Aligning Critical Success Factors to Organizational Design
- *A study of Swedish textile and clothing firms*

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Abstract

Purpose – Concurrent designing of products, processes and supply chains (3-DCE) has proved to be beneficial in rendering holistic, market-responsive architecture to organizations through linkages created by dynamic capability development and innovation. The purpose of this paper is to investigate the promises of 3-DCE in synthesizing and sustaining critical success factors (CSFs) for organizations, and also underpin the existing gap between its offerings in devising the CSFs and the 'real solutions' essential in a dynamic system's perspective.

Design/methodology/approach – The paper adopts an intermediary approach combining both explanatory and exploratory researches. The conceptual framework of the paper is based on a matrix for organizational mapping of TCF firms prepared through content analysis. This is followed by an extensive semi-structured survey. The selection of firms was based on contacting TEKO and Europages. Usable responses were obtained from 42 firms for detailed analysis, making the response rate around 15 percent.

Findings – The results were manifold. It showed that most of the key success factors are synthesized and sustained through 3-DCE designing. The paper also highlights the necessity to incorporate intangible value propositions of culture, leadership and governance, knowledge, image and relationship into the 3-DCE model to generate an 'extended 3-DCE' framework for mediating operational performance and hence organizational success. Such a model required in a dynamic environment is argued to show a fit to represent a *design for resilience* perspective, requiring further research.

Practical implications – The findings from the paper can be beneficial for organizations to understand the key areas in which to invest and how to invest their resources and time, as CSF identification is largely qualitative and can result in differing opinions in pinpointing them. It is thus recommended to synthesize or identify them from the 3-DCE perspective.

Research limitations – Firstly, the selection of sample size of organizations was small and arguments regarding its representation of the Swedish TCF firms' population could be raised. So the claims and propositions of the paper cannot be widely generalized. Secondly, the responses to the survey were based on judgments of the company top management and could vary if intra-organizational responses were considered.

Originality/value – The paper is original in realizing how 3-DCE can be instrumental in devising critical success factors in organizations and also what factors needs to be incorporated into its 'extended' framework to match the requirements for organizations in a dynamic environment.

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1. INTRODUCTION

The global textile, clothing and fashion (TCF) industries are one of the most competitive industries with growing complexities and market dynamics related to globalization and competition. Comparatively low entry barriers have substantially increased the bargaining forces of innumerous competitors. Moreover, differentiation has become a key aspect in developing competitive advantage for these TCF firms owing to greater market dynamics, rapid fluctuations in postmodern consumer behaviour, shortening of fashion product life-cycle, product proliferation to mention a few. Barney (2002) highlighted the major ways a firm can gain competitive advantage through differentiation based on product feature, linkages, timings, reputation, product mix etc. while Porter (1998) corroborated the means of gaining advantage through cost leadership by implementing efficient-scale facilities, cost minimization and control over various processes (Bruer *et al*., 2005). It is critical to understand that these differentiating strategies are basis for tailoring 'success factors' for specific industries and particularly for the companies operating in it, which needs careful attention and management to highlight performance and emerge successful (Anthony *et al*., 1972). Rockart (1979) extended the ideas corroborated by Daniel (1961), Anthony *et al*. (1972) and others to suggest that firms develop different critical success factor (CSFs) depending on their structure, competitive strategy, industry position, location, environmental and time factors integrated with the strategic objectives. A comprehensive idea that was communicated by this CSF framework was the significant impact of the key success drivers on profitability and their importance in determining organizational successful performance (Leidecker & Bruno, 1984). Performance of any organization is measured mostly in terms of its economic viability (profit-ratio or growth rate). Competitive priorities, like price, cost, quality, delivery performance (speed), flexibility etc. are also considerable measurement characteristics to determine organizational performance (Selldin & Olhager, 2003). Thus critical success factors have been used significantly to present or identify the key factors that companies should focus on to ensure successful competitive performance (Rockart & Bullen, 1981). Identifying CSFs is important as it allows firms to focus their efforts on building their capabilities/competencies, or decide if they have the capability to build the requirements necessary to devise these CSFs. Some researches (Camp, 1995; Porter, 1998; Barney, 2002; Završnik, 2007) have analyzed the broad spectrum of competitive advantages and critical success factors, in application.

But, how are these success factors (CSFs) synthesized? Fine *et al*. (2005) advocated that increased efficiency, operational performance, and competitive advantage, hence, critical success factors are devised effectively by designing and aligning of products, processes, and supply chains. This strategic adoption of simultaneous designing of products, processes, and supply chains, along with their myriads of attributes and components is essential to provide distinctive competencies to organizations (Fine, 1998). The implications of these 3-dimensional designing aspects are immense in shaping-out success factors for organizations. We discuss the exiting researches relating 3-DCE and how to devise critical success drivers from them, succinctly under the next section of the paper. However, this is quite a premature concept and as Ellram *et al*. (2007) advocate, "*there are virtually no empirical studies that explicitly look at the outcomes of 3-Dimensional Concurrent Engineering (3-DCE), or try to evaluate whether firm or even supply chain performance measurably improves with 3-DCE*

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implementation".

In this context the paper investigates how commonly identified CSFs for the textile, clothing and fashion firms can be managed and aligned to achievements and designing along 3-DCE domain. In order to position our analysis in between the diverse contexts of 3-DCE and CSFs we conceptualize by following a distinctive organizational competency mapping for streamlining the complex perspectives across two broad organizational routines viz. exploring new opportunities (innovation) and exploiting existing capabilities (specialization) along the 3-DCE domains (product, process, & supply chain) (Lengnick-Hall and Beck, 2005).

The remaining of the paper is organized as follows. First it focuses on presenting the underlying aspects of product, process and supply chain designing along with intangible value creation in extended organizations and how they are manipulated to synthesize and develop the success drivers and distinctive competencies, especially for the TCF firms in consideration. The next section consists of the results obtained from an extensive survey related to organizational competency mapping on the Swedish TCF firms, further analyzed through statistical observations. The findings reported are concerned with understanding how critical success drivers for textile and clothing firms are synthesized through 3-DCE designing attributes followed by investigation of the critical aspects related to organizational competency mapping. At last, we endeavor to underpin the understanding of the existing gap between the offerings of three dimensional designing attributes in devising the CSFs and 'real solutions' essential in a dynamic system's perspective (Choi *et al*., 2001) by fitting the organizational structure to strategy (Chandler, 1962; Miles and Snow, 1978). This corroboration proposes the need to identify a common denominator in any unique success solution for organization, what we term, an 'extended' 3-DCE designing approach, the basis of designing organizational resilience.

However, before continuing with the concepts of 3-DCE and critical success factors again, it is essential to provide succinctly a broader view of the Swedish TCF firms. The Swedish textile and clothing industries, and its firms, have seen formidable shifts underlying to the industry structure, characterized by shifts in apparel production and manufacturing facilities to low-cost regions, emergence of retailers and brands in dominance as compared to manufacturers in the apparel pipeline, and transition from labour intensive characteristic to knowledge driven characteristics since 1960s (Ludwig and Valente, 2009). These changes had been detrimental to the developmental cycle, of many organizations in terms of reduced production volumes, export ratio etc., hence, profitability. However, many of the Swedish manufacturing companies by the time have started to develop and reshape their strategies and structures according to the dynamic requisites of the time. For example, in the 1970-80s signs of more value-creating activities through designing, marketing and integrated information and material flows have pronounced, thus changing the industry boundary. Thus by the end of the 1980s there has been a considerable rise in the clothing service sector (the largest being Hennes & Mauritz) (Bäckström, 1990). The period saw great advancements in the development of the technical textile industry as well – a shift towards more technology and knowledge drivenness to favourably achieve sustainable competitive advantages with the changing time (Jacobsson and Alänge, 1994). In a nut shell, the companies that could match their organizational structures and strategies to the dynamic changes in the environment were successful, while others failed and perished. Space precludes a detailed discussion on the developmental history of the Swedish TCF industries but we refer to the use of an 'extended 3-DCE' building block by the successful Swedish firms, under study; for designing their

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organizations.

2. 3-DCE AND CSFs

The foundation of 3-DCE is based on the concepts of designing product, process and supply chain. Thus, before coordinating *product design*, *process design* and *supply chain design* decisions it is critical to highlight the design decisions along each of the three domains implicit to it (Forza *et al.*, 2005). Researches on product design dealing with the product's specifications for subsequent product innovation (by exploring new opportunities) and/or specialization (by exploiting current capabilities) have been contributed by several authors like Koufteros & Vonderembse (2001, 2002), Brown & Eisenhardt (1995), Fine *et al*. (2005). Designing of processes is also key for the foundation of 3-DCE, focusing on the methods, facilities, equipment and output that are used for supply-source-make-store and distribute-sell processes (Safizadeh *et al.*, 1996; Fine, 1998). In addition, the third pillar of 3-DCE, supply chain (SC) design considers the aspects of sourcing decisions, contracting decisions (type of relationship an organization has with other members of the supply chain), make-buy decisions (in-sourcing or outsourcing), coordination decisions (logistical channels, suppliers and customers) (Choi & Hartley, 1996; Choi *et al.*, 2001; Mason *et al.*, 2002; Parker & Anderson, 2002).

