aesthetic benefits							
Total							

Values ranging from 3 to 0 are assigned (3-highly desirable, medium desirable, less desirable, and 0-not desirable) to quantify the relationship. The innovation solutions that have obtained higher total scores are considered as the potential innovation solutions (appearances / features) that need to be explored and achieved to satisfy the end consumer.

Figure 6.5 shows the process of identifying innovation solutions.

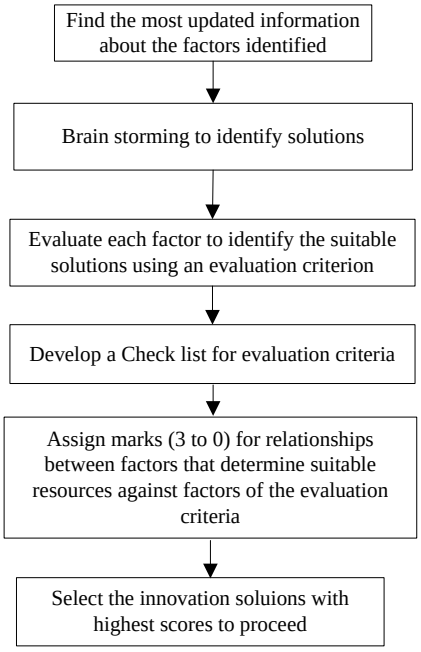


Figure 6.5: The process of identifying innovation solutions

6.2.1.8 Gate 6B - decision on most applicable developments to be generated

As discussed in section 5.2.2.5, at decision gate 6B, the already identified technologies and materials in gate 3 are further refined by identifying a variety of developments that can be generated from them (textures / structures/ features). For example, if the selected machine at gate 3 is lacer decoration, the variety of developments that can be generated from this machine are engraving, 3D effects, aperture cuts and mends, embossing, marking, and fading (Nayak & Padhye, 2016). Column 1 of Table 6.24 shows the sources of information to identify a variety of developments that can be generated from the identified technologies and materials in gate 3. The research

activities (case studies and/or the citation of the previous work) that directed the requirements of these factors are also presented in column 2 of Table 6.24.

Table 6.24: Sources of information to identify the factors for gate 6B and the research activity that depicted these sources of information – *scenario1*

Sources for Information	Research activity
Data and knowledge base of the company	Case study interviewee a-2, a-4, b-2, b-4, c- 1, & c-3 (Appendix 5)
Communicating with the identified network actors (suppliers and other organizations)	Bandarian, 2007; Case study interviewee a-2, b-2, c- 3, & c-5 (Appendix 5)
Trade journals	Case study interviewee a-4, b-4, c- 1, & c-3 (Appendix 5); Kirby, 2001
Visiting trade fairs and exhibitions	Bandarian, 2007; Case study interviewee a-2, a-4, b-2, b-4, c- 1, & c-3 (Appendix 5)
Watching futuristic movies	Case study interviewee a-4, b-4, & c-3 (Appendix 5); Kirby, 2001; Shen, et al., 2010

Evaluation matrix for gate 6B- scenario1

The potential developments of each of the identified technologies and materials in gate 3 can be evaluated against the criterion listed in Table 6.25.

Table 6.25: Factors for evaluation criterion for reaching decision at gate 6B and the research activity from which the factors for evaluation criterion identified – *scenario1*

Factors for evaluation criterion		Research activity
Compatibility	Appropriateness to address identified innovation ideas at gate 2	Case study interviewee a-2, a-4, b-2, b-4, c- 1, & c-3 (Appendix 5); Bandarian, 2007
	Can be managed with the allocated budget at gate 3	Case study interviewee a-2, a-4, b-2, b-4, c- 1, & c-3 (Appendix 5)
	Manage with the identified partnerships at gate 5	
	Compatible with the predicted time to market	Case study interviewee a-2, b-2, & c- 1 (Appendix 5); Kirby, 2001
Manufacturability	Applicable for many products	Case study interviewee a-2, & b-2 (Appendix 5); Shen, et al., 2010
	Ease of use or process integration	Bandarian, 2007; Case study interviewee a-2, a-4, b-2, b-4, c- 1, & c-3 (Appendix 5)

The suitable developments from each of the identified technologies, and materials in gate 3 are finalized using the matrix presented in Table 6.26.

Table 6.26: Evaluation matrix for gate 6B to decide applicable developments– *scenario1*

Developments from technologies and materials 1 at gate 3 / Factors for evaluation criteria at gate 6B	Technologies				Materials			
	Lacer engraving	3D effects	Lacer embossing	Development 4	Denim	Material 2	Material 3	Material 4
Appropriateness to address identified innovation ideas (gate 2)								
Can be managed with the allocated budget (gate 3)								
Manage with the identified partnerships (Gate 5)								
Compatible with the predicted time to market.								
Applicable for many products								
Ease of use or process integration								
Total								

At this stage, numerical values ranging from 3 to 0 (3-highly appropriate, medium appropriate, less appropriate, and 0-not appropriate) are assigned to each of the factors in the columns of the evaluation matrix (Table 6.26) to indicate the strength of the relationship between the potential developments and the criterion presented in column 1 of Table 6.25. The developments which have obtained higher total scores are considered as the suitable developments (textures / structures/ features) for innovation from each of the identified technologies and materials in gate 3. For example, if the higher score technology is laser embossing and the higher score fabrics is denim, suitable development would be laser embossing on denim fabric.

6.2.1.9 Gate 7 - decision on suitable feasibility studies to be executed

As mentioned in section 6.1, apparel brands want to be the pioneers in the market, and they demand innovative products within a shorter time frame. Therefore, realization feasibility study plans are developed to minimize wasteful efforts, and speed up the process (discussed in section 5.2.2.6). The feasibility studies are essential to verify the materials, techniques, and technologies, and to check the viability of the concept.

In order to work out the concept realization feasibility studies, the potential solutions (appearances/features) identified at decision gate 6A, and the most suitable developments identified at gate 6B provide the necessary information.

Table 6.27 presents the matrix to identify the possible realization feasibility study plans. The columns of Table 6.27 present the most suitable developments identified at gate 6B, and rows present the potential solutions identified at decision gate 6A.

Table 6.27:Matrix to identify the realization feasibility studies– *scenario1*

Developments from gate 6B / Solutions from gate 6A		Development identified at gate 6B						
		Laser embossing with Denim fabric	Laser embossing with fiberglass fabrics	Technology Development 1 & material development 3	Technology Development 1 & material development 4	Technology Development 2& material development 1	Technology Development 2 & material development 2	Technology Development 2 & material development 3
Solutions identified in gate 6A	Convertible and multipurpose	1						
	Adjustable							
	Easily transform							
	Variation in colours	1						

The decision on the viability of achieving the solutions using the materials and technologies is based on scores. Each of the yes (1) indications are considered as the possible realization feasibility studies to be executed. For example, if laser embossing on denim fabric is viable to achieve variations in colours, it is selected as a possible feasibility study.

Evaluation matrix for gate 7- scenario1

These identified possible realization feasibility studies must be viable with the allocated funds, and must be achievable within a shorter time frame. Therefore, the evaluation criterion listed in column 1 of Table 6.28 is necessary to evaluate realization

feasibility study plans. The related research activities in determining these evaluation criteria are also presented in column 2 of Table 6.28.

Table 6.28: Factors for evaluation criterion for reaching decision at gate 7and the research activity from which the factors for evaluation criterion identified – *scenario1*

Factors for evaluation criterion	**Research activity**
Compatible with predicted time to complete	Case study interviewee a-2, a-4, b-2, b-3, c-1, & c-3 (Appendix 5)
Viable with the allocated funds/ budget	

Table 6.29 is the matrix to finalize the appropriate realization feasibility studies to be explored. Numerical values are assigned to indicate the relationship between the realization feasibility studies and the criterion presented in column 1 of Table 6.28. A value scale ranging from 3 to 0 is assigned (3-highly viable, medium viable, little viable, and 0-not viable). The higher scored feasibility plans in the evaluation matrix in Figure 6.29 are considered as the suitable feasibility studies to be explored at gate 8.

Table 6.29: Evaluation matrix for gate 7 to decide appropriate feasibility studies – *scenario1*

Realization feasibility studies / Factors for evaluation criteria at gate 7	Feasibility study 1	Feasibility study 2	Feasibility study 3	Feasibility study 4	Feasibility study 5	Feasibility study 6	Feasibility study 7	Feasibility study 8	Feasibility study 9	Feasibility study 10
Compatible with predicted time to complete										
Viable with the allocated budget										
Total score										

The process of identifying suitable feasibility studies is graphically represented in the flow chart in Figure 6.6.

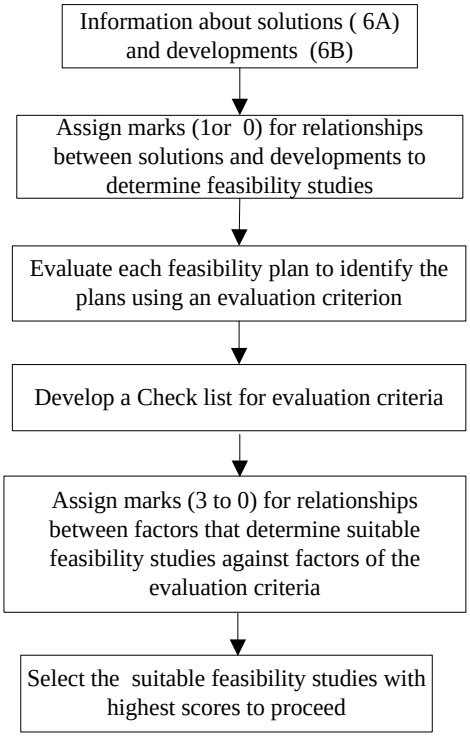


Figure 6.6: The process of identifying suitable feasibility studies

6.2.1.10 Gate 8 - decision on final concepts to be proceeded with

The lists of realization feasibility plans that scored higher total marks at decision gate 7 are explored at this gate as discussed in section 5.2.2.7. The feasibility studies are the finalised set of experiments to prepare mock-ups using the identified materials and technologies.

Evaluation matrix for gate 8- scenario1

Evaluation of the outcome of the explored concept realization feasibility studies is essential to reach the decision on final concepts.

The factors for the evaluation criterion to arrive at the decision gate 8 are presented in Table 6.30.

Table 6.30: Factors for evaluation criterion for reaching decision at gate 8 and the research activity from which the factors for evaluation criterion identified – *scenario1*

Factors for evaluation criterion			Research activity
Company viewpoint	Compatibility	Contributes to positive image of company (attract B2B customer)	Case study interviewee a-2, a-4, b-2, b-4, c-1, c-2, & c-3 (Appendix 5); Lee, et al, 2012
		Enhance customer relationship & loyalty	
		Acceptable quality and production	Aya˘g & Özdem˙, 2007; Case study interviewee a-2, a-4, b-2, b-4, c-1, c-2, & c-3 (Appendix 5)
		Manufacturability (considerable number of pieces)	Case study interviewee a-2, b-2, c-1, & c-3 (Appendix 5)
B2 B Customer viewpoint		Fit with the brand focus	Case study interviewee a-2, a-4, b-2, b-4, c-1, c-2, & c-3 (Appendix 5)
		Contributes to positive image of the brand (attract market)	
		Enhance end customer relationship & loyalty through fulfilling requirements	
		Acceptable quality	Case study interviewee a-2, a-4, b-2, b-4, c-1, c-2, & c-3 (Appendix 5)
		Marketability	Aya˘g & Özdem˙, 2007; Case study interviewee a-2, a-4, b-2, b-4, c-1, & c-2 (Appendix 5)

Table 6.31 is the matrix for evaluating the concepts to be proceeded with. The strength of the relationship is evaluated by assigning numerical values ranging from 3 to 0 (3-highly desirable, medium desirable, less desirable, and 0- not desirable). If all the explored concept realization feasibility studies are not desirable (not scored) or less desirable, the realization studies are carried out repeatedly evaluating the concepts until reaching an agreeable outcome. Perhaps, the innovation team may go back to decision 7, and identify the next possible feasibility study plans to be explored. Therefore, this is an iterative process as discussed in section 5.2.2.7.

Table 6.31: Evaluation matrix for gate 8 to decide final concepts – *scenario1*

Concept realization feasibility studies / Factors for evaluation criteria at gate 8	Explored Concept realization 1	Explored Concept realization 2	Explored Concept realization 3	Explored Concept realization 4	Explored Concept realization 5
Compatibility					
Contributes to positive image of company (attract B2B customer)					
Enhance customer relationship & loyalty					
Acceptable quality and production					
Manufacturability (considerable number of pieces)					
Contributes to positive image of the brand (attract market)					
Enhance end customer relationship & loyalty through fulfilling requirements					
Acceptable quality					
Marketability					
Total					

6.2.1.11 Outcome of the concept development feasibility phase

The outcome of the concept development feasibility phase is the final concepts accepted by the B2B customers for the purpose of improving the concepts further to ensure successful commercialization. This is the key performance indicator (KPI) of the front-end decision making.

The activities and the decisions within the concept development phase in scenario1 can be illustrated in Figure 6.7. Information related to innovation opportunities and applicable techniques and materials for gate 6A & 6B comes from the innovation project canvas (Figure 6.3). Similar to the format used in Figure 6.4, the information at each step of the process and the evaluation criteria are indicated in rectangles and the diamonds depict the final decisions. The rectangles with dotted lines depict the simultaneous process activities. The flow of the process is illustrated with arrows. The arrows curved left show the iterative process. The responsible actors for each decision are presented on the rectangle at the top of the diagram outside the final decision. At the end of the process, the outcome is presented.

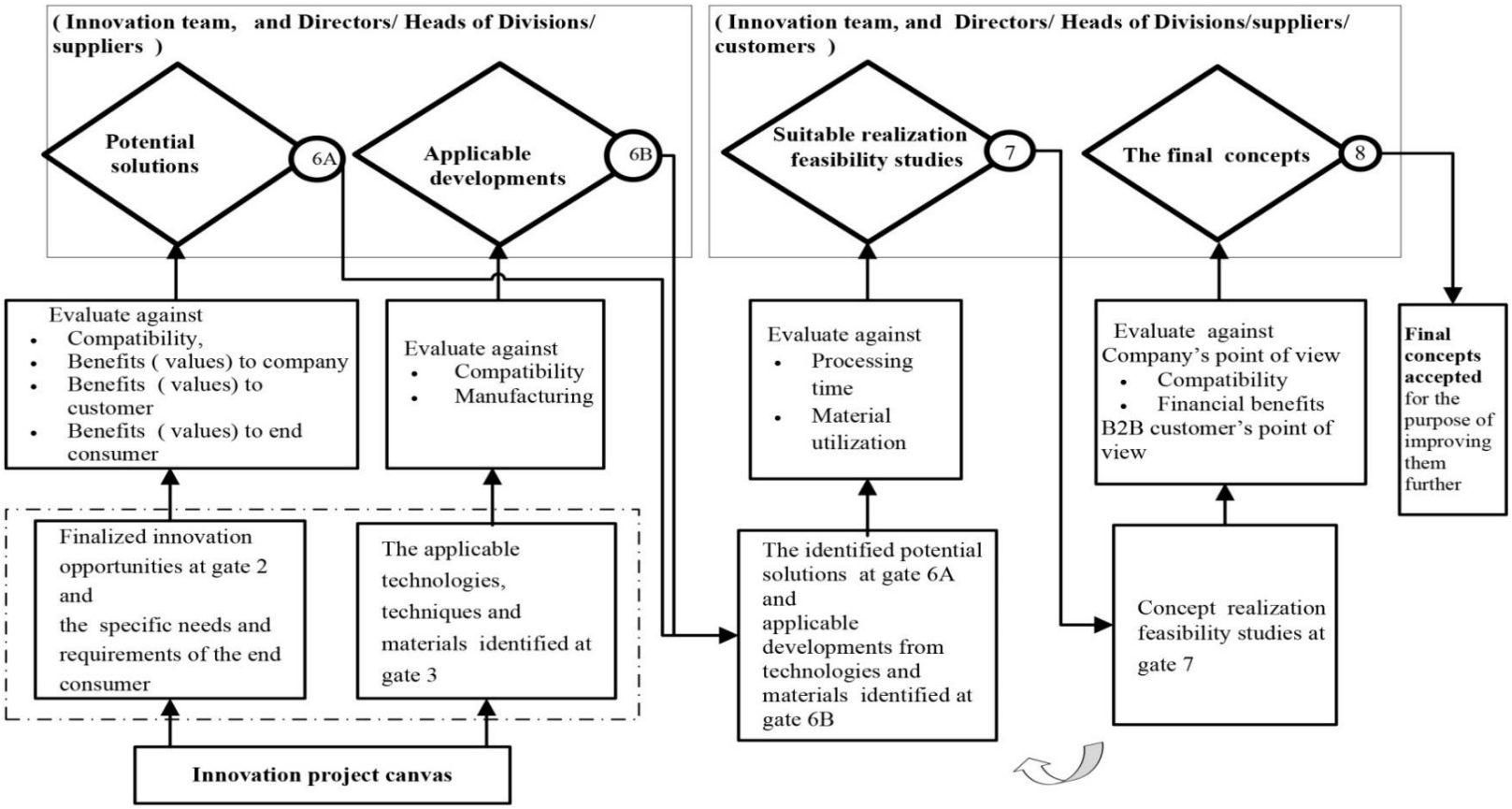


Figure 6.7: Activities and the decisions within the concept development phase – s*cenario 1*

6.2.2 Decision making process steps - Scenario 2 (innovation initiated by the B2B customer)

In scenario 1, the initial innovation opportunities (ideas) are determined at decision gate 1 by studying the specific market and related industry, customer needs, and current and emerging technologies (section 6.2.1). At gate 2, the innovation opportunities identified at gate 1 are reviewed further to identify which of them would be attractive in the market, commercially viable, and marketable to decide the suitable opportunities.

In scenario 2, the innovation is initiated by an already known B2B customer. Initial opportunity identification is not necessary. Therefore, decision gate 1 described in section 6.2.1 for scenario 1 is removed for scenario 2. Therefore, scenario 2 has the following four decision gates in the 'preliminary strategy identification activity phase'.

- Gate 1- decision on 'suitable innovation opportunities (ideas) to be proceeded with'
- Gate 2 - decision on 'resources and budget'
- Gate 3 - decision on 'appropriate practices to be implemented'
- Gate 4 - decision on 'network actors'

Further, as per the findings of the case studies in section 5.2, the decision making process steps in the 'concept development phase' of innovation 'initiated by B2B customer' are similar to the decision making process steps (steps 6,7 and 8) of scenario 1 discussed in section 6.2.1. Therefore, these 3 steps in scenario 1 named as decision gates 6,7, and 8 were named as decision gates 5,6 and 7 for scenario 2 as follows:

- Gate 5A - decision on potential solutions need to be generated (from innovation ideas related to targeted end consumer requirements).
- Gate 5B - decision on most applicable developments to be generated (from technologies, and materials identified at gate3)
- Gate 6 - decision on suitable feasibility studies to execute
- Gate 7 - decision on final concepts to proceed with

At decision gate 1 in scenario 2, suitable innovation opportunities are identified as discussed in section 5.2.1.1. Since B2B initiates the innovation, gathering updated

information on customer attributes is sufficient. Column 1 of Table 6.32 presents the information on customer attributes required to determine suitable innovation opportunities. The research activities in identifying these customer attributes are presented in column 2 of Table 6.32.

Table 6.32: Factors that determine the determine the suitable innovation opportunities at gate 1 and the research activity from which these factors were identified– *scenario2*

Information on customer attributes	Research activity
Sizes of the target	Case study interviewee a-1, a-2, b-1, b-2, c-1, & c-2 (Appendix 5); Cooper,1998; Dahan, 1998
market segments	
market share	
growth rate	
Season calendar	Case study interviewee a-1, a-2, b-1, b-2, c-1, & c-2 (Appendix 5)

These information about the company and B2B customer is mainly based on the existing data and knowledge base of the company and industry reports (Case study interviewee a-1, a-2, a-3, b-1, b-2, b-5, c-1,c-2, & c-4;Dahan, 1998).

Evaluation matrix for gate 1- Scenario2

The evaluation of the factors listed in Table 6.32 is necessary to identify suitable innovation opportunities. Each of the factors listed in column 1 of Table 6.32 is evaluated against the criterion listed in Table 6.33.

Table 6.33: Factors for evaluation criterion for reaching decision gate 1 and the research activity from which the factors for evaluation criterion evolved - *scenario2*

Factors for evaluation criterion		**Research activity**
Strategic alignment	Compatible with the context (current / future situation) of the company	Case study interviewee a b-1, b-2, c-1, & c-2 (Appendix 5)
	Sizes of the target market segments, / market share, and growth rate	Case study interviewee a-1, a-2, b-1, b-2, c-1, & c-2 (Appendix 5); Stevanović et al.,2012
	Align to the expected time / season calendar (urgency)	Case study interviewee a-1, a-2, b-1, b-2, c-1, & c-2 (Appendix 5)
New values to company	Enable to overcome the competitors/ competition	Kirova,2009
	Enable to offer new values to existing customers	Case study interviewee b-1, b-2, c-1, c-2, & c-4 (Appendix 5); Kirova, 2009
	Enable to acquire new technical knowledge or skills	Case study interviewee b-2, c-1, c-2, & c-4 (Appendix 5) ;Stevanović et al.,2012
	Will enhance impact of the company	Stevanović et al.,2012
Address environment issues	Ecology and recyclability	Case study interviewee b-1, & b-2 (Appendix 5); Stevanović et al.,2012
	Water consumption / reduce waste	Case study interviewee b-2 (Appendix 5)
	Material usage / prevent waste	

The matrix to finalize the innovation opportunities with the apparel brand (B2B customer) is presented in Table 6.34. Numerical values ranging from 3 to 0 are assigned (3-highly desirable, medium desirable, less desirable, and 0-not desirable) to show the strength of the relationship between the innovation opportunities and each criterion presented in column 1 of Table 6.33. The innovation opportunities that obtain higher total scores are considered as suitable opportunities to proceed with.

Table 6.34:Evaluation matrix for gate 1 to decide innovation opportunities-*scenario2*

Factors (from Table 6.32 & opportunities from B2B customer) / Factors for evaluation criteria at gate 1	Potential innovation opportunities by B2B customer				
	1	2	3	4	5
Compatible with the context of the company					
Enable to overcome the competitors/ competition					
Sizes of the target market segments, / market share, and growth rate					
Align to the expected time / season calendar (urgency)					
Enable to offer new values to existing customers					
Enable to acquire new technical knowledge or skills					
Will enhance impact of the company					
Ecology and recyclability					
Water consumption / reduce waste					
Material usage / prevent waste					
Total					

At decision gate 2 in scenario 2, resources and budget are decided to realize the finalized opportunities at gate 1. The decision making process is similar to gate 3 of senario1 discussed in section 6.2.1.3. The third decision gate in scenario 2 is to identify the 'appropriate practices to be implemented' and the fourth decision gate is to select 'network actors' to work with. The process of reaching these two decisions is the same as the procedures discussed in section 6.2.1.4 (gate 4) and 6.2.1.5 (gate 5) for scenario 1. The outcome at the preliminary strategy identification phase in scenario2 is the summary of the decisions taken from gates 1 to 4 for scenario 1. The activities and the decisions within the preliminary strategy identification phase in scenario 2 can be presented in Figure 6.8.

The decision making process of decision gate 5A (decisions on potential solutions), decision gate 5B (decisions on most suitable technologies**,** and materials), decision gate 6 (decisions on suitable plans to be utilized) and decision gate 7 (decisions on final concepts to be proceeded) in scenario 2 are similar to gate 6A, gate 6B, 7 and 8 for scenario1 discussed in sections 6.2.1.7 to 6.2.1.10.

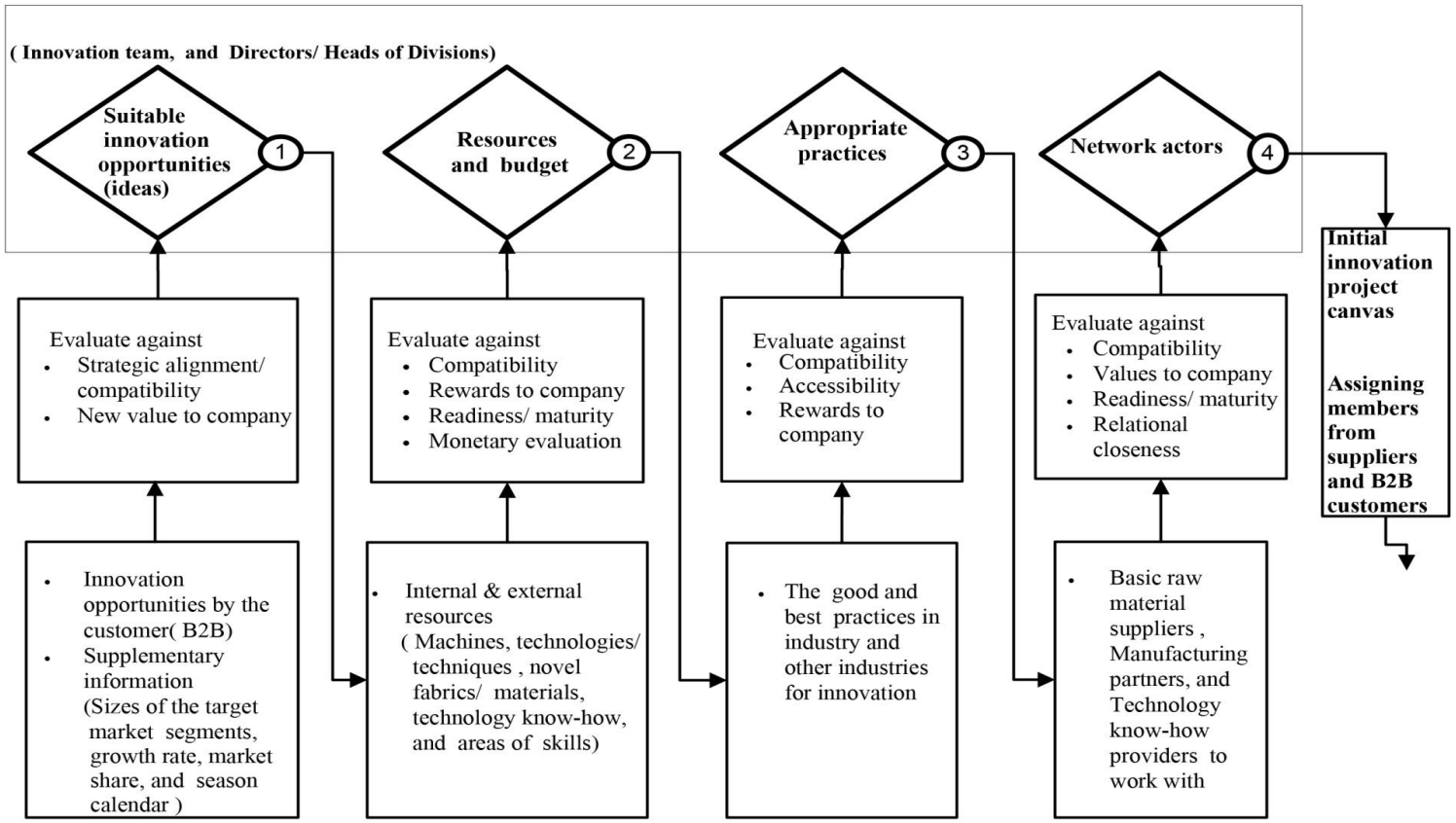


Figure 6.8: Activities and the decisions within the preliminary strategy identification phase– *scenario2*

6.3 Verification of the front-end decision making process steps

Verification of the front-end decision making process steps is one of the two objectives of refinement interviews formulated and described in detail in section 6.2 for scenarios 1 and 2. A few suggestions and recommendations were made for the activities of the decision making process steps by the senior managers involved in the refinement interviews. These recommendations are discussed in line with the order of the decision gates for scenarios 1 and 2 in sections 6.2.1 and 6.2.2.

6.3.1 Verification of the front-end decision making process steps- Scenario1

Predictive trends as a new factor at gate 1 - Trends in apparel get modified every season, and every year (Refinement interviewee 2,3, & 5). The predictive trends focus on potential business prospects and consist of styling strategies, colours, fabrics, and accessories that stimulate customer demand. The 'trends' provide direction for companies to introduce new products for the relevant and target customers at the right time. These timely factors must be considered in decision making and are useful to identify opportunities at gate1. Therefore, 'predictive trends' are suggested to be included as a useful factor to consider at gate 1.

Views of frontline personnel as a new factor at gate 1- Frontline personnel (innovation team and employees involved in innovation) who are closely working with apparel brands may have fresh ideas. The respondents of the refinement interviews are in agreement that the 'views of frontline personnel' is a useful to include at gate 1 (Refinement interviewee 1-6) as their ideas may lead to identify new innovation opportunities. Therefore, frontline personnel can be a source of innovation.

Compatibility with strategic plan as a criterion in evaluation matrix at gate1- Three respondents proposed to include the 'compatibility with the strategic plan' as a criterion in the evaluation matrix at gate 1(Refinement interviewee 2,4, &5). The strategic plan provides an idea of the long-term goals of the company. The innovation ideas need to be compatible with the goals of the company. Therefore, 'compatibility with the strategic plan' will be an important factor in the criteria to evaluate innovation opportunities.

Route to market, compliance issues, and innovation calendars of target customers as factors at gate 2- Commenting on the decision gate 2, Chief Executive Officer (Refinement interviewee 4) stated that,

> "*We need to identify what are the routes to commercialize our products, what are the compliance issues, what are the possible techniques to reach the market and what is the right time to place our innovation on the market or to hit our target customers' calendar."*

As stated earlier, apparel manufactured in Sri Lanka reach the market through apparel brands. Identifying the route to market, compliance issues, and innovation calendars of target customers are essential for the apparel company to satisfy apparel brands and reach the market with suitable innovative ideas. Hence, these timely factors were proposed as important for decision gate 2 when selecting suitable ideas (Refinement interviewee 1,2,4, & 5).

Name gate 2 as 'Refined innovation opportunities and apparel brands'- The view of the respondents of the refinement interviews were to rename the decision gate 2 as 'Refined innovation opportunities and apparel brands' since the opportunities identified at gate 1 are further refined at gate 2 as discussed in section 6.2.1.2 (Refinement interviewee 1, & 5).

Availability of resource base as a factor at gate 3- Availability of a technically qualified and highly skilled human resource base is also vital for product innovation. Therefore, apparel companies need to pay close attention in developing the requisite practical, technical, and scientific capabilities within the internal innovation team. The category of skills was already included in gate 3 and in the evaluation criteria in section 6.2.1.3, though it was not added to the title. Therefore, the respondents of the interviews proposed to rename decision gate 3 as 'resources, areas of skills and budget' (Refinement interviewee 2,4, & 6).

Suitable practicing mechanisms as a factor at decision gate 4 -The participants of the refinement interviews reflected on their current practices and suggested to include suitable practicing mechanisms of innovation as a factor at decision gate 4, as these are used currently in some apparel companies (Refinement interviewee 1, & 5). A few

examples of mechanisms of collaboration are investment sharing, joint planning, sharing responsibilities and rewards, and joint decision making.

Similar profitable situations practiced by other industries as a factor at gate 4- The results of the refinement interviews showed that similar profitable situations practiced by other industries would be a useful source of information at decision gate 4 to learn from (Refinement interviewee 1, & 5).

Research institutions as a factor at gate 5- R&D centres**,** universities, special institutes, and training providers are important to enrich the practical, technical, and scientific capabilities of the company. Therefore, institutional directories were proposed for consideration as sources to develop the knowledge of actors at gate 5, since this is one of the information sources to identify potential working partners in some companies (Refinement interviewee 1, & 6).

Social media as a source of information to identify consumer requirements at *gate 6*- The only suggestion made for decision gate 6A was to include Facebook and Instagram as sources of information to identify end consumer requirements and true needs (Refinement interviewee 2, & 3). Facebook and Instagram are used to share consumer opinions about products online.

Name gate 7 as solution profile- Commenting on the proposed title for decision gate 7, Head of Research & Innovation (Refinement interviewee 2) stated that *"You can simply say solution profiles"*. That is because, at gate 7, the viability of achieving the solutions generated using the materials and technologies is decided. Accordingly, 'solution profiles' was understood as a suitable title to replace the name of decision gate 7.

Information on test reports as a factor at gate 8- Supplier's test reports will contain the details on physical properties of materials and actual test result on each material parameters such as colour fastness to wash, perspiration, and other technical details. Supplier's test reports are useful for initial experimentations since they provide information about structural, chemical and performance properties of the materials. Therefore, for decision gate 8, suppliers' test reports were suggested as a reliable source of information (Refinement interviewee 2, 3, & 5).

Name gate 8 as 'final concepts or solutions' - Re-titling the decision gate 8 as 'final concepts or solutions' was also suggested since the potential solutions are produced from innovation opportunities (Refinement interviewee 2, 3, & 5).

The proposed changes for the front-end decision process in scenario1 based on the refinement interview are presented in Table 6.35.

Table 6.35: Suggestions for front-end decision making process steps- *scenario 1*

Decision gate	**Factors to determine**		**Evaluation criteria**	**Decisions**
	Factors	Sources of information		
Gate 1	• Predictive trends	•Ideas from front line people	• Compatible with the strategic plan	
Gate 2	• Route to market/ route to commercialization • Compliance issues • Target Customers' innovation calendars			• Refined innovation ideas and apparel brands
Gate 3				• Resources, areas of skills and budget
Gate 4	• Mechanisms	• Other industries with similar situation and profitability		
Gate 5		• Institutional directories		
Gate 6A		• Facebook and Instagram		
Gate 7				• Solution profiles
Gate 8		• Suppliers' test reports		• Final concepts or solutions

The revised decision making process steps for the preliminary strategy identification phase and the concept development phase in scenario 1 are presented in Figure 6.9 and 6.10.

