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A model of contextual factors and inter-organizational integration: A Grounded Theory study of two supply chains

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A Grounded Theory study of two supply chains

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Abstract

The purpose of this thesis is to contribute to understanding of the effect of organizational context on supply chain integration. One result is a context-based model that can provide support for practitioners regarding what level of integration to establish with suppliers and customers.

Given the notion that most organizations are dependent on other organizations, it leads to a need for not only cross-functional integration but also for integration across organizational boundaries. However, in many organizations the level of integration with suppliers and customers is often inappropriate, inefficient and limited mainly to dyadic integration of order processing and operational scheduling. The existing literature provides only a limited insight concerning the essential circumstances for the integration and the slow growth of the implementation of inter-organizational integration has been attributed primarily to lack of guidelines for creating business relationships with supply chain partners. In the literature, "the more integration the better performance" solutions have often been presented without consideration of very complex internal and external organizational environments of involved companies.

During recent years, questions have been raised regarding the nature of integration with suppliers and customers and the extent to which it can be accomplished. Instead of all-encompassing integration, selectivity has been suggested in terms of what level of integration should be applied to each link of the supply chain. The problem for an organization is not to find "one best way"; rather it is to search for solutions that advance integration and differentiation simultaneously. Preferable level of integration depends on many contextual factors associated with e.g. focal company, industry, competitive environment, and nature and type of products. However, in the previous research the focus has primarily been on studying single or limited sets of contextual factors and their impact on integration. These results are often fragmented, leading to multiple frameworks and models. A unifying model providing recommendations in terms of what level of integration to establish with suppliers and customers considering organization's specific circumstances is desirable. In this study, a large number of contextual factors of integration with suppliers and customers were identified and structured. Additionally, the relationship between these factors and level of the integration was clarified.

The study is based on the Grounded Theory methodology. To understand the effect of context on level of integration, two supply chains (triads) from two different industries - medical devices and fast moving consumer goods - have

been selected as core samples. Findings are based on in-depth analysis of qualitative data obtained from fourteen interviews with practitioners such as CEOs, SC managers, sales managers, purchasing managers, and logisticians. Following the Grounded Theory methodology, the analysis of the collected data was conducted in three major rounds divided into six steps. The results were compared with a theoretical frame of reference.

The main result of this study is a model that describes the relationship between contextual factors and integration activities with suppliers and customers. The findings suggest that the assumption of a fit between context and integration of the Structural Contingency Theory is applicable also from an inter-organizational perspective. The model can be applied to contextual factors both external and internal to an organization. It is supplemented by structured lists of identified contextual factors and integration activities.

Recalling the notion of fit between value of contextual factors and level of integration with suppliers and customers, it can be stated that even low levels of integration can be appropriate as long as they are consistent with the values of certain factors representing organizational context. Furthermore, the model adds to existing models and frameworks as it can be used as a diagnostic tool. Applying this model, an organization can evaluate if current levels of integration fit with the corresponding values of contextual factors. Furthermore, the model support identification of misfits between values of contextual factors and present level of integration and it provides an opportunity to adjust or reevaluate the current levels of integration. The model, in combination with the lists of contextual factors and integration activities, can then be used to develop corrective actions in order to regain the desired fit.

Intention of this study was to identify and analyze integration of triads in the studied supply chains, commonly known as Supply chain integration. However, this scope of integration has not been found, which is in line with previous research indicating that triadic integration is rare. To reflect the actual situation in more accurate way it is suggested to use the term Inter-organizational integration, implying dyadic scope of integration, rather than Supply chain integration.

Sammanfattning

Syftet med denna studie var att bidra till förståelsen för ett företags kontext och dess inverkan på integrationen i försörjningskedjor. Ett av resultaten är en kontextbaserad modell som kan ge stöd för företag om vilken nivå av integration som ska implementeras med leverantörer och kunder.

De flesta organisationer är beroende av andra organisationer vilket leder till behovet att inte bara integrera internt utan också externt över organisationsgränserna. Men i många organisationer är graden av integration med leverantörer och kunder ofta bristande och ineffektivt, begränsad främst till dyadisk integration av orderhantering och operativ planering. Den befintliga litteraturen ger bara en begränsad insikt om viktiga förutsättningar för integration och den långsamma utvecklingen av extern integration har i praktiken tillskrivits främst bristen på riktlinjer för hur integration med parter i försörjningskedjan ska skapas. Den befintliga forskningen ger endast begränsad insikt om viktiga förutsättningar för detta. Lösningar som " mer integration bättre prestanda " har ofta presenterats utan hänsyn till företags, ofta komplexa, inre och yttre miljö av involverade företag.

Under de senaste åren har frågor väckts när det gäller typen av extern integration och i vilken utsträckning det kan ske. Vilket innebär att i stället för allomfattande integration, har selektivitet föreslagits i fråga om vilken nivå av integration som bör tillämpas på varje länk i försörjningskedjan. Problemet är inte att hitta " ett bästa sätt " utan det är att söka efter lösningar som tar hänsyn till integration och differentiering samtidigt. Lämplig nivå av integration är beroende av kontextuella faktorer som är förknippade med t.ex. företag, bransch, konkurrensutsatt miljö, och typen av produkter. Dock har fokus främst varit på att studera enstaka eller begränsade kontextuella faktorer och deras inverkan på den externa integrationen. Dessa resultat är ofta fragmenterade vilket leder till förekomsten av flera ramarverk och modeller. Därför, är en modell som ger rekommendationer på vilken nivå av integration som ska etableras mellan ett företag och deras leverantörer och kunder, med tanke på deras kontext, önskvärd. I denna studie har det identifierats och strukturerats en

mängd kontextuella faktorer av extern integration. Dessutom har påverkan av dessa faktorer på nivå av integration med leverantörer och kunder klargjorts.

Studien är baserad på Grounded theory metoden. För att förstå effekten av kontexten på nivå av integration, har två försörjningskedjor (triader) från två olika branscher, medicinsk utrustning och snabbrörliga konsumtionsvaror, valts att studeras. Slutsatserna bygger på en djupgående analys av kvalitativa data från fjorton intervjuer med respondenter som VD, SC manager, försäljningschefer, inköpschefer, och logistiker. Enligt Grounded theory metoden, analyserades insamlade data i tre omgångar, indelade i sex steg. Resultaten jämfördes med en teoretisk referensram.

Det viktigaste resultatet av denna studie är en modell som beskriver förhållandet mellan kontextuella faktorer och integrationsaktiviteter. Resultaten tyder på att den viktigaste förutsättningen för en matchning mellan kontext och integration enligt Structural Contingency teori kan tillämpas även från en extern perspektiv. Modellen kan appliceras på både externa- och interna kontextuella faktorer i en organisation. Modellen kompletteras med strukturerade listor över identifierade kontextuella faktorer och integrationsaktiviteter.

Gällande begreppet matchning mellan värdet av kontextuella faktorer och nivå av extern integration kan konstateras att även låga nivåer av integration kan vara lämpliga så länge de är i linje med de värden av vissa faktorer som representerar organisationens kontext. Detta resultat verkar vara i konflikt med den optimistiska syn inom supply chain management litteratur som hävdar att " ju mer integration desto bättre prestanda i försörjningskedjor”. Modellen kan användas i kombination med de befintliga modeller och ramaverk som ett diagnostiskt verktyg. Med hjälp av modellen kan en organisation bedöma om tillämpade nivåer av integration är i linje (dvs. matchar) med motsvarande värden för kontextuella faktorer. Dessutom, modellen ger möjlighet att identifiera, justera eller omvärdera nuvarande integrationen i fall att den inte matchar med kontextuella faktorer. Modellen i kombination med listor över kontextuella faktorer och integrationsaktiviteter kan sedan användas för att ta fram korrigerande åtgärder för att återfå önskad matchning.

Avsikten med denna studie var att studera integrationen av triader. Resultaten av studien visar att integration av triader inte kunnat identifieras i de studerade försörjningskedjorna. Denna slutsats är i linje med tidigare forskning som hävdar att triadisk integration är ovanlig. För att spegla den verkliga situationen mer korrekt rekommenderas det att använda termen Inter-organisatorisk integration, vilket innebär en dyadisk omfattning av extern integration, snarare än Supply chain integration.

1. Introducing Supply Chain Integration

In this chapter the absence of a unifying empirically based model of Supply Chain Integration that takes into consideration different contextual factors given by specific organizational circumstances is discussed. Furthermore, the overall purpose, research objective and research questions of the thesis are formulated. Finally, the structure of the thesis is outlined.

1.1 Background

During the last couple of decades, the concept of Supply Chain Management (SCM) has gained substantial interest among researchers and practitioners alike (Grubic et al., 2010). Although there is no single definition of the concept, according to Mentzer et al. (2001), the existing definitions can be categorized into three groups based on their focus: *a management philosophy* taking a systems approach seeing supply chain as a single unit, *implementation of a management philosophy* through establishment of management practices (e.g. integrated behavior) that permit firms to behave in accordance with the philosophy, and finally *a set of management processes* to manage relationships, information, and material flows across organizations. In this study, the implementation of a management philosophy view of SCM is adopted.

A considerable body of knowledge exists on this broad subject. To illustrate, in academia the number of published refereed journal articles on the topic of SCM has grown from 49 in 1994 to over 1 100 articles in 2008 (Stock and Boyer, 2009). Increased interest for SCM, reflecting its significance, is also visible outside the academic world. According to *The Eight Annual Global Survey of*

Supply Chain Progress[1] conducted in 2010, companies perceive the importance of this concept. Specifically, 77 percent of respondents reported that emphasis on SCM has increased in the last 12 to 24 months. Considering the economic decline resulting from the financial crisis during 2008, this survey concluded that companies turn to SCM as a major means to control costs and maintain revenues.

To cope with the turbulent economic environment and its consequences is not the only reason why practitioners and researchers direct their efforts and resources to SCM related topics. Rather it is the notion that firms are linked in networked supply chains. The rationale behind this is, among others, more demanding customers and increasing product complexity (Cagliano, 2006), shortening of product life cycle (Perona and Saccani, 2004), as well as advancement in information and communication technology (Grubic et al., 2010) that contribute to a higher degree of outsourcing, vertical disintegration, and increased globalization (Chen and Paulraj, 2004). Consequently, these aspects lead to the dependency of most organizations on contribution from other organizations; as stated by Thompson (1967, p. 25) *"none is self-sufficient".*

The dependency causes a need for not only intra-organizational integration, but also integration with suppliers and customers across organizational boundaries. Integration is defined by Lawrence and Lorsch (1969, p. 34) as *"…the process of achieving unity of effort among the various subsystems in the accomplishment of the organization's tasks…."* The inter-organizational form of integration is commonly recognized as Supply Chain Integration.

1.1.1 Supply Chain Integration

There is no clear and unifying definition and no consistent terminology related to Supply Chain Integration (SC Integration) (Pagell, 2004, Fabbe-Costes and Jahre, 2008; Lummus et al., 2008). In the literature, terms like *Integration*, *SC Integration* or *SCM* can be found. These concepts are often used to describe the same phenomenon, but from different perspectives. Campbell and Sankaran

[1] Conducted by CSC (Computer Science Corporation), Supply Chain Management Review, and Michigan State University, with assistance by the Council of Supply Chain Management Professionals and Supply Chain Europe magazine. 20 industries have been represented. 164 complete responses regarding current competencies and future plans in field of SCM have been received from main geographical areas in the world.

(2005) pointed out that in the literature, there is ambiguity in using terminology associated with SC Integration, as integration has been simultaneously used to describe both the goal of SCM as well as the process of connecting with supply chain partners. These inconsistencies lead to considerable confusion regarding the meaning of the specific concepts (Fabbe-Costes and Jahre, 2008).

Recalling the adopted view of SCM as *an implementation of a management philosophy* via establishment of management practices, SC Integration is seen as one of the management practices. In this study, SC Integration is referred to as the management of inter-organizational relationships of autonomous firms (a focal company's relationship with both customers and suppliers) (e.g. Morash and Clinton, 1998; Mentzer et al. 2001; Samaranayake, 2005; Thun, 2010). Specifically, management of inter-organizational relationships relates to customers and suppliers, and includes business processes, functions, activities, people and technology involved. The aim is to break the organizational boundaries and to jointly work with suppliers and customers (Romano, 2003). This can be achieved by employing a number of coordination mechanisms (e.g. standardization, plan, and mutual adjustment) as suggested by Thompson (1967) and by integration mechanisms such as integration of activities, functions, processes, and technologies/-information systems (e.g. Stock et al, 1999; Croxton et al. 2001; McAdam and McCormack, 2001).

Several authors have presented empirically based research demonstrating a positive impact of SC Integration on organizational and supply chain performance (e.g. Rodriques et al., 2004; Bagchi et al., 2005; Kannan and Than, 2010). Benefits of SC Integration, such as lower costs, higher quality and enhanced service level, are often mentioned. It is believed that integration with supply chain partners leads to achievement of smooth and efficient flow of products, services and information throughout the supply chain (Wong et al., 2011).