A review of the extant literature that complements the fit between two or more of Fine's three dimensions of concurrent engineering is provided below and summarized in Table 1.

2.1. Product-process linkages and CSFs

Overview of the simultaneous and concurrent consideration of products and processes designing for enhanced operational performance by tuning technology and product specifications yields more consumer-focused activities, highlighted by Hayes & Wheelwright (1979a, 1979b), Ettlie (1995, 1997). It leads to multi-faceted benefits supporting product innovation or quality focus (O'Leary-Kelly & Flores, 2002), cost minimization, quality improvements and improved customer satisfaction (Balasubramanian, 2001; Koufteros & Vonderembse, 2002) and sensitivity to time-to-market demands. As Swink (1998) corroborated, tailoring elements of concurrent engineering (CE) to match specific process priorities and product characteristics render lower costs, greater variety, and greater performance along the domains of innovation, new product development (NPD) and specialization. In this process, the integrity of product characteristics in terms of variety-volume and generic processes becomes inevitable to create FAT (Focus-Architecture-Technology) – 3-DCE linkages (Fine, 1998). More competitively the CE concept broadens up into addressing product producibility issues, product design decisions and product life-cycle considerations associating more control and responsibility factors in the system. Overall, CE fosters higher design excellence in the organization leading to improvements in factors for differentiation, efficiency, responsiveness, value and profitability.

2.2. Supply chain-process linkages and CSFs

According to Fine (2000), the supply chain and process design and linkages, focus on capability development across processes (manufacturing, inventory control, logistics and distribution etc.) (Cavinato 2005) into *design for supply chain* along with supply chain innovations by controlling make/buy decisions, enhanced sourcing and coordination decisions (Jain *et al.*, 1991; Krajewski & Wei, 2001). This significantly enhances the

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customer-supplier information exchange for different processes ensuring systemic integration across the processes (Ellram *et al.*, 2007; Kopczak and Johnson, 2003). Properly integrated supply chain is essential to minimize the inventory level hence cost tied-up with stock keeping and maintenance (Evers and Beier, 1998). The demand visibility and hence forecasting accuracy across any process in the value chain is invariably enhanced, thus, increasing the accuracy of information exchange (Moinzadeh, 2002; Lee, 2002), supplier/customer relationship and coordination (Simatupang & Sridharan, 2005; Smaros *et al.*, 2003) and revenue. Christopher and Towill (2001, 2002), on the other hand, suggested the perspective of increased responsiveness and agility gained through supply chain-process designing, as the order winning criterion, especially for the highly volatile clothing and fashion industry.

2.3. Supply chain-product linkages and CSFs

In addition, aligning the design of the right supply chain for the right product improves the overall efficiency of the value chain focusing on reduced developmental costs and lead times (Bonaccorsi & Lipparini, 1994; Hartley *et al.*, 1997; Wynstra *et al.*, 2001). This characterizes higher market-responsiveness and flexibility for innovative products while cost minimization, price reduction and higher economies of scale through higher resource utilization for functional products fostering higher specialization (Fisher *et al.*, 1994; Fisher, 1997). The strategic fit between product characteristics and supply chain architecture by molding the sourcing, make/buy and contracting decisions according to the requirements is critical in building a collaborative supply network, higher participation of the supplier and customer in design and development (Fine, 2000). This results in synthesizing and enhancing the competitive advantages in terms of reduced timings, reduced price level and higher service level and efficiency (Barney, 2002; Porter, 1998). This has a favourable impact on the financial returns of the firm and the product design performance (Petersen *et al.*, 2005). Linkages between functions, is inevitable to deliver in-line with the customer wants and break down functional silos internal to the organization to unify across a common goal. Christopher & Towill (2001, 2002) advocated that the customer is the ultimate judge of quality and product performance and incorporating customer needs into product development lead time decreases time-to-market and improves quality, as well as ensures the firm's overall market success.

2.4. 3-DCE linkages and CSFs

Fine's model of 3-DCE corroborates and formalizes the simultaneous consideration of product, process, and supply chain designing. 3-DCE designing thus yields a combined effect of product-process-supply chain designing necessary for firms to achieve competitive advantage and generate success factors. Fisher (1997), Petersen *et al.* (2005), Kopczak & Johnson (2003) matched the supply chain designing aspects to the product and process design requirements with overall supply chain integration (early supplier involvement - ESI and customer involvement) to design for improved financial performance. These approaches generate a holistic view of the interact-ability of all the necessary components like customer involvement, quality management, ESI, concurrent engineering, to essentially map and also generate the CSFs for the firms like improved quality, reduced lead time and time-to-market, cost minimization, improved manufacturability, reduced relationship risk and improved product innovation & success. 3-DCE, thus, provides a valuable lens to view the supply chain management problems and diagnose the functioning of an organization and determine the distinctive competencies through careful understanding and mapping (Salvador *et al.*, 2002).

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This alignment of the product-process-supply chain designing must be supported by effective adaptation to strategies and organizational structure to conform to the market turbulences, thus making organizational governance, culture and leadership one of the major prerequisites as a success factor (Ellram *et al*., 2007; Repenning & Sterman, 2002; McCann, 1991). Ellram *et al*. (2007) argues that "when properly implemented, 3-DCE takes a holistic viewpoint that considers the key functional interfaces within the organization and includes suppliers and customers, and how the product, process and supply chain work together to efficiently and effectively meet the customer's needs".

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Table 1. Complementary literature supporting 3-DCE linkages

Key 3-DCE concept	Contribution to 3-DCE designing and mapping	Benefits in terms of synthesizing and identifying success factors	Contributing authors	CSFs possibly synthesized and mapped (as observed)
Product-Process design linkages (Concurrent engineering)	• Develops close relationship between manufacturing system capabilities, product's volume-variant specification, and the nature of the product • Effective linking through information sharing has improved cost, quality, time, and flexibility • Links the processes of product development, manufacturing & technology, marketing & communication channels to superior product development & organizational performance in the areas of time to market, product cost, quality, innovation & responsiveness to add overall product performance	• Improved operating performance • Improved cash flow • Improved communication infrastructure • Increased organizational culture and trust • Supports product innovation and quality focus Time to market reduction • Cost reduction • Quality improvement • Improved customer Satisfaction • Higher profits • Higher Brand Value	Hayes *et al.* (1979a, b, 1984), Kim *et al.* (1992), Ettlie (1995), Safizadeh *et al.* (1996), Anumba *et al.* (2000), Willaert *et al.* (1998) Blackburn *et al.* (1996), Swink (1998), Balasubramanian (2001), Koufteros *et al.* (2001, 2002) O'Leary-Kelly *et al.*(2002)	• Optimized lead time • Quality of product • Cost minimization/optimization • Higher product flexibility • Higher service level • Innovation and responsiveness • Improved Brand perception
Supply chain-Process design linkages	• Customer-supplier information exchange for different processes in the multi-echelon supply chains ensuring their integration across the processes • Links process capability achievements to *design for supply chain* and SC strategies by controlling the sourcing–, contracting–, make/buy–, and coordination– decisions • Design for manufacturing, distribution strategies	• Minimize the inventory level hence cost tied-up with stock keeping and maintenance • Improved forecasting accuracy across processes in the value chain • Supplier/customer relationships and coordination • Considerable innovation in supply chain architecture • Improved productivity	Davis (1993), Carter *et al.* (1995), Cavinato (2005), Evers *et al.* (1998), Fine (1998), Sauvage (2003), Jain *et al.* (1991), Krajewski *et al.* (2001), Christopher *et al.* (2001, 2002), Childerhouse and Aitekey (2000), Lee (2002), Moinzadeh (2002), Smaros *et al.* (2003), Simatupang *et al.* (2005)	• Information Sharing • Coordination and trust • SC Flexibility • Service Level • Cost Minimization • SC & Process Innovation • Higher Productivity
Supply chain-Product design linkages	• Channel structure/design: Better competition as integrated network entities against channel members to render better performance outcomes to reduce risks • Integrating the customer needs to reduce lead time, improve quality and overall market success	• Decreased time to market • Increased product innovation and quality • Lower prices for customers • Improved design for manufacturability	Anderson and Schmittlein (1984), Klein *et al.* (1990), Appleyard (2003), Hillebrand and Wim (2004), Hult and Swan (2003) Ettlie (1997), Burchill and Fine (1997), Swink (1998), Christopher and Towill (2001, 2002), Griffiths *et al.* (2000)	• Cost minimization • Quick Response • Quality of service • Flexibility and coordination • Innovation and product development