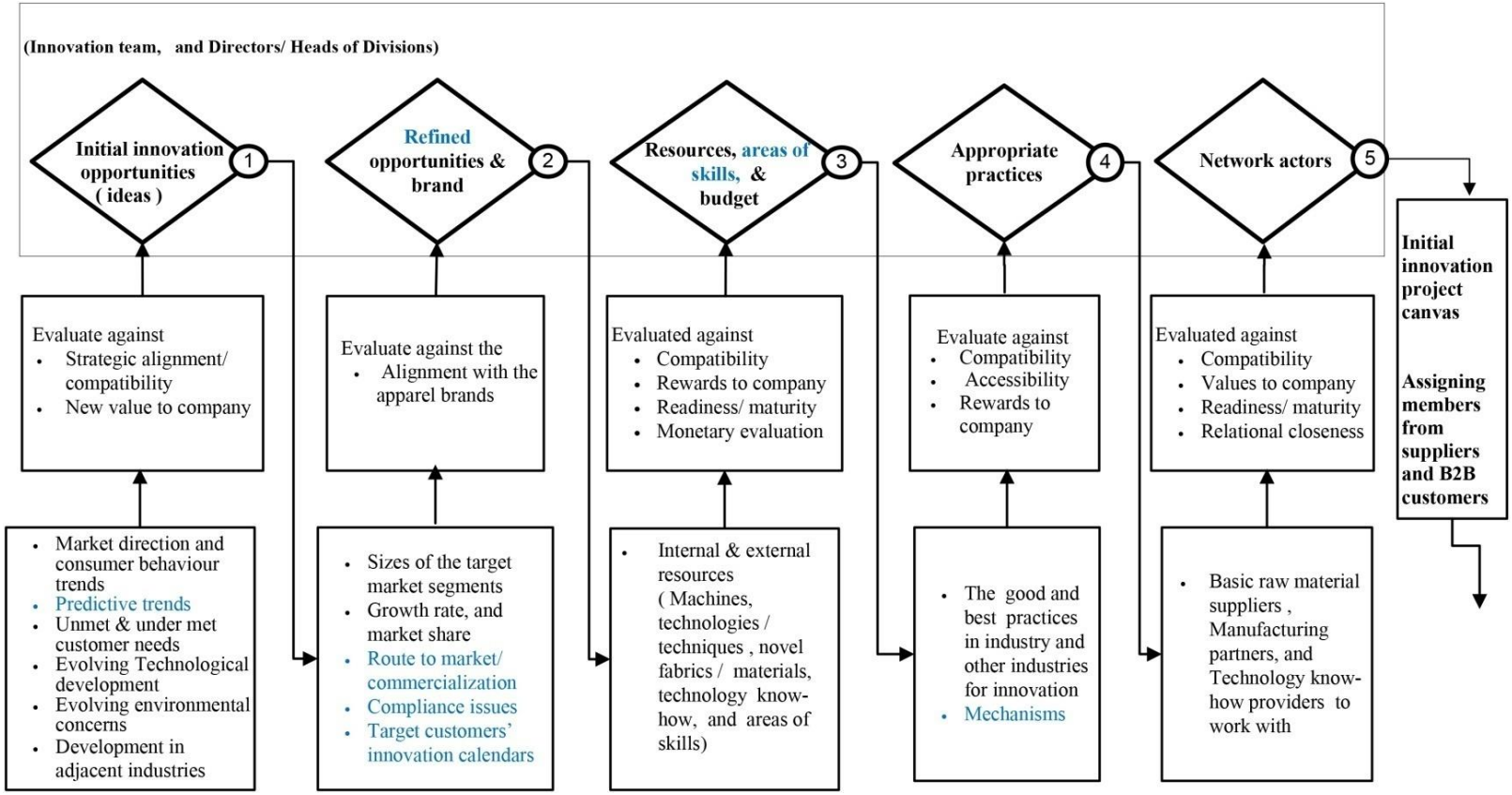


Figure 6.9: Revised decision making process steps for the preliminary strategy identification phase-*scenario 1*

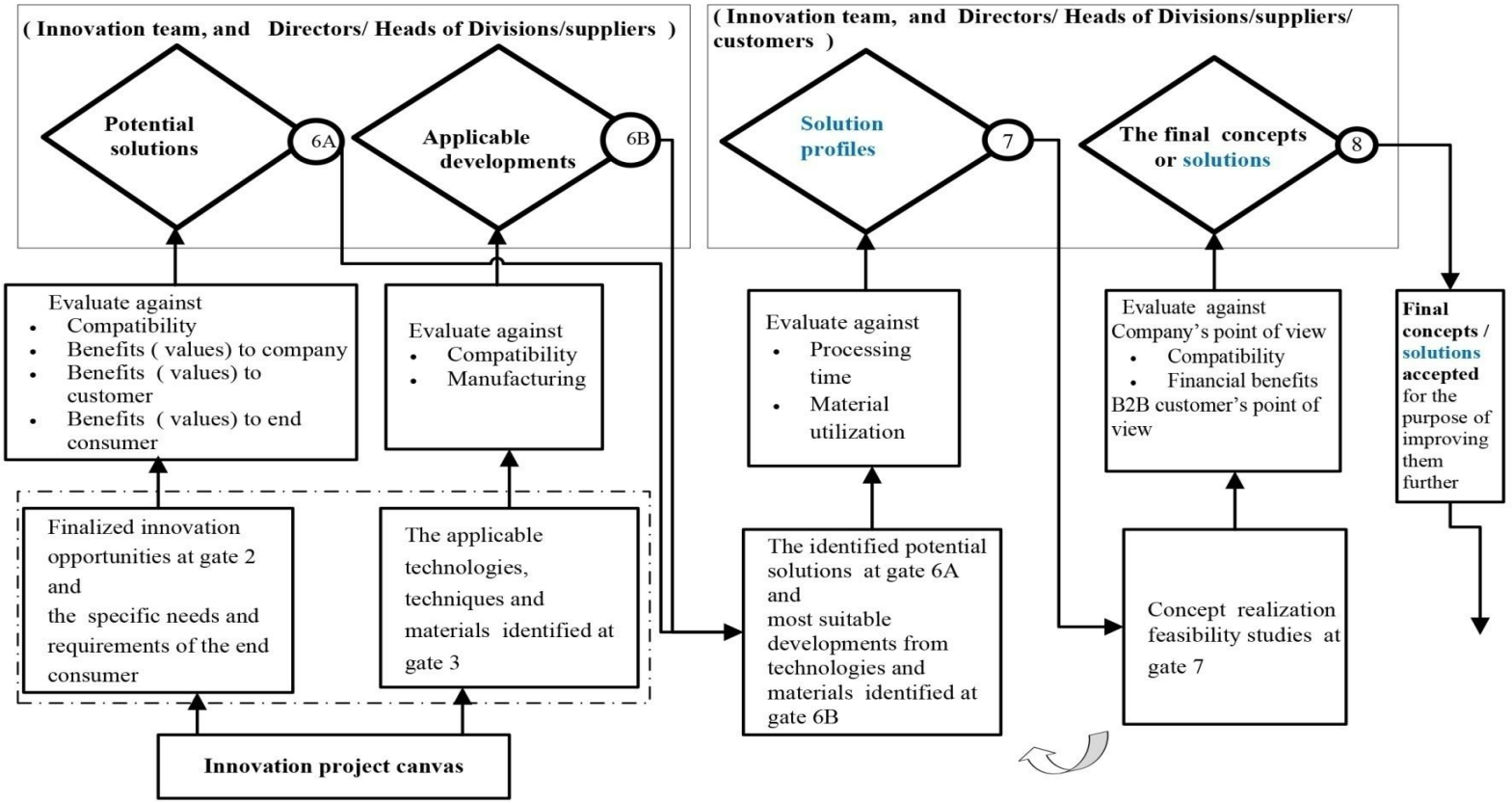


Figure 6.10: Revised decision making process steps for the concept development phase -*scenario 1*

6.3.2 Verification of the front-end decision making process steps- Scenario 2

B2B customer inputs as a factor at gate 1- When the innovation is initiated by a B2B customer (Scenario 2), customer wish list and /or pain points, compliance issues, and B2B customers' innovation calendars were proposed as important to include in the decision gate 1(Refinement interviewee 1,2, & 5). These timely factors are essential for the apparel company to think and find suitable innovative ideas that meet the requirements of B2B customers. Satisfying B2B customers will help to build-up more reliable relationships.

Compatibility of the innovation idea with the strategic plan as a factor in the evaluation criteria at gate 1- As mentioned in scenario 1, the company has its long term goals. Each and every innovation idea may not be compatible with company goals. Therefore, at decision gate1 compatibility of the innovation idea with the strategic plan was proposed to be included as an evaluation criteria (Refinement interviewee 2, & 5).

Name gate 1 as innovation opportunities - In addition, decision gate 1 was suggested to be reworded as 'innovation opportunities or customer needs' (Refinement interviewee 1,2, &5) as the process is started by the B2B customer.

Suggestions for decision gates 2 and 3 of scenario 2 are similar to the suggestions discussed for scenario 1 at decision gates 3 and 4 in section 6.3.1. In order to develop the required knowledge, institutional directories were indicated as useful sources (Refinement interviewee 1,2, & 6). The proposed inclusions for 'decision gate 5A', 'decision gate 6' and 'decision gate 7' are similar to that of the gates 'decision gate 6A', 'decision gate 7' and 'decision gate 8' of scenario 1 discussed in section 6.3.1.

The proposed changes to the front-end decision making process - scenario 2 based on the refinement interviews are presented in Table 6.36.

Table 6.36: Suggestions for front-end decision making process steps - *scenario 2*

Decision gate	**Factors to determine**		**Evaluation criteria**	**Decisions**
	Factors	Sources of information		
Gate 1	• Customer wish list • Compliance issues • Customers' innovation calendars		• Compatibility with the strategic plan	• Innovation opportunities or customer needs
Gate 2				• Resources, areas of skills and budget
Gate 3	• Mechanisms	• Other industries with similar situation and profitability		
Gate 4		• Institutional directories		
Gate 5A		• Facebook and Instagram		
Gate 6				• Solution profiles
Gate 7		• Suppliers' test reports		• Final concepts or solutions

The initial decision making process steps for two activity phases in scenario 2, which were discussed in section 6.2.2 were revised. The sequence (order of the decision gates) and the procedure of decision making process steps presented in section 6.2.2 were not changed. However, decision gates were renamed. The factors and evaluation criteria for decision gates were included in the refined decision making process steps. Figures 6.11 and 6.12 present the revised decision making process steps for the preliminary strategy identification phase and the concept development phase respectively, for scenario 2.

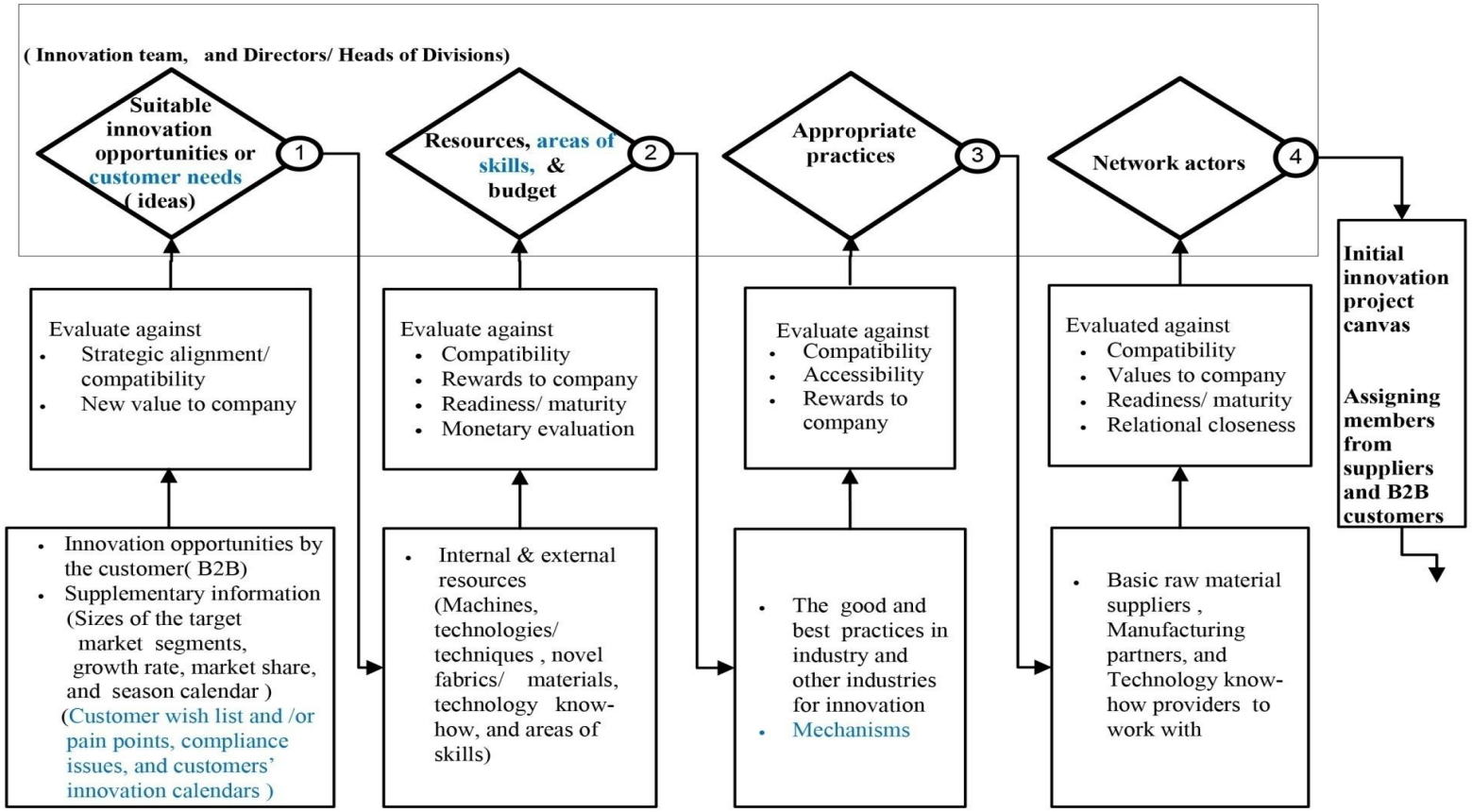


Figure 6.11: Revised decision making process steps for the preliminary strategy identification phase – *scenario2*

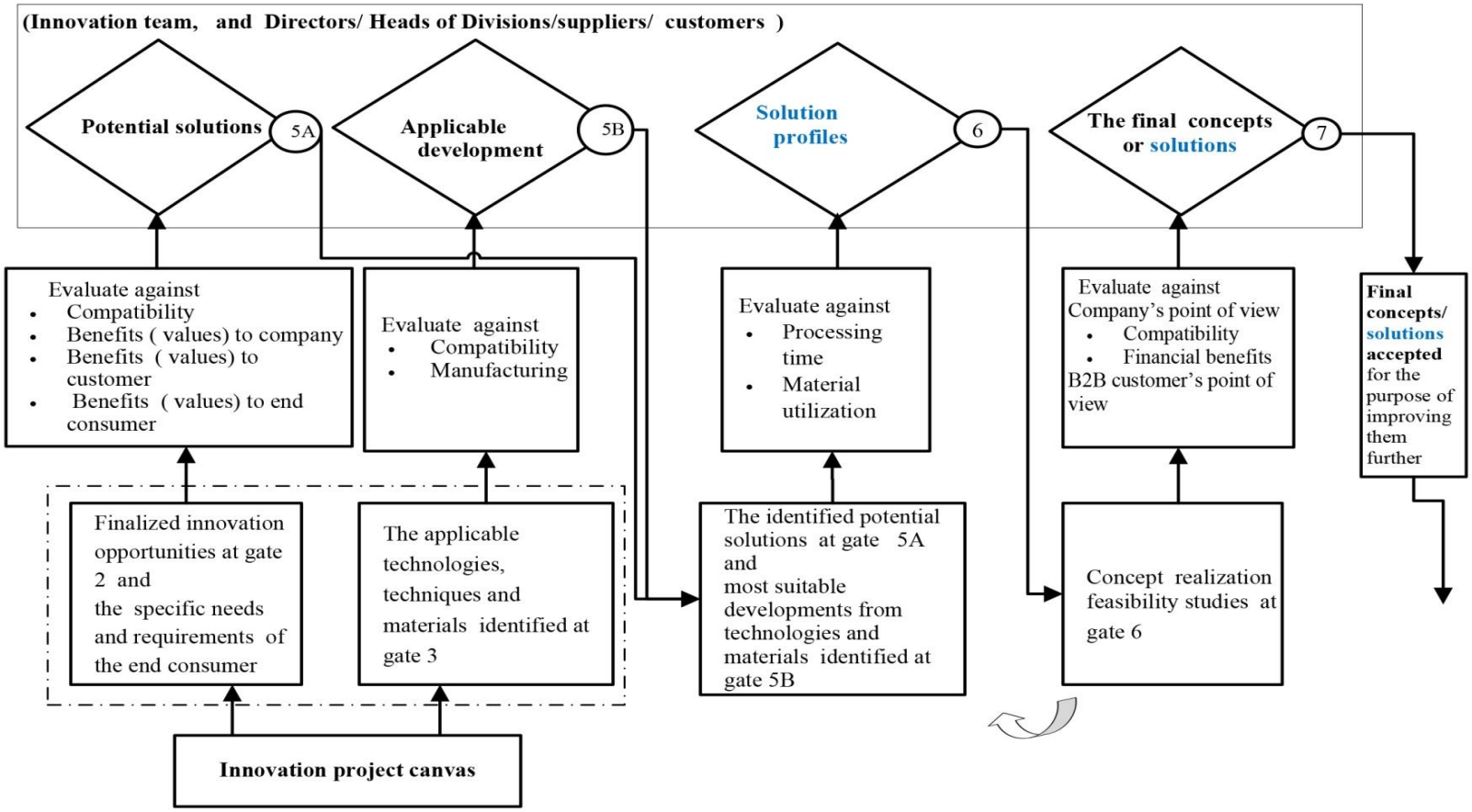


Figure 6.12: Revised decision making process steps for the concept development phase– *scenario2*

The interactive roles of B2B customers, apparel producer and suppliers in two activity phases of the front-end of incremental apparel product innovation for two innovation initiation scenarios (initiated by company' and 'initiated by customer') are discussed in section 6.4.

6.4 Interactive roles of B2B customers, apparel producers and suppliers in the front-end of incremental apparel innovation

The model focuses on incremental innovation and two innovation initiation scenarios as discussed in section 6.1. Within these two innovation initiation approaches, the existing involvement of supplier, producer and B2B customer in two activity phases of the front-end in actual apparel industry practice were identified, discussed in sections 5.3, & 5.4, and summarized in Tables 5.3, & 5.4. The identified interactive roles were purely based on the exploration case studies discussed in detail in section 5.3. By integrating the work of previous researchers where applicable, these identified interactive roles of B2B customers, apparel producers, and suppliers in the front-end of incremental apparel innovation, were re-examined and verified by finding solutions to the following research question:

Q2 - What would be the interactive roles of B2B customers and suppliers in the front-end of incremental apparel product innovation 'initiated by company' and 'initiated by customer'?

The identified interactive roles of B2B customers, apparel producer and suppliers in two activity phases of the front-end of incremental apparel product innovation in sections 5.3, & 5.4, and summarised in Tables 5.3, & 5.4 are discussed further in this section.

6.4.1 Interactive roles of B2B customers, apparel producer and suppliers - Scenario 1

As discussed in section 5.2.6 and Table 5.3, four roles of the apparel producer have been identified in the two activity phases of the front-end of incremental apparel innovation: i. an originator of the incremental innovation (strategy identification phase), ii. an investor of money for the innovation (strategy identification phase), iii. developer who conducts initial experiments, feasibility studies, selection of technologies, and materials,

and engages in developing new solutions (concept development phase) and iv.an investor for concept development.

According to Tables 5.3, & 5.4, and section 5.3.3, there are three active roles that B2B customers can play in the two activity phases of the front-end of incremental apparel innovation:

- Serve as a source of information in the strategy identification phase
  The B2B customers provide details of market directions and consumers' behaviour trends.
- Involve for concept development phase as facilitators
  The B2B customers provide details of end consumers' specific requirements, suggestions, and feedback.
- Involve in the concept development phase as reviewers or selectors
  B2B customers provide feedback for functional solutions and final concepts.

Tables 5.3, 5.4, and section 5.3.3 outlined the four roles that the suppliers can play in the two activity phases of the front-end of incremental apparel innovation.

- Facilitators for the initiation of incremental apparel innovation (strategy identification phase)
  Suppliers provide updated information on newly developed materials, improved techniques, and upgraded technology know-how
- Initiators of the initial innovation ideas (strategy identification phase)
  Suppliers approach the apparel manufacturer with their own new ideas for materials and techniques.
- Facilitators (concept development phase)
  Suppliers conduct initial experiments to verify the suitability of the new materials.
- Co-developers or co-innovators (concept development phase)
  Suppliers actively involve themselves in the initial experiments, feasibility studies, selection of technologies, and materials, and engage in hands-on development of new solutions and fresh ideas for further improvements.

Furthermore, suppliers collaborate as a financier or investor, as well as a material and technological know-how sponsor for the innovation (Lehtimäki et al., 2012).

Based on the above, the interactive role of B2B customers, apparel producers, and suppliers within the two activity phases of the front- end of incremental apparel innovation in scenario1 can be integrated and illustrated as shown in Figure 6.13.

The two activity phases of the front-end process; preliminary strategy identification and concept development, are presented in the backward middle rectangle. The arrows between the two activity phases and the end of the second phase refer to the flow of the front-end process. The apparel producer is directly involved in activities and decision making throughout the process, taking all the responsibilities. The involvement of apparel producers is indicated by the forward middle rectangle, and two separate rectangles inside illustrate the roles of apparel producers in two front-end activity phases. At the top of the front-end process activities, the interactive role of B2B customers within the two activity phases is indicated. It is represented by arrows between two rectangles: the front-end activity phases and B2B customers. The rectangles located on the bottom of the front-end activities indicate the involvement of the suppliers in two front-end activity phases. This relationship is represented by arrows between the front-end activity phases and suppliers.

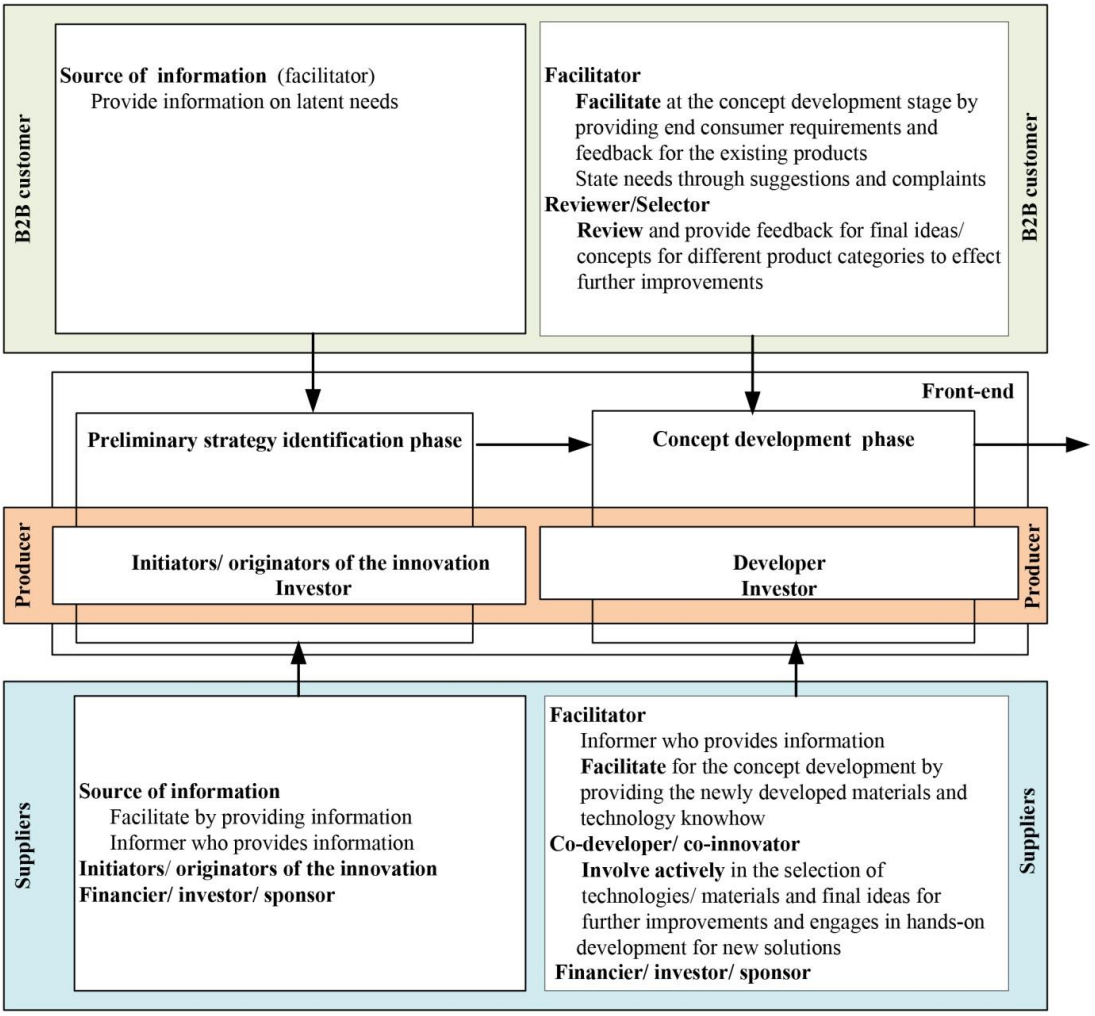


Figure 6.13: Interactive roles of B2B customers, apparel producers and suppliers - *scenario 1*

6.4.2 Interactive roles of B2B customers, apparel producer and suppliers - Scenario 2

As discussed, and revealed in section 5.2.3, and summarized in Tables 5.3 and 5.4, in the two activity phases of the front-end of incremental apparel innovation, the B2B customer is

- an active initiator of the innovation idea (Case study interviewee b-1, b-2, c-1, c-2, & c-4; Coviello & Joseph, 2012; Schweitzer, 2013)

- a co-developer who shares knowledge and involves himself in activities and decision making during the 'concept development' phase would be the working arrangement when the customer himself initiates the innovation
- a reviewer who provides feedback for functional solutions and concepts
- a selector who selects final concepts in the concept development phase
- a source of information who provides information on the needs of the end consumer in the strategy identification phase

According to Tables 5.3 & 5.4, and section 5.3.3, the apparel producer facilitates implementing the innovation idea and also invests in the innovation. As a developer, the apparel producer conducts initial experiments for feasibility studies and explores new solutions.

The apparel companies have to work with the B2B customer nominated suppliers as discussed in section 5.2.6.2. Tables 5.3, 5.4, and section 5.3.3 outlined that based on the policies of the B2B customer, the suppliers get involved as

- source of information at the strategy identification phase
- facilitators at the concept development phase
- co-developers or co-innovators at the concept development phase

The interactive roles of B2B customers, apparel producers, and suppliers within the front-end of incremental apparel product innovation in scenario 2 can be represented in Figure 6.14. As discussed in section 6.4.1 in Figure 6.13, the backward middle rectangle represents the two activity phases of the front-end process, and the arrows refer to the flow of the front-end process. Further, the roles of the apparel producers are indicated by the forward middle rectangle. The interactive role of the B2B customer is illustrated on top of the front-end activities. This relationship is denoted by arrows between the front-end activity phases and B2B customers. The involvement of the suppliers is shown at the bottom of the front-end activities. This relationship is represented by arrows between the front-end activity phases and suppliers.

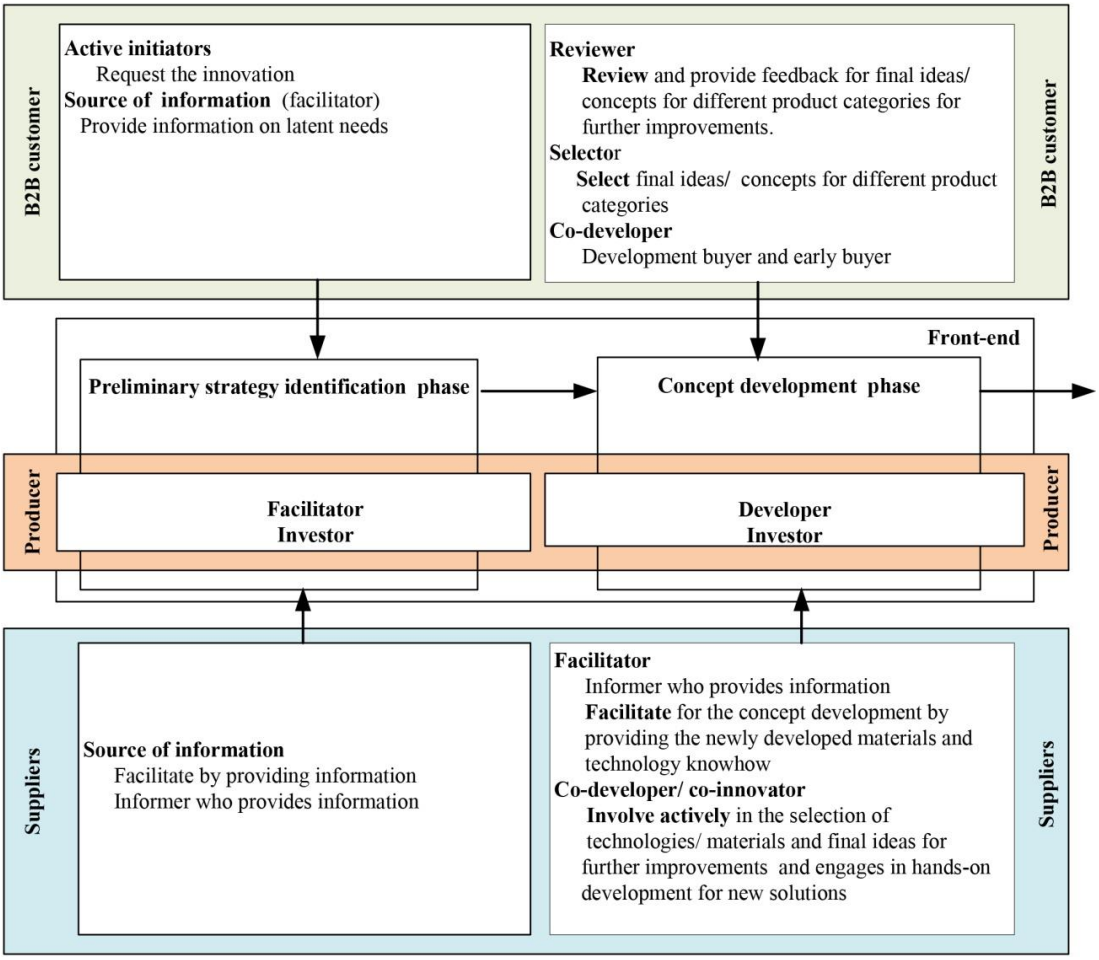


Figure 6.14: Interactive roles of B2B customers, apparel producers and suppliers-*scenario2*

6.5 Verification of the interactive roles of B2B customers, producers, and suppliers

The second objective of the refinement interviews with senior managers was to verify the interactive roles of B2B customers, apparel producers, and suppliers for scenarios 1 and 2. The senior managers who participated in refinement interviews in general agreed with the identified interactive roles discussed in detail under section 6.4. However, a few suggestions were made on the interactive roles of B2B customers, apparel producers, and suppliers, reflecting the current practices in apparel companies. These suggestions are presented in relation to two scenarios in the following sub sections.

6.5.1 Interactive roles – Scenario 1

Suppliers as solution providers - There were two main suggestions made by the senior managers. The first suggestion was the role of suppliers. As Innovation General Manager (Refinement interviewee 5) stated, *"Advice and opinions can be taken for technical or material problems from material and technology suppliers."* Thus, suppliers were proposed as solution providers of the front-end as it is one of the suppliers' currently practicing roles in some companies.

Apparel brands to act as route to the market - The second suggestion was on the role of B2B customers or the apparel brands. The B2B customers who are selected to offer the innovation by the company, where possible may act as the route to market, taking full responsibility in commercializing the innovation. This is a good mechanism to enter the market while reducing the risks involved for commercializing the innovation (Refinement interviewee1,4, & 6).

With the inclusion of the suggestions by the senior managers, the initial interactive roles developed in section 6.4.1 were revised. No changes were made to the interactive roles of the apparel producer. Figure 6.15 illustrates the refined interactive roles within the front-end of incremental apparel innovation for scenario 1.

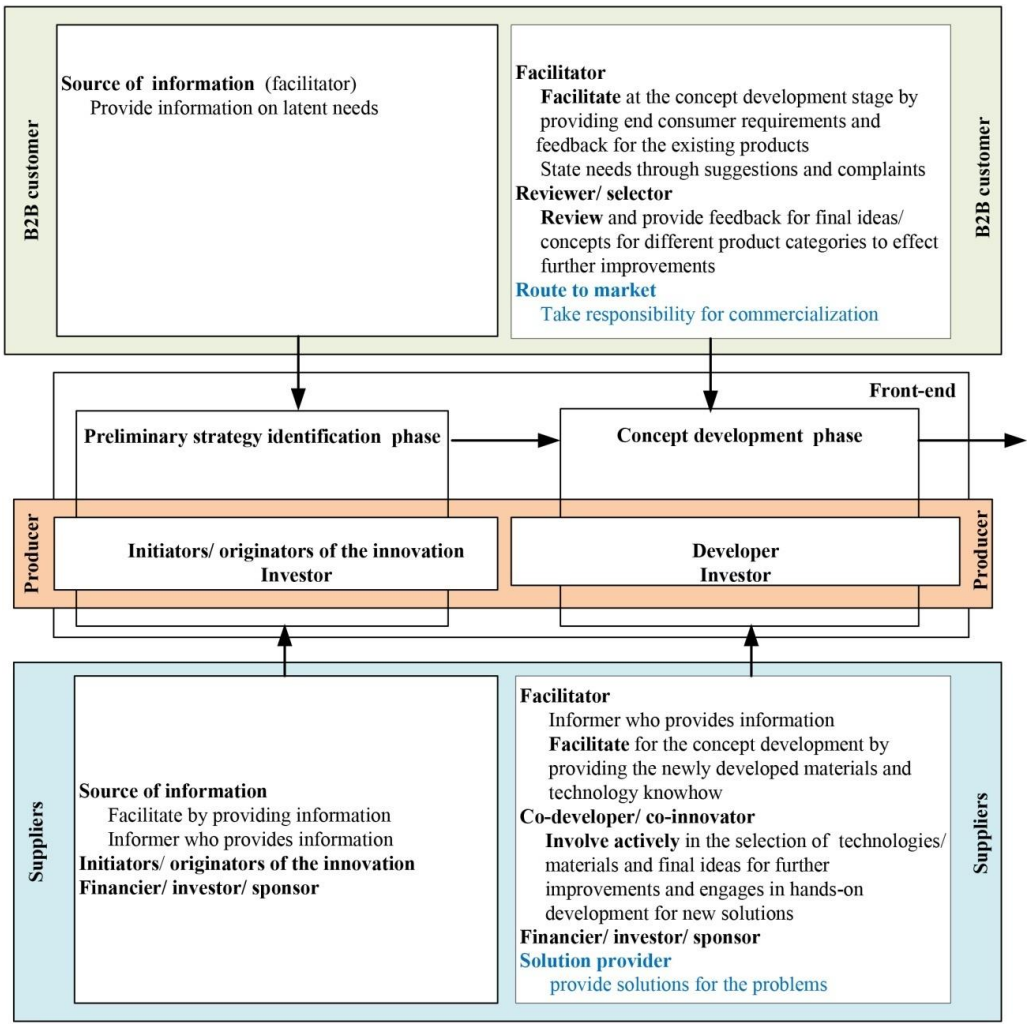


Figure 6.15: Revised interactive roles of B2B customers, apparel producers and suppliers– *scenario1*

6.5.2 Interactive roles - Scenario 2

As mentioned in section 6.5.1, scenario 1, suppliers were suggested as solution providers for the front-end (Refinement interviewee 1,2,3, & 5). However, as discussed in section 6.4.2, the involvement of suppliers as solution providers is mainly based on the policies and preferences of the B2B customer.