However, there are also researchers who express a more skeptical view and started to question the results and approach used in SC Integration research (e.g. Schoenherr and Swink, 2012; Fabbe-Costes and Jahre, 2008). SC Integration is *"more a rhetoric than reality in most industries…"* (Bagchi et al., 2005, p. 288) and total *"end-to-end"* seamless integration is difficult to achieve in practice (Grubic et al., 2010; Trkman et al, 2007). It is a subject of serious scientific doubts, debates and discussions, and relatively little knowledge is available on this topic (Van Donk and Van der Vaart, 2005). Moreover, theory related to this subject is still underdeveloped (Schoenherr and Swink, 2012). It can be concluded that despite more than 25 years of research and a vast body of literature, there still remains a considerable gap between the evidence and

claims presented in SC Integration theory and the actual practice (Childerhouse et al., 2011).

Regarding the degree of actual implementation of SC Integration, the trend to mainly present the best practice companies has resulted in misrepresentation of the actual situation (ibid). The literature has typically concentrated on exploring specific industries, most frequently the automotive sector. However, managers in other sectors may experience significantly different business problems related to integration (Lamming et al., 2000).

Additionally, Frohlich and Westbrook (2001) concluded that the current knowledge regarding which forms of integration should be applied to connect suppliers and customers is somewhat weak. To increase that knowledge, the authors also advocate that the unit of analysis should be the chain of collaborating companies rather than a single firm (ibid.).

Another issue is the assumed positive relation between SC Integration and performance. Several authors commonly believe that more integration means better performance (Frohlich and Westbrook, 2001; Stank et al. 2001; Gimenez and Ventura, 2005). In previous research, it is often claimed that this positive effect has been discussed and empirically proven (Cagliano et al. 2006, p. 284). However, a number of authors started to question these positive findings (Grubic et al., 2010; Fabbe-Costes and Jahre, 2008). Power (2005) stressed the inconsistency in the existing research among proven benefits and still limited implementation of SC Integration in practice.

The scope of implementation of SC Integration differs broadly across industries and companies; many firms report only limited success of integration with their immediate suppliers or customers (Jayaram et al., 2010). Companies do not feel comfortable to extend coordination beyond order processing and operational scheduling at the dyadic level (Kemppainen and Vepsäläinen, 2003). Recently, Childerhouse et al. (2011) investigated the maturity of integration of 72 supply chains located in New Zealand, Thailand and the UK. They concluded that the majority of the companies experience significant difficulties in putting the concept of SC Integration into practice, and that the current level of integration is on average poor. Naslund and Hulthen (2012) concluded, based on a set of interviews conducted with managers and consultants, that SC Integration beyond the dyadic relationship is rare in reality. The interviews also reveal difficulties in understanding the term *integration*, and the struggle of companies to integrate their processes even internally. Mortensen and Lemoine (2008) propose that explanations for this situation might be insufficient understanding

of collaborative practices or the unwillingness to engage in such activities with key supply chain partners.

Slow growth of the implementation of the concept has been attributed primarily to lack of guidelines for creating business relationships with supply chain partners (Lummus and Vokurka, 1999) as the existing literature provides only limited insight concerning the essential circumstances for integration (Van Donk and Van der Vaart, 2005). Therefore, more research is needed to gain more understanding of how to achieve SC Integration (Fabbe-Costess and Jahre, 2007).

1.2 Problem discussion

It is not surprising that during recent years, questions have been raised regarding the nature of SC Integration and the extent to which it can be accomplished. Meaning that instead of all-encompassing integration, selectivity has been suggested in terms of what level of integration should be applied to each link of the supply chain. Bask and Juga (2001) concluded that the problem of an organization is not to find "one best way"; rather it is to search for solutions that advance integration and differentiation simultaneously.

Recently, a number of researchers started to emphasize the importance of a more tailored approach to SC Integration to achieve success. SC Integration should be conceptualized as a multidimensional construct (Wong et al., 2011) instead of pursuing the common notion that "the more integration the better performance" (Frohlich and Westbrook, 2001; Stank et al. 2001).

Cox (2004) pointed out that full-scope implementation of the SC Integration concept is very resource intensive. The cost grows exponentially as the capabilities need to be extended from the first -tier throughout the whole supply chain. Consequently, accomplishing implementation is not really possible for every company due to lack of resources and competency to carry out the work or to develop the long-term relationships that are required (ibid). Thus, firms typically segment their external relations and develop collaborative relationships with some supply chains partners while stay at arm's length from others. It is not reasonable to assign a global level of integration to a company. Instead, it is recommended to establish an appropriate level of SC Integration in each supply chain relationship (Gimenez and Ventura, 2005; Lummus et al., 2008).

The level of SC Integration can be depicted by an element, *strength of the integrative relationship* (i.e. arm's length, cooperation, coordination, and collaboration) (Spekman et al., 1998). As concluded by the authors, not all business relationships should be collaborative, and it is considered to be acceptable to be involved in an arm's-length relationship if such behavior is appropriate.

Bagchi and Skjoett-Larsen (2002) suggest that the preferable level of SC Integration depends on several situational factors representing *context* associated with a focal company, industry, competitive environment, and nature and type of products. Context is defined as: *"…the setting in which organizational practices are established and applied."* (Ho et al., 2002, p.4424). Context can be characterized by a set of contextual factors or contingencies both internal and external to each company within the supply chain.

This approach is supported by contingency theory in that the environment of which an organization is a part forms its structure and processes. Therefore, organizations should strive to achieve a fit between their structure and processes and their environment to maximize performance (Donaldson, 2001). The main assumption of this theory is that if there is a match between the actual integration and the requisite integration, then the *fit* is achieved and, consequently, there is high performance (Donaldson, 2001). Fit has been defined as a fit line in which the level of structural variable is equivalent to that of contingency (Alexander and Randolph, 1985; Keller, 1994). The main contingencies are task uncertainty and task interdependence. Donaldson's causal model shows that the higher the degree of task interdependence between units the more intense integration is desired. Although the focus of the theory is on intra-organizational cross-functional relationships, several authors have applied contingency theory when examining integration between organizations within supply chains (e. g. Flynn et al., 2010; Skipper et al., 2008; Fawcett et al., 2008).

In association with contingency theory research, some studies have focused on additional factors in relation to SC Integration, referred to as contextual factors, as more empirical testing is needed to confirm their being contingencies. To illustrate, Bagchi and Skjoett-Larsen (2002) proposed that SC Integration depends on the power, influence, motivation and enthusiasm of the prime mover. Sako et al., (1994) stressed the power structure as an important factor of integration. Cox (2004) concluded that SC Integration can be more easily accomplished in circumstances where customers are more powerful than suppliers, or at least if there is interdependence in the power relationships

among them. Chen et al. (2009) emphasized factors such as organizational ownership, structure, policies, and values as major differences among trading partners having considerable impact on the scope of integration as well as type of activities and mechanisms involved in the integrative process.

One limitation of existing SC Integration research based on, or associated with, contingency theory is that the focus has primarily been on studying single contextual factors. Examples include types of products, demand uncertainty, size, power structure, industry, organizational form etc. and their impact on SC Integration (e.g. Richey et al. 2009; Dyer et al. 1998). These results are often fragmented, which leads to the existence of multiple frameworks and models (e.g. Frankel et al. 2008).

1.2.1 A unifying context-based model of SC Integration is needed

A unifying model providing recommendations in terms of what type of link to establish between an organization and its suppliers and customers, considering their specific circumstances, is desirable (Lambert et al., 1998). Organizations are in need of guidance to action they have to undertake when they face the range of different contextual factors as a result of circumstances that can occur when managing the supply chain (Cox, 2004). Such a model can prevent managers from spending resources on developing integrative relationships if the gains are only marginal or little success can be expected.

The frameworks or models that specifically consider context in relation to integration with customers and/or suppliers are e.g. the Kraljic' (1983) matrix, and frameworks by Van Donk and Van der Vaart (2005), by Fisher (1997), by Lee (2002), and by Christopher et al. (2006).

The main assumption of the Kraljic' (1983) purchasing portfolio -approach is that the type of supplier relationships can vary across the supply chain depending on type of items purchased (bottleneck, strategic, leverage, and non-critical items), the supply market complexity (number of potential suppliers), and the financial impact of the purchasing transaction. A similar analysis can be conducted for the segmentation of the relationship with customers (Van Donk and Van der Vaart, 2005). Specifically, for strategic products in general, a collaborative relationship is recommended. On the other hand, for the non-critical items there is no need for close collaboration unless cost advantage can be achieved. Moreover, the nature of the product in terms of volume, variety and variability also determines the type of integrative relationship among supply chain partners (ibid). Context is also considered in Fisher's matrix (1997) that

distinguishes between functional and innovative products and appropriate types of supply chains. Building on Fisher's work (1997), Lee (2002) extended the framework by investigating demand and supply uncertainties related to different type of products in order to propose a framework determining matching supply chain strategies. Fisher's framework has been further extended by Christopher et al. (2006) by adding replenishment lead-times and predictability/-variability of demand to select appropriate supply chain strategies.

The limitations of the frameworks and models presented above are that they tend to not account for integration of both suppliers and customers, or they tend to be too generic to address what specific level of integration is needed with a supplier and customer. Moreover, they are based on single or limited numbers of contextual factors that overlap in different frameworks, models or taxonomies. They often address only dyadic relationships and are inadequately grounded in contingency theory.

Therefore, a comprehensive empirically-based model of SC Integration considering contingency theory and providing a systematic approach with specific guidelines and recommendations needs to be developed to support practitioners through the integrative process and also to develop the theory. Development of such model would add both to SC Integration literature and to contingency theory, as contributions to this theory can be made through the construction of theoretical models of fits between contextual factors and organizational aspects (Donaldson, 2003). Additionally, contributions can also be made by applying the classical contingency theory to inter-organizational relationships, i.e. outside the intra-organizational area, which was the original focus of this theory.

1.3 Purpose, research objective and research questions

Taking into account the previous discussion, the overall purpose of this thesis is to enhance our knowledge regarding organizational context and its effect on Supply Chain Integration.

To accomplish this purpose, the following research objective and research questions have been formulated.

Research objective: To develop a model of contextual factors and Supply Chain Integration that can provide support for practitioners regarding what level of integration to establish with suppliers and customers.

- **Research question 1:** What are the contextual factors related to Supply Chain Integration and how they can be structured?
- **Research question 2:** What is the relationship between contextual factors and level of Supply Chain Integration?

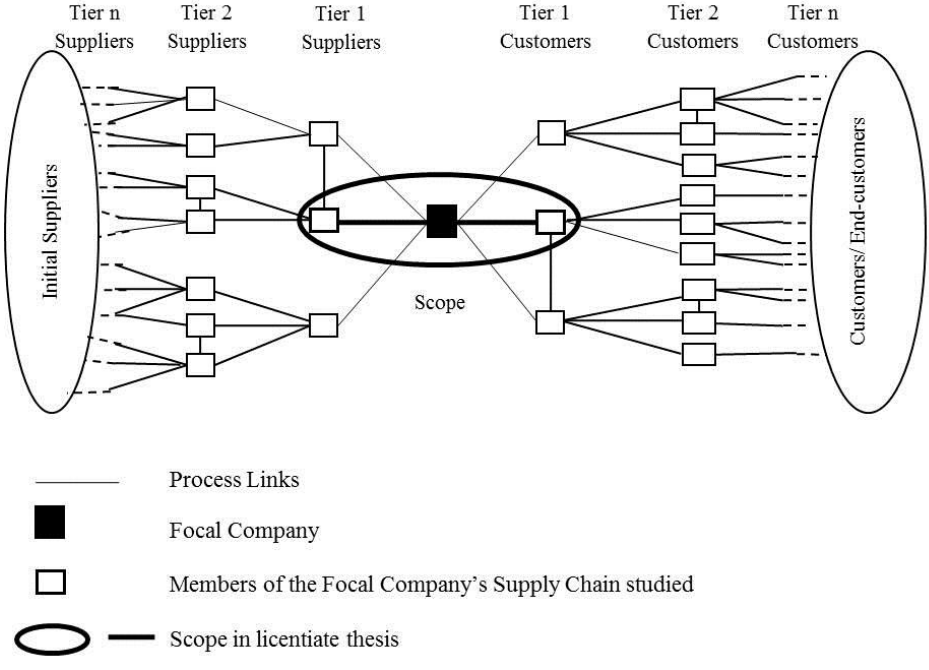
1.4 Research scope and limitations

Recalling the discussion above, the thesis is limited to inter-organizational integration beyond boundaries of an organization. Specifically, management of inter-organizational relationships between a focal company, 1-tier customers and 1-tier suppliers is examined, including business processes, functions, activities, people and technology involved. The very important forms of vertical integration, such as mergers and acquisitions, are left outside the scope of this study.