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Key 3-DCE concept	Contribution to 3-DCE designing and mapping	Benefits in terms of synthesizing and identifying success factors	Contributing authors	CSFs possibly synthesized and mapped (as observed)
Supply chain-Product design linkages	• Early supplier involvement: Integrates material suppliers into the product development cycle; Focuses on supplier participation in the initial stages of design and development; Reduces the relationship risk; Overall improvement in NPD success • Match the innovative products with collaborative supply chain designs showing significantly higher organizational innovativeness • Develop high market-responsiveness for high-fashion products for driving competitiveness through high flexibility, QR, and branding	• Decreased time to market • Improved commercial success • Reduces concept to customer development time • Improves quality, reduces the cost of new products and facilitates the smooth launch of new products	Fisher (1997), Fisher *et al*. (1994, 1997), Christopher and Towill, 2001; 2002; Mason-Jones *et al*., (2000) Bonaccorsi and Lipparini (1994), Holland (1995), Hartley *et al*. (1997), Fine (1998), McCutcheon *et al*. (1997), Lucas (1999), Wynstra *et al*. (2001), Primo and Amundson (2002), Spina *et al*. (2002), Stump *et al*. (2002)	• Sustainability concerns • High brand value
3-DCE Supply chain-Product-Process design linkages	• Higher level of integration • Higher collaboration and partnership • Strategic process engagement, control and planning, higher degree of cost-efficient processes • Focus on responsive supply chains characterized flexible (manufacturing or marketing)	• Deploys the right customer focus, increased product design and technology and enhanced supply chain architecture • Cost minimization • Reduced lead time	Kopczak and Johnson (2003), Fine, 1998), Singhal and Singhal (2002), Fine *et al*. (2005), Blackhurst *et al*. (2005), Huang *et al*. (2005), Petersen *et al*. (2005), Fixson (2005)	• Cost leadership • Fast response, Flexibility in (manufacturing or marketing • Higher organizational brand value • Proper alignment of organizational culture • Higher productivity • Higher coordination
Extended 3-DCE linkages	• Extends or complements the concept of 3-DCE by incorporating the intangible value propositions like knowledge, image, relationships, shared vision and organizational culture • Incorporates organizational change and innovation, relates strategy to structure • Incorporates the notion of self-organizing adaptive system	• Develop dynamic competencies and competitive advantage with changing market dynamics to match the strategy and structure	Marr (2007); Bobbitt & Ford (1980); Molnar (2004); Repenning & Sterman (2002) McCann (1991); Miles and Snow (1978); Holland (1995); Lucas (1999) Senge (1990b); Dooley (1997)	• Organizational Resilience

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2.5. A gap in research supporting CSFs synthesis through 3-DCE

However, a realistic model for developing critically successful performance for organizations strive beyond just the alignment and overlapping of the product, process and supply chain designs. As Bobbitt and Ford (1980) advocated there certainly exists something (some variable) that influences the overall design performance of the organization. Marr (2007) substantiates these as the intangible elements such as value system, knowledge, image, relationships and organizational culture, critical for the future success of businesses (Molnar, 2004). Thus, it becomes anticipatory, even though the scope of 3-DCE covers a significant breadth of issues it does not possibly encompass all factors contributing to firms' successful performance, especially in a dynamic environment (Senge, 1990b). A potential limitation is its lack of credibility in incorporating the intangible assets of the organizations for value creation, as recognized by Repenning & Sterman (2002, p. 292) as the "interaction among the physical, economic, social, and psychological structures". As put by Bobbitt & Ford (1980), the alignment of product, process and supply chain needs sufficient orchestration with the potential contingency variables like organizational inertia (Boeker, 1989), organizational mindset (Miller & Droge, 1986) or image (Levy, 1959; Marr, 2007). Researches signify the need to capture the holistic interactions in organizations, supply chains with their surrounding environment in a systemic view; beyond the component view (Senge, 1990b; Dooley, 1997).

3. RESEARCH QUESTIONS

The formulation of the research questions are related to the development of the research model as mentioned in Figure 1.

Take in Figure 1: Research Framework

Subsequently, the questions addressed in the paper are: (i) how synthesis of CSFs is related to 3-DCE linkages and their interact-abilities (ii) what gap is evident in devising CSFs, hence organizational success, from 3-DCE perspectives (iii) what wider lens is required to extend the 3-DCE model, how and why? what is the common denominator existing in developing the success factors?

4. METHODOLOGY

The paper adopts an intermediary approach combining the facets of both explanatory and exploratory researches. The conceptual framework of the paper is based on a matrix for organizational mapping of firms in the TCF industries according to their competencies/capabilities based on the product, process and supply chain perspectives of 3-DCE, along routines of innovation and specialization, earlier developed by authors. The study also develops a list of most important TCF success factors – somewhat intermediate to the macro CSFs obtained through environmental scanning (by going beyond industry-firm focus) and the micro level analysis of CSFs arising from development of firm-specific internal business processes with sufficient temporality; via review of the relevant literatures in this field (Table 1). A detailed content analysis is chosen to define the scope of 3-DCE and relate it to product-process-supply chain designing attributes as identified by TCF firms. Results of the content analysis on 3-DCE designing are highlighted in Table 1 along with its connection in generating the required CSFs. Table 2 denotes the characteristics and attributes of 3-DCE designing we analyzed through the survey. The paper holds a constructivist epistemological position, through abductive reasoning, as the research framework is derived from the

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interplay of product-process-supply chain designing aspects and CSFs underpinning organizational success. However, justification of the complementariness of 3-DCE design aspects and intangible value design is provided through rational viewpoint based on observations and survey results.

TABLE 2. Identified attributes considered for product–, process– and supply chain– designing and the CSFs

PRODUCT DESIGNING	**IDENTIFIED CSFs FOR TCF ENTERPRISES**
- Product variety-volume and portfolio - Product Quality - Product life cycle - Product Price - Product Innovation (Different degrees) - Rates of product development and innovation - Lead times - Brand Value, Technology, Functionality **PROCESS DESIGNING** - Process Innovation - Process System Capabilities (value addition, quality, responsiveness, cost efficiency, innovation) - Process Engagement - Rate of Process development **SUPPLY CHAIN DESIGNING** **SC Architectural design** - Sourcing decisions - Contracting or SC relationship decision making - Make/buy decisions ↓ Focus on collaboration, cost minimization, Quick Response (QR), Quality functions, Flexibility & Coordination, Social & Environmental concerns - Coordination decision/Logistics - SC Partnership criteria (production, technology, marketing etc.) - SC rate of development (in design, capability, product-process, organizational structure) - SC Integration - Differentiated SC Strategy (Decoupling supply chain)	Cost Minimization Price Level Product/Service Quality Lead Time Productivity Supply Chain & Product Flexibility (Volume, Mix) Coordination & trust Brand Value Service Level Information Sharing Innovation Sustainability Concerns (Social, Environmental, Economic) Organizational Culture

4.1. Data Collection

The research framework, hence its validation has been based on an extensive semi-structured survey conducted on 42 Swedish companies representing various levels in the TCF value chains. A properly framed questionnaire containing questions divided into 5 sections viz. General Business Information, Critical Success Factors, Product Design, Supply Chain Design, and Process Design was prepared and mailed to 290 firms between December 2009 and February 2010. The selection of the firms was based on contacting TEKO (TEKO, n.d.) - the business and employers' organization for the Swedish textile and fashion companies - and searching through Europages directory. Convenience- and judgement- based non-probabilistic sampling techniques were combined for selecting the companies based on the following selection criteria: all the companies were Aktie Bolag (public listed in Sweden), were common in both the lists and had a proper contact detail convenient for mailing survey. Usable responses were obtained from 42 enterprises for detailed analysis, making it around 15 percent, which must be considered satisfactory for this type of open-end surveys (Forza, 2001, 2002 mentions that 20 percent can be considered a considerable response rate in the operations research field). The survey employed four different question formats: Likert scales (1-5), multiple responses, metric scale measurement and open-end questions. The basic results indicate how product-process-supply chain design is vital for organizations and what are the key success factors synthesized by them to be successful.

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Among the respondents more than 50% reported an increasing profit margin in the last 5 years (52.4% precisely) while nearly 31% informed a decline in the same period. Earlier analysis by authors showed that the successful firms, considerably, have higher levels of innovation and/or specialization across product, process, and supply chain aspects. Though the respondents include various firms, ranging from yarn manufacturers, fabric manufacturers, dyeing houses, apparel manufacturers, industrial goods producers, marketers, branded retailers, the paper considers that the basic CSFs identified by these firms are significantly similar, and supports the basic skeleton of underlying success - driven by innovation and/or specialization. However, a detailed analysis of the survey results required classifying the companies into three broader groups viz.; Group 1: Consumer goods manufacturer/marketer (B2B), Group 2: Consumer goods retailer (B2C), Group 3: Industrial goods manufacturer (B2B), for easier representation and analysis. Table 3, below, highlights a succinct demographic profile of the respondents.

Table 3. Enterprise characteristics

	Percent
Firm's annual turnover – 2009 (in SEK)	
15M or less	20
16M to 50M	27.5
51M to 250M	35
251M to 1000M	7.5
More than 1000M	10
Number of employees	
Fewer than 20	37.5
20 to 50	32.5
51 to 500	17.5
More than 501	12.5
According to position in Global Textile Complex (overlapping)	
Group 1: Consumer goods manufacturer/marketer (B2B)	85.7
Group 2: Consumer goods retailer (B2C)	25
Group 3: Industrial goods manufacturer (B2B)	20

4.2. Data Analysis

Statistical analysis using SPSS 17.0 was done with the responses related to CSFs, profit-ratio, product–, supply chain–, and process– designs with the objective to identify the relationships as in Figure 1. The operational success of the companies was measured using profit margin and how the companies related their business portfolio in terms of achievements along the key success factors chosen for representing their performance, using Likert scale. Questions related to product design specifications were divided into the routines of innovation and specialization. Product innovation questions aimed at finding out different degrees/intensities of innovation along with how the companies perceive themselves to be competitive in terms of product brand value, new design, new model, new material, new technology, and better functionality, as success drivers in 5-step Likert scales. Product specialization characteristics were resolved into identifying where the companies position themselves according to variety and volume of their main product (Hayes & Wheelwright, 1979a, 1979b) and was later transformed into convenient Likert ratings where required. The supply chain designing section started with a pictorial question of the value chain aimed at identifying the respondent's position in the Global Textile Complex, essential for identifying their position in the value chain. Supply chain innovation questions were aimed at determining the extent of supply chain structural innovation, what factors motivate it followed by criteria for supply chain partnership, all represented in five-step Likert scale from 'very low'/'not at all' to 'very high'/'completely'. The supply chain specialization aspect was derived by tabulating the responses obtained to 'how the company decouples its value chain (lean, leagile or agile)'.