Two suggestions were made on the role of B2B customers by the senior managers. *Apparel brands to act as a route to the market* – B2B customers should act as the route to market was the first suggestion as indicated in section 6.5.1, scenario 1. Since the

customer is the initiator of the innovation in scenario 2, the responsibility lies with the B2B customers for commercialization of the product.

B2B customer as a financier - The second suggestion was to involve the B2B customers as financiers for the innovation, as it is in practice in some organizations at present (Refinement interviewee 1, & 4).

Based on the suggestions for improvements by the senior managers of the refinement interviews, the initial model developed in section 6.4.2 was revised. No improvements were made to the interactive roles of the apparel producer. Figure 6.16 illustrates the amended model of the interactive roles within the front-end of incremental apparel innovation for scenario 2.

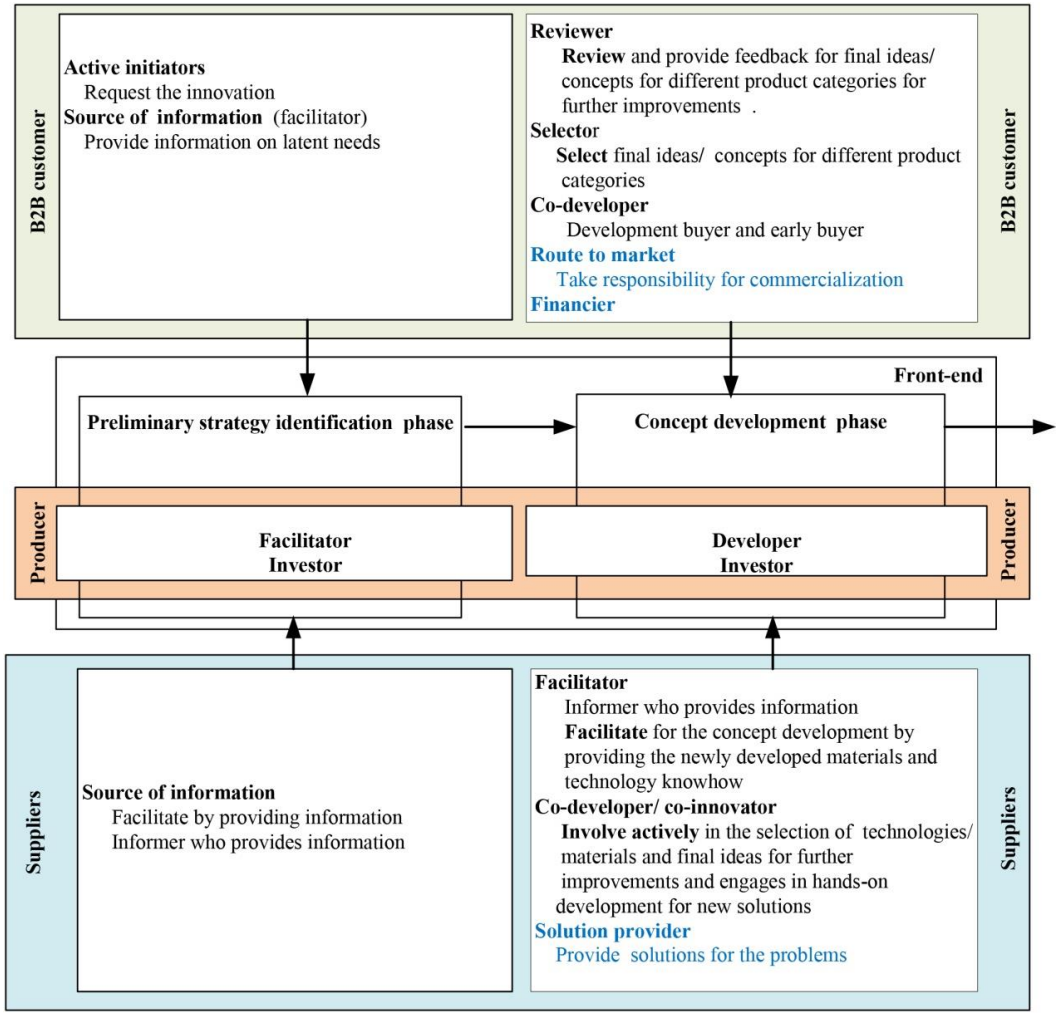


Figure 6.16: Revised interactive roles of B2B customers, apparel producers and suppliers - *scenario 2*

6.6 Summary of the chapter 6

This chapter re-examined and verified the results obtained in case studies (step 1 of model development) on the decision making process steps, as well as the interactive roles of suppliers, apparel producers, and B2B customers for incremental innovation of the two selected scenarios: innovation 'initiated by company' and innovation 'initiated by B2B customer.'

Incremental apparel product innovation was chosen because it is common in the apparel industry, and previous research has also highlighted the broad application and benefits of incremental innovation. Further, two approaches to innovation initiation were considered: innovation 'initiated by company' (scenario 1) and initiated by 'B2B customer' (scenario 2), as both information and knowledge of the customer are expected to be utilized for the innovation process in the 'co-creation of value'. The two components discussed in Chapter 5 (i. the decision-making process steps, and ii. the interactive roles of suppliers, apparel producers, and B2B customers) were further discussed with the two research questions posed for two scenarios.

In scenario 1, under the preliminary strategy identification activity phase, five decision gates were discussed with the process of handling the decisions, and an 'initial innovation project canvas' was introduced as the summary of these decisions (gate1-gate 5). Four decision gates within the concept development phase were discussed too. In scenario 2, as the innovation is initiated by an already known B2B customer, four decision gates were discussed under the preliminary strategy identification activity phase. Senior managers in general agreed with the sequence (order of the decision gates) and the procedure of decision making process steps. However, suggestions were made for factors and evaluation criteria in a few decision gates in scenario 1 (1,2,3,7, & 8) and scenario 2 (1,2,6, & 7). Based on recommendations of the senior managers, decision gates 2, 3, 7 & 8 were renamed. The suggested additions to the factors, sources of information, and evaluation criteria of the decision gates of both scenarios 1 and 2 were revised.

For scenario 1, four interactive apparel producer roles, three interactive B2B customer roles, and five interactive supplier roles were presented in the two activity phases of the front-end of incremental apparel innovation. In the two activity phases of the front-end

of incremental apparel innovation, three interactive roles of the apparel producer, five interactive roles of B2B customers, and three interactive roles of the supplier were presented in scenario 2. Senior managers in general agreed with the interactive roles too. However, they proposed suppliers as solution providers and B2B customers as the route to the market for both scenarios 1 and 2. These suggestions raised for the interactive roles were included and revised the interactive roles of suppliers, apparel producers, and B2B customers.

CHAPTER 7

VERIFICATION OF THE EFFECT OF ENVIRONMENTAL FACTORS ON FRONT-END DECISIONS

This chapter re-examines and verifies the results obtained in case studies (step 1 of model development) on the factors that exert influence on front-end decisions in incremental innovation of the two selected scenarios: innovation 'initiated by company' and innovation 'initiated by B2B customer.'

A number of environmental factors influence the front-end decision making process. As per the findings of the case studies discussed in section 5.2.3, these factors arise from the organization's internal as well as external constitution. The identified internal factors are the core competencies and climate of the organization. The external factors are the operational competencies and relationship characteristics of the external actors (customers and suppliers). However, it was not determined to what extent these factors influence the front-end decisions on incremental apparel product innovation. In addition, these factors have not been adequately explored at the front-end of apparel innovation in past studies. Therefore, these internal and external factors are further examined using existing relevant literature related to innovation and discussed in this section to endorse the findings of the case studies discussed in section 5.2.3, and to verify their influence on the front-end decisions on incremental apparel product innovation. The following research question was formulated to further examine and verify these identified internal and external factors.

Q3. *Do the core competencies, climate of organization and customers, suppliers influence the front-end decisions on incremental apparel product innovation 'initiated by company' and 'initiated by customer'?*

To verify the extent of the influence of these external and internal factors on front-end decisions on incremental apparel product innovation, hypotheses (H_{1a} -H_{4b}) that are postulated based on the literature on product innovation were derived. The hypotheses (H_{1a} - H_{4b}) were tested through a questionnaire survey (Appendix 9- Questionnaire).

Since the questionnaire survey was used to further refine the influential factors, this questionnaire survey was termed as the 'refinement questionnaire'.

The respondents for the study were the members of the innovation teams engaged in the front-end of product innovation activities in apparel manufacturing. 41 completed questionnaires were received from the personnel actively engaged in the front-end of product innovation of different apparel companies across Sri Lanka. Their working experience at the front - end varied from 1 to 9 years (Appendix 10 - Questionnaire survey respondents and questionnaire data). The data was analysed using the SPSS version 20 statistical software package.

A five-point Likert scale ranging from 5 = 'very much' to 1 = 'not at all' was used to assess individual factors within each main internal and external factors relating to front-end decisions (Appendix 8 - Individual factors used to measure each main factor). With the use of Spearman's *rho* correlation, the significant individual factors within each main factor that influence the front-end of incremental apparel innovation were identified. Cronbach's alpha coefficient was used to assess the scale's reliability. Cronbach's alpha values greater than 0.7 confirmed the research instrument's reliability (Appendix 10). The Correlation Coefficient (*r*) that had values between -1 and +1 was used as a guideline to assess the relationship between individual factors within each main factor and front-end decisions (Saunders et al., 2009). Further, Linear regression analysis was performed in order to test the hypotheses of the study (H_{1a} - H_{4b}). The statistical significance between the factors and the front-end decisions were determined by the Standardized Coefficients value (β). The impact of the factors on front-end decisions was quantified through the Adjusted R^2 value (Saunders et al., 2009). The internal and external factors and their influences on the front-end decisions are presented in the following sections.

7.1 Influence of internal factors on front-end decisions

7.1.1 Core competencies of organization on front-end decisions

The fundamental internal strengths of the organization that emerged over time are its core competencies (Godbout, 2000; Krishna, 2017; Torkkeli & Tuominen, 2002). A set of knowledge, skills, capabilities, practices, technologies, and in house resources are the

main elements of the core competencies of an organization (Marucha, 2012; Enginoğlu & Arikan,2016; Godbout, 2000; Javidan, 1998; Prahalad & Hamel,1990; Torkkeli & Tuominen, 2002). The dimensions used to measure internal core competences of an organization can be grouped broadly into three classes: functionality related, integrative, and market accesses (Fowler et al., 2000; Krishna, 2017; Lokshin et al.,2008; Prahalad & Hamel,1990; Rajkovic,2009; Ritter & Gemunden,2004; Wang et al., 2004). Within these three broad categories, there are sub categories as shown in Table 7.1.

Out of the seven categories in Table 7.1 identified through the review of existing literature, four groups of competencies are frequently discussed in academia as they are directly related to innovation activities. These organization's core competencies are technological (technical), competencies to serve customers, partnerships (network) and financial competencies. Therefore, these four competencies were chosen as internal core competencies of an organization to derive the hypothesis.

Table 7.1: Types of competencies within the umbrella of core competencies of organizations

Types of competence	Sources
Technological / technical	Fowler et al.,2000; Krishna,2017; Lokshin et al., 2009; Prahalad& Hamel,1990; Rajkovic,2009; Ritter & Gemunden, 2004. Wang et al., 2004.
Competencies to serve customers	
Network / partnership	
Financial investment	
Manufacturing/production	
Organizational practices	
Competencies related to marketing	

7.1.1.1 Organization's technological competencies on front-end decisions

Technological competencies are the development skills of a firm, resulting from knowledge that the firm has gained during previous development activities (Weigelt et al., 2003). A state-of-the-art study concluded that technical competence has a substantial positive effect on innovation performance (Hao & Yu, 2012). Further, technological competence has a significant positive impact on innovation success (Ritter & Gemunden, 2004). In view of this, the impact of the technological competencies of an organization

on front-end decision making in an incremental apparel innovation context is investigated by formulating the following hypothesis.

H_{1a}- *Organization's technological competencies influence the front-end decision making process of incremental apparel innovation*

Table 7.2 shows the factors and the results of the correlation analysis on the factors related to the technical competencies of an organization (questions a, b, & c in section A of Appendix 8). As shown in Table 7.2, the Correlation Coefficient value (*r*) of the availability of equipment and other facilities in the manufacturing plant is 0.425. This indicates that the availability of equipment and other facilities in the manufacturing plant has a significant effect on the front-end decisions. Besides, engineering, technology, and manufacturing know-how (*r*=0.446*)* are substantially associated with front-end decisions. This analysis indicates the importance of know-how related to the technologies, techniques, and manufacturing processes to effectively address the technical feasibility of the concept.

Table 7.2: Organization's technical competencies – Correlations between individual factors and front-end decisions

	Individual factors of organization's technical competencies	**Front- end decisions**	
Spearman's *rho* N-41	The availability of equipment and other facilities in the manufacturing plant	Correlation Coefficient- *r* Sig. (2-tailed)	0.425* 0.045
	The manufacturing, and engineering/ technology know-how	Correlation Coefficient- *r* Sig. (2-tailed)	0.446* 0.042
	The knowledge and use of quality assurance tools	Correlation Coefficient- *r* Sig. (2-tailed)	0.190 0.073

Note -$p \leq 0.05$ * Correlation is significant at the 0.05 level (2-tailed).

Table 7.3 shows the results of the linear regression analysis for technological competencies in front-end decisions. The Standardized Coefficients value of the technical competencies variables is 0.370 (Table 7.3). It denotes that the variables of the technical competencies are statistically significant and have a moderate positive relationship with front-end decision making in apparel innovation.

Table 7.3: Linear regression coefficients and regression estimates for technological competencies on front-end decisions

Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**T**	**Sig.**
	B	Std. Error	Beta(β)		
(Constant) Technological competence	1.883 0.078	0.133 0.034	0.370	14.205 1.234	0.000 0.050
R Square	0.137				
Adjusted R Square	0.118				
Std. Error of the Estimate	0.14556				
F value	3.055				
Dependent variable –front- end decisions					

The Adjusted R^2 value is 0.118. The results confirmed that 11.8% of the front-end decisions are influenced by the factors relating to the technical competencies of the organization. Hence, the hypothesis H_{1a}- *"Organization's technical competencies influence the front-end decision making process"* is accepted.

7.1.1.2 Organization's competencies to serve customers on front-end decisions

Competences of organization relating to customers are essential for firms to survive the competition in the market (Danneels, 2002). A past study confirmed customer related knowledge has a positive impact on product innovation novelty (Engen & Holen, 2014). The effect of customer competence on innovative performance was also verified by a previous study (Lokshin et al., 2008). Based on the above reasoning, assuming a direct relationship between the customer competencies of an organization and the front-end decision making in apparel innovation, the following hypothesis is formulated.

H_{1b}- *Organization's competencies to serve customers influence the front-end decision making process of incremental apparel innovation*

Table 7.4 presents the factors and the results of the correlation analysis on the factors related to the competencies of an organization to serve customers (questions d, e, and f in Appendix 8, section A). The Correlation Coefficient value (*r)* value of the knowledge of customer needs and capabilities is 0.538 ($p< 0.05$). It indicates that the knowledge of customer needs and capabilities has a significant effect on front-end decisions. As

shown in Table 7.4, the Correlation Coefficient value (*r*) of the good communication channel with customers is 0.349, while a company's reputation with customers is 0.358. It shows that a good communication channel with customers and a company's reputation with customers have a notable association with front-end decisions. The results confirm that the company's ability to understand and maintain good relationships with customers is helpful in front-end decision making.

Table 7.4: Organization's competencies to serve customers - Correlations between individual factors and front-end decisions

	Individual factors of organization's competencies to serve customers	**Front -end decisions**	
Spearman's *rho* N-41	The knowledge of customer needs and capabilities	Correlation Coefficient- *r* Sig. (2-tailed)	0.538* 0.031
	A good communication channel with customers	Correlation Coefficient - *r* Sig. (2-tailed)	0.349* 0.020
	Company's reputation with customers	Correlation Coefficient - *r* Sig. (2-tailed)	0.358* 0.017

Note-$p \leq 0.05$ * Correlation is significant at the 0.05 level (2-tailed).

The results of the linear regression analysis for customer competencies on front-end decisions is presented in Table 7.5.

Table 7.5: Linear regression coefficients and regression estimates for competencies to serve customers on front-end decisions

Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**T**	**Sig.**
	B	Std. Error	Beta(β)		
(Constant) Competence to serve customers	1.600 0.073	0.161 0.037	0.320	9.938 1.964	0.000 0.050
R Square	0.102				
Adjusted R Square	0.083				
Std. Error of the Estimate	0.13895				
F value	3.858				
Dependent variable -front -end decisions					

The Standardized Coefficients value is 0.320 ($p < 0.05$). This suggests that the variables of customer competencies have a statistically significant relationship with front-end decision making in apparel innovation. The Adjusted R^2 value is 0.083. This confirms

the hypothesis H_{1b}- "*Organization's competencies to serve customers influence the front-end decision making process"*.

7.1.1.3 Organization's partnership (network) competencies on front-end decisions

Effectively maintaining relationships with network partners is known as 'network competencies' and this enables a company to build and benefit from relationships with other organizations that have resources (Ulaga, 2001; Wagner & Hoegl, 2006). The effect of network competence on innovation performance was assessed and proved using three indicators: increased efficiency of the R&D process, number of successful new product developments and shortened time-to-market (Chiu, 2008). Further, network competence has a significant positive effect on innovation performance (Hao & Yu, 2012). In view of that, the impact of the partnership competencies of an organization on front-end decision making in apparel innovation is investigated by formulating the following hypothesis.

H_{1c}- *Organization's partnership competencies influence the front-end decision making process of incremental apparel innovation*

The factors and the results of the Spearman's *rho* correlation analysis (Table 7.6) revealed that there is a significant correlation between knowledge of project management (r = 0.650, $p<0.01$) and the front-end decisions. Moreover, good communication with external parties (r = 0.572, $p<0.01$) correlates substantially with front-end decisions. The two other factors, viz. knowledge of the capabilities and processes of suppliers and related firms as well as maintaining reliability show a noticeable relationship with front-end decisions at a 0.05 significance level. This signifies the ability of the company to understand and maintain good relationships with network partners to facilitate front-end decision making.

Table 7.6: Organization's partnership competencies –Correlations between individual factors and front-end decisions

	Individual factors of Organization's network competencies	Front- end decisions	
Spearman's *rho* N-41	The knowledge of project management	Correlation Coefficient - *r* Sig. (2-tailed)	0.650** 0.000
	The knowledge of capabilities and processes of appropriate suppliers and related firms	Correlation Coefficient - *r* Sig. (2-tailed)	0.390* 0.012
	Good communication with external parties	Correlation Coefficient- *r* Sig. (2-tailed)	0.572** 0.000
	Maintaining reliability	Correlation Coefficient- *r* Sig. (2-tailed)	0.323* 0.050

Note-p ≤ 0.05 ** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table 7.7 presents the results of the linear regression analysis for partnership competencies of organization on front-end decisions.

Table 7.7: Linear regression coefficients and regression estimates for partnership competencies on front-end decisions

Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
	B	Std. Error	Beta(β)		
(Constant) Partnership competence	1.134 0.188	0.119 0.028	0.727	9.532 6.611	0.000 0.000
R Square	0.528				
Adjusted R Square	0.516				
Std. Error of the Estimate	0.10-003				
F value	43.703				
Dependent variable -front end- decisions					

Further, Standardized Coefficients value (β =0.727) shows that the variables of partnership competence have a strong positive relationship with front-end decision making in apparel innovation. The results confirmed that 51.6% of the front-end decisions (Adjusted R^2 =0.516) are influenced by the factors of partnership competencies of an organization, accepting the hypothesis H_{1c}- "*Organization's partnership competencies influence the front-end decision making process"*.

7.1.1.4 Organization's financial competencies on front-end decisions

Financial resources are a key requirement for organizing the other resources for the innovation process (Hottenrott & Peters, 2012). The financial resources of a firm have a direct relationship with its innovation activities (Hottenrott & Peters, 2012). Assuming a direct relationship between the financial competencies of an organization and front-end decision making in apparel innovation, this relationship is investigated by testing the following hypothesis.

H_{1d}- *Organization's financial competencies influence the front-end decision making process of incremental apparel innovation*

Table 7.8 shows the factors and the results of the correlation analysis on the factors related to the financial competencies of an organization (questions k &l in section A of Appendix 8). The Correlation Coefficient value (*r*) of the allocation of sufficient funds for R&D including training is 0.565. For new machinery and materials, the Correlation Coefficient value (*r*) is 0.354 as shown in Table 7.8. This indicates that the ability to allocate sufficient funds for R&D, including both training and for new machinery and materials, has a significant effect on front-end decisions. Further, the result signifies the importance of them for making decisions on developing existing knowledge and skills to enter the innovation process successfully.

Table 7.8: Organization's financial competencies – Correlations between individual factors and front-end decisions

	Individual factors of Organization's financial competencies	**Front- end decisions**	
Spearman's *rho* N-41	Allocation of enough funds for R&D (including training)	Correlation Coefficient- *r* Sig. (2-tailed)	0.565** 0.000
	Allocation of enough funds for new machinery and materials	Correlation Coefficient- *r* Sig. (2-tailed)	0.354** 0.010

Note -$p \leq 0.05$ ** Correlation is significant at the 0.01 level (2-tailed).

Besides, the results of the regression analysis (Table 7.9) show that the variables of financial competencies (β =0.417) have a statistically significant moderate positive relationship with front-end decision making in apparel innovation. The Adjusted R^2 value (0.153) indicates that the financial competencies of an organization influence the

front-end decisions. Hence, hypothesis H_{1d}- "*Organization's financial competencies influence the front-end decision making process"* is accepted.

Table 7.9: Linear regression coefficients and regression estimates for financial competencies on front-end decisions

Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
	B	Std. Error	Beta(β)		
(Constant)				15.983	0.000
Financial competence	1.628	0.102		2.865	0.007
	0.077	0.027	0.417		
R Square	0.174				
Adjusted R Square	0.153				
Std. Error of the Estimate	0.13239				
F value	8.209				
Dependent variable -front end decisions					

7.1.2 Climate of organization on front-end decisions

Organizational climate comprises shared beliefs, common practices, and value systems followed by an organization (Janz et al., 1997; Schneider, 1990). Dimensions commonly discussed in past studies of an organization's climate are presented in Table 7.10.

Table 7.10: Dimensions used to measure climate of an organization

Orientation	**Dimensions**	**Authors**
Goal oriented	Strategic orientation (Organization)	Açikgöz & Günsel, 2011 ; Al-Saudi, 2012 ; Broeze, 2014; Lone, et al, 2011;Porzse et al, 2012
Functional / process oriented	Structural / relational characteristics (Team/group and individual)	

Two dimensions that were recognized through reviewing existing literature are the organization's strategic orientation and its structural characteristics. These two factors, which are frequently discussed in academia as directly related to innovation activities, were selected to define the climate of organization to realize the objective of this study.

7.1.2.1 Organization's strategic orientation on front-end decisions

The strategic orientation of an organization is "the set of activities and behaviours that are implemented for achieving the organization's goals" (Jeong et al., 2006). Strategic orientation of an organization is directly associated with product ideation novelty (Spanjol et al., 2011). The impact of the strategic orientation of an organization on the front-end decision making process in apparel innovation is explored by testing the following hypothesis.

H_{2a} - *Organization's strategic orientation influences the front-end decision making process of incremental apparel innovation*

Table 7.11 presents the factors and the results of Spearman's *rho* correlation analysis for strategic orientation of organization on front-end decisions (questions a-f in section B of Appendix 8).

Table 7.11: Organization's strategic orientation - Correlations between individual factors and front-end decisions

	Individual factors of organization's strategic orientation	**Front -end decisions**	
Spearman's rho N-41	Consideration of the needs of the current customers	Correlation Coefficient -*r* Sig. (2-tailed)	0.558* 0.031
	Consideration of the needs of the future customers	Correlation Coefficient-*r* Sig. (2-tailed)	0.356* 0.030
	Orientation towards new technological developments/ solutions	Correlation Coefficient-*r* Sig. (2-tailed)	0.791* 0.028
	Overseeing the possible strategies to be implemented	Correlation Coefficient-*r* Sig. (2-tailed)	0.256* 0.041
	Overseeing the possible practices to be implemented	Correlation Coefficient-*r* Sig. (2-tailed)	0.538** 0.000
	Policies on providing training to develop the capabilities	Correlation Coefficient-*r* Sig. (2-tailed)	0.411** 0.008

Note- $p \leq 0.05$ ** Correlation is significant at the 0.01 level (2-tailed).

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

As shown in Table 7.11, the Correlation Coefficient value (*r*) of overseeing the possible practices to be implemented is 0.538, while policies on providing training to develop staff capabilities is 0.411. This is a clear indication that overseeing the possible practices to be implemented and policies on providing training to develop the staff capabilities have a notable association with front-end decisions. The other indicators also

demonstrate a noticeable relationship with front-end decisions at a 0.05 significance level.

The results of the linear regression analysis for the strategic orientation of an organization on front-end decisions are presented in Table 7.12.

Table 7.12: Linear regression coefficients and regression estimates for strategic orientation on front-end decisions

Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**T**	**Sig.**
	B	Std. Error	Beta (β)		
(Constant) Organization's strategic orientation	1.216 0.165	0.211 0.050	0.470	5.774 3.323	0.000 0.002
R Square(R^2) Adjusted R Square Std. Error of the Estimate F value	0.221 0.201 0.12859 11.043				
Dependent variable -front -end decisions					

The Standardized Coefficients value of the variables of strategic orientation is 0.470, which shows a moderate relationship with front-end decision making in apparel innovation. The Adjusted R^2 value of 0.201 confirms that 20.1% of front-end decisions are influenced by the factors of strategic orientation and accepts the hypothesis H_{2a}- "*Organization's strategic orientation influences the front-end decision making process"*.

7.1.2.2 Organization's structural characteristics on front-end decisions

Organizational structure is based on the roles and activities of employees, internal patterns of relationships, authority, and nature of communication, which may encourage or discourage communication within departments, between departments, and with external partners (Kohli & Jaworski, 1990). Organizational structure has a more powerful effect on innovation (Hao, et al.,2012). Therefore, the impact of structural characteristics of organization on the front-end decision making process in apparel innovation is studied to identify its effect, formulating the following hypothesis.

H_{2b} - *Organization's structural characteristics influence the front-end decision making process of incremental apparel innovation*

Six factors were identified in order to examine the relationship between the structural characteristics of an organization, and the front-end decision making process (Appendix 8- individual factors used to measure each main factor).

The Correlation Coefficient value in Table 7.13 demonstrates that there is a significant correlation at the 0.01 and 0.05 level between each of the individual factors of the structural characteristics of an organization and the front-end decision making process in incremental apparel innovation. This confirms that the organization's administrative mechanisms, and its work activities influence front-end decision making.

Table 7.13: Organization's structural characteristics- Correlations between individual factors and front-end decisions

	Individual factors of organization's structural characteristics	**Front- end decisions**	
Spearman's rho N-41	Freedom to freely debate and discuss new ideas and to conduct work	Correlation Coefficient-*r* Sig. (2-tailed)	0.395* 0.050
	The delegation of authority to make decisions	Correlation Coefficient-*r* Sig. (2-tailed)	0.550** 0.000
	Effective communication of task relevant information among the team members	Correlation Coefficient-*r* Sig. (2-tailed)	0.465** 0.002
	The willingness to share information related to innovation freely with other members of the team	Correlation Coefficient-*r* Sig. (2-tailed)	0.651** 0.000
	The willingness of senior management to accept external ideas	Correlation Coefficient-*r* Sig. (2-tailed)	0.502** 0.001
	The commitment of the management and the innovation team to the project in hand	Correlation Coefficient-*r* Sig. (2-tailed)	0.492** 0.001

Note- $p \leq 0.05$ ** Correlation is significant at the 0.01 level (2-tailed).

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

Table 7.14 presents the results of the linear regression analysis for the structural characteristics of an organization on front-end decisions. The Standardized Coefficient value ($\beta = 0.578$) suggests that the variables relating to the structural characteristics of an organization have a statistically significant relationship with front-end decision making in apparel innovation.

Table 7.14: Linear regression coefficients and regression estimates for structural characteristics on front-end decisions

Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**T**	**Sig.**
	B	Std. Error	Beta(β)		
(Constant) Organization's structural characteristics	1.287 0.147	0.143 0.033	0.578	9.021 4.425	0.000 0.000
R Square (R^2) Adjusted R Square Std. Error of the Estimate F value	0.334 0.317 0.11885 19.581				
Dependent variable -front -end decisions					

The value of Adjusted R^2 confirmed that 31.7% of the front-end decisions are influenced by the factors of structural characteristics. Hence, the hypothesis H_{2b}- "*Organization's structural characteristics influence the front-end decision making process"* is accepted.

7.2 Influence of external factors on front-end decisions

7.2.1 Influence of B2B customers and suppliers on front-end decisions

It can be argued that in terms of building good relationships with B2B customers and suppliers, both operational competencies as well as relationship characteristics are vital which should be well thought out (Handfield et al., 1999; Wagner & Hoegl, 2006). Operational competencies are the capacity to identify and respond to product and process related problems effectively and efficiently (Jap, 1999). Relational properties are the foundation for understanding the nature and quality of the relationships between actors (Perho, 2015; Woo & Ennew, 2004). Relationship characteristics are treated as multi-dimensional and higher-order constructs that consist of several dimensions: for example, trust, commitment, cooperation, information, and knowledge sharing (Woo & Ennew, 2004).

7.2.1.1 B2B customers' influence on front-end decisions

The relationship between capabilities of B2B customers and the front-end decisions making is studied by testing the following hypothesis.

H_{3a}- *Operational competencies of B2B customers influence the front-end decision making process of incremental apparel innovation*

As shown in Table 7.15, the Correlation Coefficient value (*r*) of the financial competencies of a customer is 0.170. It indicates that the financial competencies of customers have a weak correlation with front-end decisions. The Correlation Coefficient value (*r*) of the technological capabilities of a customer is -0.053 and manufacturing expertise is 0.064. It indicates that there is no statistically significant correlation between the technological capabilities, manufacturing expertise of customers and the front-end decisions.

Table 7.15: Operational competencies of B2B customer - Correlations between individual factors and the front-end decisions

	Individual factors of operational competencies of customers	**Front -end decisions**	
Spearman's rho N-41	Customers' technological capabilities	Correlation Coefficient-*r* Sig. (2-tailed)	-0.053 0.740
	Customers' manufacturing expertise	Correlation Coefficient-*r* Sig. (2-tailed)	0.064 0.693
	Customers' financial competencies	Correlation Coefficient-*r* Sig. (2-tailed)	0.170* 0.050

Note- $p \leq 0.05$ * Correlation is significant at the 0.05 level (2-tailed).

Table 7.16 shows the results of the regression analysis for the operational competencies of B2B customers on front-end decisions. The results inform that the influence of the operational competencies of B2B customer variables (β =0.092; p = 0.569) are not statistically significant. Hence, the hypothesis H_{3a}- *"Operational competencies of B2B customer influence the front-end decision making process"* is not accepted.

Table 7.16: Linear regression coefficients and regression estimates for operational competencies of customer on front-end decisions

Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**T**	**Sig.**
	B	Std. Error	Beta(β)		
(Constant)	1.843	0.124		14.885	0.000
Operational competence of customers	0.021	0.037	0.092	0.574	0.569
R Square(R^2)	0.008				
Adjusted R Square	-0.017				
Std. Error of the Estimate	0.14505				
F value	0.330				
Dependent variable -front -end decisions					

The relationship between relational characteristics of B2B customers and front- end decision making is determined by formulating the following hypothesis.

H_{3b}- *Relational characteristics of B2B customers influence the front-end decision making process of incremental apparel innovation*

Seven individual factors were used to examine the relationship between the relational characteristics of B2B customers and the front-end decision making process (Appendix 8- Individual factors used to measure each main factor). These factors indicate the readiness of the customer to discuss and negotiate, mutual support and learning, reliability and trustworthiness, commitment and degree of responsibility towards innovation, communication effectiveness, accurate and timely information sharing, and a proactive role towards the initiation of innovation. The results of the correlations between individual indicators of the relational characteristics of B2B customers and the front-end decisions are presented in Table 7.17. The results show that there is a statistically significant correlation between all the individual factors of the relational characteristics of customers and the front-end decision making process in incremental apparel innovation. These results establish that relationship compatibility is important to determine the nature of the relationship between B2B customers.

Table 7.17: Relational characteristics of B2B customer -Correlations between individual factors and front-end decisions

	Individual factors of relational characteristics customers	Front -end decisions	
Spearman's rho N-41	Customers' readiness to discuss and negotiate	Correlation Coefficient-*r* Sig. (2-tailed)	0.382* 0.014
	Customers' mutual support and learning	Correlation Coefficient-*r* Sig. (2-tailed)	0.586** 0.000
	Customers' reliability and trustworthiness	Correlation Coefficient-*r* Sig. (2-tailed)	0.541** 0.000
	Customers' commitment and degree of responsibility towards innovation	Correlation Coefficient-*r* Sig. (2-tailed)	0.592** 0.000
	Customers' communication effectiveness	Correlation Coefficient-*r* Sig. (2-tailed)	0.407** 0.008
	Customers' accurate and timely information sharing trait	Correlation Coefficient-*r* Sig. (2-tailed)	0.522** 0.000
	Customers' proactive role towards initiation of innovation idea	Correlation Coefficient-*r* Sig. (2-tailed)	0.385* 0.013

Note -$p \leq 0.05$ ** Correlation is significant at the 0.01 level (2-tailed).