The scope of integration initiatives within a supply chain that are subject of the scrutiny in this thesis extends beyond the dyadic relationship (i.e. triads). It encompasses a focal company and the links with its immediate suppliers and customers. The reason for this choice is that several authors suggested that the scope of investigation should be on a supply chain beyond the dyadic relationship (Frohlich and Westbrook, 2001; McAdam and McCormack, 2001; Fabbe-Costes and Jahre, 2008). It can also be supported by how the concept of supply chain is actually defined. According to Mentzer et al. (2001, p. 4) supply chain (SC) is *"a set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, finances, and/or information from a source to a customer." Figure 1* shows an

idealized and general supply chain situation with an indication of the scope of this thesis.

The type of industry that is investigated in this study is manufacturing. Two supply chains are approached, as the goal is to study how different contexts affect the level of SC Integration. One supply chain operates within medical industry, and the second one in the fast-moving consumer goods industry. Supply chains are considered as open systems that are both influenced by their environment and have impact on the environment (Skipper et al., 2008). It is also assumed that supply chains are complex and face uncertainties, but simultaneously rational in their need of determinateness and certainty (Thompson, 1967).



Adapted from Lambert et al., (1998, p.7)

Figure 1. An overview of the scope of this licentiate thesis

1.5 Thesis structure

This thesis is organized in eight chapters, as follows:

Chapter 1: This chapter starts by introducing the concept of SC Integration and by discussing a need for a unifying empirically-based model of SC Integration that takes into consideration different contextual factors given by specific organizational circumstances. The research purpose, objective and research questions are presented.

Chapter 2: The theoretical frame of reference is based on a review of existing research on the concept of SC Integration focusing on its main features. Additionally, assumptions of contingency theory related to integration are presented. SC Integration research associated with integration is reviewed to provide an overview of what contextual factors have been studied in SC Integration literature. Finally, existing frameworks and models of SC Integration considering organizational context are discussed.

Chapter 3: In the third chapter methodological choices, sampling, and empirical data collection process are discussed. In addition, the stepwise process of data analysis is described.

Chapter 4: This chapter offers main characteristics of the selected samples, specifically two supply chains, to introduce the contexts in which SC Integration is being studied.

Chapter 5: The analysis chapter focuses on examination of empirical data. All information used is based on interviews with respondents. Firstly, a brief overview of the analysis process using GT methodology is presented, followed by a summary of pilot interviews. After that, empirical data from each of the SC actors involved in the study are scrutinized in terms of identifying and structuring contextual factors and their influence on level of SC Integration.

Chapter 6: In this chapter it will be described a development of a final model of contextual factors and Inter-organizational Integration with customers and suppliers. Additionally, results derived from the analyses will be delineated and the model will be accompanied by two lists: (1) Identified relations of values of contextual factors and corresponding levels of Inter-organizational Integration activities, and (2) Levels of Inter-organizational Integration activities. Finally, a step-by-step approach illustrating application of the model will be presented.

Chapter 7: This chapter presents the outcomes of systematic comparison of results obtained from analysis of empirical data with the theoretical frame of

reference. Moreover, results of the study are summarized to revisit answers to the research questions and research objective.

Chapter 8: In the eighth chapter, theoretical and practical contributions are presented. Additionally, criteria for judging the quality of research applying the Grounded Theory method are addressed. Finally, limitations of this study and future research opportunities are discussed.

2. Theoretical Frame of Reference

The aim of this chapter is to review existing SC Integration literature and contingency research related to the topic of this thesis. Firstly, to offer theoretical foundation of the concepts SC Integration and contextual factors of SC Integration and secondly, to provide support for the previously discussed arguments regarding the fragmented (i.e. focusing on single or limited number of often overlapping contextual factors) and predominantly dyadic approach when studying contextual factors associated to integration of an organization with suppliers and customers. Moreover, multiple context based models and frameworks of SC Integration are presented to highlight the absence of a unifying model that considers organizational context and can provide support for practitioners regarding what level of integration to establish with both suppliers and customers.

2.1. Supply chain integration

Chen et al. (2009) stated that SC Integration is very broad concept and can be applied to various structural linkages among departments and firms. Although, there has been a lot of research on this topic, the concept is not well defined and agreed among research. It has been conceptualized in various ways. Different areas and various directions of SC Integration have been mentioned in the previous research (Van Donk and Van der Vaart, 2005). SC Integration suffers from "conceptual vagueness" as concluded by Pagell (2004) and Fabbe-Costes and Jahre (2008).

Van Donk and Van der Vaart (2005) concluded that SC Integration is closely related to conducting activities in number of areas through co-operation with supply chain members. In this thesis, SC Integration is referred to as the management of inter-organizational relationships of autonomous firms (a focal company's relationship with both customers and suppliers) (e.g. Morash and

Clinton, 1998; Mentzer et al. 2001; Samaranayake, 2005; Thun, 2010). The focus is on management of inter-organizational relationships related to customers and suppliers, and including business processes, functions, activities, people and technology involved (Romano 2003). In terms of implementation of the concept, the previous research point out that it can be conducted through coordination mechanisms and through integration mechanisms (ibid).

2.1.1 Implementation of SC Integration

To implement SC Integration it is desirable to shift from managing single functions to integration of activities into key supply chain business processes (Lambert et al., 1998). As several authors (Power, 2005; Campbell and Sankaran, 2005; Croxton et al., 2001; Cooper et al., 1997) stressed the integration of key business process as a prerequisite for SC Integration.

Yet, companies experience difficulties to become process oriented (Naslund and Hulthen, 2012). Moreover, companies within the same supply chain may have various structures of activities. Consequently, some companies are structured based on functions, other based on processes or combination of both (Lambert et al., 1998). In existing literature, several ways have been suggested for how to put SC Integration into practice. This can be done through *coordination mechanisms* and *integration mechanisms* (Romano 2003).

Coordination mechanisms

Coordination mechanisms may assist the managers to determine the most important actions that need to be undertaken from a set of possible actions to coordinate various flows within the supply chain. Thompson (1967) suggested three coordination mechanisms: *standardization*, *plan*, and *mutual adjustment.*

Coordination by *standardization* is appropriate for pooled interdependence as this level of dependence can be described as relatively stable, and repetitive. Standardization means the establishment of internally consistent routines and rules (ibid). This type of coordination ensures that each unit within the supply chain remains in line with other units. There is less emphasis on communication and knowledge sharing; instead, units are encouraged to follow the established rules and routines (Skipper et al., 2008).

Coordination by *plan* is based on development of detailed schedules. In contrast to the coordination by standardization, it does not stress the same high level of stability and routines. Thus, it is appropriate for more dynamic situations (Thompson, 1967). It also allows for adjustment as result of reaction on the

changed external circumstances of the supply chain. The effectiveness of process, the flow of products and information needs to be planed. The planning process enables to adjust to the environmental changes. The element of coordination by plan brings in the idea of a larger shared goal (Skipper et al., 2008).

The coordination by *mutual adjustment* includes the information sharing during the process of action and it is best suited for situations characterized by higher levels of variability and uncertainty. As according to Thompson (1967), this type of coordination includes sharing of new information during the action. In contrast to coordination by plan, the approach of joint problem solving and decision-making instead of central planning is implemented. To be able to select an appropriate action, high level of knowledge sharing and communication is necessary (Skipper et al., 2008).

Generally, in case of low level of interdependence, units can conduct work independently without interactions, consultation or exchange. On the other hand, under higher level of interdependence, increased level of interaction is needed in order to reduce related uncertainty, risk and disruption (ibid).

Additionally, Lambert et al., (1996) identified eight partnership components, discussed below, that can be considered as coordination mechanisms:

- *Planning:* it represents a key component for an effective relationship. The range of planning spans from sharing of existing plans to the joint work on establishment of strategic objectives.
- *Joint Operating Controls*: each company within the supply chain should be able to make changes related to operations of the other company to improve the relationship. The range of changes can span from encouragement to propose changes to having empowerment to implement a change without receiving approval from the partner.
- *Communications:* it is a crucial tool for successful inter-organizational relationship. The breadth and depth of communication determine how strong the relationship is likely to be. It should involve strategic, operational and tactical level of organizations.
- *Risk and reward sharing:* it requires presence of mechanisms to make sure that benefits and rewards, as well as costs and risks are shared.
- *Trust and commitment:* their main elements are loyalty to each other and a long-term focus. If trust and commitment exists in an inter-organizational relation, the partners do not need to be constantly concerned about being replaced.

- *Contract style:* the type of contract reflects the strong of a relationship.
- *Scope*: a relationship can be stronger by expanding the included activities of each firm.
- *Financial investment:* sharing of financial resources can contribute to strengthening a relationship in terms of joint assets, joint investment in technology, exchange of key personnel, and joint research and development. These activities mean high degree of interdependence that result in a stronger relationship.

Somewhat overlapping ten coordination mechanisms have been suggested by Grandori and Soda (1995), such as: (1) Communication, decision and negotiation mechanisms; (2) Social coordination and control; (3) Integration and linking-pin roles and units; (4) Common staff; (5) Hierarchy and authority relations; (6) Planning and control systems of partners; (7) Incentives systems; (8) Selection systems; (9) Information systems; and (10) Public support and infrastructure.

Integration mechanisms

Integration mechanism provide assistance in decision-making regarding to what extend (i.e. functions, processes, activities, areas, technologies/ information systems) the most important actions (i.e. coordination mechanisms) should exceed the organization boundaries between companies (Romano, 2003). The most frequently discussed inter-organizational integration mechanisms in the previous literature are: (1) external integration of processes/activities; (2) external integration of functions/activities; (3) external integration of technologies/information systems (ibid).

1) External Integration of processes/activities

The process-orientation organizational activities alter the focus from traditional functional structure within and between organizations. There is a difference between a company that is organized based on the traditional functions and between companies that is a process-oriented. The process-oriented organization has the customer focus of the process-oriented approach and that the whole organization is structured around these processes (Cooper et al., 1997).

Davenport cited in Cooper et al. (1997, p. 5) defines processes as: *"a structured and measured set of activities designed to produce a specific output for a particular customer or market".* According to Danese et al., (2004), inter-organizational business processes may be disaggregated into activities

representing building parts that add to the entire process. Supply chain business processes may span internal- and external boundaries of organizations regardless the organizational formal structure (Cooper et al., 1997).

Companies usually have various numbers of processes that include different activities. The Global Supply Chain Management Forum determined the following eight key processes that can be linked with supply chain partners (Croxton et al., 2001, p. 14): (1) Customer Relationship Management (CRM); (2) Customer Service Management (CSM); (3) Demand Management (DM); (4) Order Fulfillment (OF); (5) Manufacturing Flow Management (MFM); (6) Supplier Relationship Management (SRM); (7) Product Development and Commercialization (PDC); and (8) Returns Management (RM). The authors stressed that the significance of each process and the activities associated with each process are likely to vary across companies. The above listed key processes span across the supply chain, single companies and across functional silos that may exist within each company. The functional silos refer to Marketing, research and Development, Finance, Production, Purchasing and Logistics. Activities that constitute the processes are part of the functional silos, but the process may span over several functions and will not be restricted only to one function (ibid).

2) External integration of logistics functions/ areas/ activities

Only few companies actually utilize the integration of business processes with supply chain partners, instead they still structure their business based on traditional functions (McAdam and McCormack, 2001; Naslund and Hulthen, 2012) such as Marketing, Research and Development, Finance, Production, Purchasing and Logistics (Croxton et al., 2001).

According to Scholz-Reiter et al., (2010), function mean "… *specific tasks and activities within and across organizations (e.g. production planning, transport scheduling).*" External integration of functions refers to the extent to which the logistics activities of one firm, such as Transportation, Warehousing, Purchasing and Distribution, are integrated with the logistics activities of its supply chain partners. As an example, firms that apply just-in-time (JIT) strategies have established "inter-firm relationships" that connect their manufacturing functions with specific suppliers (ibid.). Another strategy used to closely cooperate with suppliers frequently used is vendor managed inventory (VMI) (Chen and Paulraj, 2004).

Bagchi et al. (2005) identified the following areas of collaboration with suppliers; R&D, Procurement, Inventory Management, Manufacturing, Distribution, SC Design, and SC Software. On the other hand, the areas of

collaboration with customers have been R&D, Sales Administration, Inventory Management, Manufacturing, CRM, Distribution, SC Design, and SC Software. Håkansson and Persson (2004) added activities such as Replenishment, Order Process, Production, and Distribution that have been coordinated with supplier and/or customers.

Cross-functional teams are used to manage long-term relationships with customers and suppliers. They significantly contribute to success of activities such as supplier selection, product design, just-in-time manufacturing, cost reduction, total quality initiatives and mainly enhanced communication (Chen and Paulraj, 2004).