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This was similar for the process design section aimed at determining the extent of innovation, process engagement and how the respondents differentiated their processes from its competitor.

Inferential statistical analyses along with cross-tabulation of answers were carried out to determine the simultaneous and concurrent effects of designing across 3-DCE attributes on the CSFs. Correlation tests at 5% significant level were conducted, where required, to find out the predictive relationship between the independent variables (3-DCE designing aspects) and how they affected the dependent one (success drivers or profit). Component factor analysis was also carried out for resolving the variables determining product and SC designs. A factor analysis was also inevitable to resolve the CSFs into components, most essentially generating them and identify along the 'extended' 3-DCE domain. The aim of conducting principle component analysis (PCA) goes in line with the objective to find the common denominators (the different 3-DCE linkages) devising the CSFs. Designing the common denominator (or identified 3-DCE linkage) will, possibly, synthesize the required success drivers in the organization. In the principle component analysis the positive factor loadings were retained for identifying all the possible variables adjusting those factors, rather than attempting to prioritize them.

5. RESULTS AND FINDINGS

The results and findings from the survey are divided into five sections viz. critical success factors and competitive advantage, product designing and CSFs, supply chain designing and CSFs, process designing and CSFs, and overall findings from the survey.

5.1. Critical Success Factors

Among the key CSFs studied, product quality was considered to be the most important success factor for organizations (4.57^{o}[1]). In fact, there was no firm which rated product quality below 'high-priority' in the scale closely followed by high service level as another key performance driver.. The surveyed firms also prioritized high flexibility in product designing and supply chain; high supply chain coordination; and brand value as critical factors in driving success. Low lead times and responsiveness (3.95^{o}) and high degrees of innovation (3.85^{o}) were also considered as potential CSFs for leading success. On the other hand, price level benefits (2.57^{o}) were considered less imperative for leading business success.

5.2. Product Design and Success Drivers

Product design perspectives were typified along the routines of product innovation and product *variety-volume* specialization.
Survey showed that the 'highly' innovative firms had a positive correlation between their product-level innovation and service level while level of NPD also showed direct correlation to the firms' success drivers indicated in terms of product quality (r=.54, σ=.21), and brand value (r=.5, σ=.25). Figure 2 confirms that innovative product designing in terms of new design (4.07^{o}), new product model (3.93^{o}), or high product functionality (3.83^{o}) were salient features in firms considering innovativeness as a critical success factor, compared to its competitors. High level of product branding also showed a positive relationship (r=.57,

[1] Average 5-point Likert scale ratings represented as x^{o}, where x = the analyzed variable, from now-on in the paper

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p=.01) to organizational brand perception. Another interesting observation was that firms which considered 'high quality' as an important success factor laid considerable emphasis on characterizing their products by high degrees of functionality and their use value (4.05^{e}).
An overall trend was observed, which suggested that most of the firms with high profit (55%) showed 'very high' level of innovation in terms of product designs, product model, new technology, functionality, or brand value while only 28% of the firms showing lower profit-ratio show such levels of innovation.

Take in Figure 2: Product innovation characteristics

Findings also supported that product innovation characteristics show a positive correlation with average innovativeness of the firm required for developing competitive advantage (Table 4).

TABLE 4. Pearson correlations (r) for innovation as a CSF and product innovation characteristics

Control Variables			Brandvalue	Newdesign	Newmodel	Newmaterial	Functionality	Newtech
Prod Q	Innovation	r	.005	.072	-.014	.064	.026	.008
		Sig.	.978	.657	.932	.695	.873	.963

The spectrum of product *variety-volume* relationship is quite diverse with concrete alignment observed in firms showing higher profits. The firms with higher operating profit, in general, had higher number of product variants for their main product range (~100-500) compared to ~10-100 for lower profit building respondents. Organizational competency mapping helped to characterize the firms' product capacity according to their volume, as well. Most of the firms either recorded considerably high-volume product portfolio (54%) or unique, individualized products (33%). Identification of the right product *variety-volume* portfolio is crucial to create product development capabilities like product design (flexible specialization through modularity) (Fine, 1998), product performance and quality, cost minimization & higher productivity (through economies of scale), higher product-volume flexibility and higher service level (through product customization); contributing in devising success drivers.

5.3. Supply Chain Design and Success Drivers

Supply chain designing highlighted in the paper considered supply chain structure design related to sourcing (choose firms in firm's value chain), contracting (decide type of relationship among all SC members in firm's value chain), and coordination, or make/buy (determine whether to manufacture or purchase).
Figure 3 suggests that most of the firms realized the importance of designing their supply chain. Over 40-48% of the firms considered these SC innovation criteria to be imperative and a precursor for winning SC performances. Findings show that SC innovation was higher (3.86^{e}) for firms having higher profit compared to those showing lower/declining profits (3.38^{e}).

Take in Figure 3: Supply chain innovation through architectural design

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Table 5 supports the above findings showing that there exists a positive relationship between the studied success factors and the supply chain design perspectives, though price level and organizational culture did not show much coherent relation to the SC design attributes. It can possibly be inferred that appropriate SC designing is instrumental in creating high competencies and hence increase the intensity of the success factors in the organization.

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TABLE 5. Pearson correlations for SC architecture design perspectives and 13 CSFs[2]

		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
A	r	.108	.118	.132	-.063	-.028	.132	.034	-.019	.132	.222	.052	.100	-.183
B	r	.255	.092	.058	-.207	.179	.220	.120	.000	-.009	.306*	.042	.195	-.097
C	r	.219	.377*	.089	.319*	-.017	.158	.091	-.084	.053	.118	-.057	.172	-.079
D	r	.048	-.035	-.033	-.255	.105	-.006	.051	.057	.114	.246	.232	.045	-.094

* $p < .05$, ** $p < .01$

Findings showed that higher SC innovation in terms of sourcing decisions foster higher flexibility in the value chain while higher coordination & trust is developed through enhanced decision-making in supply chain relationship along with increased coordination decisions. Determining the sourcing and contracting decisions were also instrumental in controlling the success factors viz. product quality, time-to-market (TTM), minimization of cost, service level and information sharing among chosen partners.

Further, supply chain designing perspectives were considered, by 57% of the surveyed firms, as crucial in yielding success factors like high service level (4.54^{e}), shown in Figure 4. This is instrumental in developing higher service quality through more customer and supplier involvements yielding lower costs, lower TTM, and improved quality. Higher SC flexibility (4.36^{e}) and quick response to demands (4.09^{e}) were also considered essential to respond to demand fluctuations, volatility and uncertainty in the market. Apart from that other CSFs arising out of supply chain designing were improved collaboration in product development (3.64^{e}); cost minimization (3.69^{e}) due to proper selection of sourcing partners and effective make/buy decisions; and higher sustainability concerns (3.9^{e}) to reduce social and environmental effects of global supply chains. Coordination across different processes viz. manufacturing, logistics and distribution, inventory management, marketing etc. was also significant for most the firms (~80%) for developing dynamic capabilities and effective resource utilization, as theorized by Aoki (1990).

Take in Figure 4: Criteria for supply chain architectural design

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It was also evident that the clothing firms mostly considered designing their supply chain for effective partner selection for acquiring more knowledge related to process and technology. On the other hand, the industrial goods producers selected their partners mainly for raw materials and logistics. The clothing retailers and marketers chiefly externalized for production capacities (3.36^{e}) and allied technology (3.9^{e}) and logistics (3.45^{e}) while internalizing their marketing and sales activities, information systems and branding and designing. Findings explain that developing partnerships through effective SC designing is critical for synergistic integration with suppliers and other SC collaborators for building competitiveness. This can be conceptualized as, 'expanding the periphery while shrinking the core' and build-in critical systemic integration and core specialization, corroborated by Prof. Gulati in his book 'Re-organize for Resilience (2010). Surveyed firms also showed high value chain flexibility (~4.25^{e}), service level (~4.5^{e}) and supply chain coordination (~4.2^{e}) by reconfiguring their partner relationship, key success factors in today's uncertain business climate (Matthyssens *et al.*, 2005; Hitt, *et al.*, 1998; Christopher & Lee, 2004; Wong, 1999).