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

The Standardized Coefficients value ($\beta = 0.515$) in Table 7.18 shows that the influence of the variables of relational characteristics of B2B customers have a statistically significant relationship with front-end decision making in apparel innovation. Further, the Adjusted R^2 value indicates that 24.6% of the front-end decisions are influenced by the factors of relational characteristics of B2B customers. This confirms the hypothesis H_{3b}- "*Relational characteristics of B2B customers influence the front-end decision making process".*

Table 7.18: Linear regression coefficients and regression estimates for relational characteristics of customer on front-end decisions

Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**T**	**Sig.**
	B	Std. Error	Beta(β)		
(Constant) Relational characteristics of customers	1.474 0.105	0.119 0.028	0.515	12.419 3.753	0.000 0.001
R Square(R^2) Adjusted R Square Std. Error of the Estimate F value	0.265 0.246 0.12485 14.082				
Dependent variable -front -end decisions					

7.2.1.2 Suppliers' influence on front-end decisions

The relationship between capabilities of suppliers' and front- end decisions making is studied by testing the following hypothesis.

H_{4a}- *Operational competencies of suppliers influence the front-end decision making process of incremental apparel innovation*

The technological capabilities, manufacturing expertise, financial competencies, and production flexibility of suppliers are the four individual factors that were used to examine the relationship between the operational competencies of suppliers, and the front-end decision (Appendix 8).

The results of Correlation Coefficient values (*r*) in Table 7.19 demonstrate that there is a significant correlation between all four individual factors and the front-end decisions. This signifies that the suppliers who possess strong operational capabilities (resources, & know-how) to extend support for innovation can influence front-end decision making.

Table 7.19: Operational competencies of suppliers' -Correlations between individual factors and front-end decisions

	Individual factors of operational competencies suppliers'	Front- end decisions	
Spearman's rho N-41	Suppliers' technological capabilities	Correlation Coefficient-*r* Sig. (2-tailed)	0.402** 0.009
	Suppliers' manufacturing expertise	Correlation Coefficient-*r* Sig. (2-tailed)	0.307* 0.050
	Suppliers' financial competencies	Correlation Coefficient-*r* Sig. (2-tailed)	0.429** 0.005
	Suppliers' production flexibility	Correlation Coefficient-*r* Sig. (2-tailed)	0.409** 0.008

Note -$p \leq 0.05$ ** Correlation is significant at the 0.01 level (2-tailed).

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

The results of the regression analysis for operational competencies of suppliers on front-end decisions are presented in Table 7.20.

Table 7.20: Linear regression coefficients and regression estimates for operational competencies of suppliers on front-end decisions

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta(β)		
(Constant)	1.549	0.093		16.635	0.000
Suppliers' operational competencies	0.096	0.024	0.539	4.001	0.000
R Square(R^2)	0.291				
Adjusted R Square	0.273				
Std. Error of the Estimate	0.12265				
F value	16.007				
Dependent variable -front -end decisions					

The results indicate that the variables of operational competencies of suppliers (β =0.539) have a moderate positive relationship with front-end decision making in apparel innovation. The Adjusted R^2 value is 0.273. It confirmed that the operational competencies of suppliers influence the front-end decisions, verifying the hypothesis H_{4a}- "*Operational competencies suppliers' influence the front-end decision making process"*.

The relationship between suppliers and front- end decisions making is determined by the following hypothesis.

H_{4b}- *Relational characteristics of suppliers influence the front-end decision making process of incremental apparel innovation*

The results of Spearman's *rho* correlation on individual factors of the relational characteristics of suppliers and the front-end decisions are presented in Table 7.21. The results demonstrate that there is a statistically significant correlation between all the individual factors of relational characteristics of suppliers and the front-end decision making process in incremental apparel innovation. The readiness of the supplier to discuss and negotiate, mutual support and learning, reliability and trustworthiness, commitment and degree of responsibility towards innovation, communication effectiveness, accurate and timely information sharing, and a proactive role towards the initiation of innovation are the individual factors. This verifies that the relationship qualities of suppliers are crucial to identify the compatibility and decide the nature of the relationship with the suppliers at the front-end.

Table 7.21: Relational characteristics of suppliers' -Correlations between individual factors and front-end decisions

	Individual factors of relational characteristics suppliers'	**Front- end decisions**	
Spearman's rho N-41	Suppliers' readiness to discuss/ negotiate	Correlation Coefficient-*r* Sig. (2-tailed)	0.533** 0.000
	Suppliers' mutual support/learning	Correlation Coefficient-*r* Sig. (2-tailed)	0.487** 0.001
	Suppliers' reliability/trustworthiness	Correlation Coefficient-*r* Sig. (2-tailed)	0.511** 0.001
	Suppliers' commitment and degree of responsibility towards innovation	Correlation Coefficient-*r* Sig. (2-tailed)	0.554** 0.000
	Suppliers' communication effectiveness	Correlation Coefficient-*r* Sig. (2-tailed)	0.474** 0.002
	Suppliers' accurate and timely information sharing	Correlation Coefficient-*r* Sig. (2-tailed)	0.429** 0.005
	Suppliers' proactive role towards initiation of innovation/ idea	Correlation Coefficient-*r* Sig. (2-tailed)	0.436** 0.004

Note -$p \leq 0.05$ ** Correlation is significant at the 0.01 level (2-tailed).

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

The results of the regression analysis (Table 7.22) demonstrate that the variable of relational characteristics of suppliers (β = 0.627) is statistically significant.

Table 7.22: Linear regression coefficients and regression estimates for relational characteristics of suppliers on front-end decisions

Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
	B	Std. Error	Beta(β)		
(Constant)	1.357	0.112		12.125	0.000
Relational characteristics of suppliers'	0.132	0.026	0.627	5.031	0.000
R Square(R^2)	0.394				
Adjusted R Square	0.378				
Std. Error of the Estimate	0.11343				
F value	25.314				
Dependent variable –front- end decisions					

Further, the Adjusted R^2 value (0.0.378) indicates that the factors of relational characteristics of suppliers influence the front-end decisions. Hence, the hypothesis H_{4b}- "*Relational characteristics of suppliers' influence the front-end decision making process"* is accepted.

The above results confirmed the internal environmental factors; the organization's core competence (technical, to serve customers, partnership, and financial) and the organization's climate (strategic orientation, and structural characteristics) as influential on front-end decisions. Further, the external factors which were confirmed as influential on front-end decisions are operational competencies and relational characteristics of suppliers and operational competencies of B2B customers. Figure 7.1 illustrates the revised factors that influence front-end decisions.

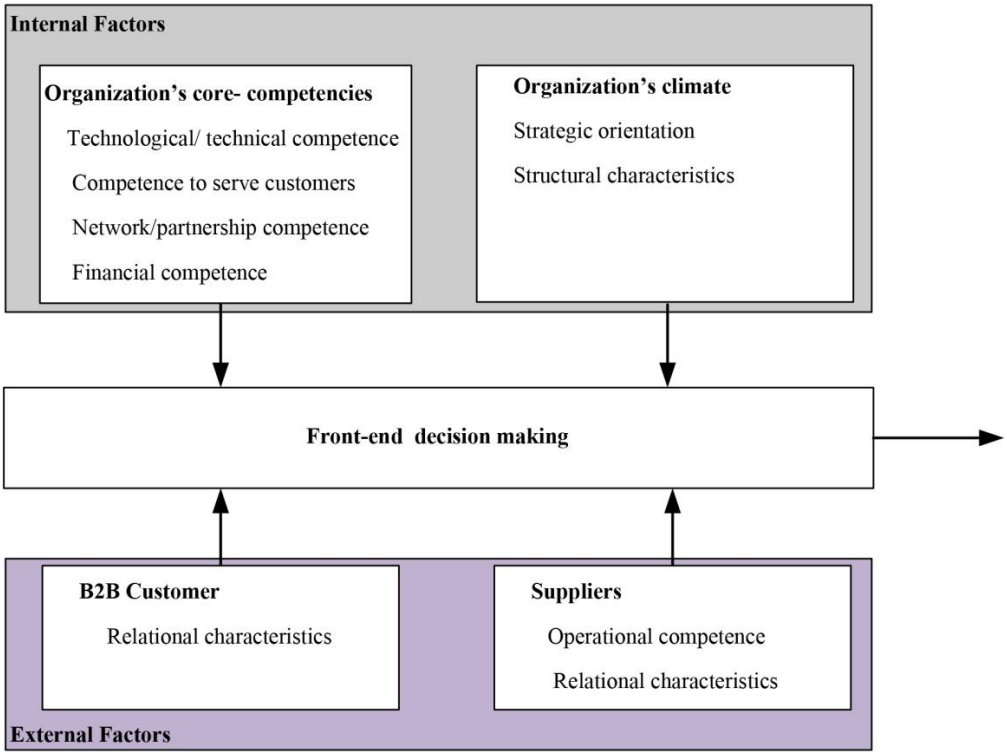


Figure 7.1: Revised factors that influence front-end decisions

7.3 Summary of the chapter 7

This chapter re-examined and verified the results obtained in case studies (step 1 of model development) on the internal and external factors that exert influence on front-end decisions in incremental innovation. The identified internal factors were the core competencies and climate of the organization. The external factors are the operational competencies and relationship characteristics of the external actors (customers and suppliers).

To verify the extent of the influence of these external and internal factors on front-end decisions in incremental apparel product innovation, hypotheses (H_{1a} -H_{4b}) were derived. A questionnaire survey was carried out to verify the internal and external environmental factors that influence the front-end decision making process through testing the hypotheses (H_{1a} - H_{4b}). The statistical analysis of the questionnaire survey confirmed that the core competence of the organization (technical, customer, partnership, and financial) and the climate of organization (strategic orientation, and structural characteristics) are influential on front-end decisions. The relationship characteristics of

suppliers and B2B customers and the operational competencies of suppliers were confirmed as external factors that influence front-end decision making in the apparel innovation context. Based on the results of the questionnaire, the factors that influence the front-end decisions identified through the findings of the case studies discussed in section 5.2.3 were revised.

CHAPTER 8

META DECISION MAKING MODEL

This chapter presents the Meta decision making model for front-end incremental apparel innovation. A Meta model describes and includes all of the constructs and relationships needed to be in a model and provides an all-encompassing picture of a process.

The chapter begins by defining 'Meta model'. The proposed Meta decision making model for the front-end incremental apparel innovation comprises three individual but interconnected components (i. the decision-making process steps, ii. the interactive roles of suppliers, apparel producers, and B2B customers, and iii. the influential factors). The relationship between three components was identified for incremental apparel innovation through the findings of the case studies discussed in Chapter 5. Three individual components were refined through a concurrent study (refinement interviews and questionnaire) and discussed in Chapters 6 and 7.

The chapter discusses the factors considered when developing the Meta decision making model and presents the model describing the relationship between the interactive roles of suppliers, apparel producers, and B2B customers and front-end decision process steps as well as the influential factors and the decision making process.

8.1 Definitions of 'Meta model'

A model is defined as "A representation of a real system. A model is an abstract, conceptual system by which a concrete system is represented" (Schwaninger, 2010). A Meta model is defined as,

- "A model that is intended to give an all-inclusive picture of a process, system, etc., especially by abstracting from more detailed individual models contained within it" *(*Oxford Dictionary, n. d.)
- "A 'model of a model', that provides an explicit representation of the constructs and relationships needed to build specific models within a domain of interest" (ASPECS, n.d.)

- "A model of a model which describes/ prescribes the concepts "(Engels, et al, 2010, p.419)

These definitions highlight the fact that a Meta model comprises a number of individual components.

8.2 Meta decision making model

The Meta decision model proposed in this study for the front-end of incremental apparel innovation was based on the following considerations:

- The decision making process steps cannot exist alone (Szutowski, 2019).
- Shared knowledge, experience, and involvement of the stakeholders (internal multi-functional team, customers and suppliers) are indispensable for each step of the decision making process.
- It is necessary to be mindful of the relationship between the internal and external factors that influence the decisions that may be either supporting or hindering innovation.
- Decision making process steps, interactive roles of stakeholders and factors influence are closely linked and interconnected that one cannot exist without the other.
- The model should provide an inclusive picture of the decision making process at the front-end.
- The model should describe and include all the constructs needed to make decisions at the front-end as well as essential relationships.

Thus, the Meta decision making model is based on the three refined individual components discussed in Chapters 6 and 7 that are interconnected to each other. The three individual components are:

i. The decision making process steps
ii. The interactive roles of suppliers, apparel producers, and B2B customers
iii. The influential factors

Figure 8.1 illustrates the Meta decision making model for front-end incremental apparel innovation along with the interconnection between three elements.

As discussed in section 3.1.2, a deeper understanding of what decisions should be made, the order of the decisions, responsible decision makers for each key decision, and how the decisions should be handled in two front-end activity phases; preliminary strategy identification phase and concept development phase facilitate to initiate and manage the innovation processes efficiently. Therefore, the main component of the model is the front-end decision making process, which is illustrated in the middle of the model. It shows the flow of the process. As discussed in section 6.2.1.1, in order to start the process, updated information must be gathered on timely factors to develop knowledge of innovation opportunities. Therefore, inside the front-end decision making process, the information needed for initiation is indicated as the starting rectangle. Since the decision making process comprises two activity phases, these two activity phases are represented by rectangles within the decision making process.

As discussed in Chapters 5 and 6, procedural differences also exist in two innovation initiation scenarios ('initiated by company' and 'initiated by B2B customer'). In scenario1, the first activity phase comprises five decision gates (illustrated in Figure 6.9) while in scenario 2, there are four decision gates (illustrated in Figure 6.11). The second activity phase comprises four decision gates as discussed in sections 5.1, 5.2 & 6.2 and verified in section 6.3 in both scenario1 and scenario 2 (illustrated in Figure 6.10 & 6.12). The rectangle in between the two activity phases represents the outcome of the first activity phase: initial innovation project canvas. The last rectangle located at the bottom of the front-end decision making process represents the outcome of the front-end of product innovation; the concepts accepted. This is the key performance indicator (KPI) of the front-end decision making process. The arrows inside symbolize the sequential flow of decision making process.

Internal multi-functional team, B2B customers as well as suppliers are key actors having important roles to play in the front-end of innovation to ensure a more effective outcome as discussed in sections 5.3, 5.4 & 6.4 and verified in section 6.5 in both scenario1 and scenario 2. The involvement of apparel brands (B2B customers), and suppliers is in different forms and in different intensities for the front-end innovation in two innovation initiation approaches ('initiated by company', 'initiated by B2B customer'). The apparel producer's role has also changed in two innovation initiation approaches due to

procedural differences, differences in the range of knowledge, skills, and information required, and different forms of customer and supplier involvement. Therefore, the interactive roles of apparel producers, suppliers, and B2B customers constitute the second component of the decision model for the front-end. The interactive roles are illustrated on the left hand side of the front-end decision making process. These three key actors are indicated by the three rectangles inside the interactive roles. The relationship between the interactive roles and the front-end is denoted by an arrow.

The importance of paying increased attention to assessing the internal and external factors influencing the front-end decision-making process is indispensable. The third component of the model is the influential factors. Two categories: internal (organization's core competencies and climate) and external actors (suppliers and B2B customers) were discussed in section 5.2.3. To verify the extent of the influence of these external and internal factors on front-end decisions in incremental apparel product innovation, hypotheses (H_{1a} -H_{4b}) were derived and verified through a questionnaire survey as presented in Chapter 7. These internal and external factors are indicated using the two rectangles. The relationship between the influential factors and the decision making process is denoted by an arrow in between the respective two rectangles, since there is a direct relationship between them as confirmed through the findings of the questionnaire survey presented in Chapter 7.

The proposed Meta decision making model for the front-end, which consists of three interconnected individual components, will facilitate apparel producers in incremental apparel innovation by improving the quality of design solutions, avoiding ineffective solutions, creating the best value for customers, and meeting the needs of demanding customers.

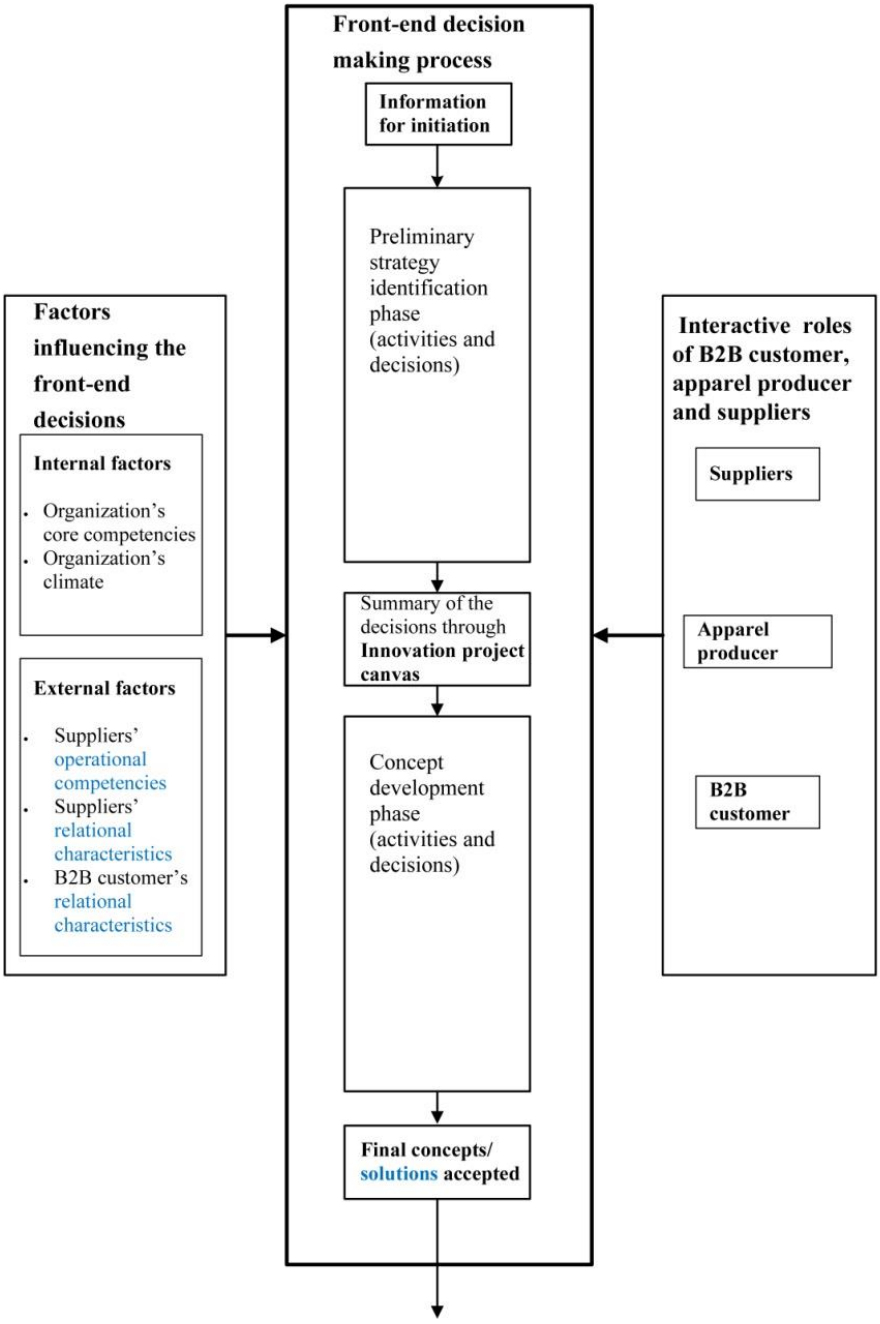


Figure 8.1: Meta decision making model for the front-end incremental apparel innovation

8.3 Summary of the chapter 8

This chapter presented the Meta decision making model for front-end incremental apparel innovation, which includes all of the constructs and relationships required to make decisions at the front-end of incremental apparel innovation.

The definitions for the 'Meta model' were presented, and it was discovered that these definitions emphasize the fact that a Meta model comprises a number of individual components. The proposed Meta decision making model in this study encompasses three individual components that are interconnected to each other.

i. The decision making process steps
ii. The interactive roles of suppliers, apparel producers, and B2B customers
iii. The internal and external influential factors

Relationships between the interactive roles of suppliers, apparel producers, and B2B customers and front-end decision process steps as well as the influential factors and the decision making process were described.

CHAPTER 9

VALIDATION OF META DECISION MAKING MODEL

Validation of the Meta Model presented in Chapter 8 was carried out following the Delphi method and presented in Chapter 9. The Delphi is an effective method for model validation. A Modified Delphi study was conducted to validate the refined Meta decision making model for the front-end of incremental apparel innovation. As stated under the methodology of the research (section 3.5.2.1), five foreign experts who have long practical working experience and expertise in the apparel product innovation process involved in the validation of the refined Meta decision making model (Details of the experts and validation results are presented in Appendix 12). These consultants are advisers to world reputed apparel brands and have experience in apparel innovation for more than 15 years. It made them the most suitable personnel to obtain feedback on the models developed and to recommend the level of acceptability of this model for the global apparel business. Further, one of these experts frequently visit Sri Lanka and four others are expatriates currently working in Sri Lanka as consultants directly involved in managing innovation. Opinions of the experts were gathered through structured face-to-face interviews in order to verify the levels of clarity, practicality, appropriateness, and overall reliability of the Meta decision making model for the front-end decision making (Appendix11-Validation interview format). The questions of the structured interviews with experts were setup seeking two possible responses: agree or disagree. The agreements and disagreements were analyzed quantitatively. The opinions of the experts on the reasons for the agreements and disagreements were analyzed qualitatively.

The analysis of the opinions of the five experts on the three individual components: i. the front-end decision making process, ii. the interactive roles of B2B customers, apparel producers, and suppliers within the front-end, and iii. the factors that influence the decisions are presented in this chapter. The opinions of the five experts on the suitability or fitness of the Meta decision making model are also presented.

9.1 Opinions on the three individual components

The opinions of the five experts on the three individual components in the Meta model are presented in the following sections.

9.1.1 Validation of front-end decision making process steps

The experts agreed on the information (factors), and the sources of information about the front-end decision making process (Expert 1, 2, 3, 4, & 5). No changes were suggested to the evaluation matrices too. Expert 4 expressed her thoughts on the front-end decision making process,

> "*The charts are very useful to put the information into context. Such evaluation frameworks will work well. For an industry like apparel, the matrices are easy to introduce without going into mathematics.*" (Expert 4)

However, the experts recommended a number of additions to the evaluation criteria of decision gate 1, gate 5, gate 6B, and gate 7 in scenario1, as shown in Table 9.1.

No revision was suggested for the titles, and the sequence of decision gates of the two major activity phases within the front-end: preliminary strategy identification phase and concept development phase. Introducing some visuals to give better appeal to the decision process steps was suggested by Expert 4. Commenting on the initial innovation project canvas, Expert 3 stated that, "*it is better to show the sequence or numbering in your project canvas."* Table 9.1 shows the changes proposed by the experts for the front-end decision making process for scenario 1: innovation 'initiated by company'.

The recommendations of the experts for decision making process steps in scenario 2 are similar to the recommendations given for scenario 1. Further, the proposed inclusions for 'decision gate 1', 'decision gate 4', 'decision gate 5B', and 'decision gate 6' in scenario 2 are similar to those of scenario 1, 'decision gate 1', 'decision gate 5','decision gate 6B', and 'decision gate 7'.

Table 9.1: Changes proposed for the front-end decision making process steps - *scenario 1 & 2*

Front-end activities and decisions	Suggestions		
Process steps	Introduce some visuals to give more reader appeal to decision process steps if possible (Expert 4)		
Factors for evaluation criterion.	Gate 1	Include into new values to company	- Enable the exploration of new areas as applicable (Expert 4)
	Gate 5	Include into rewards to company	- Enable to increase revenue (Expert 2)
	Gate 6B	Include into manufacturability	- Financial sustainability (Expert 3)
	Gate 7		- Design for production (Expert 3,&4) - Design for profit (Expert 5)
Initial innovation project canvas	Insert the priority order (numbering) if possible (Expert 3)		

9.1.2 Validation of interactive roles of B2B customer, apparel producers and suppliers

All five experts agreed with the interactive roles of B2B customers, apparel producers, and suppliers. Expert 1 affirmed the demonstrated interactive roles, stating that,

> "*You have properly captured the roles. As you proposed, nowadays at the early stages, we like to closely work with our apparel brands to reduce our risks in business. But on the other hand, it is a challenge. Working closely with suppliers is also hard. Anyway, I agree with your proposed roles*." (Expert 1)

As per the opinion of experts, no revisions or amendments were required for the demonstrated interactive roles of B2B customers, apparel producers, and suppliers since the researcher had accurately judged their roles.

9.1.3 Validation of environmental factors that influence the decisions

The experts had not proposed any changes or modifications to the factors (Expert 1, 2, 3, 4, & 5). The expert 2 accepted the environmental factors by stating that,

"*Actually, when we talk about decisions, it is very challenging. We know some factors influence it. Especially I would say our internal capacity. But producers do not discuss them. I think your identified factors really matter when we make decisions*." (Expert 2)

The opinion of the experts confirmed that no changes were required to the factors.

9.2 Validation of the Meta decision making model

The fitness of the Meta decision making model was evaluated based on three main criteria.

i. Clarity of the contents

   Clarity of a model which includes language, terminology, components, and their relationships is essential and important. Because, without a readable and understandable model, all the efforts are fruitless (Marx,2021; Nordin, et al., 2012; Rahman, et al., 2016). Therefore, a model should provide adequate information and the graphics in the diagrams and/or textual expressions used in the model must be meaningful and easy to understand (Fabri, et al.,2022; Halpin, 2001 as cited in John,2002).

ii. Accuracy of overall structure

   A model should include all major components of what it is supposed to be or claims to be, and the logical relationship between the components should be clearly demonstrated in order to provide practitioners with a better understanding for successful implementation (Fabri, et al.,2022; Marx,2021; Nordin, et al., 2012;Schwaninger,2010).

iii. Practical applicability

   Practitioners must be able to determine whether the model is appropriate for the applications (Fabri, et al.,2022; Hay, 1999 as cited in John,2002).

The Modified Delphi study was employed in validating the above three criteria. In the Modified Delphi method, the previously developed work can be further refined, whereas in the conventional Delphi method, the study may start with little or no background information. As discussed in section 3.5.1, the Modified Delphi is a

method intended to obtain agreement from experts by means of structured questionnaires or interviews, and to verify the suitability of a model. In the Modified Delphi study, the agreements of experts are analyzed both qualitatively and quantitatively.

The opinions of the five foreign experts were gathered through structured interviews: yes or no (agree /disagree) for each individual item under each of the above three criteria (Appendix 11-validation interview format). Most of the time, the experts responded to the structured questions by explaining their 'yes' and 'no' responses with a comment. The agreements were quantified by adding the 'yes' and 'no' answers received for each individual item and dividing it by the total number of experts. The agreements were expressed as a percentage.

The results of the Modified Delphi study analysis for the above three criteria are presented in the following sub sections.

9.2.1 Verification of the clarity of the contents

The clarity and readability of the contents of the Meta decision making model were verified considering four aspects. The four aspects are

1. Language or terminology used
2. Components included
3. Relationships between components
4. Decision steps, and sequence of the steps

The results of the Modified Delphi study analysis for the four aspects are presented in the following sub sections.

9.2.1.1 Verification of the clarity of the language or terminology used

The following question in the structured interview format presented in Appendix 11 focused on verifying the language and terminology used in the Meta model.

6a. Is it easy to understand the language and terminology used in the model? (yes/ no)

Four experts agreed with the language and terminology. Expert 4 disagreed with the language and terminology and commented,

> "*This is really good for academics. But for the industry, it should be in simple wording. The wording could be more simplified and made a bit lighter for the reader*." (Expert 4)

Based on this suggestion, the wording of the model could be simplified for further improvement of the Meta model for industry practitioners.

9.2.1.2 Verification of the clarity of the components included

As discussed in Chapter 8, three individual components are in the Meta decision making model: i. the front-end decision making process, ii. the interactive roles of B2B customers, apparel producers, and suppliers within the front-end, and iii. the factors that influence the decisions. The clarity of the components considered in the Meta model was verified through the following question.

6b. Is it easy to understand the components used in the model? (yes/ no)

All five experts agreed that the three components included in the model were clear. Expert 1 accepted the three components by saying that,

> *"The front-end process is not easy. Decision making does not stand alone. It needs a lot of information, and involves various stakeholders, as you indicated, both internal and external. The other component you indicated is the factors. Yes, internal factors really matter for innovation. The components are clear."* (Expert 1)

9.2.1.3 Verification of the clarity of the relationships between components

The following question was to verify the clarity of the relationship between the three components.

6c. Is it easy to understand the relationship between the components used in the model? (yes/ no)

As indicated in section 9.2.1.2, all the experts agreed that the logical relationships between the three components were understandable.

9.2.1.4 Verification of the clarity of the decision making steps

The eight decision making process steps are the main components of the Meta decision making model. The following question in the structured interview format presented in Appendix 11 focused on verifying the clarity of the decision process steps, and the sequence.

6d. Is it easy to understand the decision steps and sequence used in the model? (yes/ no)

All five experts agreed on the decision steps and the sequence. Expert 3 commented on the clarity of the decision gates.

> *"The apparel brands are really important for apparel manufacturers. They also come up with new ideas. The captured scenarios are clear. The front-end is hard and risky. Each and every activity is important. The decision gates are understandable and clear."* (Expert 3)

The results of the interviews with experts on the clarity of the contents of the Meta decision making model is presented in Table 9.2.

Table 9.2: Clarity of the contents of the Meta model

Clarity of the model		**Agree %**
6a	Easy to understand the language and terminology used in the model	80
6b	Easy to understand the components used in the model	100
6c	Easy to understand the relationship between the components used in the model	100
6d	Easy to understand the decision steps and sequence used in the model	100

As shown in Table 9.2, the agreement for the language and terminology used in the model is 80%. The other three aspects scored 100%.

In the Modified Delphi method, no universally established standard exists yet on the percentage of agreement to conclude consensus on the content validity indicators. However, 67 per cent on a nominal scale (yes/no) is an acceptable percentage for the

purpose of determining a consensus on content validity indicators (Pasukeviciute & Roe,2000, as cited in Gracht, 2012). The percentage of agreement for each individual aspect with a value 80 was taken as the minimum percentage to validate the clarity of the content of the Meta decision making model.

The outcome of the structured interviews with experts resulted in that the agreement on each aspect was over 80% as shown in Table 9.2. It indicates that the contents (language, components included, relationships between components and decision phases, and sequence of the steps) of the Meta decision making model is clear and easy to understand, though one expert disagreed with the language and terminology.

9.2.2 Verification of the overall structure of the Meta decision making model

Four main areas were considered in verifying the overall structural accuracy of the proposed Meta decision making model.

1. The front-end decision making process
2. The interactive roles of B2B customers, apparel producers, and suppliers
3. The factors influencing the front-end decisions
4. The overall structure of the Meta model

The results of the Modified Delphi study analysis for the above four areas are presented in the following sub sections.

9.2.2.1 Verification of the front-end decision making process

Agreement of the accuracy of the front-end decision making process was verified through the following five questions in the structured interview format presented in Appendix 11.

7a. Does the model clearly demonstrate essential input information of the front-end decision making to initiate an incremental product innovation? (yes/no)

7b. Does the model clearly demonstrate evaluation mechanisms for front-end decision making steps? (yes/ no)

7c. Does the model clearly demonstrate major decision steps/ gates at the front-end of decision making? (yes/ no)

7d. Does the model clearly demonstrate suitable decision gates of B2B customers, internal teams and supplier involvement in front-end decision making? (yes/ no)

7e. Does the model clearly demonstrate potential key performance indicators (KPI) of the front-end decision making clearly? (yes/ no)

All five experts agreed on the process steps and activities within the front-end, which includes

- the initial input information,
- evaluation mechanisms,
- decision gates,
- involvement of actors, and
- key performance indicators (concepts accepted).

9.2.2.2 Verification of the interactive roles

The following three questions aimed at verifying the accuracy of the interactive roles.

7f. Does the model clearly demonstrate the interactive roles of B2B customers in front-end decision making to acquire new and diverse viewpoints beyond those of the team, to optimize the product features? (yes/ no)

7g. Does the model clearly demonstrate the interactive roles of suppliers in front-end decision making to gain in-depth technical knowledge, and find potential solutions? (yes/ no)

7h. Does the model clearly demonstrate the roles of the internal multifunctional team at the front-end of decision making to reduce ambiguity, and enhance idea transfer? (yes/ no)

Five experts agreed on the interactive roles of B2B customers, apparel producers and suppliers within the two phases of the front-end of apparel innovation as discussed in section 9.1.2. Expert 2 affirmed the accuracy of the interactive roles by stating that,

> "*Apparel producers are catering to diverse markets. Do various product categories. At the same time, we need to satisfy consumers and need to quickly respond to the changes in the market. Specialized knowledge is essential for*

that. Apparel producers cannot do the innovation alone. The apparel producer needs to work with responsive partners upstream and downstream. It helps to mitigate risks. You have indicated how these people can be involved in the process." (Expert 2)

9.2.2.3 Verification of the factors influencing the front-end decisions

Agreement on the accuracy of the factors was verified through the following two questions.

7i. Does the model clearly demonstrate internal factors' influence on front-end decision making? (yes/ no)

7j. Does the model clearly demonstrate external factors' influence on front-end decision making? (yes/ no)

All experts agreed that the proposed Meta model took into consideration all the factors influencing the front-end decisions.

9.2.2.4 Verification of the overall structure of the Meta model

Finally, overall structural accuracy of the Meta decision making model was verified through two questions.

7k. Does the model cover all the major components of front-end decision making? (yes/ no)

7l. Does the model present a systematic and logical relationship between the components and front-end decision making? (yes/ no)

All experts agreed that all the major components of front-end decision making were illustrated in the proposed Meta decision making model. Expert 4 expressed her views, stating that,

"*This is a very deep and complex study that raises a number of important points, specially three components: decisions, interactive roles, and influence factors. That needs to be addressed in front -end decision making. It covers major components within the front- end.*" (Expert 4)

The agreement of experts on the overall structural accuracy of the Meta decision making model is presented in Table 8.3. All the aspects scored 100%. The results signify that the Meta model clearly demonstrates the decision process steps within the front-end, interactive roles, and the factors influencing the front-end decisions.

Table 9.3: Accuracy of overall structure of the Meta model

Overall structure of the model		Agree %
Decision making process	Clearly demonstrates essential input information of the front-end decision making to initiate an incremental product innovation	100
	Clearly demonstrates the evaluation mechanisms for front-end decision making steps	100
	Covers all the major decision steps/ gates at the front-end of decision making	100
	Clearly demonstrates the suitable decision gates of B2B customers, internal teams and supplier involvement in front-end decision making	100
	Clearly demonstrates the potential key performance indicators (KPI) of the front-end decision making	100
Interactive roles of B2B customers, producers, and suppliers	Clearly demonstrates the interactive roles of B2B customer in front-end decision making to acquire new and diverse viewpoints beyond those of the team, to optimize the product features	100
	Clearly demonstrates the interactive roles of supplier in front-end decision making to gain in-depth technical knowledge, and find potential solutions	100
	Clearly demonstrates the roles of the internal multifunctional team at front-end of decision making to reduce ambiguity, and enhance idea transfer	100
Factors influence	Clearly demonstrates the internal factors' influence on front-end decision making	100
	Clearly demonstrates the external factors' influence on front-end decision making	100
All components	Covers all the major components of front-end decision making	100
	Presents a systematic and logical relationship between the components and front-end decision making	100

9.2.3 Verification of the applicability or practicality of the Meta decision making model

General agreement on the applicability and practicality of the Meta decision making model for the front-end in the apparel sector was verified through eight questions. The

first three questions focused on determining the feasibility of implementing and customizing the Meta decision making model in a real working environment.