There seems to be ambiguity regarding the external integration of logistics functions/ activities, and/or areas as some authors define external integration as inter-organizational integration of logistics activities, others as integration of functions or areas among supply chain members. The content of these groups is somewhat overlapping. For example, purchasing appears both as a function and logistics activity, while the other logistics activities (i.e. transportation, warehousing, and distribution) could be incorporated in the function of logistics.

3) External integration of technologies/information systems

For success of SC Integration, one of the main preconditions is the ability of partners to share information (Scholz-Reiter et al., 2010). The volume and complexity of information that are transmitted across supply chain partners has increased due to implementation of information technology (IT). As result of development in the area of IT, companies are allowed to access real-time data including, i.e., inventory levels, delivery status, production planning and scheduling which enables to manage and coordinate inter-organizational activities (Prajogo and Olhager, 2012). EDI is the most commonly used communication technology. It allows firms to accomplish "electronic integration" and thus influence the interaction with their suppliers and customers (Shah et al., 2002).

To enhance flow of information across the supply chain, a large number of software applications can be utilized such as; ERP systems, order management systems to mechanize the order fulfillment process, demand planning system for managing and monitoring forecasts, management systems for warehousing, transport management systems for planning and sending of shipments, advanced planning and scheduling system for managing production, customer relationship management systems for customer service (Campbell and Sankaran, 2005. IT is seen as an enabler and facilitator of SC Integration. It has the potential to make supply chain efficient, responsive and innovative. However, compatibility

issues between supply chain members still impede inter-organizational integration (ibid).

2.1.2 Levels of SC Integration

The intensity of the relationship will most likely vary at various points in the SC. Close integration with all SC members would be ineffective and hardly possible as development and management of long-term relationships is time consuming and requires commitment. Thus, selectivity is important in deciding which relationship should remain only on transactional-basis and which relationship should be developed into partnership (Lambert et al., 2005). The relationship that fits to the given circumstances is the most appropriate one (Lambert et al., 1998). Spekman et al. (1998) suggested four intensity levels of relationships with customers and suppliers, such as: (1) arm's length relationship, (2) cooperation, (3) coordination, and (4) collaboration.

1)Arm´s length relationship

Arm's length relationship refers to pure exchange type of relationship between supply chain members. The exchanges may be multiple over a short or long time period. There are no joint commitments or operations which mean that the relationship is terminated when the exchange ends (Shah et al., 2002). The level of information sharing is limited and only some operational coordination takes place. An example of communication is implementation of transactional system in order to coordinate orders and payment between suppliers and customers (Swink et al., 2007). Typically, a supplier offers standard products/ services to number of customers. (Lambert et al., 1998)

2) Cooperation

Typically cooperative behavior has short-term focus and the scope spans one function or division at each firm in a supply chain (Lambert et al., 1996). Cooperation broadly means shared goals among various actors (Malone and Crowston, 1994). It is characterized by focus on information sharing (in some cases assets) between supply chain partners, identifying areas of joint interest and shared competitive advantages (Power, 2005). The cooperative relationship represents the beginning of demand synchronization and cross-functional interaction, involvement of relevant parties, clear understanding of responsibilities (Ajmera and Cook, 2009).

According to Shah et al., (2002), at this stage of inter-organizational relationship information and communication system (i.e IOIS) may be used to

transmit small amount of documents to a limited number of suppliers and/or customers. IOIS is utilized mainly on at departmental level for communication between one functional unit or division and its counterpart in the partner organization (e.g. customers can place orders on a supplier's website or purchasing from a supplier through an EDI (ibid). At this point no critical data are shared (Ajmera and Cook, 2009).

3) Coordination

Coordination may be accomplished by coordination of actions between supply chain members and by working jointly to achieve materials and information flows efficiency across the supply chain. As supporting tools may be employed common management indicators and performance measures. Fully coordinated supply chain is characterized by aligned decisions to achieve global system objectives (Sahin and Robinson, 2002). The authors have proposed two methods for accomplishing coordination, such as centralized decision making and decentralized decision making through usage of coordination mechanisms. The centralized decision-making represents the approach where a single unit optimizes the supply chain

Regarding the use of IOIS, coordination can be characterized by using multiple documents when communicating with suppliers and/or customers; however, partnering firms are restricted when manipulating of shared data and documents. Examples of IOIS at this type of relationship are shared ordering and scheduling systems (Shah et al., 2002). Coordination allows for implementation of JIT, EDI or other systems to enable the traditional linkages among supply chain partners to become seamless. However, business partner can cooperate and coordinate specific actions or activities but still not being true partners (Spekman et al., 1998).

4) Collaboration

Attributes of collaboration are that the partners' are voluntarily engaged in reciprocal relationship and that both partners have enough power to avoid other organizations to force solutions on them (Ho et al., 2002). To achieve collaboration, increased interaction among supply chain partners beyond information sharing is desirable. The focus is put on joint planning and carrying out of supply chain activities which include logistics, product development and strategic planning (Ajmera and Cook, 2009). Collaboration as highest level of SC Integration can also be seen as strategic partnership characterized by high degree of supplier-buyer interdependence (reciprocal), multiple functional interfaces (engineering-to-engineering, etc.), capabilities benchmarking, substantial supplier assistance, supplier performance on non-contractible

variables (e.g. innovation, quality, responsiveness) is vital, self-enforcing agreements (e.g. trust, stock ownership, etc.) (Dyer et al., 1998).

The main attributes are high level of integration on both strategic and operative level with one or two partners (key suppliers/customers) who are mutually dependent in many areas of their business. One of precondition for transition from coordination relationship to collaboration is presence of trust and commitment that are beyond the level traditionally found in JIT and EDI based relationships. In other words, an organization can be engaged in cooperation and coordination in a supply chain but not collaborate. To illustrate, to ensure JIT delivery, coordination of production and logistics activities is necessary, however to establish collaborative relationship future visions, product performance and long-term strategic plan needs to be shared (Spekman et al., 1998).

The collaborative relationship can be characterized by complete system integration which means that every involved supply chain partner possess the ability to adjust the shared data and documents. The IOIS are used frequently by partners firms and large portion of each partner's system is integrated with other partnering firms. These partners share freely information, work jointly to resolve common problems related to design of new products, plan future, and their success become interdependent (ibid). Programs that can be utilize in order to collaborate are: Vendor Managed Inventory (VMI); Collaborative Forecasting, Planning and Replenishment (CPFR); and Continues Replenishment (CR) (Ajmera and Cook, 2009).

Classification of levels inter-organizational relationships

Lambert et al., (1996) developed classification framework comprising of eight partnership components and their level of occurrence at the three types of inter-organizational relationships (see *Table 1*). It needs to be stressed that after selecting an appropriate strength of the inter-organizational relationship, majority, but not necessarily all of the corresponding components should be implemented. Decision has to be made regarding what components at what level (low, medium, or high) should be applied. To illustrate, when deciding on, for example, high level of SC Integration as an appropriate relationship with a major supplier, the partners have to agree on how to communicate, what type of joint planning to use, what operations should be jointly managed and what other parts of the components need to be implemented (ibid).

Table 1. Components of inter-organizational relationships

Components	Partnership Component Levels			
	Specification	**Low**	**Medium**	**High**
Planning	- Style - Level - Content	- Ad-hoc basis - Focus on projects/tasks - Sharing of existing plans	- Regularly scheduled - Process focus - Jointly performed to avoid conflicts in strategies	- Scheduled, ad hoc - Relationship focus - Jointly at several levels, participate in other's planning
Joint Operating Controls	- Measurement - Changes	- Performance measures developed independently and results are shared - Partners may suggest changes to other's system	- Jointly developed and shared; focus on single firm's performance - Partners may make changes to other's systems after approval	- Jointly developed, shared; focus on relationship and joint performance - Partners may make changes to other's system without approval
Communication	*Non-routine* *Day-to-day* - Organization - Balance - Electronic	- Very limited, only critical issues on task/project level - Ad-hoc between individuals - One-way - Use of individual system	- Regularly, at several levels, open and honest - Some scheduled; routinization - Two-way unbalanced - Joint modification of individual systems	- At all levels; partners "speak the same language" - Systems are linked -Two-way balanced -Joint development electronic com.
Risk/ reward sharing	- Loss tolerance - Gain commitment - Commitment to fairness	- Very low tolerance for loss - Limited willingness to help to other gain - Fairness is evaluated by transaction	- Tolerance for short-term loss -Willingness to help the other gain - Trucked year to year	- High tolerance for short-term loss -Desire to help other party gain -measured over life relationship
Trust and commitment	- Trust - Commitment to each other's success	- Limited to believe that partners will perform honestly and ethically - To specific transaction/ project; it has to be constantly "re-earned"	- Partners is given more trust than others "most favored" supplier - To longer-term relationship	- Implicit, total trust does not have to be earned - Long-term success, inter-org. functions/levels
Contract Style	- Time frame - Coverage	- Short time frame - Contracts are specific in nature	- Covers a longer time - Contracts more general in nature	- Very general - Outlines the basic philosophy for the relationship

(continued)

Components	Partnership Component Levels			
	Specification	**Low**	**Medium**	**High**
Scope	- Share -Value-added -Critical activities	- Cooperative activities involve very small share of business for each partner - Cooperation covers only one or a few value-added steps (functions) - Only activities relatively unimportant for partner's success	- Represents a modest share of business for at least one partner - Multiple functions, units are involved in the relationship - Activities important for each partner's success are included	- Significant share of business to both parties - Extend to all levels in both organizations - Activities critical for each partner's success included
Investment	- Financial - Technology - People	- Low or no investment between two partners - No joint development of products/ technology - Limited personnel exchange	- May jointly own low value assets - Some joint design, R&D planning - Extensive personnel exchange	- High value assets jointly owned - Significant joint development - Participation on other party's board

Adapted from: Lambert et al (1996, p. 12)

2.1.3 Scope of SC Integration

To integrate with all partners across the supply chain is not desirable and not even possible since companies in the same supply chain may have a functional structure, process structure, or a combination of both. All organizations make the strategic decision regarding scope of upstream and downstream integrative initiatives they want to take on (Frohlich and Westbrook, 2001).

To determine scope of how the actions within the coordination/integration mechanisms should pass between organizational boundaries it is important to define scope of SC Integration. While scope of SC Integration is referred to as: *"…the number of steps in the chain of processing which a firm engages in-from ultra-raw materials to the final consumer."* (Harrigan, 1985, p. 400), the Supply chain is defined as*"…a set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, finances, and/or information from a source to a customer."* Mentzer et al. (2001, p. 4). Given these defections, the assumptions seems to be that the coordination and integration mechanisms should spent at least three autonomous organizations, indicating triadic integration, involved in material, financial, and information flows.

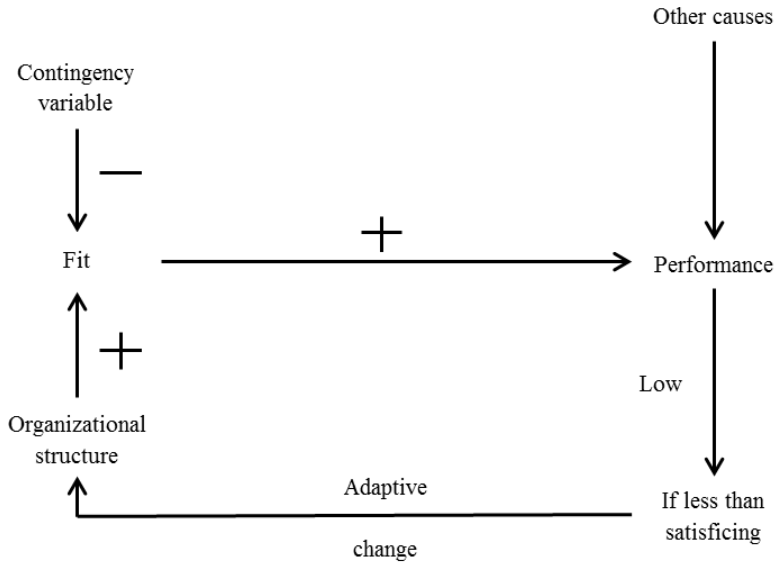
However, in reality, the scope of implementation of SC Integration differs broadly across industries and companies, many firms report only limited success of integration with their immediate suppliers or customers (Jayaram et al., 2010). The dyadic integration is the most common (Stonebraker and Liao, 2004). The dyadic management gained popularity as it can be accomplished without total central coordination and control which is less complex and less resource intensive (Cooper et al., 1997).

2.2 Organizational context and its effect on SC Integration

Organizations constantly face various internal and external forces that influence them (Bask and Juga et al., (2001). These forces can be seen as factors determining the level of SC Integration. Contingency theory suggests that factors such as production technology, size and uncertainty should be examined in order to determine the form of integration for the specific context (Donaldson, 2001).