Take in Figure 5: Partnership selection criteria and CSFs

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[2] 1. Product quality 2. Lead time 3. Cost minimization 4. Price level 5. Productivity 6. Flexibility 7. Coordination & Trust 8. Brand value 9. Service level 10. Information sharing 11. Innovation 12. Sustainability concerns 13. Organizational History

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Another important finding emphasized that firms with comparatively higher rate of developmental change in terms of SC design and structure (3.3^e vs. 3^e), capability (3.4^e vs. 3.15^e), and organizational structure & mindset (3.75^e vs. 3.15^e) showed higher economic viabilities compared to those showing lower/declining profits.. It exemplifies that harnessing a culture of change creates and sustains growth, necessary for flexibility and adaptivity in the organization (Jones *et al.*, 2005; Matthyssens *et al.*, 2005; Hitt *et al.*, 1998; Swafford *et al.*, 2006).

The survey also reveals some important considerations of how the supply chain performance drivers on the basis of market orientation [customer relations and closeness (3.64^e), branding and marketing (3.56^e)], technical aspects [innovation and technology (3.73^e), manufacturing specialization (3.56^e), and information systems (3.31^e)], price competition (3.27^e) and high capital and financial assets [High ROI (2.68^e) and turnover volume (2.83^e)] are essential for dominating global value chains, as considered by the respondents. Such determination is essential to identify the key factors like technology and innovation, branding, flexibility, process specialization, information sharing requisite for successful performance (Hitt *et al.*, 1998; Barney, 1991, Ferdows and de Meyer, 1990).

Internal and external specialization of organizations along the supply chain is also imperative to identify the needs of the customer, initiate flexible specialization (agility) and eliminate non-essential components (leanness) (Bruce *et al*., 2004). Investigation showed that the high profit firms with differentiated SC strategy and customer-order decoupling point (CODP) pushed upstream (Make to Order – MTO, Engineer to Order – ETO) sustained their need to respond rapidly by having higher flexibility (4.22^e) and coordination (4.22^e) as key SC performance drivers. On the other hand, firms having CODP upstream but showing lower/declining profit seemed to underrate flexibility and coordination in their supply chain compared to other peers. Similarly, the high profit firms having CODP downstream (Deliver to order – DTO, MTS – Made to Stock) showed higher consideration for cost minimization (3.5^e) and productivity (3.7^e); as CSFs; compared to the other peers (3.44^e and 3.65^e respectively), indicating the need to follow lean principles for forecast-driven supply chains. These findings support the essentiality to match the requirements for dynamic capabilities to the product characteristics and business model for successful performance as researched by Lau (1994), Fischer (1997), Hamel (2000) and others.

5.4. Process Design and Success Drivers

The construct of process designing, in the paper, focuses on management, methods, technology, operations, and equipments related to most essential activities in the textile and clothing value chain (Hung, 2006; Koufteros & Vonderembse, 2002; Brown & Eisenhardt, 1995; Fine *et al*., 2005; Safizadeh *et al*., 1996). Companies with higher profit showed increased process engagement compared to those with lower/declining profits suggesting that higher degrees of process control is significantly important in improving operational, hence financial, performance. It was interesting to note that companies showing higher profit-ratio had higher extent of process engagement with a positive correlation with the CSFs while for those showing lower/declining profits the correlation was negative (Table 6).

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TABLE 6. Pearson correlations (r) of CSFs to extent of process engagement

	CSFs →	1	2	3	4	5	6	7	8	9	10	11	12	13
PD	r (higher profit firms)	.298	.042	.089	.132	.219	.072	.065	.199	-.210	.206	.370*	-.071	-.062
	r (lower/declining profit firms)	-.365	-.276	-.067	-.038	-.067	-.215	-.260	-.135	-.266	-.412	.010	-.271	-.444
Manufacturing	r (higher profit firms)	.204	-.049	.015	.026	-.044	.122	.037	.186	-.120	.219	-.089	-.244	.084
	r (lower/declining profit firms)	-.560*	-.440	.191	-.114	-.070	-.334	-.060	.146	-.011	-.107	-.046	-.529	-.333
Logistics	r (higher profit firms)	.337	-.170	.023	-.214	-.080	-.020	-.285	.065	.044	.180	-.286	-.257	.261
	r (lower/declining profit firms)	-.399	-.357	-.073	-.162	-.073	-.549	-.138	.187	-.044	-.011	.056	.131	.263
Marketing	r (higher profit firms)	.216	.000	.143	.118	.042	-.022	.036	-.146	-.014	.233	-.180	.019	.056
	r (lower/declining profit firms)	-.343	-.325	.082	.156	.082	-.437	-.082	-.085	-.138	-.059	.085	-.112	-.033

* $p < .05$, ** $p < .01$

In light of the results concerning higher correlation between studied CSFs and degree of process engagement for firms with higher profit, it can be corroborated that operational performance for organizations may possibly have linkages to process engagement to generate success factors through higher degrees of control, process internalization and integration. Higher control of product development confirmed positive relationship with improved product quality, brand value, and innovation for developing competitive advantages, while, higher manufacturing control associates increased flexibility in production and hence higher productivity, as considered by the high profit firms. Higher logistics and marketing management facilitate improved control on price, higher marketing service innovation, as well. The high profit organizations consistently specified their processes, generally, to be more value-adding, responsive, high quality, cost efficient, and/or more innovative compared to its competitors as a point of differentiation to generate priorities (Figure 6).

Take in Figure 6: Factors for process differentiation

Process innovation is another crucial criterion for process designing to match innovative products and supply chains. Findings highlighted that nearly 60% of the firms were mostly engaged in redesigning existing processes in terms of process management, technology, operations or equipments to match their innovative product portfolio or changes in supply chain or market demands, a requisite as theorized by Bolwijn, and Kumpe (1990). Around 35% of the companies did still show lower levels of process innovation, whereas, complete process development or innovation was observed only in 5% of companies, mostly the highly innovative industrial textile producers.

5.5. Overall Findings

It was clearly evident from the results of the survey that product design, supply chain design or process design perspectives, are imperative in synthesizing various competencies, hence, key success drivers in the TCF firms.

6. DISCUSSION AND ANALYSIS

6.1. Product-Process Designing and CSFs

Concurrent engineering (CE) perspectives show realization along different CE conceptual areas viz. design for cost (DFC), enabling technology (DFET), lifecycle use – inspectibility, maintainability, and reliability (DFLC-I, DFLC-M, DFLC-R), manufacturability (DFM), and quality (DFQ) (Kincade *et al.*, 2007). Analysis of CE perspectives was done along two routines viz. 'product-process designing for specialization: exploiting capabilities' and

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'product-process designing for innovation: exploring opportunities' to investigate how they yielded CSFs.

It was observed that firms specializing in 'unique' or 'one-of kind' products in their product segments strived for higher customization (4.29^{e}) with higher degrees of process engagement in product development (3.94^{e}) and marketing (4.53^{e}). These firms mostly, build-up their process competencies through differentiation to match their unique product characteristics by designing for quality and lifecycle-use to meet the customer expectations; involving customers in the co-creation process. Most of these firms differentiated product development either through value addition (50%), high quality (~30%), or innovation (~41%); or through manufacturing techniques (DFM) through cost-effectiveness or high quality. Using DFQ, firms recognized product designing and manufacturing to meet the customer's expected quality requirements. Nearly 50% the firms considered their marketing activities to be responsive and value added, as well. This highlights that CE designing is inevitably a powerful tool for firms to build-up their competencies to achieve reduced lead times, minimized cost, higher flexibility, higher service level, high coordination and efficient information sharing, as critical success drivers. The goal of CE is highly compatible with the goals of a consumer-centric firms using mass customization with particular sensitivity to time-to-market demands (Tseng and Jiao, 1995; Kincade *et al.*, 2007).

On the other hand, firms concentrating on high volume or mass produced apparel or textiles also showed high degrees of engagement e into quality product development, realizing the concurrent design perspectives by designing for cost, manufacturability and quality for greater economies of scale, in the lines of Hull *et al.* (1996). Such control over product development and manufacturing processes were instrumental for differentiation from competitors through cost leadership. Firms controlling their manufacturing processes (3.73^{e}), inspite of rapid outsourcing trends, also considered high quality and cost efficiency as key to cost effectiveness and production flexibility. Most of these firms also rated marketing practices highly (3.92^{e}); concentrating on innovation and cost effectiveness. At the organizational level designing for such concurrent engineering practices yielded CSFs like reduced lead time (4.08^{e}), productivity (3.88^{e}), flexibility (4.35^{e}), and service level (4.4^{e}) imperatively.

CE routines through innovational product design, model functionality, technology or branding matched with redesigned processes (in process management, technology, equipment, operation) was significantly critical among the profitable firms, surveyed, to cater their innovational competencies. The extent of process redesigning enhanced with increase in level of product innovation. For respondents showing high product-process innovation with inherent strategic fit high product quality, time-to-market, supply chain flexibility & coordination, high brand value, and service level were distinct as key success drivers for gaining competitive priorities by attaining innovation routines.

The investigation thus determined the potential of simultaneous and concurrent CE designing in order to support future re-organization and implementation of strategies matching the business model and synthesize necessary success factors.