8a. Can the model be easily implemented in any real working environment? (yes/ no)

8b. Can the model be easily customized to support individual company needs in a real working environment? (yes/ no)

8c. Will the model be useful for the apparel manufacturers who do not start the innovation yet but prefer to study it first, and to evaluate the competencies before initiating an innovation? (yes/ no)

Expert 4 disagreed with the above first two questions, saying,

> "*The content in this respect is very good. But the industry cannot easily implement this overall model. But your decision making steps alone can be implemented, and your proposed roles of the internal teams, suppliers, and customers can be implemented too. As you indicate in your factors, the manufacturer should do a self-evaluation about the internal capabilities, and their climate for innovation. The manufacturer should have some idea about their future, and they should have knowledgeable people with them to implement or customize as mentioned earlier*." (Expert 4)

Therefore, before the model is introduced to the apparel producers, providing guidelines would be beneficial. In order to identify the difficulties and to eliminate any weaknesses the Meta model might have, the practical implementation of the model is suggested in future research.

The rest of the questions were designed to verify the expected benefits of implementing this model.

8d. Will the model of front-end decision making be beneficial for the apparel manufacturers who have already started with innovative products using their competencies with passive customers, and to uplift the innovation work later with demanding customers? (yes/ no)

8e. Will the model provide support for managers to make appropriate managerial decisions to improve the quality of the design solutions, and to optimize the product features and functions? (yes/ no)

8f. Will the model for front-end decision making with straightforward decision steps be more effective at creating the best value for customers through shared knowledge and experience than is the case right now? (yes/ no)

8g. Will the model be a valuable strategic guide that will show the way to improving a company's innovation success rate above the level that is prevailing now? (yes/ no)

8h. Will the formalized and structured model of front-end decision making be capable of forming a strong foundation for an apparel product innovation superior to what is available presently? (yes/ no)

The experts agreed that the Meta decision making model will be a fundamental strategic guide and will provide support for managers. Expert 3 expressed his views stating,

> *"Most manufacturers do practice most of these process steps. This model gives an indication of what the producer should do in each step to achieve effective innovative solutions. This is useful for managers. The producers will not miss the important decisions in the process. This is a good guideline. This gives an idea how of the apparel producer can work with demanding customers, and how the producer and brands can share knowledge."* (Expert 3)

Table 9.4 presents the agreement of the five experts on the applicability of the Meta decision making model in the apparel sector. The agreement for the feasibility of implementing the Meta decision making model is 80% and for customizing the Meta decision making model in a real working environment is also 80%. The other six aspects focused on benefits after implementation scored 100%.

As mentioned in section 9.2.1, the percentage of agreement for each individual aspect with a value of 80 was taken as the minimum percentage to validate the applicability of the Meta decision making model. As shown in Table 9.4, the agreement on each aspect is over 80%. The results confirmed the applicability of the Meta model in a

real working environment, though one expert disagreed with the easy implementation and customization of the Meta model.

Table 9.4:Applicability or practicality of the Meta model in the apparel sector

Practicality/ applicability of the model		Agree %
8a	Can be easily implemented in any real working environment	80
8b	Can be easily customized to support individual company needs in a real working environment	80
8c	Will be useful for the apparel manufacturers who do not start the innovation yet but prefer to study it first, and to evaluate the competencies before initiating an innovation	100
8d	Will be beneficial for the apparel manufacturers who have already started with innovative products using their competencies with passive customers, and to uplift the innovation work later with demanding customers	100
8e	Will provide support for managers to make appropriate managerial decisions to improve the quality of the design solutions and to optimize the product features and functions	100
8f	Will be more effective at creating the best value for customers through shared knowledge and experience than is the case right now	100
8g	Will be a valuable strategic guide that will show the way to improving a company's innovation success rate above the level that is prevailing now	100
8h	Will be capable of forming a strong foundation for an apparel product innovation superior to what is available presently	100

9.3 Summary of the chapter 9

This chapter presented the results of the Modified Delphi study conducted to verify the suitability of the refined Meta decision making model at the front-end of incremental apparel innovation. Five foreign experts each had more than 15 years' experience in the apparel innovation involved to verify the levels of clarity, practicality, appropriateness, and overall reliability of the Meta decision making model.

The experts ensured that the sequence of decision gates of the two major activity phases within the front-end are clear. The decision process steps, and activities within the front-end were verified in the following aspects.

- the initial input information,
- evaluation mechanisms,

- decision gates,
- involvement of actors and
- key performance indicators (concepts accepted).

Experts proposed to make a few additions to the evaluation criteria in a few decision gates in scenario 1 (1,5,6B, &7) and scenario 2 (1,4,5B, & 6). In order to give more reader appeal, one expert suggested introducing suitable visuals to the decision process steps, and priority order for project canvas. Though the decision making process was validated on the basis of the percentage of agreement, the decision making process steps should be further refined with the inclusion of the recommendation by the expert before practical implementation. The experts validated the interactive roles of B2B customers, apparel producers, and suppliers and no suggestions were made for the interactive roles. The experts also verified the influence of internal and external factors on the front-end decision making process.

The validation study ensured that three individual components: i. the front-end decision making process, ii. the interactive roles of B2B customers, apparel producers, and suppliers, and iii. the factors that influence the decisions are understandable. The experts confirmed that the Meta model has given due consideration to all the major components of front-end decision making. The clarity and readability of the contents of the Meta decision making model (language, components included relationships between components and decision phases, and sequence of the steps) were verified on the basis of the percentage of agreement. Commenting on the language and terminology, one expert advised to simplify the wording of the model for industry practitioners. Therefore, the Meta model can be further refined by simplifying its terminology when used by the industry. Easy implementation and customization of the Meta decision making model was not endorsed by one expert. This implies the importance of providing a guideline prior to the implementation of the Meta decision making model. A guideline for implementation of the Meta model is proposed in section 10.3. The experts ensured that the Meta decision making model is appropriate for front-end innovation in the apparel sector. That is because it is intended to provide a valuable fundamental strategic guide for the effective implementation of the front-end of apparel product innovation.

CHAPTER 10

DISCUSSION AND CONCLUSION

This final chapter begins by revisiting the primary aim of the study. This is followed by a discussion of the findings of the study presented in Chapters 5, 6, 7 and 9 and guidelines to implement the Meta decision making model. The chapter concludes with the contribution made by the study to the literature, knowledge of academia, and apparel industry practices. Finally, the chapter presents a number of opportunities identified for future studies in the field of the front-end of innovation.

10.1 Revisiting the aim of the study

A significant research gap exists in decision making at the front-end of innovation practices in the apparel industry. This was endorsed by the senior managers of the apparel industry during the research interviews with them. Initiatives to foster innovation have already been made with the aim of enhancing the business performance of the industry. Although identified sets of guidelines are available and practiced for innovation at the front end, there are no guidelines and no structured approaches for decision making at the front-end of innovation. In making decisions, the industry heavily relies on previous experience. There is no documentation on the front-end decisions on selected or dropped innovation opportunities, and concepts, or the reasons for selection or dropouts. At present, apparel manufacturers are closely working with B2B customers (apparel brands) to mitigate risks in apparel innovation. However, no documented guidelines are available on the roles and responsibilities of the B2B customers within the front-end. A systematic, documented approach to innovation can offer better value to customers and allow an organization to effectively thrive in the market.

Reviewing the existing literature on the front-end of product innovation, two research gaps were identified in academia, as discussed in section 1.2.

i. All existing models lack a detailed discussion of how the decision making process should be organized, what decisions should be made at different stages, and the order in which decisions should be made at the front-end of innovation.

There is no clear evidence in the literature of studies regarding models developed on decision making at the front-end that take into account the co-creation of value in the B2B context.

ii. Research on decision making and models developed on decision making in the front-end of apparel product innovation are not evident. There is no strong evidence of studies on decision making that integrate co-creating value in the B2B context at the front- end of apparel product innovation.

Thus, the study attempted to develop a model for decision making at the front-end, incorporating 'co-creation of value in the B2B context' not only to prepare a valuable guide on decision making in the front-end of the innovation process in apparel product innovation, but also to broaden the knowledge on this topic.

10.2 Discussion of the findings

Incremental innovations to reach the market within a shorter span of time

The research gap and the existing practices of the industry were identified through case study interviews with three companies that have been involved in apparel innovation for the past ten years. Incremental innovation is the general practice of these apparel manufacturers due to practical ease. Incremental innovation is associated with continuous small moderations where new ideas are applied vigorously on existing product categories (Garcia & Calantine, 2002; Paananen, 2010). The apparel products keep changing each and every fashion season with the environmental factors such as the prevailing weather, seasonal activities, and cultural traditions, unlike other consumer products (Ariyatum & Holland,2005; Lou, 2020; McKinsey & Company,2022; Pitimaneeyakul et al., 2004; Zulch et al., 2011). The number of fashion seasons can be as high as 8 with an average of 8-12 weeks each (Lou, 2020; McKinsey & Company, 2017; Zulch et al.,2011). This is one of the reasons for the shortening of the product life cycles and declining phases of apparel products. The time frame allowed for differentiation, and development of apparel products is relatively limited and short. Apparel manufacturing companies are demanding new ideas over a shorter span of time. Therefore, in the practical apparel industry setting in Sri Lanka, 90-95 percent of innovations are incremental, as discussed in section 5.1.

Aesthetic characteristics of apparel products

Apparel products are characterized 80 percent by aesthetics and 20 percent by function where as other products are 80 percent function and 20 percent aesthetics (Regan et al., 1998). Aesthetical characteristics of apparel products are abstract, intangible, and continuously vary mostly with the season, fashion and trends in each year, and the growth of social media interactions (McKinsey & Company,2017, & 2022) . This updated information must be gathered to identify the true opinions of the consumer on aesthetic needs in order to develop innovative products that offer superior value to end consumers. In the practical apparel industry setting in Sri Lanka, (section 5.2.2.4) feedback from end consumers at the front-end is acquired to generate innovative solutions for apparel products.

Three innovation initiation approaches

However, the findings of the case study interviews highlighted the fact that satisfying the needs of the end consumer is not enough in the apparel business. Apparel manufacturers must satisfy the apparel brands too, since they reach the end consumers through apparel brands. In the apparel manufacturing business, the world reputed international apparel brands who have their own retail shops, or fashion houses are the decision makers of the final products (Ariyatum & Holland,2005; Ban, 2020; Lou,2020; May-Plumlee & Little, 1998). That is due to the fact that apparel brands as retailers serve diverse markets which are divided into a number of segments mainly based on price, product quality, and specifications. Therefore, the apparel brands are directly involved in the manufacturing process from the beginning to ensure quality and specifications of the product to maintain and enhance their brand reputation. The findings of the case studies in section 5.1 indicated that three innovation initiation approaches are practiced in apparel product innovation. The first initiation approach utilizes the information of the apparel brands, while the other two utilize both information and knowledge of the apparel brands.

i. Initiation approach 1- innovation ‘initiated by company’ (for B2B customer)
   The manufacturer initiates the innovation process. Information concerning the expectations of the apparel brands is considered. After finalizing the concepts, at the end of the front-end the targeted customers are invited to review.

ii. Initiation approach 2-innovation ‘initiated by company’ (with B2B customer)
The manufacturer initiates the innovation process. The apparel brands are involved in the middle of the front-end.

iii. Initiation approach 3- innovation ‘initiated by B2B customer’ (by B2B customer)
The apparel brand is the initiator of the innovation process and is actively involved in the front-end.

Input from apparel brands for the front-end

The inputs from apparel brands (B2B customers) are in different forms and in different intensities for the front-end innovation in the innovation initiation approaches 2 (‘initiated by company’) and 3 (‘initiated by B2B customer’) in the practical apparel industry setting in Sri Lanka as discussed in section 5.3.

The apparel brands are involved as sources of information, facilitators, and reviewers in approach 2. In approach 3, apparel brands act as initiators, source of information, reviewers, selectors, and co-developers. These business relationships at the front-end of innovation enable the apparel producer to generate unique consumer value. This was supported by the senior managers who had more than eight years of experience in apparel innovation at the refinement interviews with them as presented in section 6.5. The refinement interviews revealed that the apparel brands also act as a route to the market by taking full responsibility in commercializing the innovation.

As discussed in section 2.2.2, apparel product development by collaborating with customers is suggested in two models (May-Plumlee & Little, 2005; Morris, 2011). Some front-end models also thought about customer integration (Alas,2011; Cooper & Sommer,2018; Khurana & Rosenthal, 1998; Sandmeier et al.,2004). However, these models do not clearly state whether they consider business to business (B2B) or business to customer (B2C) contexts. Customer initiated innovation was not taken into account in these models.

Steps in the decision making process at the front -end of apparel innovation

In the practical apparel industry setting in Sri Lanka, as discussed in section 5.2, the steps in the decision making process are different in three innovation initiation

approaches. Due to the procedural differences, the range of information required also varies. The step-by-step approach to decision making involves careful consideration of all contributory factors. These factors are evaluated at the decision gates of the decision making procedure developed in this research (section 6.2).

The findings of the case study interviews (section 5.2) indicated that eight key decision gates are practiced in innovation approaches 1 and 2: five decision gates at the 'preliminary strategy identification' phase and three at the 'concept development' phase. 'Preliminary strategy identification' phase occurs immediately before commencing the innovation process, where the suitable innovation opportunities, strategies, and the mechanisms required to implement the opportunities are identified. 'Concept development' phase occurs while refining the concept for further development by applying technical solutions. At decision gate 1, initial innovation opportunities are identified. At decision gate 2, the apparel brands are considered, and the innovation opportunities identified at gate 1 are reviewed further to identify attractive, commercially viable, and marketable opportunities through apparel brands.

The first decision gate of approaches 1 and 2; decision on 'initial innovation opportunities' is aligned with first activity of the published front-end models which introduced three decision gates (Cooper, 1994; Cooper & Sommer,2018; Husig et al., 2005; Orawski et al.,2011; Preez et al., 2009). 'Go to development' has been described in the existing front-end models as the final decision at the front-end of product innovation (Cooper, 1994; Cooper & Sommer,2018; Husig et al., 2005; Khurana & Rosenthal, 1998). The process activities, and evaluation mechanisms including the criteria, have not been clearly demonstrated, and the two activity phases are not separately indicated or defined in the existing front-end models developed depicting the decisions.

The case study interview findings indicated that seven decision gates are practiced in approach 3 by the industry: four at the preliminary strategy identification phase and three at the concept development phase. There is no evidence in the existing front-end models developed depicting the decisions that considered the involvement of B2B customers, and the initiation of innovation 'by B2B customers'.

Importance of the true needs of the consumer is emphasized in the concept development phase of the front-end to verify the innovation ideas, and to generate innovation solutions. Therefore, in the practical apparel industry setting in Sri Lanka as discussed in section 5.2.2.4, identifying the true needs of the consumer is the first process activity in the concept development phase of the front-end to verify the innovation ideas and to generate innovation solutions. Identifying the importance of translating the requirements of consumers into relevant product features, one front-end model proposed a decision gate called 'requirement specification' (Preez et al.,2009). However, the model did not clearly illustrate the evaluation mechanisms, including the criteria for this decision gate.

Senior managers involved in the refinement interviews to verify the innovation initiation approaches 2 and 3 (scenario1 and 2) agreed with the sequence (order of the decision gates) and the procedure of the decision making process steps (section 6.3). The procedure includes the timely factors (information) at the front-end to initiate an innovation, the required updated information for each and every step of the process to acquire knowledge, sources of information, and evaluation matrices with appropriate evaluation criteria.

Functional characteristics of apparel products

The apparel producers must pay attention not only to aesthetic characteristics but also to functional characteristics of the apparel products. Therefore, a variety of technological developments are integrated into current apparel industry practice to achieve the functional and aesthetic attributes of the products (section 5.2.2.5). In order to reduce lead time for apparel manufacturing, and to generate unique consumer value, a 'responsive supply chain' is essential in which suppliers, producers and apparel brands collaborate to produce apparel products with a considerable level of variety (Ahmed & Shepherd,2010). Apparel manufacturers closely work with material suppliers (fabrics, and accessories) and supporting industries (fabric finishing, and surface decoration) to effectively use the technological expertise of the suppliers from the beginning of the innovation process.

Input from suppliers for the front-end of apparel innovation

In current apparel industry practice in Sri Lanka, as discussed in section 5.3, the inputs from suppliers are in different forms and in different intensities for the front-end in the three initiation approaches. The involvement of suppliers in approach 3 is mainly based on the policies and preferences of the apparel brands, since they are the initiators of the innovation. Suppliers are involved as sources of information, facilitators, initiators, financiers, and co-developers in approaches 1 and 2. The senior managers of the apparel industry confirmed these interactive roles of the suppliers during the refinement interviews with them (section 6.5). The refinement interviews indicated that suppliers act as solution providers in approaches 2 and 3. One front-end model emphasizes supplier involvement (Sandmeier, et al., 2004). However, the model brings limited clarity on the roles and responsibilities of suppliers in the front-end.

An internal team for innovation

The range of information, skills, knowledge, and resources required to commence an innovation also vary in two innovation initiation scenarios. In order to initiate and manage front-end process activities, a team for innovation is essential. In current apparel industry practice in Sri Lanka, a team of 5-7 members who have different competencies and specialized in diverse fields involve for task completion at the front-end of innovation.

Influence of internal and external factors on front-end decisions

A number of internal and external factors were identified as having an impact on the front-end decision making process (section 5.2.3). The internal factors are the core competencies and the climate of the organization. The external factors are the operational competencies and relationship characteristics of the external actors (customers and suppliers). In order to ensure smooth implementation of the front- end of innovation, carefully assessing internal and external factors is vital. Internal and external environmental factors are taken into account in two front-end models as discussed in section 2.5.1, (Koen et al., 2001; Preez et al., 2009). These models do not address the impact of internal and external factors on front-end decisions.

The results of the linear regression analysis of the refinement questionnaire survey verified the above internal and external factors in actual apparel industry practice in Sri Lanka, accepting the derived hypotheses (H_{1a} – H_{4b}) (Chapter 7).

i. *Influence of partnership competencies of organization on front-end decisions* - The results of the regression analysis presented in Chapter 7 (Table 7.7) revealed that the variables of partnership competencies of an organization (β =0.727) have a relationship with front-end decision making in apparel innovation. The results highlight the fact that the ability of apparel producers to maintain good communication and reliable partnerships with suppliers is necessary to acquire materials and expertise to enhance both the aesthetic and functional attributes of apparel and to offer unique value to consumers.

ii. *Influence of competencies of organization to serve customers on front-end decisions*- The Standardized Coefficients value for organization's competencies to serve customers (β =0.320) in Table 7.5 indicated that the variables of organization's competencies to serve customers have a relationship with front-end decision making in apparel innovation in Sri Lanka. This signifies that the ability to understand and maintain good relationships with apparel brands is essential to bridge the information gap between expectations and receipts.

iii. *Influence of technical competencies of organization on front-end decisions*- The regression analysis results of the refinement questionnaire have shown that a variable of the technical competencies of an organization (β =0.370) has a relationship with front-end decision making in apparel innovation. The know-how relevant to the technology, techniques, and manufacturing methods and the availability of equipment are important to improve the aesthetic and functional attributes of a product.

iv. *Influence of financial competencies of organization on front-end decisions*- The Standardized Coefficients value for financial competencies of an organization (β =0.417) in Table 7.9 shows that the variables of financial competencies have a relationship with front-end decision making in apparel innovation. In order to obtain and configure the resources and skills to respond in a timely and efficient

manner to the needs of the customer, strengthening the financial capacity of the producer is an important aspect.

v. *Influence of strategic orientation of organization on front-end decisions* - The results of the regression analysis of the refinement questionnaire indicates that that variable of strategic orientation of an organization (β =0.470) has a relationship with front-end decision making in apparel innovation (Table 7.12).

vi. *Influence of structural characteristics of organization on front-end decisions* - The Standardized Coefficient value of the variables of structural characteristics of an apparel producer (β =0.578) reveals that the variables relating to the structural characteristics of an organization have a statistically significant relationship with front-end decision making in apparel innovation. The results of the linear regression analysis of the refinement questionnaire survey highlight the value of paying more attention to the establishment and maintenance of a healthy organizational environment, including administrative processes and work practices to promote apparel innovation.

vii. *Influence of relational characteristics of apparel brands' on front-end decisions* The Standardized Coefficients value (β=0.515) reveals that the variables of relational characteristics of apparel brands (B2B customers) influence front-end decision making in apparel innovation. It shows the importance of considering the relational characteristics of apparel brands before collaboration.

viii. *Influence of operational capabilities and relational characteristics of suppliers' on front-end decisions* - The results of the regression analysis indicate that operational capabilities (β =0.539) and relational characteristics of suppliers (β = 0.627) also influence front-end decisions. This signifies that paying attention to the operational capabilities and relational characteristics of suppliers is necessary before collaborating with them at the front-end to effectively and timely respond to the needs of the customer and the market.

The findings of the case study interviews, refinement interviews, and the refinement questionnaire were endorsed by the five foreign experts of the apparel industry at the validation interviews with them (Chapter 9).

Proposed Meta model for decision making in the front-end

Based on the findings of case studies, refinement interviews, and the refinement questionnaire, a Meta model was proposed for decision making in the front-end of incremental apparel innovation. (Chapter 8). In comparison to published existing front-end models developed to depict decisions discussed in section 2.5 (Brandtner,2017; Cooper, 1994; Cooper & Sommer,2018; Hüsig et al., 2005; Khurana & Rosenthal, 1998; Orawski, et al., 2011; Preez, et al., 2009), the Meta decision making model developed in this research for front-end differs in the following aspects.

- Key decisions (decision gates), the order of taking decisions, responsible decision makers for each key decision, and how the decision making process should be organized in two front-end activity phases; preliminary strategy identification phase and concept development phase are clearly demonstrated.
- Active participation of apparel brands (B2B customers) is emphasised and two innovation initiation approaches; innovation 'initiated by company - with customer' and innovation 'initiated by B2B customer' are considered.
- Differences in the number of key decision gates, responsible decision makers for each key decision, and decision making procedure (the timely factors (information) of the front-end to initiate an innovation, the required updated information for each and every step of the process to acquire knowledge, sources of information, and evaluation matrices with appropriate evaluation criteria) are clearly demonstrated in two innovation initiation approaches.
- Involvement of apparel brands is clearly demonstrated in two front-end activity phases in two innovation initiation approaches, as both information and knowledge of the customer are required for the innovation process in the 'co-creation of value'. The power of decision making at key decision gates is shared with apparel brands during the concept development phase, giving apparel brands the opportunity to make decisions together with apparel producers.
- Active participation of suppliers in two innovation initiation approaches, as well as shared decision making power at key decision gates during the concept development phase, are also emphasized.

- Changes in the roles of apparel producers are considered in two innovation initiation approaches due to procedural differences, differences in the range of knowledge, skills, and information required, and different forms of customer and supplier involvement.
- The importance of paying increased attention to assessing the internal and external factors influencing the front-end decision making process is also emphasized. The internal factors are the core competencies and climate of the organization. The external factors are the operational competencies and relationship characteristics of the apparel brands and suppliers.

10.3 Guideline for implementation

A guideline proposed for the implementation of the Meta decision making model in the front-end of apparel product innovation is presented in this section.

The implementation of the Meta decision making model should start by analyzing the current state of the front-end to identify the practice gaps. The following steps describe how the current practice gaps can be identified.

i. Make clear the current focus of the company with regards to incremental innovative offerings and the innovation initiation approaches; innovation 'initiated by company' or innovation 'initiated by B2B customer'. It is essential to know the typology of the innovative offerings provided by the apparel product developers since the process activities and decision gates are different in these two scenarios.

ii. Review activity phases of the front-end and check whether the company follows two activity phases: strategy identification phase and concept development phase. That is because, the 'preliminary strategy identification' phase occurs immediately before commencing the innovation process where the suitable innovation opportunities, strategies and the mechanisms required to implement the opportunities are identified. 'Concept development' phase occurs while refining the concept for further development by applying technological solutions.

iii. Go through how the process activities are arranged at the front-end. The process activities, decisions, and interactive roles of stakeholders are changed with the innovation initiation approaches.
    a. What is the information, information sources, the mechanisms used, and factors considered to arrive at the final decisions, and main decisions?
    b. How many members are in the innovation team (or R&D team), and what are the activities and responsibilities assigned to the members ?
    c. Who are the internal stakeholders (senior managers) involved in the decision making other than the assigned team?
    d. Who are the external holders involved in the front-end, what are their roles, and in which activities and decision gates they involved (apparel brands, suppliers, and other institutions)?
    e. How the apparel producer communicates the strategic decisions related to suitable innovation opportunities, strategies and the mechanisms required to implement the opportunities?
    f. How the apparel producer assesses the outcome of the front-end, what are the key performance indicators and to what extent the front-end is successful?

iv. Make clear the current financial support for R&D, resources acquired from outside, visits to trade fairs, exhibitions, and training.

v. Look at the internal resource base, including machinery, skills, and know-how, and whether they maintain a data base on the available resources.

vi. Find out who are the apparel brands (B2B customer) working with and to what extent the apparel producer established and maintained a relationship with them.

vii. Find out who are the suppliers (fabrics, machinery, and know-how providers) working with and to what extent the company established and maintained a relationship with them.

Senior managers involved in the innovation process and the innovation team should be made aware of current practice gaps, and the importance of improvements and / or change in terms of ‘co-creation of value’.

In order to provide an understanding and make aware of how each decision can be made at the front-end using evaluation matrices, the following steps in the decision making process should be explained. (The information, sources of information, factors for evaluation criterion, evaluation matrices, and the stakeholders involved in the decision making are discussed in detail in sections 5.2 and 6.2).

i. Identify potential innovation opportunities (ideas)

   Use the matrix provided in Table 6.4 (section 6.2.1.1). Allocate the values 1 or 0 (yes/no) for each of the opportunities, taking into account the relationship to the evaluation criteria in the evaluation matrix. Opportunities that have obtained higher total scores are selected.

ii. Select commercially viable innovation ideas for apparel brands

   Assign values ranging from 3 to 0 (3-highly desirable, medium desirable, little desirable, and 0-not desirable) to signify the strength of the relationship between opportunities and apparel brands in the evaluation matrix presented in Table 6.8. The opportunities that score higher marks are the appropriate opportunities. The apparel brands which have obtained higher marks are chosen to offer innovation.

iii. Select appropriate resources, areas of skills, and allocate budget

   Use the given matrix (Table 6.12). Evaluate the strength of the relationship between the resources against each of the criteria by assigning a value scale ranging from 3 to 0 (3-highly essential, medium essential, little essential, and 0-not essential). Resources that have obtained higher scores are considered essential. Revisit the cost related information and estimate the initial budget.

iv. Identify appropriate practices to be implemented

   Allocate values ranging from 3 to 0 (3-highly applicable, medium applicable, little applicable, and 0-not applicable) for each of the practices, taking into account the relationship to the factors for evaluation criteria in the evaluation matrix provided in Table 6.16. Applicable practices that score higher marks are selected.

v. Select suitable network actors/ external partners (fabrics, machinery, and know-how providers)

Evaluate the extent of relationship between network actors and each of the criteria provided in the matrix (Table 6.19) assigning values ranging from 3 to 0 (3-highly appropriate, medium appropriate, less appropriate, and 0-not appropriate). Suppliers, manufacturing partners, and technology know-how providers who score higher marks are the appropriate actors to work with.

vi. Communicate the above strategic decisions through an '*Initial innovation project canvas*' (Figure 6.3). It visualises the opportunities, selected apparel brands, value to producer and customer, resources, practices, external partners, and initial budget.

vii. Identify potential solutions need to be explored to satisfy the end consumer

Brainstorm solutions that can be generated from innovative ideas. Assign values ranging from 3 to 0 (3-highly desirable, medium desirable, less desirable, and 0-not desirable) to identify the strength of the relationship between the variety of potential solutions and the criteria provided in matrix Table 6.23 (section 6.2.1.7). The solutions which have obtained higher scores are the potential innovation solutions (appearances / features).

viii. Identify applicable developments from each of the identified materials and technologies

Allocate values ranging from 3 to 0 (3-highly appropriate, medium appropriate, less appropriate, and 0-not appropriate) for each of the developments (textures/ structures/ features), taking into account the relationship to the factors for evaluation criteria in the evaluation matrix provided in Table 6.26. Developments (textures/ structures/ features) that score higher marks are selected as applicable developments.

ix. Select feasibility study plans / solution profiles

Use the given matrix (Table 6.27). Consider each yes (1) indicators as a possible feasibility plan. Assign values ranging from 3 to 0 (3-highly viable, medium viable, little viable, and 0-not viable) for each of the feasibility plans, taking into account the relationship to the evaluation criteria in the matrix presented in Table 6.28. List down the feasibility plans from the highest score to the lowest score. Feasibility studies which have obtained higher scores are the suitable feasibility studies to be explored.

x. Decide the final concepts or solutions.

Evaluate the strength of the relationship between concepts and the evaluation criteria provided in the matrix (Table 6.31) by assigning values ranging from 3 to 0 (3-highly desirable, medium desirable, less desirable, and 0- not desirable). The concepts (solutions) that score higher marks are the final concepts (ideas) to be proceeded with.

xi. Performance indicator of the front-end is the number of final concepts accepted by the apparel brands (B2B customers).

In addition, the team should be aware of the roles of the apparel brands and suppliers, and in which activities and decision gates they should be invited to make decisions.

10.4 Conclusion

The gaps identified in industry practice as well as academia inspired to develop a model for the decision making process incorporating 'co-creation of value in the B2B context' at the front-end to provide a useful base in the apparel product innovation process.

The pressure to reduce lead time for apparel manufacturing due to the seasonal nature of the apparel business is directly related with the decision making of the front-end of apparel product innovation. The general practice of the apparel manufacturers is incremental innovations which account for an average 90-95 per cent of small modifications in existing product categories (sections 5.1 and 6.1). The proposed Meta decision making model aimed at the front-end of 'incremental' apparel product innovation.

The findings of the case study interviews, refinement interviews, questionnaire survey, and validation interviews concluded that the apparel brands (B2B customers) are indispensable in front-end decision making since the apparel products are made available to end consumers through world reputed international apparel brands. Both information and knowledge of the apparel brands are utilized for the front-end activities and apparel brands can also involve decision making at key decision points. As the research study aimed to incorporate 'co-creation of value in the B2B context' in decision making at the front-end, the proposed Meta model focused on two apparent

innovation initiation approaches in general practice in apparel product innovation; innovation 'initiated by company- with customer', and innovation 'initiated by B2B customer' (sections 5.1 and 6.1).

Shared knowledge, experience, and involvement of suppliers, including raw materials, and accessories as well as internal team are also confirmed as essential for the front-end of apparel innovation. The internal innovation team retains complete decision making authority, but suppliers can participate in decision making at key decision points.

The results of the questionnaire survey and validation interviews concluded that not only the core competencies and climate of the apparel producer, but also the operational competencies and relationship characteristics of suppliers and relationship characteristics of the apparel brands influence front-end decisions.

The findings of the case study interviews, refinement interviews, questionnaire survey and validation interviews concluded that the decision making process steps cannot exist alone. Decision making process steps, interactive roles of internal and external stakeholders as well as factors influencing for decisions are closely linked and interconnected so that one cannot exist without the other. Therefore, the proposed Meta model considers all three components (i. decision making process steps, ii. interactive roles of B2B customers, producers, and suppliers, and iii. factors that affect the front-end decision making process) to create the best value for end consumers, B2B customers and the apparel producers themselves through shared knowledge, and experience. The proposed Meta decision making model considered two activity phases of the front-end (preliminary strategy identification phase and concept development phase). All constructs needed to make decisions at the front-end as well as the relationships between three elements (i. decision making process steps, ii. interactive roles of B2B customers, producers, and suppliers and iii. factors that affect the front-end decision making process) are included in the Meta model to provide an inclusive picture of the decision making process of the front-end.

10.5 Contribution made to the existing literature and industry practice

The contributions made by this study to both knowledge and practice are threefold. The first two contributions are to the existing literature on the front-end of innovation, and the third contribution is to apparel industry practice. Accordingly, the contribution of this research study to existing knowledge and practice is discussed below in detail.

10.5.1 Contribution to the existing literature

This research contributes to the existing literature, more specifically to the field of front-end of incremental innovation in two ways.

i. Contribute to the general literature
ii. Contribute to apparel specific literature

How this research adds value to the existing general literature and apparel specific literature is discussed below in line with the order of the identified research gaps in academia as outlined in section 1.2.

10.5.1.1 Contribution to general literature

As discussed in section 2.5, the models available so far in academia to depict the process activities including decisions within the front-end have brought only limited clarity on how the decision should be handled, what decisions to be taken at different stages, and the order of taking decisions in order to achieve success in innovation. In contrast to this, as discussed in section 10.2, the Meta decision making model proposed in this research study provides a clear and detailed view on the activities of the decision making process. Further, it explains

- the timely factors (information) to initiate an incremental product innovation,
- the required updated information to develop knowledge with relevant sources of information,
- evaluation mechanisms, including the criteria,
- key decisions,
- potential key performance indicators (concepts accepted by apparel brands),
- the stakeholders responsible for moving forward in a more proactive way during the decision making process at each step, and

- the internal and external factors that call for attention during decision making.

The personnel responsible for decision making at the decision gates are not specifically mentioned in the previous research on front-end models, as concluded in section 2.5. There is a lack of studies on co-creation of value in a B2B context in the front-end innovation process in general too. This study has been able to provide insights into the interactive roles played by B2B customers, internal members of the apparel producing companies, and suppliers within the two phases of the front-end of innovation. This study offers an opportunity to extend the current understanding and knowledge of the potentially effective business relationships that can be developed within the front-end, especially with B2B customers.

As mentioned in section 1.2.1, there was no clear existing evidence of studies on decision making in the front-end for incorporating co-creation of value in the B2B context in general. The Meta decision making model developed in this study addresses not only the aspect of co-creation of value in a B2B context at the front-end, but also identifies the factors influencing the decisions. Based on the above, it can be concluded that this research significantly enriches the knowledge or literature based on this topic.