2.2.1 Structural contingency theory

According to Donaldson (2001), the main assumption of the Structural contingency theory is *"…that organizational effectiveness results from fitting characteristics of the organization, such as its structure, to contingencies that reflect the situation of the organization."* (ibid, p.1). The core paradigm of contingency theory is that by fitting features of an organization (e.g. structure) to specific circumstances (i.e. contingencies) that reflect the context of the particular organization, organizational effectiveness can be achieved. Environment, organizational size, and organizational strategy are some examples of contingencies. Thus, to maximize performance, the organization needs to fit to contingencies that influence the particular organization. In other words, an organization that experiences misfit between its contingencies and its organizational characteristics becomes ineffective (ibid).



Source: Donaldson (2001, p. 12)

Figure 2. The Contingency theory of structural adaptation to regain fit.

This is illustrated by the model in *Figure 2*. According to the model, an organization is originally in fit, meaning that it has a structure that fits its current level of contingency variable which has a positive effect on performance. However, the level of the contingency variable changes, while the organization retains its current structure which leads to misfit with organization's new contingency level (shown by negative effect of the contingency variable on fit in *Figure 2)*. The misfit then affects performance negatively (withdrawing the positive effect of fit on performance in *Figure 2*). Due to the effect of misfit and other causes the performance becomes less than satisficing, an adaptive change is needed to adopt a new organizational structure to fit its new contingency level to regain positive performance (shown by positive effect of organizational structure on fit in *Figure 2*).

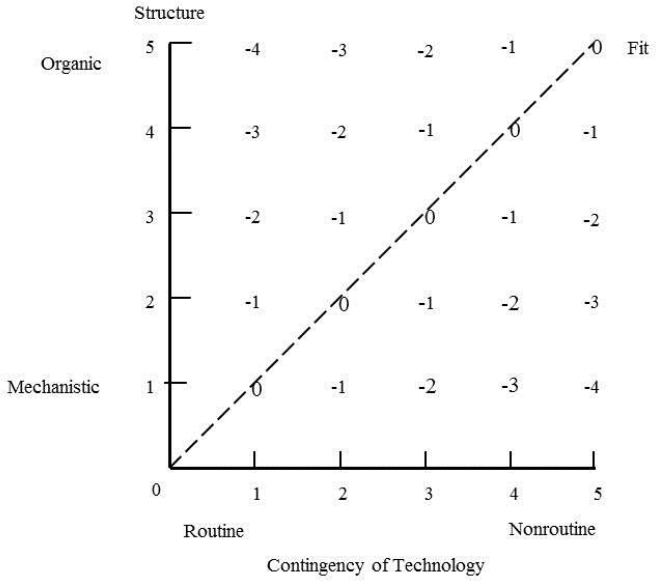
The focus of contingency theory on effectiveness has its origin in organizational theory concerned with explaining organizational success or failure. As organizational effectiveness have a broader meaning it can include, for example, efficiency, profitability, employee satisfaction, and innovation rate. Ability of an organization to achieve its organizational goals is defined as organizational effectiveness (ibid).

To define the core concept of fit between contingency and an organizational aspect the model developed by Alexander and Randolph, (1985) and Keller, (1994) can be used. As illustrated in *Figure 3*, the authors define the fit between level of contingency, specifically routine and non-routine technology, and level of organizational structure, mechanistic or organic, as a fit line in *"which the level of the structural variable equals that of the contingency variable, that is, it passes through the origin…"* (Donaldson, 2001, p. 210). The models shows that increase of one level in technology, requires increase by one level in structure in order to fit it to the level of technology.

Context based models of intra-organizational integration

The Structural contingency theory has been originally developed in intra-organizational context. Especially the work by Lawrence and Lorsch and Thompson, constitute a theoretical base relevant for purpose of this thesis as their theories are directly related to integration issues.

Donaldson (2001) developed a causal model to formalize their work (see *Figure 4*). The model shows that the degree of intended innovation (i.e. degree of novelty and amount of new products per time unit) influences the intense of the interdependence between functional units. The higher the degree of interdependence the more intense integration is required. If there is a match between the actual integration and the requisite integration, then the *fit* is achieved and, consequently, there is high degree of achieved integration and thus high performance.



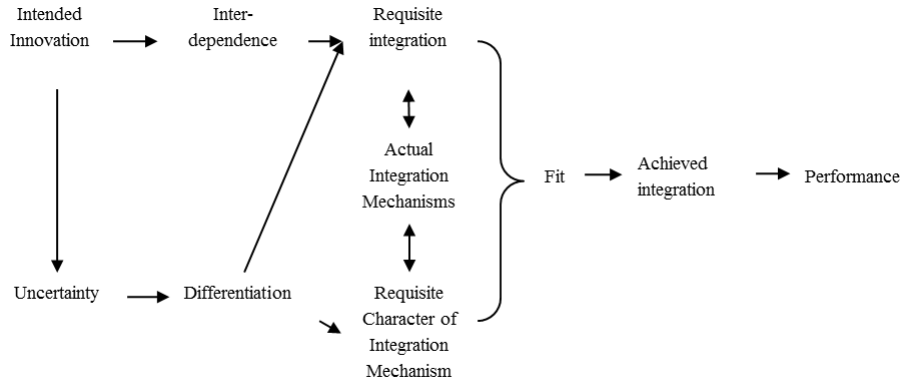
Source: Donaldson (2001, p. 211)

Figure 3. Misfit and performance

The degree of departmental differentiation is determined by the degree of task uncertainty caused by the intended innovation. Higher degree of innovation leads to greater task uncertainty in some functions (e.g. R&D) but not in all functions (e.g. production). The result is greater differentiation between functions. Consequently, the greater differentiation the greater requisite integration mechanisms are needed (ibid).

Studies using structural contingency theory in inter-organizational settings

Although, the focus of the structural contingency theory is solely on intra-organizational cross-functional relationships, and not on inter-organizational serially connected activities, several authors suggested this theory to be applied when examining interaction between organizations within supply chains as supply chains are systems that are open and thus influenced by their environment (Stonebraker and Afifi, 2004; Fawcett et al., 2008; Skipper et al., 2008; Flynn et al., 2010; Danese, 2011).



Source: Donaldson (2001, p. 45)

Figure 4. A causal model of interdependence, integration, and differentiation of functional departments

According to Stonebraker and Afifi, (2004), the current studies, with only some exceptions, do not take into consideration the structural contingency research. Instead they have moved directly to narrowed focus with definitional, descriptive, theoretical or empirical goals (e.g. Boon-itt and Wong, 2010;). Additionally, only very limited subset of the contingency theory in form of general statements is often considered (e.g. Fawcett et al., 2008, Flynn et al., 2010; Danese 2011). On the other hand, studies that build on structural contingency research and carefully examine the theoretical contingencies are those by Skipper et al., (2008) and Stonebraker and Afifi (2004).

Skipper et al., (2008, p.39) aimed to *"…provide a conceptual/theoretical foundation to enhance the body of knowledge related to supply chain interdependence and technology-enabled coordination."* The authors heavily rely on, among others, Thompson's theory of interdependencies and coordination mechanisms and elaborate on it in details to develop a conceptual foundation for their propositions.

The work by Stonebraker and Afifi (2004) focus on categorization of four historical stages of supply chain development and classification of supply chain strategies appropriate for each stage. The authors use *"…the classically defined relationship between internal differentiation and integration to external supply chain activities."* (ibid, 2004, p. 1139). They developed set of propositions based on assumptions considering the structure variables, namely differentiation and integration, in supply chain management context and the impact of technology. To examine these supply chain contingencies, two automotive parts

suppliers and two food processing companies have been selected. They also provide implication for managers stating that *"…the more evolved the technology, the greater the differentiation, and consequently the greater the amount of integration effort required."* (ibid, p. 1142). The positive side of this study is that it builds on structural contingency research and extends its application to context of external supply chain activities. The authors also propose a contingency theory of supply chain management.

Yet, there are some issues related to the findings of this study. Firstly, the authors do not consider the work by Thompson and its interdependencies that has been used by Lawrence and Lorsch. Stonebraker and Afifi (2004) related only to the first part of the Lawrence and Lorch theory focusing on relation between differentiation and integration. Doing so, they did not consider the further development of that theory made by Lawrence and Lorsch (1967) and Lorsch and Allen (1973) in Donaldson (2001) which clarifies that it is not the level differentiation among internal functions that primarily determines the level of integration. Rather, it is the level of interdependence that needs to be matched with an appropriate level of integration. So differentiation contribute to performance only under circumstances that an organization is an interdependent system. Thus, the simple relationship between differentiation and integration has not been confirmed by the classical contingency theory (Donaldson, 2001).

2.2.2 Contextual factors of SC Integration

Donaldson (2001) in the structural contingency theory defines a contingency as any factor *"…that moderates the effect of an organizational characteristic on organizational performance."* (ibid, p.7). Two main contingencies are *task uncertainty* and *task interdependence*. The first contingency relates to rate of technological change, and environmental change. The later contingency *task interdependence* refers to rate of interdependency among units. It includes aspects of strategy, type of product and its innovation rate (Donaldson, 2001). It is important to stress that not every contextual factor that is a cause of an organizational aspect is automatically a contingency. To show that a contextual factor is a contingency entails demonstrating (empirical testing) that the fit between a contextual factor and an organizational aspect leads to improved performance. In other words, a contextual factor could be a cause of an organizational aspect without it being a contingency. These factors are open to be empirically tested in further research to prove if they are contingencies or only a cause.

Associated to contingency theory research, some studies have focused on additional factors referred to as contextual factors as more empirical testing is needed to confirm them being contingencies. To distinguish between contextual factors of internal or external organizational environment and their components Duncan (1972) proposed a classification scheme (see *Table 2*). The majority of factors are related to inter-organizational environment.

To identify contextual factors that have been studied in inter-organizational context, a comprehensive literature review of SC Integration research has been conducted, apart from the classical contingency research, Although, the factors might be potential contingencies, for the purpose of this thesis they will be labeled as contextual factors as empirical testing is needed to classify them as contingencies of SC Integration.

The result of the literature review presented in *Appendix 1* and *Appendix 2* reveals the fragmented approach to studying contextual factors related to integration. The majority of studies focus often on single factors. The identified contextual factors of SC Integration have been scrutinized in terms of their effect on level of integration. It has been distinguished between contextual factors leading to either high or low level of integration. Additionally, corresponding coordination mechanisms and integration mechanisms of managing particular levels of integration are presented, as suggested in the previous research.

Contextual factors related to high level of SC Integration

Appendix 1 contains identified contextual factors related to high level of SC Integration. Prevailing features are high unpredictability and uncertainty of demand, shortening of PLC, strategic importance, and complexity, innovativeness of products / components, differentiation strategy, competitive intensity, and scarcity of resources. The majority of these contextual factors are related to internal organizational environment, specifically to nature of organization's product or services.

It can be concluded that high rate of technological uncertainty, environmental turbulence and complex organizational environment should be managed by implementing collaboration or cooperation on strategic level with major suppliers and customers. Suggested coordination and integrative mechanisms involve mainly information sharing, technology implementation, joint planning, involvement in NPD, trust and interdependence (e.g. Boon-itt and Wong, 2010; Stonebraker and Liao, 2004; Power, 2005).

Table 2. Factors and components comprising the organization's intra-organizational and inter-organizational environment

Factors and components comprising the organization's intra-organizational and inter-organizational environment	
Intra-organizational	**Inter-organizational**
(1) Organizational personnel component	(4) Customer component
• Educational and technological background and skills	• Distributors of product or service
• Previous technological and managerial skills	• Actual users of product or service
• Individual member's involvement and • commitment to attaining system's goals	(5) Supplier component
• Interpersonal behavior styles	• New materials suppliers
• Availability of manpower for utilization • within the system	• Equipment suppliers
(2) Organizational functional and staff units Component	• Product parts suppliers
• Technological characteristics of organizational units	• Labor supply
• Interdependence of organizational units in carrying out their objectives	(6) Competitor component
• Intra-unit conflict among organizational functional and staff units	• Competitors for suppliers
• Inter-unit conflict among organizational and staff units	• Competitors for customers
(3) Organizational level component	(7) Socio-political component
• Organizational objectives and goals	• Government regulatory control over the industry
• Integrative process integrating individuals and groups into contributing maximally to attaining organizational goals	• Public political attitude towards industry and its particular product • Relationship with trade unions with jurisdiction in the organization
• Nature of organization's product service	(8) Technological component
	• Meeting new technological requirements of own industry and related industries in production of product or service
	• Improving and developing new products by implementing new technological advances in the industry

Source: Duncan (1972, p. 315)

This is in line with Kannan and Tan (2010) stating that supply chains of innovative products (e.g. new products for new markets and shifting customers characterized by uncertain demand) exhibit a higher level of integration and use more integrative mechanisms than supply chains of functional products (e.g. simple commodity products, standardized with predictable demand) in terms of planning, control, quality management, and service and after sales support. Moreover, suppliers in supply chains of high innovative products are more proactive compared to suppliers of functional products. Contrary to these findings, Kemppainen and Vepsäläinen (2003) concluded that joint planning is less common in situation when there is more data uncertainty and longer planning scope. The authors investigated six finish supply chains in electronics, mechanics and paper industries.