6.2. Product-Supply Chain Designing and CSFs

Simultaneous and concurrent product and supply chain designing contributes to synthesis of certain success factors, as well. Product design specifications across the domains of product–

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innovation and specialization were distinguished into 3 factors viz. (i) Category 1 - with NPD technological innovations for improved functionality, (ii) Category 2 - with innovations through new design etc. for enhancing the fashion content and brand value and (iii) Category 3 - with specialized product characteristics through higher variety-volume; as in Table 7 (i). Supply chain design characteristics also showed distinction into two distinguishing factors when subjected to principle component test. Category 1 identified as SC design specifications for physically efficient supply chains and market-responsive supply chains (Fisher, 1997) (supply chain specializations), loaded considerably by characteristics like cost minimization, quick response (QR), quality of service, flexibility and coordination, and sustainability concerns while Category 2 mainly for innovative supply chains with more concentration on collaborative product development (CPD), cost and quality; as shown in Table 7 (ii).

TABLE 7. Factor analysis

Component Matrix

TABLE 7 (i)[a] Factor analysis for product design specifications

	Product Characteristic Category 1	**Product Characteristic Category 2**	**Product Characteristic Category 3**
Brand value		.686	.426
Functionality	.784		
Technology	.934		
Fashion Content		.754	
Customization		.583	
HighVariety- Volume			.700

[a] Principal Component Analysis, 3 components extracted, other items deleted due to low loadings

TABLE 7 (ii)[b] Factor analysis for supply chain design specifications

	Category 1	**Category 2**
CPD		.707
Cost minimization	.760	.497
Quick Response	.829	
Quality of service	.785	.561
Flexibility and coordination	.784	
Sustainability concerns	.761	

[b] Principal Component Analysis, 2 components extracted, other items deleted due to low loadings

Product-supply chain design relationships revealed significant correlation between the performing design attributes, as well. The operational performances of companies analyzed in terms of their CSFs to emphasize how these competitive priorities are developed through simultaneous product-supply chain designing. Textile firms with high technology-driven product innovation (>4[e]; indicated in terms of functionality and technology) and matched through collaborative supply chain designs showed significantly higher organizational innovativeness compared to the average value for other firms (Table 8). On the other hand, companies with high-fashion products characterized by high– fashion content and branding and sufficient market-responsiveness through high flexibility and QR, showed high coordination and brand value for driving their competitiveness, compared to their competitors. However, results failed to show appreciable competitiveness in terms of time-to-market and SC flexibility for firms having higher design attributes. For the third category, of product-supply chain design strategic fit for *high variety-high volume* (functional) products, comparatively higher significance of price level, productivity, and service level were noticeable for companies adept at product-supply chain designing. An effective product-supply chain design fit proved to be instrumental in devising certain competitive priorities for organizations critical for success, as theorized by Christopher and Towill, 2001; 2002; Mason-Jones *et al.*, 2000).

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TABLE 8. Performance relative fit between products and supply chain designing to yield CSFs

CSFs →	1	2	3	4	5	6	7	8	9	10	11	12	13
μ	4.57	4.00	3.59	2.57	3.76	4.23	4.19	4.00	4.37	3.64	3.83	3.69	3.57
σ	.501	.796	.734	1.23	.576	.692	.706	.987	.671	.655	.729	.811	.940
Product Design (Category 1) – SC Design (Category 2) (Functionality, Technology – CPD, Cost Minimization)													
μ	4.50	3.50	3.33	2.83	3.83	4.00	4.00	3.83	4.17	3.33	4.00	3.50	2.83
σ	.547	.547	.516	.983	.408	.000	.632	.983	.753	.516	.000	.547	.752
Product Design (Category 2) – SC Design (Category 1) (Customization, Brand Value, Fashion Content – All: CPD, Cost Minimization, QR, Flexibility & Coordination, Quality of Service, Sustainability concern)													
μ	4.46	3.85	3.62	2.62	3.85	4.15	4.23	4.17	4.38	3.54	3.77	3.54	3.15
σ	.518	.800	.650	1.192	.375	.375	.725	.912	.650	.518	.438	.660	.800
Product Design (Category 3) – SC Design (Category 1) (High Variety-Volume, Brand Value – All: CPD, Cost Minimization, QR, Flexibility & Coordination, Quality of Service, Sustainability concern)													
μ	4.60	3.40	3.60	1.80	3.80	4.20	4.00	4.00	4.40	3.80	3.60	3.80	3.60
σ	.547	.547	.894	.447	.447	.447	.707	1.000	.547	.836	.894	.447	.894

6.3. Process-Supply Chain Designing and CSFs

Simultaneous and concurrent supply chain and process designing showed imperative linkages, when firms concentrated on their structural designing along sourcing, coordination and make/buy decisions with focus on innovative process engagement techniques. Such supply chain-process fit was observed to yield improved product quality, time-to-market and cost leadership for setting competitive advantage over other firms, shown in Table 9. This ensures capability development across different processes into *design for supply chain* and strategy, coherent with ideas corroborated by Fine (1998), Jain *et al*. (1991), Cavinato (2005) and others, thus, emphasizing higher level of coordination, planning and organizational innovation to impact higher profitability. Another important success driver evolving out of supply chain-process designing is increased collaboration through increased customer-supplier information exchange, inevitable for enhancing transparency, coordination & trust, and reduce cost. Brand value also show significant development due to higher transparency, customer relationship and orientation.

TABLE 9. Average CSF ratings for companies showing simultaneous supply chain-process design innovations

CSFs →	Product Quality	Speed	Cost Minimization	Price Level	Brand Value	Information Sharing	Innovation
μ (σ) (1)	4.66 (1.00)	4.11 (0.9)	3.77 (0.89)	2.88 (1.32)	4.44 (1.07)	3.88 (1.4)	4 (1.5)
μ (σ)(2)	4.57 (0.49)	3.95 (0.60)	3.55 (0.77)	2.57 (1.33)	4.05 (0.79)	3.63 (0.88)	3.85 (0.83)
(1): Firms with high process-supply chain designing fit (2): Firms lacking process-supply chain designing fit							

Results showed that organizations with agile/leagile supply chains, sufficiently valued responsiveness and flexibility to support their responsive, high quality and value added processes and considered reduced time-to-market very critical for product development (4.04$^{\theta}$) and marketing (4.07$^{\theta}$). These firms also considered higher branding through product development (4.76$^{\theta}$) and marketing (4.92$^{\theta}$) to be drivers of their improved operational performance, as said by Christopher and Towill (2001; 2002). The criticality of operating a lean/leagile supply chain with optimized process designing through higher quality, value addition and cost efficiency show that companies generate higher operational performance in terms of product quality (4.62$^{\theta}$), and cost minimization (3.66$^{\theta}$) during product development. Such supply chain-process designing aspects has been an imperative requisite for gaining higher productivity (3.78$^{\theta}$), product quality (4.65$^{\theta}$), and cost optimization (3.65$^{\theta}$) through resource-utilized manufacturing, and improved channel of distribution, as argued by Småros et al. (2003); Krajewski and Wei (2001). Supply chain-process design linkages aligned along

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the routines of innovation and specialization are, thus, instrumental in fostering increased operational performance for organizations by improving their success factor ratings.

6.4. 3-DCE Designing and CSFs

Overall routines of organizational success (in terms of profitability) showed that simultaneous designing for innovativeness across products, processes and supply chains were imperative for nearly a quarter of the studied firms. Innovational product designs, material or technology coupled with redesigned processes and matched supply chain architecture for establishing contracts and coordination, securing sourcing partners and determining make/buy decisions was key to strive for success drivers such as cost leadership (3.6^{e}) and fast response (4^{e}). This was inevitable to deploy the right customer focus, increased product design and technology and enhanced supply chain architecture (Fine, 1998), leading to higher organizational brand value (4.45^{e}) and proper alignment of organizational culture (4.27^{e}), significant, for strategic decision making and learning (Marr, 2007). On the other hand, firms with higher variety-volume product specialization and matched supply chain strategy also showed considerable strategic process engagement, control and planning. We speculate that firms having high variety-volume product portfolio and sustaining them through significant designing of lean/leagile supply chains, aimed at cost-efficient processes yielded higher degrees of cost minimization, price reduction and higher productivity (in case of manufacturing) for differentiation. For high fashion products, a focus on responsive supply chains characterized processes to be highly flexible (manufacturing or marketing), thus generating higher flexibility, coordination and reduced time-to-market as CSFs. Though this area lacks proper empirical research to support the efficacy of 3-DCE, Kopczak and Johnson (2003) provided evidence that such product-process-supply chain design integration can help firms to achieve competitive advantage.

6.5. Summary and Gap Analysis

Overall, in this section of 'Discussion and Analysis', we highlighted the critical relationship that exists between the explicit linkages of 3-DCE; focusing on two or sometimes all three elements of it; to key success drivers. All the linkages, when devised effectively, were instrumental in developing key success drivers and competitive advantages, in different ways, by contributing to operational performances and organizational profitability, as argued by Ellram *et al*. (2007), as well. However, certain success drivers (the intangible values) like organizational culture, knowledge, image, relationships etc. were less dependent on the 3-DCE building blocks (Marr, 2007; Bobbitt & Ford, 1980; Molnar, 2004; Repenning & Sterman, 2002). Thus, 3-DCE should not just consider the relationship among processes, but must also consider the human factors and intangible value assets for successful implementation and execution, considering the systemic view of the organization as complex adaptive systems in a dynamic environment (Senge, 1990b; & Sterman, 2002). Thus we underpin here the need to extend the 3-DCE building block of organizations by incorporating organizational culture and skills in the perspective of a dynamic environment as corroborated by Robb (2002), as well. The next section conceptualizes this further by carrying out a PCA to identify the common denominator required to synthesize the critical success drivers for TCF firms.