10.5.1.2 Contribution to apparel specific literature

As indicated in section 1.2.2, only a little attention has been paid by academia to the aspect of the front-end in apparel production according to the literature. This research study clarifies, and provides significant insights into key decisions (decision gates), responsible decision makers for each key decision, and how the decision making process should be organized to achieve successful incremental product innovation. In addition, assessing internal and external factors that influence front-end decisions is emphasized. In light of this, this research study will be of special interest to apparel specific academics as it could extend their current understanding and knowledge of the front-end of incremental apparel innovation.

Thus, it can be concluded that this research will enrich the knowledge base of decision making in the front-end of apparel innovation by providing insights into decision situations. As mentioned in section 1.2.2, there is no clear evidence of studies to date

on co-creating value in the B2B context in front-end apparel innovation. This research study clarifies the tasks of B2B customers, internal members of the apparel producing companies, and suppliers at the front-end of incremental apparel innovation. This research adds value to the existing literature by providing potentially useful business relationships that should be built up with B2B customers at the front-end of incremental apparel innovation.

As discussed above regarding the contribution of the Meta decision making model of this research study to the general literature, it addresses the previous research gaps in academia. This research study makes a significant contribution by filling those gaps and extending the current knowledge or literature base in the apparel context.

10.5.2 Contribution to the existing industrial practice- apparel context

This research study contributes particularly to the apparel industry practice since a significant research gap in decision making at the front-end of innovation practices in the apparel industry was pointed out in section 1.2.3. How this research adds value to the existing apparel industry practice is discussed below.

As discussed in Chapter 8 and section 10.2, the Meta decision making model demonstrates key decisions (decision gates), the order of taking decisions, responsible decision makers for each key decision, and how the decision making process should be organized in two front-end activity phases; preliminary strategy identification phase and concept development phase. Further, differences in the number of key decision gates, responsible decision makers for each key decision, as well as the timely factors (information) of the front-end to initiate an innovation, the required updated information for each and every step of the process to acquire knowledge, sources of information, and evaluation matrices with appropriate evaluation criteria are also demonstrated for two innovation initiation approaches; innovation 'initiated by company - with customer' and innovation 'initiated by B2B customer'. The model clarifies the initial strategies and basic effective mechanisms applicable to the early decision making process. Therefore, the Meta decision making model helps industrialists to deepen their understanding of how the decision should be handled at each step in the front-end since there are no guidelines or structured approaches for

decision making at the front-end of innovation practices in the apparel industry. This understanding would lead to appropriate managerial decisions that would not only improve the quality of the design solutions, but also help avoid ineffective solutions while delivering greater benefits from financial investments.

The Meta decision making model demonstrates involvement and changes in the roles of apparel producers, apparel brands, and suppliers in two front-end activity phases of two innovation initiation approaches. Key decision gates at which decision making power is shared with apparel brands and suppliers are also demonstrated. As there are no documented guidelines on the roles and responsibilities, the model will be beneficial for the apparel domain practitioners to clarify and evaluate the tasks, and the precise roles and responsibilities of B2B customers, internal members of the apparel producing companies, and suppliers within the front-end. The validation study with experts ensured that the model could assist the apparel manufacturers to create the best value for customers through sharing knowledge and experience. This would lead to the improvement of the innovation work later, enabling them to meet the needs of demanding customers.

The Meta decision making model emphasizes the importance of assessing the internal and external factors influencing the front-end decision-making process. Internal factors include the organization's core competencies and climate. The operational competencies and relationship characteristics of the apparel brands' and suppliers' are the external factors. The model supports industrialists to understand the importance of paying increased attention towards assessing the characteristics of internal as well as external factors when they make the decisions for efficient front-end apparel product innovation.

Thus, this research will be of much interest to apparel specific practitioners and manufacturers who do not wish to embark on product innovation right away but prefer to study it first to enhance their current understanding and knowledge. The validation study with experts ensured that it will facilitate implementation of the model in the future. The apparel specific practitioners and manufacturers who have already started innovation will also be enabled to analyze their practices to understand the present

context and customize the proposed Meta decision making model to meet their specific production needs in the real working environment.

It can be concluded that the apparel manufacturers will benefit by this potentially valuable strategic guide to ensure effective and smooth running of the front-end of the apparel product innovation process.

10.6 Opportunities for further research

This research study would help filling in the previous research gaps in academia. However, for those interested in further research, this study could serve as a starting point for extended studies. A number of potential research avenues are presented below.

As the first idea for further research, the Meta decision making model should be implemented in apparel companies in actual manufacturing environment. Implementing it in a real working environment would lead to further refinements of the model. It will provide the opportunity for monitoring and evaluating the actual performance of the proposed model to verify its usefulness in the long run. Such an experiment would provide a richer insight into the diverse approaches adopted and modifications made by the different companies to suit the geographical, economic, and other contexts of their region. This in turn could provide valuable contributions to eliminate any weaknesses and adapt the Meta decision making model to run efficiently at the front-end of all types of apparel innovation.

Either directly or with adjustments to decision making process stages and evaluation criterion, the Meta decision making model developed in this study for incremental apparel product innovation for two innovation initiations (i. 'initiated by company with customer', and ii. 'initiated by B2B customer') can be applied the front-end of innovation process of companies and industries with similar characteristics to the apparel industry. The following are the specificities of the apparel industry.

- Caters for a number of fashion seasons (Ariyatum & Holland,2005; Lou, 2020; McKinsey & Company,2022;Pitimaneeyakul et al.,2004; Zulch et al.,2011)

- Shorter product life cycles (Ariyatum & Holland,2005; Lou, 2020; McKinsey & Company, 2022; Pitimaneeyakul et al.,2004; Zulch et al., 2011)
- Highly sensitive of aesthetic characteristics which change with season, trends and social media interactions (McKinsey & Company,2017, & 2022)
- Final concepts are developed for several different product categories (May-Plumlee & Little, 1998; Moretti, & Braghini, 2017)
- Produce a collection of garments (Ariyatum & Holland,2005; Lou,2020; May- Plumlee & Little, 1998)
- Reach end consumers through internationally recognized apparel brands (B2B customers) (Ariyatum & Holland,2005; Ban, 2020; Lou,2020; May-Plumlee & Little, 1998)
- Apparel brands (B2B customers) are involved in the manufacturing process from the beginning (Ariyatum & Holland,2005; Ban, 2020; Lou, 2020; May-Plumlee & Little, 1998)
- A globalized and competitive industry which caters for diverse market segments (Ban, 2020; Barrie,2018; Lou,2020)

Future researchers could retest the methods used in this study with different apparel companies in different economies in order to cover the global apparel industry as well as industries with similar characteristics to the apparel industry to generate interesting insights not only to refine the findings of this study but also to improve the proposed Meta decision making model further.

Investigating and developing appropriate ICT (Information and Communication Technology) based support for the Meta decision making model in order to shorten the time spent on the front-end process would be another promising research avenue.

Identifying the interactive roles that third parties (universities, laboratories, etc.) could play in the decision making process at each step within the two phases of the front-end of apparel innovation will prove to be interesting extended research. It will provide insights into how the co-creation of value is achieved in the networks. That is because this study has narrowed down the interactive roles of B2B customers and suppliers to those of external actors. The study can be extended to investigate the

influence of operational competencies and relational characteristics of third parties on the front-end decision making process in apparel innovation.

As a further research project, a separate quantitative study can be undertaken to identify the impact of the working experience and competencies of the innovation team members on the front-end decision making process of apparel innovation. These factors were not considered in this study for the Meta decision making model.

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Appendix 1: Initial discussions

A. Initial discussions format

The focus of this initial discussion is to identify whether the apparel companies have taken up initiatives for promoting innovation. Further, it is expected to understand whether the company follows a structured step by step process, and keeps a record on the process of making decisions in the front-end of innovation.

Based on your actual everyday working life in the current position, I would like to have your opinion specially on documenting the process of making decisions in the front-end phase of innovation.

Company overview

1. What are the objectives of your organization in terms of offerings?
   Probe - strategic vision/ focus and growth targets?
2. What type of offerings /products does your company provide?
3. Have you taken up initiatives for promoting innovation?
   Probe – What type of innovations?
4. Are there any strategic plans to enhance your business in terms of offerings?

Product innovation process

1. Is there an innovation process model in use in your Company?
2. What are the main steps involved in your product innovation process? Can you briefly explain?
3. What are the tools/ techniques/ systems used to facilitate your product innovation process?
4. How does your organization measure the performance of product innovation process?
   Probe - What are the criteria?
5. Are you working with B2B customers?
6. Do you have any documents regarding the precise roles & responsibilities of the B2B customers?

Decision making

1. Is there a decision process model in use in your Company?
2. How do you make decisions in your product innovation/ process?
   Probe - Are the decisions independent or collaborative?
3. What are the techniques used in documenting the important decisions?
   Probe – Are the current techniques effective? facilitate proactive decision making?
4. What is your opinion specially on documenting the process of making decisions in the front-end phase of innovation?

Closing

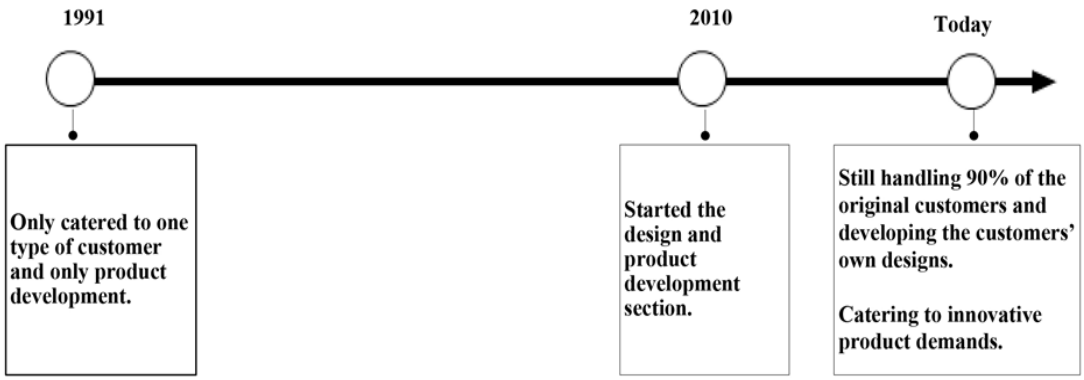
1. Who else you can recommend for me to interview in this regard?

B. Details of the discussions conducted

	Company	Designation	Experience in the apparel filed (years)	Date of discussion	Time duration (minutes)
1	P	Design Director	20	7th November 2013	48
2	Q	Senior Designer	5	20th November 2013	50
3	R	Design Asst Manager	8	30th November 2013	45
4	S	Design Director	35	10th December 2013	40
5	T	Product Development Manager	15	07th January 2014	35
6	U	Design Director	18	29th January 2014	43

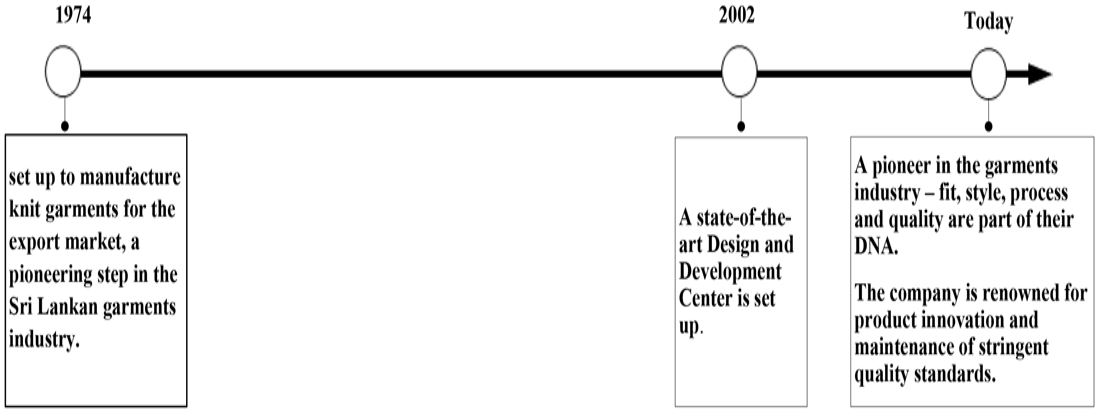
Appendix 2: Companies studied for the exploratory study

- Company A - It is engaged in product design and development for certain globally recognized brands. Though this company was established in 1991, the design center came into operation only in 2010. At present, the center is actively engaged in developing innovative apparels aiming at enhancement of both the aesthetic and functional aspects. Company A produces active wear, sleep wear, intimates, and casual wear. The vision of the company is to become a leader in providing total solutions for fashion clothing.



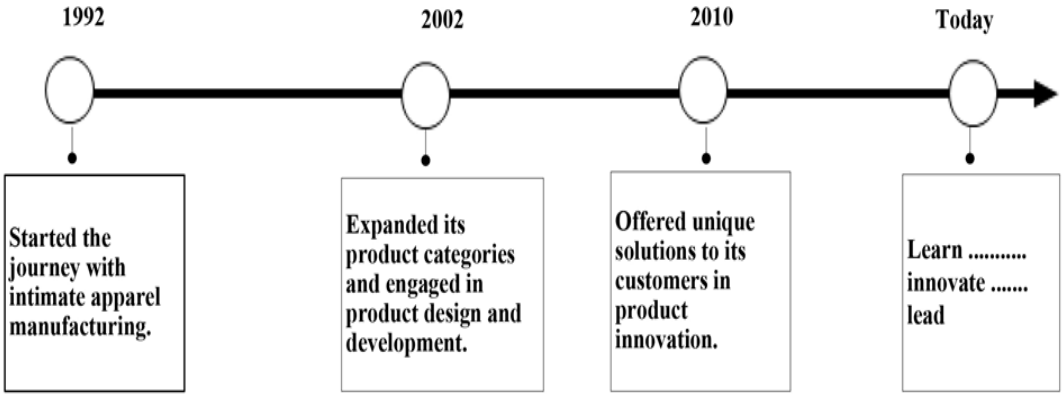
Company A- origin and how it evolved

- Company B– The design center of Company B commenced its operation in 2002. Having identified the competition, the company works towards differentiating their products with innovative surface treatments, embellishments, and stitching techniques, focusing on enhancement of both the aesthetic and functional aspects. The Company B manufactures active wear and sportswear. The mission of the company is to offer quality products and customer service through innovation, leadership and excellence while being responsive to changes in a competitive global environment.



Company B- origin and how it evolved

- Company C -The Company C was established in 1992. Presentably the company engaged in product design and development of a few global super brands. Nearly two decades later, the company became one of the leading suppliers of intimate apparel, sports brand swimwear. The product categories of company have been expanded to include ultramodern performance wear using unique precision sewing and 3D (three dimensional) fit methods. The company offers unique solutions to its customers with the emphasis on product innovation. The incorporation of novel methods and techniques borrowed from different fields, disciplines, and cultures to arrive at extraordinary new ideas for their product lines are encouraged. The strategic focus of Company C is 'learn ----- innovate------ lead.'



Company C- origin and how it evolved

Appendix 3: Case study interview format

Decision making process within the front-end of apparel innovation

The focus of this case study is to explore actual apparel industry setting to understand the everyday activities to bring in new insight about relationships among key decisions and actors on front-end innovation. Based on your actual everyday working life in the current position, I would like to have your experience on how you arrive at the key decisions on innovative offerings within the front-end of apparel innovation process.

This interview generally takes place in approximately 30-60 minutes. With your agreement, I would like to record this interview. All the information from this interview will be kept confidential and will not be used for any other purposes. Your name (or the name of your organization) will never be mentioned without your consent in any of the analysis or resultant publications.

Interview Guideline	**Supportive Documents**
Personal overview 1. Could you please tell me how many years you are working in this company? a. Probe – Number of years and job roles? 2. In what capacity you are involving in front- end of innovation process? a. Probe - Your involvement in front end of innovation process?	
Organization 1. How would you describe your Company's vision/ objectives? 2. Could you briefly explain about your company? a. Probe – When the company started? b. Probe – In which year you have started offering innovative apparel products? 3. What are the core products your company offer now?	Company profile
Types of innovative products 1. What types of innovative products you are producing now? a. Probe – In what way they are new/ how these products differ? b. Probe – Are they incremental innovations or disruptive innovations? 2. How do you initiate innovation? a. Probe – Do you (company) initiate the dream innovation or your B2B customer initiate innovation (customer driven)?	Company profile & Business strategy
Product innovation process 1. How would you describe the key processes or activities involved in your innovation process? a. Probe - Are there any differences in the process of innovation for different products offerings (incremental/ disruptive)? b. Probe – Are there any differences for the innovation initiate by company and innovation initiate by B2B customer?	

2. Do you have any formalized structured system of stages / operations early before starting the innovation process? (Front- end of innovation)? a. Probe –What are the key activities? b. Probe – Are there any differences for different products offerings (incremental/ disruptive)? c. Probe – Could you please explain how you start your innovation in your own and how you start it if B2B customer come up with innovative idea	Process map
Decisions involved in the front-end 1. How would you describe the key decisions involved in your front-end of innovation process? a. Probe – What type of decisions? b. Probe - Are there any differences in the process of making decisions for different products/ customers? c. Probe – Are there any differences for the innovation initiate by company and innovation initiate by B2B customer? 2. How the front -end activities are linked with the decision making? a. Probe – What are the activities involve in decision making process? b. Probe – Are there any differences for the innovation initiate by company and innovation initiate by B2B customer? 3. How does the decision making authority distribute in the front- end of innovation process? a. Probe - Who are the key people involved from the company? b. Probe – In which stage do they involve? c. Probe - What is their level of involvement for decision making? 4. What are the major factors impact on your front- end decisions? a. Probe – What are the internal factors? b. Probe – What are the external factors? 5. What are the implications encountered when making decisions and how are you dealing with them?	Process map Meeting minutes- innovation
Key actors/ people involved (internal and external) in decision making in the front-end 1. Who are the internal key people involved for the front- end of innovation process? a. Probe – What type of role they play? b. Probe – In which stage, do they involve? c. Probe –Are there any differences in their role for different products offerings? d. Probe – Are there any differences in their role for the innovation initiate by company and innovation initiate by B2B customer? 2. Who are the external key people involved for the front- end of innovation process? a. Probe – What type of role they play? b. Probe – In which stage, do they involve? c. Probe –Are there any differences in their role for different products offerings? d. Probe –How do you assess their level of involvement?	Relationship documents

e. Probe – Are there any differences in their role for the innovation initiate by company and innovation initiate by B2B customer? 3. How would you see the interaction between your company and your B2B customers? a. Probe – What level of interaction exists between the company and different B2B customers? b. Probe - Does this vary for the innovation initiate by company and innovation initiate by B2B customer? 4. How would you see the interaction between your company and your suppliers? a. Probe – What level of interaction exists between the company and different suppliers? b. Probe - Does this vary for the innovation initiate by company and innovation initiate by B2B customer?	
General 1. According to your knowledge, how successful you are in innovation process in terms of satisfying customer needs and enhancing customer value? a. Probe - What are the main issues or concerns related to the performance of the innovation process? 2. Are there any plan for changes or further developments for the front- end of innovation process in the future? a. Probe – What drivers towards it?	

Appendix 4: Case study data base

Interview #	Organization	Date	Interview duration (minutes)	Role of the interviewee	Experience in the apparel industry (years)	
					Apparel industry	Apparel innovation
Interviewee a-1	**Company A**	26/03/ 2015	53	Director	28	6
Interviewee a-2		07/04 /2015	68	Head of Design team	18	6
Interviewee a-3		30/04/ 2015	57	Fabric sourcing and Technical Manager	15	6
Interviewee a-4		08/05/ 2015	58	A member of design team	08	5
Interviewee a-5		22/05/ 2015	55	Product Development Manager	12	4
Interviewee b-1	**Company B**	14/07/ 2015	57	Chief Operating Officer	20	7
Interviewee b-2		04/08/ 2015	53	Design Manager	17	7
Interviewee b-3		14/08/ 2015	46	Marketing Manager	15	6
Interviewee b-4		21/09/ 2015	52	A member of design team	09	5
Interviewee b-5		04/10/ 2015	54	Merchandising Manager	14	5
Interviewee c-1	**Company C**	27/11/ 2015	67	Innovation Manager	15	5
Interviewee c-2		08/01/ 2016	58	Innovation Director	23	8
Interviewee c-3		20/01/ 2016	63	Technology/ technical Entrepreneur	07	5
Interviewee c-4		22/02/ 2016	57	Technical Director	25	8
Interviewee c-5		27/03/ 2016	53	Marketing Entrepreneur	06	5

Appendix 5: Case study data analysis

The case study data were arranged under 4 headings: innovative offerings, key decisions, factors influence, and key actors.

1. Innovative offerings

Company A

"In Sri Lanka we do not have direct competitors. We are not selling our products directly to consumers. We are working with apparel brands to reach the world market. But nowadays apparel brands are demanding. Because they have competitors, and they need to focus on their end consumers' preferences. Brands are very concern about innovative ideas to stay competitive in the market. At the moment, we are working with 12 world recognized apparel brands. Therefore, we need to first satisfy our brands by providing value-added innovative products." (Interviewee a-1)

"We produce different product categories. Each season we try to do some incremental improvements to our products, may be the appearance, style details, or functional improvements. We do the initial work and produce new concepts to our buyers. Because we are working with 10-12 globally recognized brands. Still, we did not go for big changes in our products. Because it is risky, and we need to spend lot money for initial work. We go with incremental changes for the existing product categories." (Interviewee a-2)

"*Actually, we do incremental innovations. Still, we are not competent enough to go for disruptive innovations. We try to give something new to customer. We go for style detail improvements. At the moment we initiate the innovation, but we get ideas from our brands."* (Interviewee a-3).

"As a member of the design team, it is our responsibility to retain our customers. We are always working on incremental improvements. Nowadays it is a must. We initiate innovations. But at the middle of the process, we present out ideas to customers" (Interviewee a-4).

"We need to think how we can stay in the business. It is very competitive. We are working with apparel brands. If we cannot offer new things, they will go to another manufacturer. We try to do at least incremental changes to our products." (Interviewee a-5).

Company B

"*The end consumer is the king. But without apparel brands. Country like Sri Lanka it is very difficult to reach end consumers. The global market competition is high. We sell our products through reputed apparel brands. We must work with them from the very beginning. We do the incremental innovation"* (Interviewee b-1).

"*Apparel brands are demanding new ideas within a shorter period. Apparel brands want to be the first in the marketplace. The time is very tight for us as manufacturers to work on innovative ideas. Therefore, we must go for small moderations. If we cannot cater them on time, they will go for another apparel manufacturer."* (Interviewee b-2).

"We do incremental changes for our products at the moment. But we are planning to go for disruptive innovations. We are working with leading international brands. They are looking for something new every season. We are working on that." (Interviewee b-3).

"*Season calendar is very tight. Our customers want to launch the new product before their competitors. Since we are working with brands to sell our products, we need to go for innovations within a shorter period of time*." (Interviewee b-4).

"*We do incremental innovations. The time schedule for the market is tight. We cannot wait for long time for innovation. We prefer to go for incremental changes."* (Interviewee b-5).

Company C

"In practice, I would say about 90-95% are small moderations for the existing products or upgrading the functionality, and appearance of the product. This is practically easy, and risk is less. Within a considerable time period we can come up with good solutions" (Interviewee c-1).

"We are working on achieving significant improvement in functions of the products. We incorporate novel methods, techniques, and technologies in the apparel industry. We borrow technologies from different fields, and disciplines too." (Interviewee c-2)

"We do both incremental and disruptive. We initiate innovations. But we are working with globally recognized brands. For example……, they are so keen on innovations. They come up with their own innovation ideas. They know their customer base. They know the requirements of the customers. We need to closely work with these brands." (Interviewee c-3)

"We try to enhance functional aspects of the products and aesthetic aspect. Apparel is an essential item for human. The demand for apparel products changes in a fast rate. We must react fast. We would like to do incremental changes." (Interviewee c-4)

"We are working with global super brands. They are so eager for innovations. Our company do incremental changes to products. At the same time, we engage on disruptive innovation too. But it takes time. At the moment we are engaging in one innovative idea. It already took more than two years. Still, we couldn't come up good solutions." (Interviewee c-5)

2. Key Decisions

Strategy identification decisions

Gate 1- decisions on 'initial innovation opportunities(ideas)'

"We start our process collecting information on market direction. We basically get information from market survey companies, and we do retail visits. This information gives an idea about the opportunities for innovation. Once we have the innovation opportunities, then we roughly assess them to check whether they are compatible with our present context, whether we can offer new values to customers, can we reach new customers, and what are the benefits for company. This is the checklist. Roughly we go this and identify opportunities for innovation" (Interviewee a-1).

"We visit retail shops, and we refer social media, you tube, and blogs. We can get an idea about consumer behaviour, and we get information from market survey companies on market directions for apparel products. Though we do incremental changes to our products, we should know how the market behave. The apparel companies should reach fast to address the requirements of the market. So, we need to identify the innovation opportunities. Through this exercise, we acquire knowledge on opportunities. At the initial stage we should make sure, whether it align with our current context, can we offer new value to our customer, can we reach new customers, and are we able to acquire new

technical knowledge through this opportunity. Because some opportunities, we have to use various technologies." (Interviewee a-2).

"We consider environmental concern of the consumer and customer. Because in our production we use finishing techniques, and variety of washing techniques and variety of materials. We gather real time information on environmental concerns of the consumer and customer. We get information from our customers on this issue. The information related to new technological developments are also gathered from web sites, trade journals, trade fairs and magazines. We visit conferences and industry forums. At the same time market directions and consumer behavior trends are also studied. We visit retail shops, and refer you tube, and blogs. Once we identify the opportunities, we must decide which opportunities we are going to address. We check whether we can offer new vale to customer, whether we can acquire new technical knowledge, and can we overcome our competitors. Though we are not reaching the consumer, we have competition with other manufacturers, and these opportunities are ecological "(Interviewee b-1).

"*We start gathering information on market directions and consumer behaviour changes. Because these two are changing fast with the technology era and people are so conscious about environment. Therefore, time to time some environmental concerns are evolved. We use social media to get this information. and we get feedback from our customers and visit retail shops. Since we use various finishing techniques, we study what the new developments related to finishing techniques. Our team members visit trade fairs, conferences, and industry forums. In addition, we go through trade journals to get an idea about new developments. Before coming to a conclusion for the opportunity, we check whether, we can give new values to customer, can address environmental issues, can acquire new technical knowledge, and can compete with our competitors."* (Interviewee b-2).

"Due to our product categories, it is essential to collect information on development in adjacent industries. Because we use different techniques to develop our products. At this moment also we are using a technique that is not using in the apparel industry. We visit trade exhibitions, and attend conferences and forums. We gather information on market directions, consumer trends, and environmental trends. We refer the customer feedback available in you tube, and blogs, and we consult our customers. This gives an idea about innovation opportunities. But to select the opportunities, we need to evaluate those. In our meeting, we discuss and check whether we can acquire new technical knowledge, offer new value to customer, and are these ideas align with the company strategy." (Interviewee c-1).

"*Our focus is to provide total solution to customer. We collect information on evolving technological development, development in adjacent industries and market directions and trends. Trade fairs, industry forums, trade magazines, and social media are good to get information and ideas for innovation. But in the actual setting, all opportunities cannot do in the company. We evaluate them, and we check whether the innovation opportunity is aligned with the current and future context of the company, and is it allow us to acquire new technical knowledge, and to offer new values to customer."*(Interviewee c-2).

Gate 2- decisions on 'suitable innovation opportunities (ideas) and apparel brands'

"*We, at the preliminary stage consider 2 or3 customers to determine what they expect from us. After working with them for a couple of years, we know what they are looking for, such as whether they like to buy innovative ideas and try them out. If we simply innovate without targeting customers, at the end we find, we have been wasting our time and money as there are no business results. Need to know the size of the target market, market segments, market share, growth rate, and calendar of the customer. The apparel brands have their own time frame to reach the market. The preferences change with the*

market segment. This information are essential to decide which brand we are going to offer our ideas. We can refer our data base to check the details of the customer, or we can get support from survey companies. We make sure the reputation, and readiness for collaboration of the apparel brand, and the relationship with the company, and whether the ideas align with the expected seasonal calendar" (Interviewee a-1).

"Though we select innovation opportunities, we cannot reach the market without the apparel brands. We need to make sure the marketability of the ideas with an apparel brand. We need to identify one or two brands to sell the concept. We should know the market segment, size of the market, and season calendar of the targeted apparel brands. We refer our data base to get the information, or we consult the apparel brands or get information from market survey companies. Few qualities of the customers we considered. They are relationship with us, reputation within the market, willingness for collaborations, their season calendar, and friendliness" (Interviewee a-2)

"We need to identify the sellable ideas. Because all the opportunities cannot be sellable. From the very beginning the most suitable 2 / 3 ideas need to be picked. In that, we highly considered our apparel brand. We sell our innovative idea through apparel brands. We identify the possible apparel brands we can sell the concept. We need to consider the market segment, size of the market, and market share. The information can be reached through our data base. The reputation of the customer, and their readiness to accept ideas also considered. Because some brands are interested on new ideas. Are they friendly, how close with the company and the time calendar of the customer is also important. Some customers only focused on seasonal calendar, some customers focus on special events, and sports. We consider all these things before selecting the customer" (Interviewee b-1).

"Even we are doing incremental changes, we need to make sure the marketability of the concept. We refine our initially identified ideas. From the initial steps we identify the brands we are going to present the concepts. From their past records we know what the brands are looking for new ideas. We identify two three brands by referring their market size, market segment, reputation, accessibility, and relationship with our company (Interviewee b-2)

"At the first, we grab all the opportunities, but we cannot do all. We need to identify the sellable ideas with our customers. We figure out the targeted customer or customers. We use our internal customer data base and identify the details of the customer, market segments, sizes of the market, and their calendar. This is to get an idea about the timeframe of the customer, their relationship with company, and readiness for accepting new ideas." (Interviewee c-1)

"We are not working on all of the available opportunities. No point in working and wasting our time and money if the market is not big enough to justify those. If there are any legal obstacles, it will not be possible to sell and make a profit at the end. We try to carefully figure out and identify the ideas that we can sell in the market. For that the target market and segment of the market need to be identified. Since the final concepts are marketed through apparel brands, their characteristics really matters. We are maintaining a data base about the apparel brands. We refer the data base and get the information. Then, we check whether we can work with them or not. are they flexible, are they close with the company, and are they accepting new ideas. We check their past records what we have, their reputation in the apparel business, and their product expectation timelines (Interviewee c-2)

Gate 3- decisions on 'resources and budget'

"The machineries, and fabrics are essential to develop the innovation idea. Basically, we identify the machineries used in the apparel manufacturing and the different fabrics based on our preferences of the customer. We check whether we can work out our idea with the machinery or the materials. We may select 2/3 machineries and 5/6 fabric types. Then we see whether they are available in our factory or

not. We are not fabric manufacturers. So, we need to buy fabrics. Sometimes we need special machineries. If we do not have the resources to develop, we need to identify from where we can borrow it or buy it. We identify those through our company data base. This is a rough screening of the resources to allocate budget for the R& D. Then we consider cost of purchasing, and maintenance to allocate an initial budget." (Interviewee a-2)

"Fabrics and machineries are essential for the apparel. Our data base is the main source to know the information related to machines and materials. If they are not available, then we decide to buy or hire from another company. This initial screening is to identify the basic resources appropriate to develop innovation idea. Then workout initial budget for development." (Interviewee a-3).

"Fabrics and machineries are essential for the apparel. Identifying what resources, we need is important. Sometimes we may need technology know-how. Visiting trade fairs, and talking to industry experts and referring trade journals, we gather knowledge about new machineries, and technologies. We refer our own data base to identify the available raw materials, and machineries appropriate to proceed the innovative idea. Materials, and machineries which are not available in the premises are decided to acquire from outside. May have to buy or rent. Then initial budget is allocated for purchasing or hiring the resources calculating cost of purchasing. Anyway, an initial budget is allocated for our research work. "(Interviewee b-1).

"Initial resource identification is to make sure the availability of the resources to develop innovation idea. Data base of the company is reviewed to see the availability of machineries, and technology know-how. Then suitable resources are decided. An initial budget is allocated considering cost of operation." (Interviewee b-2).

"Our products are performance wear. Therefore, various technologies are utilized. We have our data base. But visiting trade fairs, and referring trade journal are valuable to gain knowledge on technology development. Specialists in apparel textile and industry can be consulted. In order to develop idea, at the planning stage the basic resources are identified. 2/3 possible techniques, and materials are identified. If the technology is not available, outsourcing is decided. Then, cost of purchasing, operation and maintenance is calculated. Those value may not be 100 % accurate. But allocating budget for R& D is essential. Initial budget is allocated based on that." (Interviewee c-1).

"We maintain a data base for the fabrics and machineries. Even at present we are using special machineries and fabrics. We refer our data base and identify suitable resources. If the available resources are not suitable then we consult textile specialist or refer trade journals to know new machineries and fabrics. If we decide to get the new machineries on board, we need to calculate cost of implementing and purchasing resources, and cost of maintenance." (Interviewee c-2).

"Lot of resources are available within the premises. We can use those. But each and every project we revisit our data base to check the availability of resources. Initially the appropriate resources need to be identified to develop the idea. In that case, if the available resources are not appropriate, then suitable machineries need to be acquired. Cost of purchasing, and maintenance cost needs to be calculated. An initial budget is allocated." (Interviewee c-4).

Gate 4- decisions on 'appropriate practices to be implemented'

"*Good innovation practices are used in other industries. In apparel context, the published information is limited. We refer articles on good innovation practices. That is not enough. We consult experts to gain better idea. When decide the practice we are going to implement, appropriateness need to be checked. I mean, to develop some innovative ideas we may not need to do the changes in our activities.*

but for some innovative ideas we need to identify good practices. However, we cannot go for drastical changes. We can manage with our budget, and it should be simple to understand." (Interviewee a-2).

"*We are searching for good innovation practices and new trends in the business world, like the methods some market reputed brands use. We may learn how they implement innovation and run their business……. Recently we got some consultants from……we learned about good innovation practices and new trends in the business world. They have explained the methods that market reputed brands practice and how they implement innovation and run their business…. when we select suitable practices considering whether we can manage with our budget. It should be easy to understand and implement and maintain.*" (Interviewee b-1).

"Based on the identified innovation opportunities or ideas, the requirements such as resources are changed. Therefore, knowledge on good innovation practices is essential to adopt them. The updated information on good practices in industry and other industries for innovation are collected from recent articles related to success stories of other companies. Before deciding the practice, check whether the information on activities, and requirements." (Interviewee b-2).

"Crowd funding, networking is some of the good practices as we learned from other industries. In apparel context, collaboration is the most common practice. However, at the planning stage, it is essential to identify the innovation practice suitable to develop the innovation idea. Based on the selected innovation ideas, the practice may be changed. When selecting the practice, it evaluated against the appropriateness. It should be easily implemented." (Interviewee c-1).