Contextual factors related to low level of SC Integration

Appendix 2 provides list of contextual factors related to low level of SC Integration. Low technological uncertainty requires mainly focus on internal integration rather than on external (i.e. Boon-itt and Wong, 2010). Regarding the contextual factor of proactive strategy, low level of integration is explained by Stonebraker and Liao (2004) in that organizations applying this strategy tend to exploit opportunities and change search for more flexible structure with less integration to be able i.e. quickly switch suppliers when new technology becomes available. Additionally, stable and less competitive industry and excess of resources can be managed without intensive integration by applying arm's length relationship (i.e. Bagchi and Skjoett-Larsen, 2002; Dyer et al., 1998). Low level of integration is desirable in situation when there is low uncertainty of demand, standardized, functional type products/ components, longer PLC, consistency in supply and quality and short-term cost reduction strategy. The factors are almost equally distributed under internal and external organizational environment. *Table 3* below provides summary of the above discussed contextual factors of low level and high level of SC Integration.

In some cases, suppliers and customers misunderstood their context and they apply inappropriate type of inter-organizational relationship, taking into consideration the internal and external power situation they are working in (Cox, 2004).

Power and level of SC Integration

The authors suggested that supplier development and SC Integration practices work successfully under circumstances of buyer dominance or interdependence. According to Cox (2004), in situation of buyer dominance or interdependence

between buyers and seller in terms of power, the proactive supplier development is more likely than reactive (supplier selection) practices. This is also valid in cases when power structure as a whole encompasses dyads of buyer dominance and interdependence. Then, proactive rather than reactive SC Integration can be applied.

Contradictory, under circumstances of independence of both buyer and supplier, the collaborative relationship is not applicable. Moreover, in cases where buyers is proactive it is likely that the originally arm's length relationship will move to more long-term and highly collaborative relationship.

Table 3. Contextual factors of low level and high level of SC Integration

Contextual factors related to high level of SC integration	Reference	Contextual factors related to low level of SC integration	Reference
High technological uncertainty,	Boon-itt and Wong (2010)	Low technological uncertainty	Boon-itt and Wong (2010)
High environmental turbulence	Stonebraker and Liao (2004)	Proactive strategy (prospector)	Stonebraker and Liao (2004)
Complex rapidly changing SC environment	Power (2005)		
High competitive intensity,	Richey et al (2009); Bagchi and Skjoett-Larsen (2002)	Low competitive intensity	Richey et al (2009); Bagchi and Skjoett-Larsen (2002)
Scarcity of resources	Dyer et al. (1998)	Excess of resources	Dyer et al. (1998)
Unpredictable market demand		Consistent supplies quality/ service ability	Cooper et al (1997)
Shortening of PLC, very short PLC	Zhao et al (2011)	Longer PLC	Zhao et al (2011)
Focus on long term value creation	Dyer et al (1998)	Short –term cost reduction	Dyer et al (1998)
Low volume uncertainty/ high uncertainty in product mix/ specification High uncertainty in volume/ high uncertainty in mix/ specification	Van Donk and Van der Vaart (2005)	High uncertainty in volume/ low uncertainty in product mix/ specification Low uncertainty in volume/ low uncertainty in product mix/ specification	Van Donk and Van der Vaart (2005
Highly strategic input	Power (2005); Kraljic (1983); Zhao et al (2011)	Standardized input	Zhao et al (2011);
Total cost reduction strategy, differentiation	Morash and Clinton (1998)		
Complex-product industries; innovative-unique products	Dyer et al (1998); Lamming et al (2000)	Functional products Standardized products industries	Zhao et al (2011); Lamming et al (2000)
		Long distance among SC members	Cooper et al (1997)

2.3 Existing context-based frameworks and models of SC Integration

In the existing SC Integration literature, the following frameworks or models specifically considering context in relation to integration with customers and/or suppliers have been found: The Kraljic's (1983) purchasing portfolio matrix, Fisher's (1997) matrix of matching supply chains with products; Lee's (2002) framework of demand and supply uncertainties; Christopher's et al. (2006) matrix of demand/ supply characteristics of various products/ markets; and Van Donk and Van der Vaart's (2005) framework of shared resources and different levels of uncertainty.

According to Kraljic's (1983) the type of relationship with suppliers depends on two factors (1) the strategic significance of purchasing (i.e. strategic items, bottlenecks items, leverage items, and noncritical items) with criterion such as value added profile of product line, the percentage of raw material costs in relations to total costs, impact on profitability; and (2) the supply market complexity with criterions such as the market conditions (i.e. monopoly, oligopoly), pace of technological development, barriers to entry the market, logistics costs. Based on these criterions organizations might determine type of supply strategy and relationship with suppliers. It means that for each of the four categories of items there is a unique purchasing approach. The author considers several contextual factors; suggest what main tasks that need to be carried out between customers and suppliers and what required information should be shared to manage supply efficiently.

Another context based framework has been developed by Fisher (1997) who investigated different consumer products within food, apparel and automotive industry to show that efficient supply chains are needed for functional products while for innovative products responsive supply chain is more appropriate to maximize performance. To identify if a product is functional or innovative the following factors have been considered, such as demand pattern, product life cycle, contribution margins, product variety, average forecast errors, average stock outs rate, and lead times. The authors provide the main characteristics of both physically efficient supply chain and market responsive supply chain.

Building on Fisher's framework focusing on supply uncertainties, Lee (2002) extended the framework by investigating specifically demand uncertainties related to different types of products in order to propose the uncertainty framework determining matching supply chain strategies. While demand

uncertainty is linked to demand predictability for a product, the supply uncertainties is low in a "stable" supply process defined by mature manufacturing process and technology used and where supply base is well established. On the other hand, supply uncertainty is high in an "evolving" supply process characterized by manufacturing process and employed technology under development or rapidly changing, and by supply base limited in scope and experience. The different demand and supply uncertainties of functional and innovative products requires different supply chain strategies such as efficient, responsive, risk-hedging, and agile supply chains.

Additionally, Christopher et al. (2006) have also connected to the work of Fisher by adding to his framework yet another dimension, namely, replenishment lead times of supply and predictability/ variability of demand as according to the authors the previous frameworks/ taxonomies focus mainly on nature of product and life cycle. Based on these supply and demand dimensions they suggest lean, leagile, or agile global supply chain strategies.

Van Donk and Vand der Vaart (2005) also focus on investigating the contextual factor of uncertainty as the authors consider it to represent one of the main drivers of close relationships in a supply chain. They examine level and scope of integration with customers characterized by shared resources with varying type and amount of uncertainty. Five supplier-customer types of relationships, including integrative practices, depending on the uncertainty are suggested.

Limitations of the above presented frameworks and models are that they tend to not account for integration of an organization both with its suppliers and customers, or they tend to be too generic to address what specific level of integration is needed with a supplier and customer. They are predominantly based on analysis of dyadic relationships between suppliers and customers rather than triadic. The addressed contextual factors seem to be often overlapping in the various frameworks and models.

2.4 Summary

The *Figure 5* illustrates the main aspects discussed in this chapter. Specifically, the concept of SC Integration was addressed in terms of coordination mechanisms, and integration mechanisms. Scope of SC Integration, as well as four levels of SC Integration was discussed. To account for the organizational context and its effect on integration, structural contingency theory was used to explain that relationship. Consequently, contextual factors of high respectively

low level of SC Integration were listed. Finally, context based models and frameworks related to SC Integration were identified in previous research.

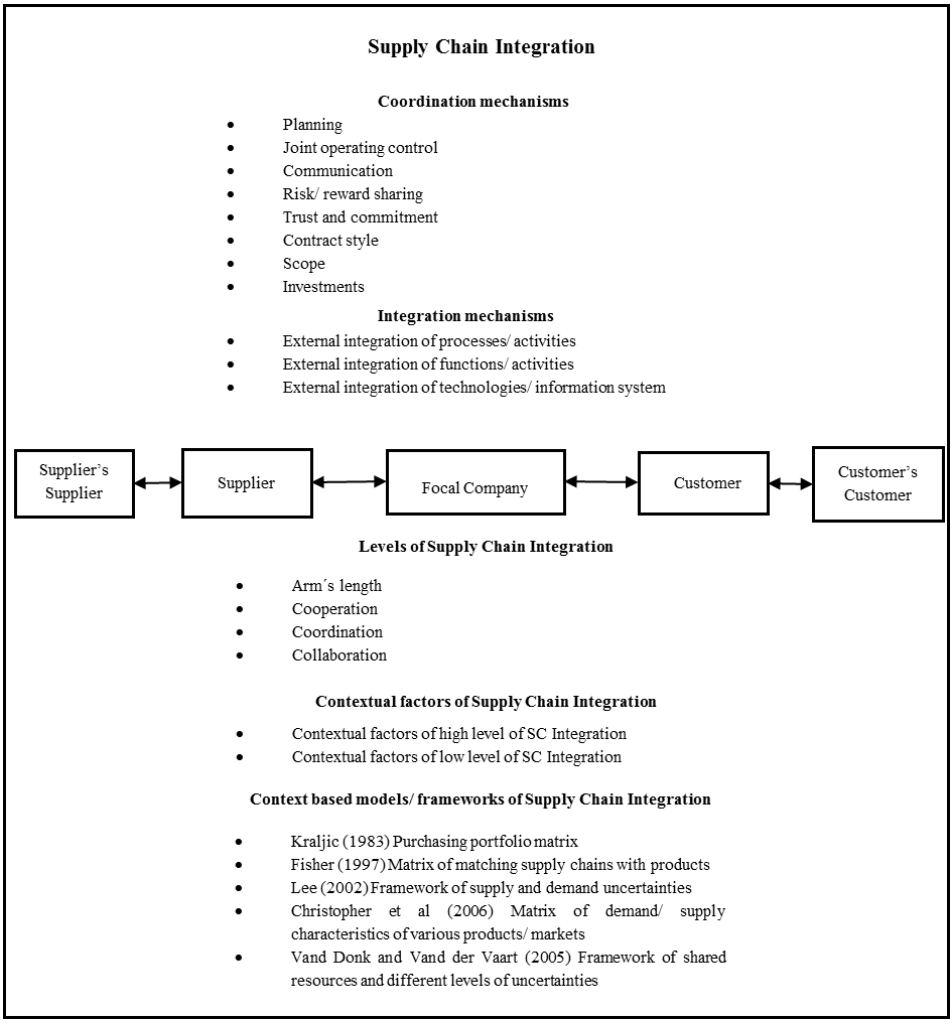


Figure 5. Summary of the theoretical frame of reference

3. Methodology

The methodology chapter starts with clarifying author's ontological and epistemological position. Next, the author argues for Grounded Theory approach as being appropriate for answering outlined research questions. The design of the research is described in terms of time horizon of study, sampling and data collection method. Moreover, six steps approach for data analysis is presented. Finally, criterions for research credibility are presented and summary of methodological choices is provided.

3.1 Scientific reasoning

Prior to questions of research methods should be the questions of paradigm representing the basic beliefs or worldview that assist the researcher both in selection of method and in defining researcher's epistemological and ontological position (Guba and Lincoln, 1994; Åsberg, 2000).

3.1.1 Research paradigm

Functionalist paradigm closely reflects the author's world view adopted in this research. Its main attributes are problem-oriented in approach with intention to provide solution to practical problems. It also assumes that organizations are rational units with rational problems to which rational solutions can be offered (Saunders et al., 2009).

The functionalist paradigm belongs to conceptual dimensions of *objectivism* and *regulatory perspective*. The objectivism will be discussed in the next section. The regulatory perspective means that the author aims at development of set of rational recommendations related to the current situation (ibid). In relation to this thesis, it implies development of a context based model of SC Integration that would provide support for practitioners.

3.1.2 Ontological position

The ontological position applied in this thesis is *objectivism*. This way of conceptualizing organizations is prevailing in the field of logistics and SCM where the author has her background. Organizations are seen as having pre-defined set of formal properties that may represent in some situation a restriction on individuals' actions.

This is in line with the main assumptions of objectivism. The objectivism implies that social entities are outside our reach and influence; they are external to us who are concerned with their existence. An organization is seen as tangible objects shaped by rules, regulations, and standardized procedures (Bryman and Bell, 2007).

On the other hand, the author also inclines towards the notion of constructionism as described by Bryman and Bell (2007), organization rules, procedures and routines are not entirely pre-given and actors have impact on shaping them as they are part of the social units (i.e organizations, cultures etc.)

3.1.3 Epistemological position

The philosophical position that is in line with the author's objectivistic ontological position implies *realism*. Two types of realism are distinguished: direct realism and critical realism.