6.6. Operational Pattern in achieving CSFs

A principle component analysis was conducted to investigate to what extent companies view

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the identified success factors to be managed together and what is the common denominator requisite for organizational design. Addressing the above-mentioned limitations, the investigation was also aimed at analyzing whether practice of 3-DCE concepts can devise (unique) combinations of the success drivers, key to organizations or there is a requirement of an even wider lens to view the challenge of managing a holistic and dynamic set of the critical success drivers. Based on the key 3-DCE concepts supported through various literature streams we expected to find a common factor that matched concurrent product and supply chain designing characteristics. Table 9, highlights Component 1, predominantly characterized by improved product quality, cost minimization, price reduction, higher resource utilization through increased productivity, higher flexibility and responsiveness, and innovativeness. There is sufficient match between these factor loadings (as CSFs) through product-supply chain designing. However, flexibility is quite insignificantly loaded, may be due to lack of proper process linkages. Another important factor: 'organizational brand value' which inevitably builds-up through synchronized product-supply chain designing, was also less represented.

Additionally, concurrent designing, a highly discussed topic in recent researches, characterized development of various CSFs, essential for developing competitiveness of textile and clothing firms. These are higher product quality, cost leadership, higher customer satisfaction hence increased service level, reduced time-to-market, responsiveness, and improved efficiency (c.f. Table 1). CE perspectives and Component 2 (c.f. Table 10) shows considerable fit, though with certain exceptions.

Proper supply chain-process designing also synthesizes various success factors like improved information exchange, cost and price reduction, higher service level by attaining improved coordination, higher responsiveness and, invariably, higher innovation characteristics (c.f. Table 1). Branding is also an important issue corroborated through supply chain-process designing, owing to higher coordination. Component 3 (c.f. Table 10) illustrates similar success pattern evolving out, though flexibility & responsiveness and higher service level were under represented. However, many of the surveyed firms managing these key success drivers actually gained them by designing their processes and supply chain concurrently.

It is also evident that a fourth component represented as Component 4, sufficiently engineered by developing competencies through higher brand value, innovation, sustainability concerns and organizational culture and mindset, is complimentary to Components 1-3 (c.f. Table 10). In the lines of several researches (Marr, 2007; Bobbitt & Ford, 1980; Molnar, 2004; Repenning & Sterman, 2002) this component identifies the intangible elements of knowledge, image, relationships, shared vision and organizational culture as factors of increasing organizational effectiveness in terms of profitability and operational performances to be considered essential apart from the material foundation of 3-DCE designing. These long-term performance drivers are insignificantly represented or associated with the 3-DCE domain, lacking a theory building approach. It is thus inevitable to incorporate these intangible elements as a business success necessity into the core model rather than segmenting them in the periphery. Table 5, also, support these findings that organizational culture does not show coherent relationship to supply chain or product – design attributes and, hence, needs to be incorporated into the 3-DCE construct (Ellram *et al.*, 2007). This supports the need as identified by Repenning and Sterman (2002, pp. 292) as it requires recognition of, '…ongoing interactions among the physical, economic, social, and psychological structures' beyond just the process-oriented relationships of present 3-DCE model for execution in a dynamic environment (Senge, 1990b; Repenning & Sterman, 2001).

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It has, thus, become imperative to extend the existing 3-DCE concept into an 'extended 3-DCE concept', as proposed in the research, incorporating value propositions/designing, contingency factors and human factors (Senge, 1990b; Repenning & Sterman, 2001). This can be associated with the ''extended 3-DCE concept' represented by Component 0 (which we call designing for organizational resilience). This component acts as a common denominator in managing and embracing most of the key success drivers we identified for textile and clothing firms. This 'extended 3-DCE concept' can help by acting as a common basic building block for devising organizational structure and strategy as proposed by Miles and Snow (1978) – based on adapting to changes through product offerings, internal structures, and transformation processes, even though variations in overall design and alignment along the 3-DCE dimensions can certainly be found among firms (Bobbit and Ford, 1980).

TABLE 10. Principal Component Analysis of CSFs

	Component 0	Component 1	Component 2	Component 3	Component 4
Product quality	.319	.292	.030		.397
Lead Time	.520				
Cost Min.	.410	.139	.488		
Price Level	.141	.432	.166	.218	
Productivity	.538	.519		.176	
SC & Prod. Flexibility	.790	.048			
Coordination & trust	.709		.016	.303	
Brand Value	.257	.276	.366	.253	.675
Service Level	.542		.019	.301	.085
Info. Sharing	.547		.523	.036	.234
Innovation	.195	.687		.268	.351
Sustainability	.337			.040	.449
Org. Culture	.293	.023	.199		.678
	Extended 3-DCE designing	**Product+SC designing**	**Product+Process designing**	**Process+SC designing**	**Value designing**

Principal Component Analysis, 5 components extracted, other items deleted due to negative loadings

7. SUMMARY & CONCLUSION

In the paper, we have studied how the 3-DCE framework, practiced through simultaneous and concurrent designing of product-process-supply chain is an inevitable concept in synthesizing and sustaining success drivers for organizations, to focus on their operational performance, thus yielding success. The outcomes of the paper are manifold. Firstly, it shows that the basic concepts of product, process and supply chain designing, when practiced individually, are also aligned to render better operational performance for organizations (by devising CSFs) (c.f. 5.5). Secondly, when along the routines of innovation and/or specialization, simultaneous consideration of the 3-DCE linkages can yield and sustain myriads of CSFs. This helps the organization to understand the key areas in which to invest and how to invest their resources and time, as CSF identification is largely qualitative and can result in differing opinions in pinpointing them. It is thus recommended to synthesize or identify them from the 3-DCE perspective. However, the paper also highlights that the3-DCE model falls short to represent the intangible elements of culture, leadership and governance, knowledge, image and relationship into core considerations for devising success (c.f. 6.5). The design framework of an organization has, thus, been proposed to be based on product-process-supply chain-value designing on different hierarchical levels into an 'extended 3-DCE' model which has a positive mediating effect on the operational performance and hence organizational success. Along the lines of Robb (2002), the paper tries to yield empirical evidence of the building blocks of organizational design as 3-DCE architecture, skills and

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culture. A dynamic environment makes it more difficult to achieve high operational performance thus it has been proposed that this 'extended 3-DCE' framework is basic building block to adapt to changing environment and devise a more complex adaptive system. This asks for designing *resilience* in the organization to cope with a dynamic environment. However this requires further research for sufficient exploration, explanation and verification for relating this to the construct of resiliency capacity.

Firstly, the selection of sample size of organizations was small and arguments regarding its representation of the Swedish TCF firms' population could be raised. So the claims and propositions of the paper cannot be widely generalized. Secondly, the responses to the survey were based on judgments of the company top management and could vary if intra-organizational responses were considered.

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FIGURE 1. Research Framework