"*We update our knowledge on good innovation practices, some world reputed brands are practicing good methods. How these companies reached their success, what are the basic requirements for implementing these practices and how they run their innovation process is interesting to know. The practices should be easy to understand and implement and maintain. When we select suitable practices, we need to consider our resources too.*" (Interviewee c-2).

Gate 5- decisions on 'network actors'

"We need to acquire materials and techniques. Maybe new yarns, fabrics, or advanced technology, software, and machinery etc. We need to make sure we get them on board to develop innovative apparels or to upgrade our current processes or systems. We basically use our data base to get the information about suppliers. Expertise, reputation, their past records, readiness for changes, and openness to share knowledge need to be considered. Because we need to overcome our manufacturing difficulties and we want to gain new knowledge from them." (Interviewee a-1).

*"If we do not have the resources internally to proceed the innovation idea, either we need to buy or we need to acquire. We must find the suitable external partners to acquire the resources. We refer our data base to identify the suitable partner. We check their past records, experience, and their willingness to share knowledge, and readiness for changes, At the same time we check whether we can overcome our development difficulties" (*Interviewee a-2).

"Since we do not have a textile plant, we have to buy fabrics and other necessary accessories. We normally refer our data base to identify the suitable suppliers and check their past records, their experience, expertise, and reputation. We refer trade journal to identify machinery suppliers. They should flexible enough to discuss and share knowledge. considering all these we select suppliers." (Interviewee a-3).

"As I said earlier, we use different finishing techniques to add value to our products. We have a washing plant to do those developments. But we need fabrics. In order to develop the innovation idea, we need suitable material suppliers. We are maintaining a data base of our suppliers, that is the past records of

the suppliers, the experience, their flexibility, quality of the product, and their position in the industry. We go through it and identify the suitable suppliers to overcome our manufacturing difficulties." (Interviewee b-1).

"Identifying the potential suppliers are important. Because throughout the innovation process we need their support. From the initial stage, we screen out the suitable suppliers to work. In that we basically use our past records related to suppliers to check their past performance, reputation, communication, and trust." (Interviewee b-2).

"Once we identify the basic resources, we need to develop innovation idea, we need to identify the manufacturing partners, and technology knowhow providers. We first refer our data base and identify the possible partners based on their past records, their expertise, and their relationship with the company. We visit annual trade fairs and exhibitions and refer trade journal to collect information on suppliers. Those things are also recorded. They are also referred when we identify the suppliers. If we don't have past records, then we need to check whether we can acquire new knowledge or skills. This is bit risky." (Interviewee b-5).

*"Though we have various new technologies inhouse, we need basic raw materials to develop our innovation idea. As I mentioned, for the performance wear different materials are using. Identifying the ideal fabrics suppliers is important. We visit our data base and check suitable material suppliers. Their expertise is considered and past records too. Specially their readiness to share knowledge. Because we suppose to work with them throughout the process. They should be with us to solve the problems and to reduce the manufacturing problems (*Interviewee c-1).

"Even at the moment we have considerable number of new technologies, we are first in Sri Lankan factory purchased …… machines for garment manufacturing. But we do not have our own textile manufacturing plant. We have to buy the fabrics for the initial developments and for the production. We go through trade journal to identify innovative fabric suppliers and at the same time we refer our data base to identify the expertise of our current suppliers. Then we check who can provide us new knowledge, who can help us to overcome manufacturing difficulties, and what their position in the industry." (Interviewee c-2).

"As I told you earlier, we have enough resources inhouse. But we do not have fabrics. We need fabrics suppliers to get onboard. We visit trade fairs and refer trade journal to get an idea about innovative material suppliers. We cannot ignore our present suppliers in our data base. We select the most suitable suppliers based on the innovative ideas going to be developed. We make sure the experience and expertise, flexibility, commitment, and reputation." (Interviewee c-4)

Concept development decisions

Gate 6 A - Decisions on potential solutions to be generated (from innovation ideas related to targeted end consumer requirements)

*"We do work with apparel brands. But the end consumer is the buyer of the product. The requirements of the consumer should be understood. We do research again to make sure the true needs of the consumer getting feedback from consumers, retail visits and customers. Then we brainstorm to identify the solutions related to innovation ideas. We evaluate those to identify the suitable solutions. The solutions should provide the company to explore new skills and improve customer and consumer satisfaction" (*Interviewee a-2).

"End consumer is important. We get true needs of the customer through social media and customer feedback. We identify solutions through brain storming. Because there are lot of ways, we can achieve innovation idea. Once we identify solutions, the most suitable one should be selected. For that we use

a check list; whether it gives an opportunity to explore new skills, and enhance customer and consumer satisfaction". (Interviewee a-4).

"At the beginning we are roughly screening the solutions, but we need to do more work. We have to think of the functional, ergonomic, and aesthetic aspects of the products. So, we must identify and implement the exact technical solutions required to meet the customers' demands." (Interviewee b-2).

"*This is one of the critical points. We already have an innovation idea. But we need to check what are the solutions we can generate from it. In that the end consumer is important. Because ultimate buyers are the consumers. We collect feedback from consumers and customers, and we visit retail shops. Then we brainstorm the solutions. Solutions should be ensuring satisfaction of consumer, and customer both."* (Interviewee b-4).

"The actual development stars with identifying true needs of the consumer. We get feedback from our consumer and customer. We need to consider requirements of the consumer. We brainstorm. One opportunity or innovation, idea there are lot of potential solutions. We need to identify those. Then we check whether they offer new values to consumer, in terms of aesthetic, functional and expressive." (Interviewee c-1).

"Requirements of the consumer vary. We must do a thorough research on end consumer using social media and retail visits if possible. Then the innovation ideas convert into solution through brainstorming. For one idea there are lot of solutions. These solutions should enhance loyalty of consumer and customer and create new market." (Interviewee c-5).

Gate 6 B- Decisions on most applicable developments to be generated (from technologies, and materials identified at gate 3)

"We again do research to identify possible developments. We visit trade fairs, use our data base, and consult suppliers. Then we check whether we can use it to explore in innovation idea, and can manage with budget. We must always think about our limitations. We should consider the time. Because we have to present this to our customer, and it can be applicable to many products." (Interviewee a-2).

"We make sure the variety of options we can go with materials or technologies. We first check in our data base, and our company allow us to visit exhibitions. We watch futuristic movies since they provide ideas. Then we evaluate the identified developments. We consider applicability of that development to variety of products. It should be easy to use and manage with our budget." (Interviewee a-4).

"Identifying the variety of developments from technologies helpful to use suitable one. There are lot of sources we can use to get information on this. We use our own data base, visit annual trade fairs, refer trade journal and talk to our suppliers. Once we collect information then we check whether they are appropriate, within our budget, and can use it for many products," (Interviewee b-2).

"Thorough research should be conducted to identify variety of developments. We watch movies, and visit fairs. Once we collect information, we carefully evaluate them. For that we use a check list. Appropriateness with budget, and ease of use are considered." (Interviewee b-4).

"*Since we produce both incremental and disruptive, we identify the development of technologies, and techniques though visiting trade fairs, referring journals or we use our data base. Then we make sure their compatibility with budget, time, and partnership"* (Interviewee c-1).

"We do thorough research on the identified technologies, and materials. They may be used in apparel or may be in other industries, and electronics. We try to find out the variety of developments we can generate from those. That may be seam types, surface decorations, and compression to identify whether we can use it for our developments. In our recent idea on functional improvement of ……., we studied the ……. and identified the most applicable development we can incorporate into our product. We

communicate with our suppliers, visit trade fairs, use our own data base, and watch movies. When evaluating those development we check appropriateness for innovation idea, allocated budget, and ease of use." (Interviewee c-3).

Gate 7- Decisions on suitable feasibility studies to be executed

"We need to select a good combination of materials, techniques and technologies for the experiments based on the applicable developments that can be generated from them. That is to execute potential solutions. This is important. Then we must think about the budget and the time frame. After that we have to go for the most doable experiments or the feasibility studies". (Interviewee a-2).

"This is one of the important activities. As I mentioned earlier, we have to complete the concept development within the targeted time frame." (Interviewee a-4).

"We check whether we can achieve the identified solutions using the materials or may be techniques. We use a check list to check 'what are the feasibility studies viable to complete within given time?" (Interviewee b-2).

"Different companies follow different techniques to prepare experimentation plan. The planned experiments should be able to complete within a specific time and the plans should be compatible with our budget." (Interviewee b-3).

"We need to identify the most suitable combination of materials, techniques, and technologies to realize the innovation solutions. However, they should be within our budget. If we are going for disruptive innovations, we do not think about time. But when we do incremental changes, we should consider the time aspect" (Interviewee c-1).

"This is one of the difficult tasks. Takes lot time. We need to give priorities for suitable plans. In our company we do not have restrictions. But time is one restriction. We have to evaluate those against time after that we can check whether it can be achievable within our budget. For our disruptive innovations we don't have such restrictions." (Interviewee c-3).

Gate 8 - Decisions on final concepts to be proceeded with

"We are using different techniques to explore the initial concepts. Some customers prefer to see the graphical presentations or visuals. But most of the time we do experiments with actual materials and techniques. We prepare small mockups, and we take photographs. ... This is really a time taking task, and this is trial and learn process. We review the initially explored ideas. We check whether the new idea would attract our customer, and manufacturable, and achieve a quality product, and it should be marketable too. Until we satisfy with the concepts, we do experiments. We must be ready with at least four or five final concepts. The customer may pick may be one." (Interviewee a-2).

*"The concepts need to be experimented. We use software, CAD, and CorelDraw to illustrate the initial solutions. We do hand sketching to illustrates the new ideas. We use actual materials, and machineries to do the experiments. The method depends on the innovation concepts, or the solutions identified related to innovation opportunity. At the end of each and every experiment we have to evaluate it. We need to consider both the company and customer. We need to make sure the customer satisfaction, manufacturability, quality, and marketability." (*Interviewee a-4).

"The initial ground works ends up in this point. But this is the time taking activity. This is the concept realization, and development. In realization though we have planned our experimentation or the feasibility studies, it is very difficult to achieve good concepts. However, we do lot of experiments. We must closely work with the material suppliers, and some finishing plants, and in house we do lot of trials. We evaluate our experiments to check the feasibility of manufacturing in our product plant. The

other important thing is to check whether our customer would select the concepts or not. Both customer and the company should earn profit. We need to think." (Interviewee b-2).

"Most of the companies do small scale mockups, and samples to identify the best concepts. We also do experiments; we prepare mockup to see the feasibility of producing it. Some experiments involve finishing, and printing techniques. We cannot do the feasibility just sketching. First sketch them. Some customers may prefer to buy the concepts in graphical form. But some customers need to see the actual sample. We do experiments and produce samples. The experimentation is time consuming. We have to do at least three or four trials to come to a conclusion. After each and every experiment we check whether the quality is good, how easy or difficult to manufacture, can we satisfy our customer, and do they pick this idea. Because ultimately the concepts are selected by the customer." (Interviewee b-4).

"The important part of the innovation process is the realization of the innovation idea. In our company we use different techniques to explore the solutions. We basically do sketch using software. This is time saving. But we do lot of experiments. ....in our initial innovation review meetings, we carefully evaluate the preferences, and demands of the customers……. in the final review meeting, they may pick a handful of ideas. Then we have to drop most of our potential ideas. If we cannot select ideas for further development, we again go back to our previous feasibility studies plan and do the experiments again" (Interviewee c-1).

"*We do lot of experiments to ensure the technologies and materials, and we do mockups. Because in our company we do work with innovative technologies. We have to ensure the application of technologies and the quality of the solutions. At the same time, we have to make sure the satisfaction of our customers, the marketability of the new concepts and the price of the solution. Because some customers buy the concepts only and ask further modifications. Most customers select the concepts and place their order with us. We need to consider customer how the concept satisfies the requirements of the customer and whether the customer can enhance the requirements of their end consumers*" (Interviewee c-2).

*"Before handing over the concepts for the development, we have to finalize the best concepts. We have to do experiments, and mockups, and we may do sketching to clarify the details. All are feasibility studies are evaluated. In that we mainly consider the manufacturability, and the quality. We check whether the concepts fit with the customer." (*Interviewee c-3).

3. Factors influence decisions

"The management should encourage the team members to express their own views in review meetings" (Interviewee a-1).

"We should develop our internal facilities; I mean logistic and technical. If not, we have to acquire it from outside. We have information about most of the suppliers in our database, we know their capabilities through reviewing their past performances. We have grouped our suppliers as those who are reliable, those who come up with innovative ideas, those who are cost effective, are flexible, and easy to communicate with and negotiate with." (Interviewee a-2).

"We don't have our own textile plant; we need fabrics for garments. We need to acquire new yarns, fabrics, other materials, or techniques and, may be, with highly advanced software. We need to make sure to get them on board to develop innovative apparels or to upgrade our current systems. However, Other resources should be available inside the company." (Interviewee a-3).

"*They have the right and freedom to arrive at decisions on their findings with no fear of failure. but the final decisions are taken at the review meetings. However, young designers or team members need guidance to make decisions. Even the interns are given the opportunity to sit in at buyer's meetings to*

learn about customer expectations, i.e., what they are looking for. Before embarking on innovation, they should understand who the customers are, and to which kind of markets they are catering for." (Interviewee b-1).

"*Our management allows and supports us to do experiments and product developments. I can say that as I have been here for the last 4-5 years. They are very supportive as that is the company strategy. They know where they are going but the results are slow and steady……. The required facilities should make available. In order to acquire support for development we have to get support from external partners. Companies prefer to work with knowledgeable, and capable partners. But communication really matters. and Intellectual property (IP) protection agreement avoid future disputes*." (Interviewee b-2).

"The internal capabilities really matter for front-end decisions. if we don't have capabilities, we should acquire them." (Interviewee b-5).

"If we are going to work with external partners, we sign Intellectual property (IP) protection agreement. That is good for both parties. In this case, trust, and communication between both parties really matters." (Interviewee c-1).

"Some companies really want to continue innovation because of their company vision. But with their internal strategies or the policies, they are reluctant to reveal the ideas to others. According to my experience, there are limitations, but if we do not open to acquire new knowledge or share our knowledge and resources we cannot go for successful innovation. I feel we are the only apparel manufacturing group in Sri Lanka willing to spend money and patiently wait for 4-5 years to get the results. Our top people believe innovation is essential to move forward. Most of the companies do not have the capacity to invest. Even the ones that have the capacity, do not take the risk. Other important thing is giving freedom to team members." (Interviewee c-2).

"When we take decision on external partners, and we consider their knowledge, and capabilities. if we do not have facilities in our own premises the company should improve the facilities. (Interviewee c-3).

"We should gradually improve our skills, facilities, and capabilities. But if we have to work with external partners, we have to think their capabilities. At the same time when we take decision on collaborations, we should sign Intellectual property (IP) protection agreement." (Interviewee c-4).

4. Key actors

Apparel manufacturing company

Team

"In our team we have 5 members. 1 marketing person, 3 designers, 1 fabric technologists from textile background. They all are qualified. All of them are graduates. Since the team is small it is easy to communicate each other. They are very helpful each other." (Interviewee a-1).

"*We formed a team for innovation. They are from different educational backgrounds, textile, design, and chemical. All are graduates. But time to time some of our designers must involve with them to verify aesthetic aspects or some graphical sketching. But somehow our team manage to do all their work."* (Interviewee b-1).

"In our team, we have one business entrepreneur, one financial entrepreneur and three technical entrepreneurs. At least one business entrepreneur, one financial entrepreneur and one technical entrepreneur should be in a team to carry out with the essential basics. They should work out the market

viability, financial viability and manufacturing or technological viability of the innovation idea. One person holds doctoral degree. All the others are graduates. 1 technical entrepreneur is from electronic background" (Interviewee c-1).

Roles

"As an apparel producer, we initiate innovation idea. Because we are doing incremental changes. We do initial research, and experiments, and engage in developing solutions. We need to allocate money for the initial work." (Interviewee a-1).

"We engage in initial exploration work. It is an essential part. Without feasibility studies we cannot identify the best ideas to develop further." (Interviewee a-2).

"Innovation involves lot of research. We have to find out suitable materials, technologies, and techniques. Our team must do research. We need to identify the customer viewpoints. Then we do lot of feasibility studies identify suitable innovation concepts, and solutions which can be incorporated to our products. For all these works we need money. Company must invest money at the beginning of the process. Then the allocated budget can be used for initial works. (Interviewee b-1).

"We are the developer of the innovation concept. We do initial experimentation before producing it to our customers, and we need to have an idea how it can be produced." (Interviewee b-2).

"We need money for experimentations. We allocate an initial budget for the experimentation work. Without investing money for innovation, we cannot stay in the market" (Interviewee c-1).

"*We conduct research, and initial experiments. That is our role as the producer."* (Interviewee c-2).

Customer

"We consult apparel brands to get information related to consumer behaviour trends and market trends. They have consumer information with them. They are closely working with marketing companies. They can get the information. They provide this information on our request." (Interviewee b-1).

"They know the requirements of the end consumer than us. They provide the details of end consumers' specific requirements, suggestions, and feedback. They provide comments for functional final concepts." (Interviewee b-2).

"*Apparel brands give feedback for functional solutions. They involve for the selection of final concepts.*" (Interviewee b-4).

"*We closely work with our customer. They involve for front-end. They give feedback for functional solutions, and final concepts. They pick the suitable concepts. We can get more information on end consumer and trends*." (Interviewee c-1).

"Our customers provide details of trends on market. They always keep in touch with the changes of the market and consumers. Since we have to sell the concept or product to the customer, better to get information from them." (Interviewee c-2).

"....in these review meetings, they pick 2 or3 ideas. Then we experiment with their consent and make the final decisions together with the customer before releasing to the development. This practice saves time and money. But sometimes they are more demanding, and then we have to drop most of our potential ideas." (Interviewee c-4).

"I consult customers to get more details on specific requirements of end consumers when we are developing the concept." (Interviewee c-5).

Suppliers

"Without suppliers we cannot produce the garments. Some suppliers come up with their new ideas, new techniques, and new materials. Most of the time we consult suppliers to get information on materials, techniques, and technologies." (Interviewee a-2).

"*Suppliers always provide information on materials, improved techniques, and technology know how. Some suppliers approach us with their own new ideas for materials"* (Interviewee a-3).

"*Some suppliers actively involve for in the initial experiments and engage in developments. Suppliers can be consulted to verify the suitability of the new materials. Some give updated information on materials."* (Interviewee b-2).

"Our suppliers give information on materials, and techniques. Some suppliers have new innovative ideas." (Interviewee b-5).

"In our company suppliers give updated information on newly materials, and improved techniques. They actively involve conducting initial experiments. Because for our innovative ideas we want to work with new materials." (Interviewee c-3).

"For our developments we must closely work with suppliers. We have to invite them to select technologies, and solutions. In addition, they provide material related information. Sometimes they are the initiator. They give innovative ideas." (Interviewee c-4).

"If they are willing to sell their idea, we try to come to an agreement on our deal. We pay for the innovation and take the ownership / IP (Intellectual Property) on that. If suppliers are not willing to do so, we must work out how to deal with them. May be with non-disclosure agreement. May be shared IP agreement between the company and material supplier. and may be collaborations." (Interviewee c-2).

"We know the capabilities of most of our suppliers, having worked with them for years. We know the suppliers who are coming forward with innovative ideas, their capacities, and their reliability. We must work hand in hand as one party cannot expect to dominate. Everyone knows that they have to work together. As we need to work for the common objective, and always there has to be mutual trust between the parties." (Interviewee a-3).

"Customers always try to keep their brand recognition. They have their own reliable parties to work with. Like us, they have their own trusted material and technology developers and suppliers. Innovation is a very competitive proposition, and all parties have to get together for innovation to succeed. It is important to maintain trust throughout the process." (Interviewee c-4).

Appendix 6: Refinement interview format

Decision making process at the front-end of incremental innovation in apparel

The main focus of this interview is to verify the research findings on the front-end decision making process for incremental innovative offerings in apparel which is designed mainly based on the results of the exploratory case studies in the apparel industry in Sri Lanka. In addition, it is expected to refine the identified interactive roles of suppliers, B2B customers, and producer within the front-end.

On the basis of your experience and the actual everyday working life in the current position, I would like to have your opinion on the front-end decision making process on incremental innovative offerings in apparel.

Personal overview

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1. Could you please tell me how many years you are working in apparel industry?
   Probe – Number of years in other organizations and job roles?
   Probe – Number of years in present organization and job roles?

2. What would you think about your current job position and responsibilities?
   Probe - Your experience in front end of innovation process?

3. In what capacity you are involving in decision making in front- end of innovation process?
   Probe - Your involvement in decision making in front- end of innovation process.

4. What type of innovation you are more familiar with?
   Probe - Do you (company) initiate the dream innovation idea (market and technology driven) or your customer initiate dream innovation idea (customer driven)?

Front- end of innovation - Decision process

I would like to present you the findings of the exploratory case studies and the developed decision process steps for the front-end of incremental innovative offerings in apparel (explain the steps and visually present the decision making process steps).
Based on your experience and the actual everyday working life in the current position, I would like to have your opinion on the above findings.

A. **If you (company) initiate the innovation idea,**

1. Could you please comment on the main steps or routine of the decision making process?
   Probe- In your opinion, have I missed anything?
   Probe -In which way do you prioritize the main steps or routine of the decision making process?
   Probe -Are there any amendments that you can recommend?

2. Could you please comment on the roles of the actors?

   a. What is the expected roles of the customer at early stage of incremental innovation?
   Probe -Customer should involve as. - (facilitators, collaborators, and/or both)

   b. What is the expected role of the suppliers at early stage of incremental innovation?

Probe -Suppliers should involve as. - (facilitators, collaborators, and/or both)

3. What is your opinion on outcome?

B. If customer initiate the innovation idea,

1. Could you please comment on the main steps or routine of the decision making process?
   Probe- In your opinion, have I missed anything?
   Probe -In which way do you prioritize the main steps or routine of the decision making process?
   Probe -Are there any amendments that you can recommend?

2. Could you please comment on the role of the actor?

   a. What is the expected role of the company at early stage of incremental innovation?
   Probe -company should involve as. (Facilitators, collaborators, and /or both)

   b. What is the expected role of the customer at early stage of incremental innovation?
   Probe -Customers should involve as. (Facilitators, collaborators, and/or both)

   c. What is the expected role of the suppliers at early stage of incremental innovation?
   Probe -Suppliers should involve as. (Facilitators, collaborators, and/or both)

3. What is your opinion on outcome?

C. What advice do you have on the developed decision process model?

Appendix 7: Respondents of refinement interviews and results

Interviewee	01	02	03	04	05	06
Current Job position/role	Open Innovation Entrepreneur	Head of Research & Innovation	Innovation Manager	Chief Executive Officer/ Director	Innovation General Manager	Technical & Innovation Director
	Provide leadership, take responsibility, and be actively involved in both incremental and disruptive innovation					
Experience in the apparel industry	10 years	12 years	15 years	22 years	19 years	25 years
	Innovation	Research & development and later in innovation.	Different job roles including production, product design & development, research & development, and later in innovation.			
Experience in apparel innovation	08 years	08years	08 years	09 years	09 years	11years
Involvement in decision making in front-end of innovation	Directly involved in the activities and decisions throughout the innovation process.					
Familiarity with innovation approaches	Both approaches are familiar to them since they have been working on both.					

The refinement interview data were arranged under 2 headings: decision gates, and interactive roles.

1. Decision gates

Gate 1- decisions on 'initial innovation opportunities(ideas)'

Scenario 1

"*We invite ideas from the employees closely working with apparel brands. These people know the requirements of the customer with their working experience. They also have fresh ideas*." (Interviewee 1)

"Trends are one of the good sources to focus on potential products, because trends give an idea what the market is going to be in the next year. I suggest including it as one of the timely changing very useful information for the apparel companies for their innovation." (Interviewee 2)

"At *the moment we follow trends although we do innovation. We use famous websites, and we get information from trend setting companies. Each season each year trends are set.*" (Interviewee 3)

"*I just wanted to highlight one point. That is evaluation criteria. The innovation ideas should be compatible with the organization's goals, and visions. You missed that criterion. Better to include it to your evaluation criteria*." (Interviewee 4)

"*Trends are useful to identify innovation opportunities. Trends are set by trend setting companies looking ahead. These companies study the changes in the market and provide colour, fabric, and style guidelines. In addition, I'll suggest innovation team and front-line employees. Because they also have ideas. May be. they can come up with good ideas for the improvements……. The other suggestions the innovation ideas should aligned with the goals of the company. You can include it to your decision gate.*" (Interviewee 5)

"*I agree with your suggestions. But front-line people also have innovative ideas. Their innovative ideas are also worth to consider. Some companies' welcome ideas from frontline people*." (Interviewee 6)

Scenario 2

"*Customer innovation calendar is really important for a company. Because as producers we need to work on customers' timelines. In addition, if they are coming up their innovation ideas, we must find out the true pain points of the customer. We need to check compliance issues too. Better to reward your decision include customer needs too."* (Interviewee 1)

"*Satisfying customer is essential to stay in the business. Though they come up with innovation idea, we must understand their calendar, and end consumers true needs. My suggestion is to include these to your gate 1 and rename your gate"* (interviewee 2)

"*I agree with your scenario1, but I would like to suggest. We as producers encourage customers for innovation ideas. However, we have to have a better understanding on their end consumer, calendar and compliance issues. Therefore, you can think of adding those aspects to your gate and reword it*" (interviewee 5)

Gate 2- decisions on 'suitable innovation opportunities (ideas) and apparel brands'

"*Most of the apparel producers sell their products through recognized brands. Better to identify their calendar. Because these apparel brands want to launch their products before their competitors. As you suggest the idea should be refined to match with the requirements of the apparel brands. Customer satisfaction is really important. One more suggestion for this gate. You can think of rewording." (Interviewee 1)*

"*Satisfying customer is essential to stay in the business. The producers must understand their calendar, and the route to market. Ultimately, we need to sell the product. My suggestion is to include these to your gate 2 and rename your gate"* (interviewee 2)

"*We need to identify what are the routes to commercialize our products, what are the compliance issues, what are the possible techniques to reach the market and what is the right time to place our innovation on the market or to hit our target customers' calendar." (Interviewee 4)*

"Since you suggest refining the innovation ideas with respect to the needs of the apparel brands, better to word the decision gate as 'refine innovation opportunity and brand'." *(Interviewee 5)*

Gate 3- decisions on 'resources and budget'

"Identifying the resources including human resources. You have already included areas of skills. But it is not in the title. Recheck your title." (Interviewee 2)

"*As you indicated, as apparel producers pay close attention in developing the technical capabilities within the internal innovation team. Indicate it in your decision gate*." (Interviewee 4)

"*I proposed you to indicate areas of skills. It is very important. Developing technical, and scientific skills within the internal innovation team is really important. Because the team members should have a sound knowledge on apparel manufacturing techniques, and technologies. Better to reword your gate and indicate it in your decision gate*." (Interviewee 6)

Gate 4- decisions on 'appropriate practices to be implemented'

"Some industries do innovation through applying good mechanisms. Therefore, better to indicate the mechanisms." (Interviewee 1)

"I would suggest suitable innovation mechanisms, and methods are important. At the moment some companies are doing well with these mechanisms. We can learn these mechanisms through studying similar profitable situations practiced by other industries or may be apparel industry in other countries." (Interviewee 5)

Gate 5- decisions on 'network actors'

"*I just wanted to highlight one point. You have mentioned variety of network actors. Include intuitional directors as sources. We identify R& D centers, training providers, and institutes, using directories. We contact even foreign institutes to train our innovation team"* (interviewee 1)

"*We want to identify working partners. We can use directories to get information on institutes, and special centers*" (interviewee 6)

Gate 6 A- Decisions on potential solutions to be generated

"*To day everyone is using Facebook and Instagram. The customer expresses their true requirements, comments, and suggestions. Most of the retailers, and apparel brands are using the comments from the customers to improve their products. Better to indicate in your sources of information*" (interviewee 2)

"*Customers share the opinion of apparel products in Facebook and Instagram. This is a good source to catch the true needs and requirements of the customer. The apparel developer can identify better solutions knowing the true end consumer needs. Though we are working with an apparel brand, end consumer is the ultimate buyer."* (Interviewee 3)

Gate 7- Decisions on suitable feasibility studies to be executed

*"You can simply say solution profiles" (*interviewee 2)

"*This is one of the important points. One of the difficult decisions. We need to identify better materials, and techniques to suit the innovation solutions. We need a plan for experiment or the viability of achieving solutions. I can say these as the solution profiles.* (Interviewee 5)

Gate 8- Decisions on final concepts to be proceeded with

*"Suppliers provide test report related to their raw materials. The technical information related to raw materials are important when we do experiments. We can come up with good solutions knowing the properties. Since at this stage we identify the best solutions, you can reword your gate." (*Interviewee 2)

*"We should know the material parameters when we do initial experiments or mockups. …. for that we can use supplier's test reports. It is one of the sources get information about properties of materials." (*Interviewee 3)

*"Nothing to add much. But as a source of information, I would suggest test reports of suppliers. For experiments the material details are really important. At the initial stage we can identify the suitable material qualities." (*Interviewee 5)

2. Interactive roles

Suppliers

*"When we do initial experiments, we have to closely work with material suppliers. Because they are the best people to get advice for material problems. They provide solutions for our material problem. As you questioned, if the innovation comes from the apparel brand, based on preference of the apparel brand, the suppliers may involve solving the material related problems." (*Interviewee 1)

*"We are working with different materials. Some materials may be really new. We don't have experience working with really new materials. We have to get advice and opinions from our suppliers during experiments. If the customer initiate innovation, we have to be careful to invite suppliers for solutions." (*Interviewee 2)

*"You have indicated all the interactive roles. But I would suggest one supplier role because suppliers help apparel manufactures to solve material related problems" (*interviewee 3)

*"Advice and opinions can be taken for technical or material problems from material and technology suppliers." (*Interviewee 5)

Customers

*"We cannot sell our innovation to consumers directly. We can negotiate with the apparel brand to sell the products. They have to take the full responsibility of marketing the products. Some apparel brands agree. This is one of the good mechanisms to enter the market. (*Interviewee 1)

*"The producer can sell the concept and make arrangement to reach the market. Then apparel brand has to take the responsibility too." (*Interviewee 4)

*"Developing product and reaching to the market is really harder. The apparel brand can involve in this process to sell the product" (*interviewee 6)

*"If the apparel brand is the initiator of the innovation, sometimes the apparel brand may invest money for the development of the product. Some famous brands…… invest money for innovation. because these brands want to be the pioneer in the market." (*Interviewee 1)

*"In some organizations, both customer and company invest money for the innovations. That is entirely dependent on the trust between the apparel brand and company." (*Interviewee 4)

Appendix 8: Individual Factors of the questionnaire

A. Organization's core competencies

Main Factors/ variables	Factors	Source
Technological/ technical competence	a) The availability of equipment and other facilities in manufacturing plants	Ahmed &Shepherd, 2010; Danneels, 2002; Weigelt et al., 2003
	b) The manufacturing, engineering / technology know-how	
	c) The knowledge and use of quality assurance tools (QFD, LEAN, etc)	
Competence to serve customers	d) The knowledge of customer (current and potential) needs and capabilities	Ahmed &Shepherd, 2010; Danneels, 2002
	e) A good communication channel with customers	
	f) Company reputation(reliability) with customers	
Network/ Partnership competence	g) The knowledge of project management	Ahmed & Shepherd, 2010
	h) The knowledge of capabilities and processes of appropriate suppliers and related firms	
	i) A good quality communication with external parties (suppliers and others)	
	j) Maintaining reliability	
Financial competence	k) Allocation of enough funds for R&D (including training)	Brinckmann et al., 2011; Hottenrott & Peters, 2012
	l) Allocation of enough funds for new machineries and materials	

B. Organization's climate

Main Factors/ variables	Factors	Source
Organizational Strategic orientation	a) Consideration of the needs of the current customers	Huber 1991 ; Pattikawa, et al, 2005 ; Spanjol, et al., 2011 ; Voss & Voss, 2000
	b) Consideration of the needs of the future (potential) customers	
	c) Orientation towards new technological developments/ solutions	
	d) Overseeing the possible strategies to be implemented (to compete)	
	e) Overseeing the possible practices to be implemented (to compete)	
	f) Policies on providing training to develop the capabilities	

Main Factors/ variables	Factors	Source
Organizational Structural characteristics	g) Freedom for freely debate and discuss new ideas and to conduct the work	Forrester, 2000; Koontz & Weihrich, 1990; Lotti et al., 2006; Miesing, 2006
	h) The delegation of authority (empowerment of the teams) to make decisions	
	i) Effective communication of task-relevant information within the team members	
	j) The willingness to share the information related to innovation openly within team	
	k) The encouragement of senior management to accept external ideas	
	l) The commitment of the management and the innovation team	

C. Suppliers' and customer's

Main Factors/ variables	Factors	Source
Operational competencies	a) Technological capabilities/ facilities	Feng et al. 2010; Handfield et al. 1999; Wagner and Hoegl, 2006; Yahaya,2010
	b) Manufacturing expertise and know how	
	c) Financial competencies / investment	
	d) Production flexibility	
Relational characteristics	e) Openness to discuss / negotiate	Perho, 2015; Sikhwari, 2015; Song, 2014; Woo & Ennew, 2004
	f) Mutual support /learning	
	g) Reliability / trust	
	h) Commitment and degree of responsibility towards the innovation	
	i) Communication	
	j) Accurate and timely Information sharing	
	k) Proactive role towards initiation of innovative ideas	

Appendix 9: Questionnaire

The environmental factors on front-end decisions

The main focus of this questionnaire is to examine how the front-end decisions on **incremental innovative offerings** in apparel are conditioned by the **climate of organization, core competencies of organization and external actors (customers & suppliers)**. Below are the identified influential factors on front-end of the innovation decisions which are based on the results of the stage 1-exploration study & the literature review.

Your professional opinions are very important to find out the impact of the above factors on front-end decisions. On the basis of your hands-on experience in front-end of apparel innovation process or your understanding of the context, you are invited to contribute this questionnaire. Please note that your responses will be held as strictly confidential and only reported in aggregate.