The author's position is within the critical realism as it is considered to be relevant in the field of logistics/SCM that is concerned with the social world we are part of. The motive for the critical realism position is also consistent with the argument made by Bhaskar (1989) in Saunders et al., (2009, p. 115) that *"…what we see is only part of the bigger picture."* Another motive is that the critical realists stress importance of conducting multi-level studies as each level contributes to researcher's understanding of the subject of scrutiny. Their position reflects the idea that the social world is in constant change. Focus is on context and the researcher is aware of biases such as world view that impact on his/her research. Consequently, the purpose of research to understand the reason for phenomena in order to be able to recommend a change (Saunders et al., 2009) is also in line with the author's view on type of research conducted within the field of logistics and SCM.

3.2 Research strategy

The choice of an appropriate research strategy is dependent on particular research question, objectives, the extent of current knowledge, researcher's own philosophical position and also on time and other resources available (Saunders et al., 2009).

3.2.1 Grounded theory approach

The research approach and method used in this thesis is the Grounded Theory (GT). The primarily idea of GT is *"to explore, to extend or to gain understanding"* of a phenomenon (Kaufmann and Denk, 2011, p. 66). GT aims at building and developing theoretical concepts from empirical data which is relevant to gain more understanding of the actual practice and to ground the theory well in empirics. The method represents a systematic, but flexible way for gathering and analyzing qualitative data to generate theories that are *"grounded in the empirical data themselves"* (Charmaz, 2006, p.2). This method is appropriate when there are discrepancies, contradictions, and ambiguities among existing knowledge or when a topic needs to be further developed (Corbin and Strauss, 2008). Additionally, the GT approach is not restricted to a particular unit of analysis, time or place (Mello and Flint, 2009).

Although the GT method is not widely used in the field of logistics/-SCM, it has slowly increased in popularity. GT has been applied to explore relatively less researched areas such as reverse logistics (e.g. Bernon and Rossi, 2011; Dowlatshahi, 2005) or sustainability issues (e.g. Flint and Golicic, 2009). It has also been used to develop frameworks and models describing relationships among supply chain actors (e.g. Boeck and Wamba, 2008; Garver and Mentzer, 2000).

Recalling the highlighted fundamental issues in existing SC Integration research that have a negative effect on current status and development of existing theory, and the nature of research objective of this study, GT approach was selected as particularly fitting method.

This systematic methodological strategy has been originally developed by Glaser and Strauss (1967). In their book *"The Discovery of Grounded Theory"* they formulated this method and stressed development of theories from research that is grounded in empirical data. The Glaser and Strauss's GT was aimed to oppose the prevailing methodological assumptions in the 1960s characterized

by positivist methods stressing objectivity, generality, and replication of research and testing of hypotheses and theories. Ironically, in 1990 GT earned reputation of being rigor, useful, but also for its positivistic attributes (Charmaz, 2006). Since the 1990, there has been vast number of researchers that moved GT away from the positivistic position represented by Glaser's and Strauss and Corbin's work. The authors such as Charmaz (1990); Bryant (2002) stand for the interpretive view on world.

However, the boundaries between these two have been blurred. Today, GT included both positivistic and interpretivistic assumptions. While Glaser's (2003) view on GT remains strongly positivistic, Strauss and Corbin's (1998, p. 15 cited in Charmaz, 2006) version has positivistic attributes but stresses relationship between theoretical concepts. The authors define theory as *"…a set of developed concepts related through statements of relationship, which together constitute and integrated framework that can be used to explain or predict phenomena."* Their view on theory construction has interpretive attributes. Moreover, In Corbin and Strauss (2008) the authors state their awareness that there is no "reality" to be discovered, yet, they believes in existence of external events that they have no influence over. The acknowledged their constructivist leaning by concluding that: *"…concepts and theories are constructed by researchers out of stories that are constructed by research participants who are trying to explain and make sense out of their experiences and/or lives, both to the researcher and themselves."* (p.10).

Given the author's ontology and epistemology that have been discussed above, the Strauss and Corbin's (2008) version of GT will be used throughout the thesis to provide guidelines for collection and analysis of qualitative data.

Using literature

One of the common misconceptions related to GT is about using literature. According to Suddaby (2006), there is a misassumption that researcher is expected to enter the field without any previous knowledge of existing research. Leaving away the discussion about how realistic it is to conduct reasonable research without clearly stated research question and prior knowledge of theory, it can be concluded as stated by Suddaby (2006, p. 634) that *"Grounded Theory is not excuse to ignore the literature."* However, this discussion seems to be more problematic. The researcher attempts to avoid existing theory as his/her desire is to find something new, especially when studying well established areas. According to Corbin and Strauss (2008) stated that existing theoretical framework can offer *"insight, direction and list of initial concepts".* It can also be used to *"complement, extend and verify the findings."* (ibid, pp. 39)

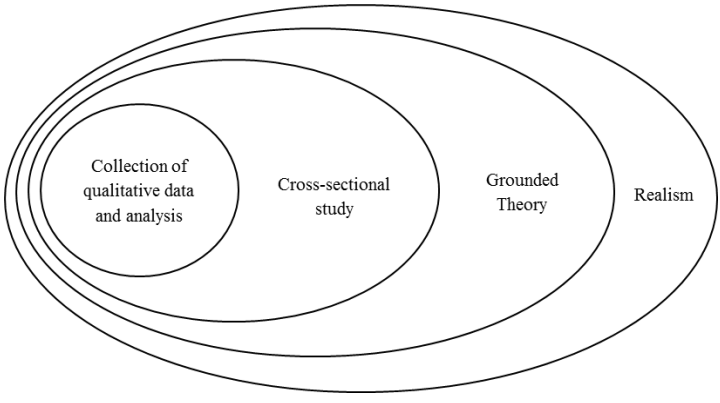
Rather, the real risk of using previous literature is that it can force researcher to unconsciously test hypotheses. There are several ways to solve this problem. One is to use more substantive areas (theory that is based on existing research) instead of focusing too narrowly to a single area. Another advice is to be constantly aware of probability to be influenced by existing conceptualization of the subject of scrutiny (Suddaby, 2006).

In order to mitigate the risk discussed above, the author attempts to approach the concept of SC Integration from broader perspective. Specifically, SC Integration has been defined in terms of coordination and integration mechanisms, and levels of integration. Moreover, number of contextual factors related to both external and internal organizational environment has been identified in previous research. Having in mind the Suddaby (2006, p. 635) statement that *"…you are only human and that what you observe is a function of both who you are and what you hope to see"* the author is aware of the possibility to be influenced by the developed theoretical frame of reference.

3.2.2 Time horizon of the study

In planning stage of the research it is important to consider the time horizon of the study. The aim of this study is to scrutinize a particular phenomenon at a particular time indicating the cross-sectional study (Saunders et al. 2009).

The author's epistemology, ontology and selected research method are illustrated in *Figure 6.*



Adapted from: Saunders et al. (2009)

Figure 6. The research "onion" relevant to this thesis

3.3 Research design

Research design represents a general plan for the process to fulfill the research objective and to answer the research questions.

3.3.1 Data collection

Sampling

In order to address one of the gaps in existing SC Integration research – the predominant focus on dyadic relationships – this study has a triadic scope (i.e. supply chain scope). Each supply chain (triad) consists of a focal company and its 1-tier customers and 1-tier supplier. At an early stage it has been decided to study two different supply chains in the project. One reason was to research two different industries. The selection process of the focal company A (FC-A) and focal company B (FC-B) has been guided by two main criteria, namely, various contexts and engagement in SC Integration efforts.

To account for various contexts the goal was to differentiate the studied sample in terms of task uncertainty and task interdependence as described in contingency literature (Donaldson, 2001). Task uncertainty relates to rate of technological change, and environmental change while task interdependence relates to rate of interdependency among units. It includes aspects of strategy, type of product and its innovation rate (Donaldson, 2001).

As illustrated in *Figure 7*, the FC-A, a component producer, of the first supply chain (SC-A) manufactures quite unique and innovative products with a strong emphasis on quality, reliability, and traceability. Close interaction with suppliers is critical. The level of environmental and technological change is assumed to be rather high. The initial contact with FC-A was established via a networking event. The company was included in the study since it could confirm active engagement in integration activities with supply chain partners, and since it was interested in participating in the research project.

The FC-B, a component producer, of the second supply chain (SC-B) manufactures functional standard products. In general, closeness to suppliers is not assumed to be a critical component for such a company, and would probably be and it is exposed to rather low level of environmental and technological uncertainty. The company was found via a web search and the initial contact was via e-mail.

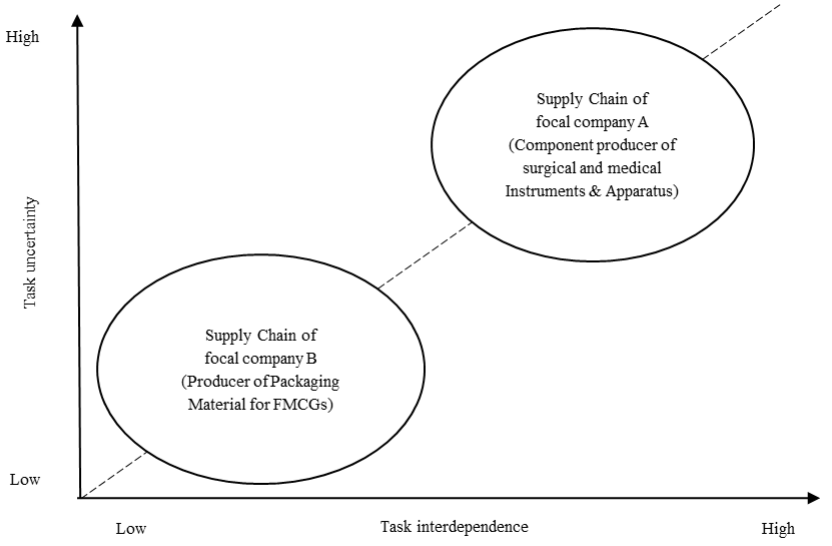


Figure 7. Sample selection

Traditional purposive sampling was applied in order to identify interviewees for the pilot interviews and for the first two initial respondents from the focal companies. To identify additional interviewees at both focal companies and their suppliers and customers theoretical sampling was applied.

Following the GT approach, the primary data collection method was in-depth interviews. The process of data collection ended when theoretical saturation had been achieved (Corbin and Strauss, 2008). In this study, saturation was achieved after fourteen interviews (between one and one and half hour long) had been conducted. Four of the interviews were pilot interviews (two with industry representatives and two with representatives from consulting companies). The pilot interviews were conducted to discuss and confirm the relevance of the research topic and to gain initial insights into the subject area. The remaining ten core interviews were conducted with members of the two supply chains. Six interviews were with members of the first supply chain (FC-A and its 1-tier raw material supplier and 1-tier customer which is an OEM). Similarly, four interviews were with members of the second supply chain (FC-B and its 1-tier customer being an OEM). Data from 1-tier raw material supplier were obtained from FC-B since the supplier chose not to participate in the study. The interviewees (CEO, SC Managers, Purchasing Managers, Sales Managers, and Logisticians) were selected based on their experience and knowledge of the topic. The list of respondents, date and length of the interview can be found in

Table 4 bellow. Due to confidentiality reason the actual names of the companies cannot be disclosed.

Conducting interviews

Prior to each interview, project description and four general interview questions have been submitted to the interviewees: (1) What is the current level of SC Integration at your company? (2) What are reasons for the particular level of integration? (3) Is there potential desire to improve the situation and why? (4) Could you provide examples of a successful/ less successful implementation of SC Integration? The interviews lasted between one and one and half hour using "grand tour" questions (e.g. Mentzer et al, 2000). During each interview additional questions have been asked to either elaborate closer on interesting and relevant concepts or to guide the interviewee in right direction towards the topic of interest. Thirteen interviews have been recorded and transcribed. Only one interview (1-tier customer of FC-B) has not been recorded as the interviewee preferred not to. The interviews were conducted between April 2012 and March 2013.

The letter of introduction, the project description, and the interview guide can be found in the *Appendix 3*. All transcriptions, as well as all additional questions are part of the database (documents included in the databases are listed in *Appendix 4*. They are available upon request.