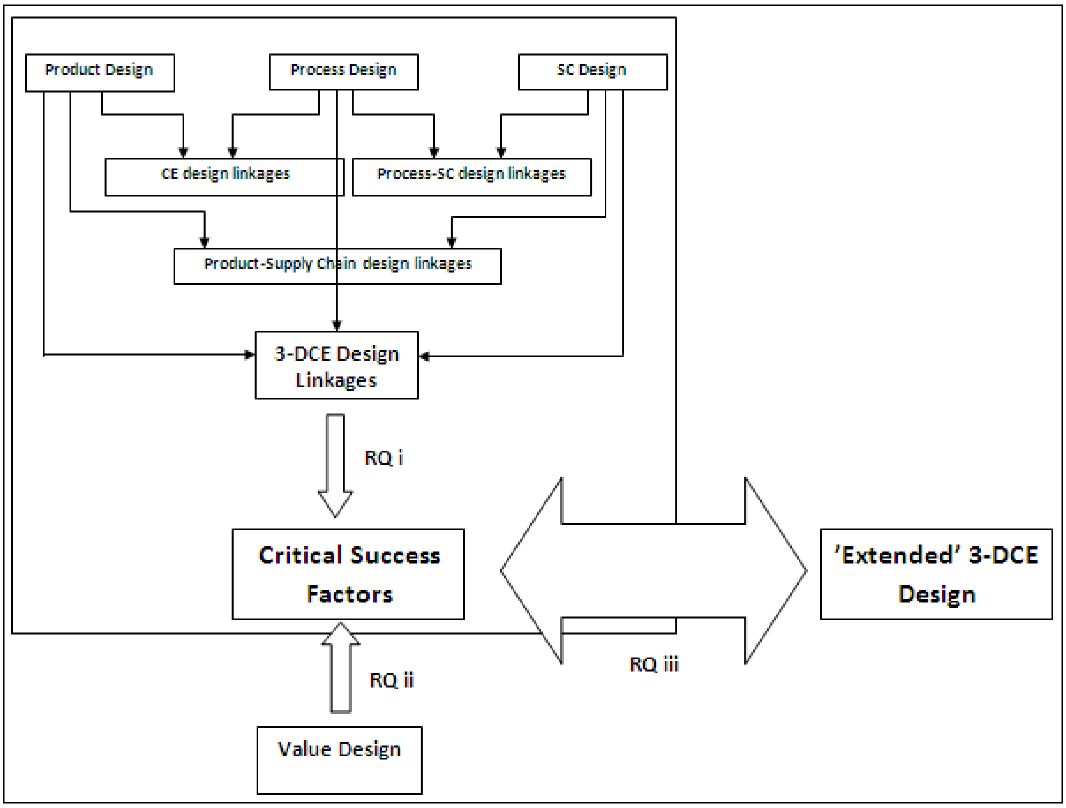

FIGURE 2. Product innovation characteristics

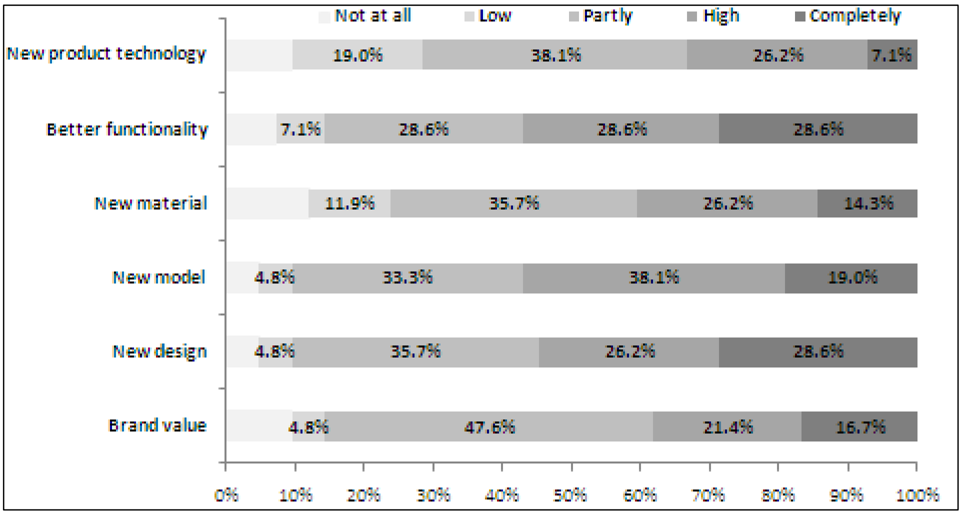

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FIGURE 3. Supply chain innovation through SC architectural design

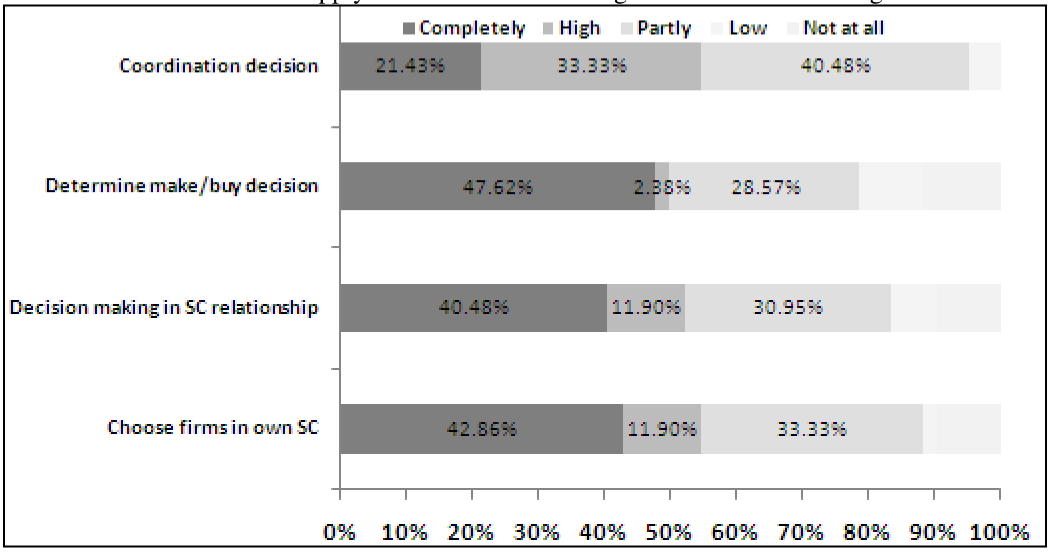

FIGURE 4. Criteria for supply chain architectural design

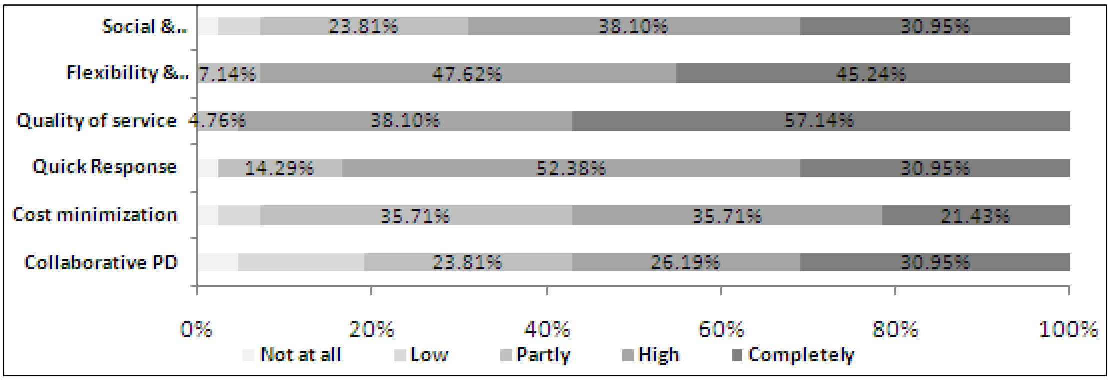

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FIGURE 5. Partnership selection criteria and CSFs

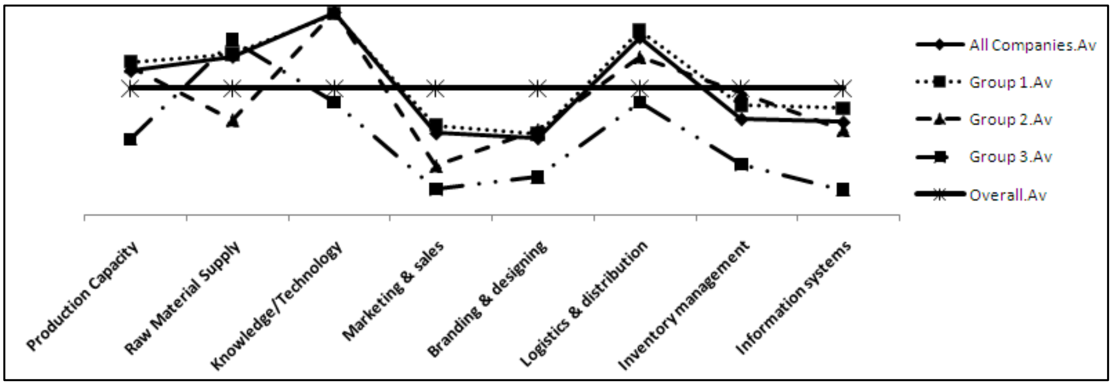
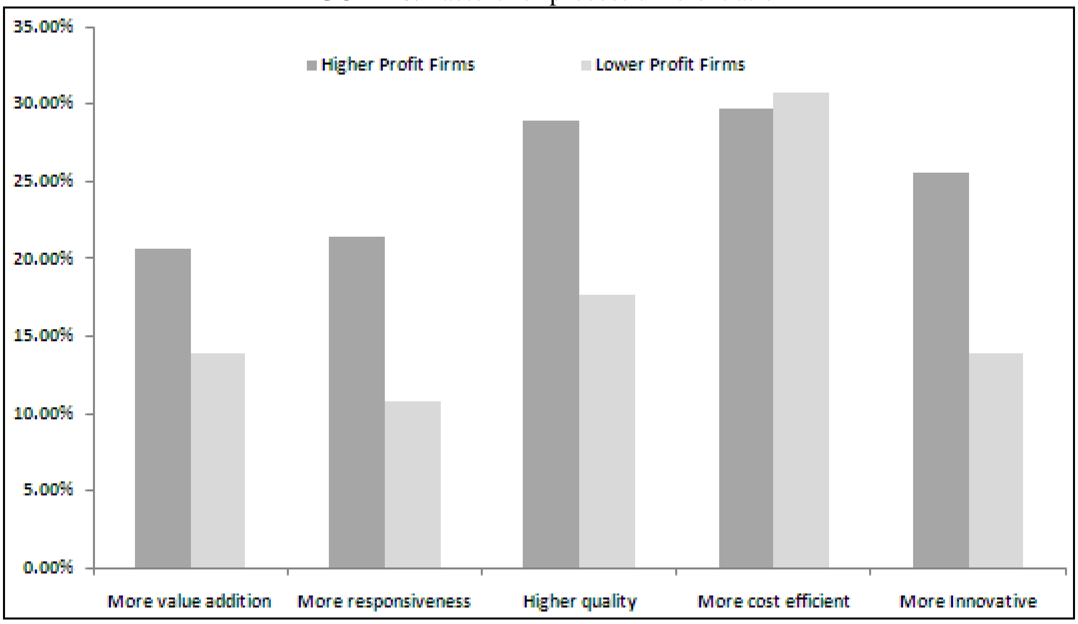


FIGURE 6. Factors for process differentiation



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