Personal overview

1. How many years you are working in apparel industry? ……..
2. Your experience in front - end of innovation process in apparel?.....years.
3. What type of innovation you are more familiar with? ☐
    1. Company initiates the dream innovation idea (market and technology driven) ☐
    2. Your customer initiate dream innovation idea (customer driven) ☐
    3. Both
4. Are you involving in decision making in front - end of innovation? 1.Yes ☐ 2. No. ☐

5. If 'yes,' your involvement in decision making in front - end of innovation?
    a. Involve in strategy identification decisions? 1.Yes ☐ 2. No. ☐

	Yes	No
Initial innovation opportunities (ideas) to be proceed		
Suitable innovation opportunities (ideas) to be proceeded		
Resources and budget		
Appropriate practices to be implemented		
Network actors (suppliers, and customers/others) to be involved		
Any other		

    b. Involve in concept development decisions? 1.Yes ☐ 2. No. ☐

	Yes	No
Potential solutions to be generated (from innovation ideas related to targeted end consumer requirements)		
Most applicable developments to be generated (from technologies, and materials)		
Suitable feasibility studies to be executed		
Final concepts to be proceeded		
Any other		

6. According to your knowledge, are these decisions differ with the type of innovations mentioned in Q 3?
    1.Yes ☐ 2. No. ☐

7. If 'yes', what are the different decisions? 1..... 2. ……
   3……4…….

8. How successful your early phase decisions are? indicate .....%

Factors influence on front-end decisions

1.Organization's climate on front-end of innovation decision making process

- Please circle the number describing the extent to which each factor has influenced on the front-end of the innovation decisions.

		To what extent has this factor influenced on front-end innovation decisions? Not at all	a little	somewhat	much	very much
Organization's strategic orientation	m) Consideration of the needs of the current customers	1	2	3	4	5
	n) Consideration of the needs of the future (potential) customers	1	2	3	4	5
	o) Orientation towards new technological developments/ solutions	1	2	3	4	5
	p) Overseeing the possible strategies to be implemented (to compete)	1	2	3	4	5
	q) Overseeing the possible practices to be implemented (to compete)	1	2	3	4	5
	r) Policies on providing training to develop the capabilities	1	2	3	4	5
Organization's structural characteristics	s) Freedom for freely debate and discuss new ideas and to conduct the work	1	2	3	4	5
	t) The delegation of authority (empowerment of the teams) to make decisions	1	2	3	4	5
	u) Effective communication of task relevant information within the team members	1	2	3	4	5
	v) The willingness to share the information related to innovation openly within team	1	2	3	4	5
	w) The encouragement of senior management to accept external ideas	1	2	3	4	5
	x) The commitment of the management and the innovation team	1	2	3	4	5

2.Organization's core competencies (capabilities and resources) on front-end of innovation decision making process

		To what extent has this factor influenced on front-end innovation decisions? Not at all	a little	somewhat	much	very much
Organization's Technical competencies	a) The availability of equipment and other facilities in manufacturing plants	1	2	3	4	5
	b) The manufacturing, and engineering / technology know-how	1	2	3	4	5
	c) The knowledge and use of quality assurance tools (QFD/ LEAN/ etc)	1	2	3	4	5
Organization's customer competencies	a) The knowledge of customer (current and potential) needs and capabilities	1	2	3	4	5
	b) A good communication channel with customers	1	2	3	4	5
	c) Company reputation(reliability) with customers	1	2	3	4	5
Organization's partnership competencies	d) The knowledge of project management	1	2	3	4	5
	e) The knowledge of capabilities and processes of appropriate suppliers and related firms	1	2	3	4	5
	f) A good quality communication with external parties (suppliers and others)	1	2	3	4	5
	g) Maintaining reliability	1	2	3	4	5
Organization's financial competencies	h) Allocation of enough funds for R&D (including training)	1	2	3	4	5
	i) Allocation of enough funds for new machineries and materials	1	2	3	4	5

3.External actors (customers/ suppliers) on front-end of innovation decision making process

3.1 Customers on front-end decision making process

		To what extent has this factor influenced on front-end innovation decisions? Not at all	a little	somewhat	much	very much
Operational competencies of **customers**	a) Customer's technological capabilities/ facilities	1	2	3	4	5
	b) Customer's manufacturing expertise and know how	1	2	3	4	5
	c) Customer's financial competencies / investment	1	2	3	4	5

Relational characteristics of **customers**	a) Customer's openness to discuss/ negotiate	1	2	3	4	5
	b) Customer's mutual support /learning	1	2	3	4	5
	c) Customer's reliability / trust	1	2	3	4	5
	d) Customer's commitment and degree of responsibility towards the innovation	1	2	3	4	5
	e) Customer's communication	1	2	3	4	5
	f) Customer's accurate and timely information sharing	1	2	3	4	5
	g) Customer's proactive role towards initiation of innovative ideas	1	2	3	4	5

3.2 Suppliers on front-end decision making process

		To what extent has this factor influenced on front-end innovation decisions? Not at all	a little	somewhat	much	very much
Operational competencies of **suppliers**	a) Supplier's technological capabilities/ facilities	1	2	3	4	5
	b) Supplier's manufacturing expertise and know how	1	2	3	4	5
	c) Supplier's financial competencies / investment	1	2	3	4	5
	d) Supplier's production flexibility	1	2	3	4	5

Relational characteristics of **suppliers**	a) Supplier's openness to discuss / negotiate	1	2	3	4	5
	b) Supplier's mutual support /learning	1	2	3	4	5
	c) Supplier's reliability / trust	1	2	3	4	5
	d) Supplier's commitment and degree of responsibility towards the innovation	1	2	3	4	5
	e) Supplier's communication	1	2	3	4	5
	f) Supplier's accurate and timely Information sharing	1	2	3	4	5
	g) Supplier's proactive role towards initiation of innovative ideas	1	2	3	4	5

Thank you for the important feedback that you have supplied kindly participating in this questionnaire.

Appendix 10: Questionnaire surveyed respondents and data of the questionnaire

A. Details of the respondents

1. Experience in the apparel industry

Description	Frequency	Percent
Less than 5 years	23	56.1
5-10 years	13	31.7
More than 10 years	5	12.2
Total	41	100.0

2. Familiarity with the innovation approaches

Description	Frequency	Percent
Company initiates the innovation idea (market and technology driven)	2	4.9
Customer initiate innovation idea (customer driven)	1	2.4
Both– company initiate the innovation idea and customer initiate innovation idea	38	92.7
Total	41	100.0

3. Experience in the front-end

Variables	Mean	Median	Mode	Std. Deviation	Minimum	Maximum
Experience in the Front-end of apparel innovation	3.378	3.000	3.0	2.0680	.5	9.0

4. Involvement in strategy identification decisions

Decisions	Yes	No
Initial innovation opportunities (ideas) to be proceed	97.6	2.4
Suitable innovation opportunities (ideas) to be proceeded	97.6	2.4
Resources and budget	82.9	17.1
Appropriate practices to be implemented	87.8	12.2
Network actors (suppliers, and customers/others) to be involved	87.8	12.2
Any other		

5. Involvement in concept development decisions

Decisions	Yes	No
Potential solutions to be generated (from innovation ideas related to targeted end consumer requirements)	97.6	2.4
Most applicable developments to be generated (from technologies**,** and materials)	97.6	2.4
Suitable feasibility studies to be executed	87.8	12.2
Final concepts to be proceeded	90.2	9.8
Any other		

6. Decisions differ with the approaches/ type of innovations

Decisions differ	Frequency	Percent
yes	11	26.8
No	30	73.2
Total	41	100.0

Decisions related to market potentials, technology readiness level, business strategy and lead time may differ for different approaches.

7. Successful in decision making

The successfulness of the decision making is basically divided into two groups based on their responses. In that, the success rate indicated less than 60% are categorized under not successful assuming that their answers are doubtful.

Success of the decisions	Frequency	Percent
Not Successful	5	12.2
Successful	36	87.8
Total	41	100.0

8. The internal and external factors that influence the front-end decision making process

Mean scores of each factor are presented below.

Organization's climate

Main Factors/ variables	Factors	Mean score
Organizational Strategic orientation	a) Consideration of the needs of the current customers	4.191
	b) Consideration of the needs of the future (potential) customers	3.836
	c) Orientation towards new technological developments/ solutions	4.341
	d) Overseeing the possible strategies to be implemented (to compete)	3..367
	e) Overseeing the possible practices to be implemented (to compete)	4.017
	f) Policies on providing training to develop the capabilities	3.921

Main Factors/ variables	Factors	Mean score
Organizational Structural characteristics	a) Freedom for freely debate and discuss new ideas and to conduct the work	3.872
	b) The delegation of authority (empowerment of the teams) to make decisions	4.107
	a) Effective communication of task relevant information within the team members	4.012
	b) The willingness to share the information related to innovation openly within team	4.256
	c) The encouragement of senior management to accept external ideas	4.201
	d) The commitment of the management and the innovation team	4.018

Organization's core competencies

Main Factors/ variables	Factors	Mean score
Technological/ technical competence	a) The availability of equipment and other facilities in manufacturing plants	3.917
	b) The manufacturing, and engineering / technology know-how	4.017
	c) The knowledge and use of quality assurance tools (QFD/ LEAN/ etc)	2.917

Main Factors/ variables	Factors	Mean score
Competence to serve customer	d) The knowledge of customer (current and potential) needs and capabilities	4.017
	e) A good communication channel with customers	3.819
	f) Company reputation(reliability) with customers	3.987

Main Factors/ variables	Factors	Mean score
Network/ Partnership competence	g) The knowledge of project management	4.121
	h) The knowledge of capabilities and processes of appropriate suppliers and related firms	3.993
	i) A good quality communication with external parties (suppliers and others)	4.117
	j) Maintaining reliability	3. 657

Main Factors/ variables	Factors	Mean score
Financial competence	k) Allocation of enough funds for R&D (including training)	4.013
	l) Allocation of enough funds for new machineries and materials	3.765

customer's

Main Factors/ variables	Factors	Mean score
Operational competencies	a) Technological capabilities/ facilities	1.013
	b) Manufacturing expertise and know how	1.567
	c) Financial competencies / investment	2.781

Main Factors/ variables	Factors	Mean score
Relational characteristics	d) Openness to discuss / negotiate	3.917
	e) Mutual support /learning	4.117
	f) Reliability / trust	4.12
	g) Commitment and degree of responsibility towards the innovation	4.263
	h) Communication	4.013
	i) Accurate and timely Information sharing	4.137
	j) Proactive role towards initiation of innovative ideas	3.961

Suppliers'

Main Factors/ variables	Factors	Mean score
Operational competencies	a) Technological capabilities/ facilities	4.021
	b) Manufacturing expertise and know how	4.017
	c) Financial competencies / investment	4.136
	d) Production flexibility	4.123

Main Factors/ variables	Factors	Mean score
Relational characteristics	e) Openness to discuss / negotiate	4.209
	f) Mutual support /learning	4.012
	g) Reliability / trust	4.117
	h) Commitment and degree of responsibility towards the innovation	4.251
	i) Communication	4.016
	j) Accurate and timely Information sharing	4.132
	k) Proactive role towards initiation of innovative ideas	3.985

Reliability statistics

All variables

		N	%
Cases	Valid	41	100.0
	Excluded [a]	0	0
	Total	41	100.0

a- Detection based on all variables

Reliability statistics

Organization's climate

1. Organizational Strategic orientation

Cronbach's Alpha	N of items
0.786	6

2. Organizational Structural characteristics

Cronbach's Alpha	N of items
0.768	6

Organization's core competencies

1. Technological/ technical competence

Cronbach's Alpha	N of items
0.712	3

2. Competence to serve customers

Cronbach's Alpha	N of items
0.726	3

3. Network/ Partnership competence

Cronbach's Alpha	N of items
0.738	4

4. Financial competence

Cronbach's Alpha	N of items
0.705	2

Customer's

1. Operational competencies

Cronbach's Alpha	N of items
0.709	3

2. Relational characteristics

Cronbach's Alpha	N of items
0.811	7

Suppliers'

1. Operational competencies

Cronbach's Alpha	N of items
0.713	4

2. Relational characteristics

Cronbach's Alpha	N of items
0.806	7

Appendix 11: Validation interview format

Decision making model for the front -end of incremental innovation in apparel

Model validation - Round 1

The initial discussions with the professionals/ Product development Managers in the apparel product development revealed that the attention for documenting the process of decision making is minimal though the apparel manufacturers focus to optimize the value offered to customer during the product innovation phase. Summing up the **literature highlighted two major literature gaps** in academia: lack of decision-making process studies in front- end of innovation process and decision making studies in the apparel product development sector. Thus, this research **focuses to develop a model for decision making in the front- end incorporating 'co -creation of value - B2B context' to provide a useful base in apparel innovation process**.

Based on the results of the exploratory case studies in the apparel industry in Sri Lanka, the initial model was developed which is focused on innovative offerings and not on a specific product category. Then it was refined with interviews and the questionnaire survey within the innovation teams.

The main focus of this **structured interview** is **to validate the proposed Meta decision making process model on front -end of incremental innovation in apparel which** is beneficial for structuring the **front-end of the business** to form a strong foundation for an efficient apparel product innovation through front loading.

I am presenting you the developed Meta decision process model for the front- end for incremental innovative offerings in apparel. On the basis of your experience and the actual day today practices in apparel manufacturing, I wish to obtain your opinion on effectiveness and the efficiency of the front -end decision making process model on incremental innovative offerings in apparel.

The findings of this study mainly contribute to the existing literature evidence on the front-end, with a focus on how this important phase can be organized and managed more efficiently and effectively. In addition to contribute to the literature evidence, the findings of this study are also very significant for the apparel manufacturers/ practitioners to upgrade themselves and keep ahead of their competitors.

Personal overview----------

1. Your working experience in apparel industry? …….. years

   1.a. Number of years in other organizations? …….. years
   Job titles?……
   1.b Number of years in the present organization? …….. years

   1.c Present job title? ……

2 Your education backgrounds? ……

3 Other professional qualifications? ……

4. Your area of expertise ?……

5. How familiar you are with apparel innovation process? …….. years

5.a. In what capacity ……

Decision making process model

Clarity

6.a. Is it easy to understand the **language and terminology** used in the model? (yes/ no)
6.a.1 If not why? ……
6.a.2 Any recommendations for improvement?……

6.b. Is it easy to understand the **components/ elements** used in the model? (yes/ no)
6.b.1 If not why? ……
6.b.2 Any recommendations for improvements ?……

6.c. Is it easy to understand the **relationship between the components/ elements** used in the model? (yes/ no)
6.c.1 If not why? ……
6.c.2 Any recommendations for improvement? ……

6.d. Is it easy to understand the **decision steps and sequence** used in the model? (yes/ no)
6.d.1 If not why? ……
6.d.2 Any recommendations for improvement? ……

Overall structure

Decision making process

7.a. Does the model clearly demonstrate essential input information of the front-end decision making to initiate an incremental product innovation? (yes/ no)
7.a.1 If not why? ……
7.a.2 Any recommendations for improvement? ……

7.b. Does the model clearly demonstrate evaluation mechanisms for front-end decision making steps? (yes/ no)
7.b.1 If not why? ……
7.b.2 Any recommendations for improvement?……

7.c. Does the model clearly demonstrate major decision steps/ gates at the front-end of decision making? (yes/ no)
7.c.1 If not why? ……
7.c.2 Any recommendations for improvement?……

7.d. Does the model clearly demonstrate suitable decision gates of B2B customers, internal teams and supplier involvement in the front-end decision making? (yes/ no)
7.d.1 If not why? ……
7.d.2 Any recommendations for improvement?……

7.e. Does the model clearly demonstrate potential key performance indicators (KPI) of the front-end decision making? (yes/ no)

7.e.1 If not why? ……

7.e.2 Any recommendations for improvement?……

Interactive roles of B2B customers, producers, and suppliers

7.f. Does the model clearly demonstrate interactive roles of B2B customer in front-end decision making to gain new and diverse viewpoints beyond those of the team, to optimize the product features? (yes/ no)

7.f.1 If not why? ……

7.f.2 Any recommendations for improvement?……

7.g Does the model clearly demonstrate interactive roles of supplier in front-end decision making to gain in-depth technical knowledge, and find potential solutions? (yes/ no)

7.g.1 If not why? ……

7.g.2 Any recommendations for improvement?……

7.h Does the model clearly demonstrate roles of internal multifunctional team at front-end of decision making to reduce ambiguity, and enhance idea transfer? (yes/ no)

7.h.1 If not why? ……

7.h.2 Any recommendations for improvement?……

Factors influence

7.i Does the model clearly demonstrate internal factors' influence on front-end decision making? (yes/ no)

7.i.1 If not why? ……

7.i.2 Any recommendations for improvement?……

7.j Does the model clearly demonstrate external factors' influence on front-end decision making? (yes/ no)

7.j.1 If not why? ……

7.j.2 Any recommendations for improvement?……

All components (Meta model)

7.k Does the model cover all the major elements/ components of front-end decision making? (yes/ no)

7.k.1 If not why? ……

7.k 2 Any recommendations for improvement?……

7.l Does the model present a systematic and logical relationship between the elements and front-end decision making? (yes/ no)

7.l.1 If not why? ……

7.l.2 Any recommendations for improvement?……

Practicality

8.a. Can the model be easily implemented in any real working environment? (yes/ no)

8.a.1 If not why? ……

8.a.2 Any recommendations for improvement?……

8.b. Can the model be easily customized to support individual company needs in a real working environment? (yes/ no)

8.b.1 If not why? ……
8.b.2 Any recommendations for improvement?……

8.c. Will the model be useful for the apparel manufacturers who do not start the innovation yet but prefer to study it first, and to identify the competencies/ initial strategies before initiating an innovation? (yes/ no)
8.c.1 If not why? ……
8.c.2 Any recommendations for improvement?……

8.d. Will the model of front-end decision making be beneficial for the apparel manufacturers who have already started innovative products using their competencies with passive customers, and to uplift the innovation work later with demanding customers? (yes/ no)
8.d.1 If not why? ……
8.d.2 Any recommendations for improvement?……

8.e. Will the model provide support for managers to make appropriate managerial decisions to improve the quality of the design solutions and to optimize the product features and functions? (yes/ no)
8.e.1 If not why? ……
8.e.2 Any recommendations for improvement?……

8.f. Will the model for front-end decision making with straightforward decision steps be more effective at creating the best value for customers through shared knowledge and experience than is the case right now? (yes/ no)
8.f.1 If not why? ……
8.f.2 Any recommendations for improvement?……

8.g. Will the model be a valuable strategic guide that will show the way to improving a company's innovation success rate above the level that is prevailing now? (yes/ no)
8.h.1 If not why? ……
8.h.2 Any recommendations for improvement?……

8.h. Will the formalized and structured model of front-end decision making be capable of forming a strong foundation for an efficient apparel product innovation superior to what is available presently?(yes/ no)
8.i.1 If not why? ……
8.i.2 Any recommendations for improvement?……

Suggestions

9. Any advice on the proposed decision process models? (yes/ no)
9.a.1 Any additional input …….
9.a.2 Recommendations for improving the model in general…….

Thank you so much for your time.

Appendix 12: Indicators to evaluate the fitness of the Meta decision making model

The fitness of the Meta decision making model was evaluated based on 3 criteria

1. Clarity of the model

Aspects		Source
6a	Easy to understand the language and terminology used in the model	Halpin, 2001 ; Nordin, et al., 2012 ; Rahman, et al., 2016
6b	Easy to understand the components used in the model	
6c	Easy to understand the relationship between the components used in the model	
6d	Easy to understand the decision steps and sequence used in the model	The main component of the proposed model is the 'front-end decision making process'. The process steps and the sequence should be understandable.

2. Overall structure of the model

Aspects		Source
Decision making process	Clearly demonstrates the essential timely factors (input information) of the front-end decision making to initiate an incremental innovation	The main component of the proposed model is the 'front-end decision making process'. The following information, process steps and activities included in the model. • essential timely factors (input information) • evaluation mechanisms • decision steps/ gates • involvement of actors and • key performance indicators
	Clearly demonstrates the evaluation mechanisms for front-end decision making steps	
	Covers all the major decision steps/ gates at the front-end of decision making	
	Clearly demonstrates the suitable decision gates of B2B customers, internal teams and supplier involvement in front-end decision making	
	Clearly demonstrates the potential key performance indicators (KPI) of the front-end decision making	
Interactive roles of B2B customers, producers, and suppliers	Clearly demonstrates the interactive roles of B2B customer in front-end decision making to acquire new and diverse viewpoints beyond those of the team, to optimize the product features	Involvement of B2B customer in front-end is important to optimize the product features (Coviello & Joseph, 2012; Schweitzer,2013). In apparel business international brands are the decision makers of the final products. Therefore, the apparel manufactures reach the end consumers through these apparel brands.

	Clearly demonstrates the interactive roles of supplier in front-end decision making to gain in-depth technical knowledge, and find potential solutions	Involvement of suppliers in front-end is important to gain in-depth technical knowledge, and find potential solutions, (Kahn & Lodi, 2010)
	Clearly demonstrates the roles of internal multifunctional team at front-end of decision making to reduce ambiguity, and enhance idea transfer	Internal multifunctional team at front-end is essential to reduce ambiguity, and enhance idea transfer (Kim & Wilemon, 2003)
Factors influence	Clearly demonstrates the internal factors' influence on front-end decision making	The third component of the model is the influential factors. Internal and external factors are vital for effective and smooth running of front-end decision making process.
	Clearly demonstrates the external factors' influence on front-end decision making	
All components	Covers all the major components of front-end decision making	Nordin, et al., 2012; Schwaninger,2010
	Presents a systematic and logical relationship between the components and front-end decision making	

3. Practicality/ applicability of the model

Aspects		**Source**
8a	Can be easily implemented in any real working environment	Hay,1999; Rahman, et al., 2016
8b	Can be easily customized to support individual company needs in a real working environment	
8c	Will be useful for the apparel manufacturers who do not start the innovation yet but prefer to study it first, to evaluate the competencies before initiating an innovation	The proposed model clarifies the initial strategies, basic effective mechanisms applicable to the front-end decision making process. The tasks, precise roles, and responsibilities of B2B customers, internal members of apparel producing companies and suppliers are clarified. The model highlights the importance of paying attention towards assessing the internal and external factors when they make decisions.
8d	Will be beneficial for the apparel manufacturers who have already started innovative products using their competencies with passive customers, to uplift the innovation work later with demanding customers	
8e	Will provide support for managers to make appropriate managerial decisions to improve the quality of the design solutions	
8f	Will be more effective at creating the best value for customers through shared knowledge and experience than is the case right now	
8g	Will be a valuable strategic guide that will show the way to improving a company's innovation success rate above the level that is prevailing now	
8h	Will be capable of forming a strong foundation for an efficient apparel product innovation superior to what is available presently	

Expert	1	2	3	4	5
Current job title/ country of work	Chief Executive Officer (SL)	Business Director (SL)	Innovation & Design Director (SL)	Freelance Consultant (UK)	Deputy General Manager (SL)
Experience in the apparel industry	34 years in the knitwear, textiles, and apparel industry	22 years in the apparel industry	20 years in the apparel and textile industry	35 years in the field of intimate and active fashion	28 years in the apparel industry
Working on apparel innovation process	18 years	16 years	17 years	21 years	16 years
Area of expertise	Extensive experience/exposure in, • Establishing automated Flat Knitting Facility • Implementing manufacturing Systems Excellence • Product development and innovation • Establishing and developing new business & new manufacturing	Extensive experience/exposure in, • Leading front-end teams for innovation • Style developments and commercialization • Budgeting process • Implementing various speed models with apparel brands and working closely in implementing the same across the supply chain and with manufacturing partners	Extensive experience/exposure in, • Fabric & apparel development • Strategic sourcing • Pricing • Innovation • Product development • Quality of textiles for sportswear, leisure wear &intimate apparel brands	Extensive experience and expertise in, • Full fit approval process • Sourcing • Construction knowhow and manufacturing in Asia • Full product cycle (taking forward a product from conception) • Innovation of intelligent product ranges	Extensive experience/exposure in, • Managing Product Development and innovation process covering activities from ideation and concept development to final style package handover for bulk production of swimwear, sports bras, performance wear and competitive swimwear • Budgeting process • Raw material sourcing
Educational background	College	Diploma in Product Creation, Fashion & Apparel Design	PG Diploma in Knitting Design & Technology Bachelors in Business Management	BA (Hons) Contour Fashion Design (UK)	MBA (UK) Bachelors in Commerce

The validation interview data were arranged under 4 headings: decision making process steps, interactive roles, influential factors and Meta model.

1. **Decision making process steps**

Apparel companies do innovations. I agree with your scenarios. Because as you captured most apparel producers reach the market through recognized brands. Each and every season we need to come up new ideas as apparel producers. Because the requirements of the customer changes with the seasons. The requirements of customer changed with the country. The apparel brands capture these changes, and they are more proactive. The apparel brands are looking for more new products. The apparel producers also should react fast. The decisions are really important in for innovation. As you mentioned incremental innovation are the most common. Therefore, this guideline is useful. You have included all information for each process activities. and evaluation criteria. You identified who should involve for the decisions. You already studied the actual practice. Nothing much to include. Anyway, I would like to suggest an evaluation criterion which can be included into your gate 1. The innovation idea should provide a value to end consumer, apparel brand and producer. But we should check whether the innovation idea gives an opportunity to explore new areas for the apparel producer. I suggest including 'enable the exploration of new areas as applicable' in your evaluation criteria in gate 1. You can include those new values to company." (Expert 1)

"This shows a lot of valuable points. The content is very good. Apparel context studies we don't have a specific model for innovation. Producers cannot spend long time for innovations because fashion changes every season. Fashion business runs on seasonal calendar. The products should be in the market for the relevant season. This kind of a structured process steps is useful to arrange. But I would like to make one suggestion for your gate 5. You talk about stakeholders or the actors. We should check whether it enable to increase revenue, and that should come under rewards to company." (Expert 2)

"*Nothing much to include. The activities of the process are clear. As you captured, the apparel brands are really important for the apparel manufacturers. They also come up with new ideas. The scenarios are o.k. I like the innovation canvas. However, it is better to show the sequence or numbering of your canvas for easy understanding. Another suggestion about the gate 6 B. you proposed to identify variety of developments from technologies, and materials. Under manufacturability, you can include financial sustainability. Though you select better development, if it is costly, then the producer must think, whether it is worth to use or not. Since we are going with incremental innovations, we cannot sell the product for higher prices. One more suggestion for gate 7. The feasibility ideas should be manufacturable in mass scale if the idea is selected for further improvements. We need to consider the design for production."* (Expert 3)

"*The charts are very useful to put the information into context. Such evaluation frameworks will work well. Industry like apparel, this kind of matrices are easy to introduce without going for mathematics. The process is clear. The involvement of stakeholders is acceptable. However, I propose to introduce some visuals to give more reader appeal to decision process steps if possible. Since I am involving with both academic and industry, I can say the presentation is good specially for academics. Because in academia this is not discussed. In industry most of the companies do engage in innovation. Some are following on their own methods and, some tried to adopt practices used in other industries. But apparel is different. It is a personal use product with highly sensible on aesthetic appeal. In some product categories we expect both functional and aesthetic appeal. Producer should address both aesthetic and functional requirements of the customers. For the apparel industry we do not have our own innovation practice. In that sense I agree with your proposed model. One more suggestion. producers do the innovation to explore new areas. You can include it to your evaluation criteria. When evaluating the innovation idea, the company can check whether the innovation idea provide an opportunity to*

explore new area or not. I would suggest criteria for your gate 7 too. You can consider manufacturability of the innovation idea" (Expert 4)

"In actual practice, we follow different methods to develop products. Because we do different product categories. Some product categories focus only aesthetic, and some product should be incorporated functional or technical. The proposed structured steps provide all the information, and criteria to reach the decisions. This information is good. But I would like to make few suggestions for your steps. When you select your partners in gate 5, you can check whether it provide an opportunity to increase your profit. Ultimately money matters. Though we do innovative products, we cannot increase their prices. Customers expect more value from less money. Same thing applies to your gate 7, we do innovation to earn profit. We need to evaluate the plans to check whether we can generate profit. All the companies are looking for profit." (Expert 5)

2. Interactive roles

"Y*ou have properly captured the roles. As you proposed, nowadays at the early stages, we like to closely work with our apparel brands to reduce our risks in business. But on one side it is a challenge. Working closely with suppliers is also hard. Anyway, I agree with your proposed roles. In addition, you propose the roles of the suppliers. Yes, they are essential for technical support, and to solve material related problems*." (Expert 1)

"*Apparel producers are catering to diverse markets. Do various product categories. At the same time, we need to satisfy consumer and need to quickly respond to the changes in the market. Specialized knowledge is essential for that. Apparel producers cannot do the innovation alone. The apparel producer needs to work with responsive partners of upstream and downstream. It helps to mitigate risks You have indicated how these people can involve for the process*." (Expert 2)

"Various stakeholders involve for the innovation. The apparel producers must work with both suppliers and customers. Nothing to include to your proposed roles." (Expert 3)

"Apparel producers need diverse viewpoints. These may come from internal members those who actively working in the front-end. Beyond the team customers and suppliers are important for apparel business to gain new ideas. Each and every season consumer expect something new. As producers we need to satisfy the consumers. The proposed roles are agreeable to improve product features and reduce the risk. We need to work with suppliers closely to develop new solutions. Nothing to change in the proposed roles." (Expert 4)

"As producers we know how important the suppliers are for apparel production. Without them, we cannot do innovations. You have identified their roles. I can say they should involve throughout the innovation process. For the front-end, the proposed roles are acceptable. When we talk about apparel brands, they are the leaders of this apparel business. They operate their business throughout the world. Most of the apparel producers are working with apparel brands. Consideration of involvement of apparel brands is important. As you propose they play different roles throughout the innovation process. For the front-end the roles identified are agreeable." (Expert 5)

3. Factors that influence the decisions

"*As you figured out various factors influence for the decisions. Especially internal factors, and the financial ability. Some companies have to drop their innovations due to financial difficulties. Suppliers are also very important. Their capabilities really matter for apparel producers. The relations with suppliers, and how far they have maintained trust and commitment is important too. You have indicated the influence of apparel brand. I agree with that. Overall, the factors you indicated are influence for the decisions."* (Expert 1).

"*Actually, when we talk about the decisions, it is very challenging. We know some factors influence. Especially I would say our internal capacity. But producers do not discuss those. I think, your identified factors really matter when we make decisions*." (Expert 2).

"*You identified all the factors. I totally agree with the internal factors. Without supportive climate of the organization, the innovation team or the members of the company cannot do innovation. The support from the company is essential for innovation. Other thing you have indicated is the capabilities. Without the capabilities of the company, working out innovative ideas are difficult. You indicate external factors as suppliers and customers. Yes, they are worth to consider." (*Expert 3).

"*Front-end decisions are very tricky. You have to jump the hurdles. One of the hurdles is internal environment. The internal environment should be friendly for innovation as you indicated. If the higher authorities are not encouraging the members of the company, the company cannot achieve good innovative solutions. The other hurdle is capabilities. You captured those. In general, these factors have discussed. But for the front-end these factors are really important. You have considered the external factors too. The suppliers are really influential for developing innovative ideas. Noting to propose more for the factors."* (Expert 4).

"*Climate of the organization should be friendly for innovation. This is really important. Freedom should be given to the innovation team. The top-level people should encourage people for innovation if they want to be in the apparel business. I agree with your internal factors related to climate. When it comes to capabilities, yes, the producer should develop the technical capabilities and network capabilities, should clearly understand the needs of the customer, and financial capability is also important. I agree with capabilities of organization. The capability of suppliers and their relational qualities influence when we made decisions on materials, and technologies. How can we neglect apparel brands? You have listed all the factors."* (Expert 5).

4. Meta Model

"The model shows valuable components. The front-end is not easy. Decision making does not stand alone. It needs lot of information, and involved various stakeholders as you indicated, internal and external. Without apparel brands the producers cannot market their products. Without material suppliers apparel producers cannot develop garments. This is really true. The other component you indicated the factors. Yes, internal factors really matter for innovation. specially money and climate of the organization. The senior people should encourage the team for continuous innovations." (Expert 1).

"This is good to implement innovation. because this shows all the activity steps with respective decisions and the responsible stakeholders. In that sense the content is very good and informative. As you questioned, the model can be customized to suit for the company. But you need to clearly study the readiness for changes within the company before implementing. Different manufacturers produce different product categories. The requirements may change with the product category. However, it is a good guideline. It shows how the manufacturer can share knowledge with customer." (Expert 1).

"The apparel brands are really important for the apparel manufacturers. They also come up with new ideas. You have given the prominence to apparel brand. The captured scenarios are clear. The front-end is hard, and risky. Each and every activity of the front-end is important. The decision gates are understandable and clear. Actually, some companies are performing good. But they do not document how they are doing their process. If new member joins the team, he has to learn the process by doing. Having this type of a guide is useful." (Expert 2)

"As I mentioned earlier, apparel producers cater for different market and produce different product categories. The companies can study this their current practice and see to what extend they are

successful in their innovation. Then they can compare this suggested process steps with their current practice. This model encourages shared knowledge. This is really good to mitigate risk." (Expert 2)

"In order to run the front-end, various stakeholders involves. In company, the senior managers involve making strategic decisions. In order to implement those, a team should be assigned. Internally research should be conducted to identify opportunities and need to do lot of experiments. Without suppliers, we cannot do innovative developments. In that sense, suppliers are important. The apparel brand, definitely we have to closely work with them. Without them most of the apparel producers cannot reach the market. The internal factors, especially money matters. The passion for innovation of the organization, and relationship with other stakeholders actually influence for the innovation. External factors also influence. The characteristics of both suppliers, and customers, the relationship of decisions, roles and factors is clear." (Expert 3)

"This is useful for managers. They will not miss the important decisions in the process. This proposed model is a structured process step. The industry is practising innovation. But they have not documented the process of reaching the final concept. This gives an idea how the apparel producer can work with demanding customer, in which stage the customer can involve, how the customer can be involved, and what are the important decisions along the front-end." (Expert 3)

"*This is a very deep and complex study that raises a number of important points, specially three components; decisions, interactive roles and factors influence. That need to be addressed in front -end decision making. It covers major components within the front- end. However, this is really good for academics. But for the industry people, it should be in a simple wording. I feel the wording could be more simplified and made a bit lighter on the reader"* (Expert 4)

"*The content in this respect is very good. But the industry cannot easily implement this overall model. But your decision making steps alone can be implemented, and your proposed roles of the internal teams and suppliers and customers can be implemented too. As you indicate in your factors, the manufacturer should do a self-evaluation about the internal capabilities, and their climate for innovation. The manufacturer should have some idea about their future, and they should have knowledgeable people with them to implement or customize as mentioned earlier.*" (Expert 4)

"The model covers all the major components. Though it is called as a decision model it shows all the process steps. Therefore, it is a front-end process model. It gives an idea how the apparel producer can start an incremental innovation. It is a guideline for implementing innovation process. You have indicated two phases within the front-end. Actually, we do practice those. But those are not documented. This gives an indication what the producer should do in each step to achieve the effective innovative solutions. The apparel brands are important for the business. The model indicates how they can involve for the process. Sharing knowledge is important for both producer and apparel brands." (Expert 5)