Table 4. Overview of the interviews

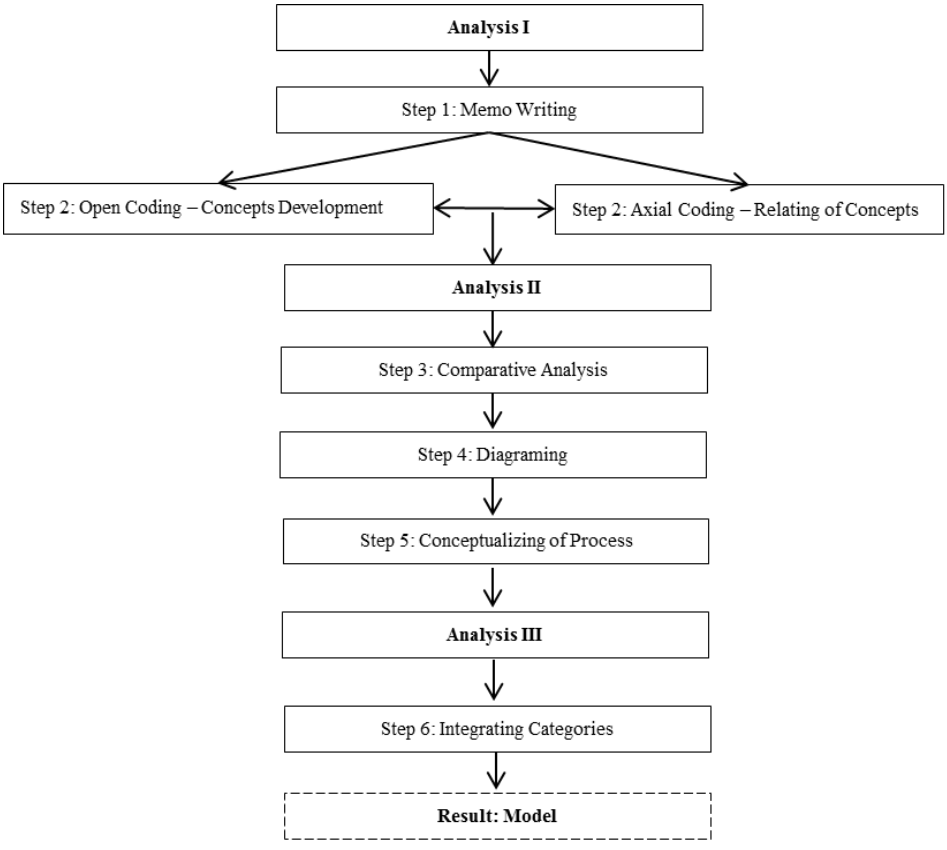
Interview Number	Focal company/ SC partner/Other respondents	Interviewees	Date of conducting interviews	Length of interviews/ type of interview
Pilot Interviews				
1	Consultancy company X	Partner (retail, manufacturing area)	2011-11-17	1 h (face-to-face)
2	Consultancy company Y	CEO	2012-04-02	1 h (face-to-face)
3	Manufacturing company Z1	Project manager	2012-05-14	1,5 h (face-to-face)
4	Manufacturing company Z2	Senior project manager	2012-08-06	1 h (face-to-face)
Core Interviews				
5	Focal company A	CEO	2012-08-23	1,5 h (face-to-face)
6	Focal company B	Sales manager	2012-09-04	1,5 h (face-to-face)
7	Focal company A	Logistics manager	2012-12-06	1,5 h (face-to-face)
8	Focal company A	Senior sales and project manager	2013-01-10	1 h (face-to-face)
9	Focal company A	Purchasing manager	2013-01-11	1 h (face-to-face)
10	Focal company B	Supply chain manager	2013-01-14	1 h (face-to-face)
11	Focal company B	Sales and customer manager	2013-02-08	1 h (face-to-face)
12	Customer of focal company A	Purchasing manager	2013-02-18	45 min (face-to-face)
13	Supplier of focal company B	NA	NA	NA
14	Customer of focal company B	Purchasing manager	2013-03-27	30min (phone interview)
15	Supplier of focal company A	CEO	2013-02-06	1,5 h (face-to-face)

3.3.2 Data analysis

The main idea of GT, as presented by Corbin and Strauss (2008), is to derive theoretical constructs from qualitative analysis of raw data. To carry out an analysis, empirical data needs to be break apart into components which are examined with purpose to identify their properties and dimensions. Finally, the knowledge regarding the components and their properties is used to make inferences about the studied phenomenon as a whole (ibid).

Analysis is a dynamic process which consists of brainstorming, trying out various ideas, elimination of some, and expanding on other ideas before reaching any conclusions. Due to fundamentally rich nature of qualitative data, more than one interpretation from the data is possible. Different researchers focus on different elements of data, interpret them differently, and recognize different meanings (ibid).

As illustrated in *Figure 8*, the process of analysis can be done by following steps such as: (1) Memo writing: it is written records of analysis; (2) Open coding – concept development and Axial coding – relating of concepts: these steps are usually performed simultaneously. The idea of open coding is to breaking apart data and defining of concepts representing raw data. Axial coding is about relating concepts to each other; (3) Comparative analysis: focuses on comparing concepts to identify similarities and differences; (4) Diagraming: is a device for visualization of relationships between concepts; (5) Conceptualization of process: aims to identify patterns between concepts, and (6) Integrating categories: deals with process of linking concepts into resulting theoretical construction (ibid).



(Based on Corbin and Strauss, 2009)

Figure 8. Process of analyzing empirical data using Grounded Theory methodological approach

3.4 Research credibility

Credibility indicates, according to Corbin and Strauss (2008) trustworthiness of findings. They should reflect experience of researcher, readers and participants to be believable. At the same time, the findings represent one of many plausible interpretations of the data.

The following ten general criteria, proposed by Corbin and Strauss (2008) for judging quality of research using GT method, were followed when conducting this study. How they have been fulfilled will be addressed in *Chapter 8.*

- *Fit*: the criterion of fit is achieved when the results corresponds to the experience both the practitioners as participants in the thesis and to professionals (i.e. scholars).
- *Applicability*: applicability or in other words usefulness of results is fulfilled when new explanations or insights are provided.
- *Concepts*: it is expected that results will be presented in form of concepts/ themes. Moreover, the results need to have substance and their properties and dimensions should be developed to ensure density and variation of results.
- *Contextualization of concepts*: it is important to provide context to help the reader to understand the reason for occurring of events, their meaning, and experiences.
- *Logic*: logic is represented by logical chain of ideas throughout the text.
- *Depth*: the findings should be well elaborated in terms of descriptive details which add richness and variation to the results and distinguish them from thin, ordinary, and uninteresting findings.
- *Variation*: it is recommended to incorporate variation into the findings to demonstrate differences in pattern, dimensions, or properties.
- *Creativity:* it is not necessary that the topic have to be new, however, understanding of the topic in a new way is desirable.
- *Sensitivity:* it should be the analysis that directs the research rather than predetermined ideas forced on the data.
- *Evidence of memos:* there should be evidence or discussion regarding memos.

3.5 Summary of the methodological choices

The following *Table 5* provides summary of above discussed methodological choices related to the thesis.

Table 5. Summary of the methodological choices relevant for the thesis

Scientific Reasoning	
Research Paradigm	Functionalist
Ontological Position	Objectivism/ Constructivism Regulatory Perspective
Epistemological Position	Realism Critical Realism
Research Strategy	
Method Time Horizon	Grounded Theory (Corbin and Strauss, 2008) Cross-Sectional Study
Research Design	
Data Gathering	
Sampling	Traditional Purposive Sampling Theoretical Sampling
Source of Data	Open-ended, in-depth interviews
Data Analysis	Analysis I Step 1: Memo writing Step 2: Open Coding/ Axial coding Analysis II Step 3: Comparative analysis Step 4: Diagraming Step 5: Conceptualizing of process Analysis III Step 6. Integrating Categories Result: A model of contextual factors and Inter-organizational integration
Discussion	Comparison of the results with theory presented in theoretical frame of reference section
Research Credibility	
Criterions	Fit Applicability Concepts Contextualization of Concepts Logic Depth Variation Creativity Sensitivity Evidence of Memos

4. Description of studied Supply Chains of Focal Company A and B

The aim of this chapter is to provide reader with main characteristics of the two supply chains, A and B, that have been purposively selected as samples for studying the phenomenon of contextual factors and their influence on SC Integration. Focal companies from each supply chain will be introduced along with the major supply and demand side attributes. Moreover, brief facts about suppliers and customers that have been interviewed for this study will also be presented.

4.1 Supply Chain of Focal Company A (SC-A)

4.1.1 General information about the Focal company A, its customers and suppliers[2]

Focal company A (FC-A), located in Sweden, is operating within medical industry with focus on production of surgical and medical components for medical technology customers. The FC-A is a subcontractor with wide technological expertise and specialist knowledge offering high-tech components, product development, and manufacturing.

The FC-A is part of an operational group within one of the three market focused business areas. Business idea of the company is close, long-term, innovative collaboration with customers. FC-A's critical success factors are medical

[2] All information presented in this section has been obtained either from interviews or from organizations' webpages. The actual sources of information have to remain anonymous due to confidentiality reasons.

understanding, broad technological offering, global production, robust quality and development expertise.

The annual sales year 2012 of the medical focused business area within the parent organization accounted for 30% of the total sales (about 1,200 SEK million). Average number of employees at FC-A was 200 year 2012, and in total in average 8400 employees.

The market comprise of large, global customers, containing demanding development work, long product life cycles and stringent quality requirements, traceability and safety. The FC-A as a part of operational business are with a strong position in the Nordic region and growing position in the Europe and the USA.

The customer base consists of about 100 customers. About 10% of customers account for 90% of the total sales. The top 15 customers of FC-A accounts for 96% of turnover, while within the top 15 there are 5 customers generating 80% of sales. Product demand can be characterized as stable in 80%-85% of products, while the remaining 10-15% of products has unstable demand.

The supplier base of direct and indirect materials comprises 500 suppliers. The most critical suppliers represent approximately 25% of all suppliers. 80-85% of suppliers are very large compared to the FC-A. The FC-A is relatively small customer in relation to suppliers in terms of volumes purchased. The scope of raw materials used is rather small which means that the SC might be considered as fairly simple. All suppliers need to be validated and certificated due to extremely high quality standards in this industry.

Customer A

The Customer A of FC-A is a global medical technology company with production facilities and sales worldwide. The annual sales for 2012 totaled about SEK 11 billion and number of employees of 7500. Products/components that currently are not available on market are outsourced by customer A to be manufactured by subcontractors (i.e. FC-A).

Supplier A

Supplier A is distributor which is up to 100% owned by large organization producing plastic raw materials for various industries. The owner of the supplier A has about 1000 employees in total with annual sales of about Euros 750 million and approximately 10,000 customers worldwide. Volumes of raw material that are delivered to FC-A by this supplier, through distributor, are small (0,4-0,5 %) compared to this supplier total volumes delivered.

4.2 Supply Chain of Focal Company B (SC-B)

4.2.1 General information about the FC-B and its customer base and supplier base[3]

Focal company B (FC-B), with its production facility in Sweden, is part of a leading global consumer packaging producer with plants worldwide. The focus is to make high quality packaging as efficiently, profitably and sustainably as possible.

The FC-B's central organization has nearly 70 manufacturing sites in over 20 countries across the globe with £ 4,300 million in annual sales year 2012 and with 11, 000 employees in average. Generally, it can be characterized as a global company with global customers. Sales to top ten customers account for 70% of total sales.

The FC-B, similarly to the other production sites within the group, is a business to business company with emphasis on quality, delivery, costs and innovations. It is one of the largest consumer packaging producers in Europa with annual sales of SEK 2,5 billion and about 250 employees.

Industry characteristics are high barriers to entry with the economy of scale (numerous production plants) that favors major players. Due to substantial transportation costs in relation to the product total cost, key success factor is to allocate plants in close proximity to customers' production plants.

The main attributes of the market are high growth, few but very large customers, long distances between FC-B's production site and customers' production sites, and highly diversified market (i.e. large number of product variants with relatively small volumes). 20% of all FC-B's products are large volume items, while 80% of all products represent medium and small volumes. The large volumes products have clear seasonal variation.

The supplier base comprise of 300 suppliers of direct material, additional direct material, and services. Direct material suppliers are very few but large. Majority of suppliers are service suppliers.

[3] All information presented in this section has been obtained either from interviews or from organizations' webpages. The actual sources of information have to remain anonymous due to confidentiality reasons.

Regarding the customer base, 80% of all customers are large organizations, while 20% are medium and small organizations. The large organizations are represented by very few large companies on market that account for 80% of total sales.

Customer B

Company B is operating within fast moving consumer goods (FMCGs) sector with annual sales 2012 of about DKK 67 million and with 41 000 employees. The company B can be characterized by high level of diversity in terms of brands and markets. Its main focus markets are in Western Europe, Eastern Europe, and Asia. FC-B represents a large supplier of company B.

4.3. Summary of the main characteristics of SC-A and SC-B

Table 6 provides summary of the main points discussed above regarding the main attributes related to market/ industry/ product, demand side, and supply side of SC of FC-A and FC-B.

Main differences between these two SCs in terms of market/ industry/ products, and demand side/ supply side attributes seem to be quality requirements, complexity of products, level of innovativeness, length of durability of products, and level of demand stability, and volumes produced by FCs in relation to their SC partners in general.

SC of FC-A operates in industry with extremely stringent quality requirements, traceability and safety, complexity of product and level of innovativeness is high, durability of products is long and demand rather stable. Volumes produced by FC-B are small in comparison to volumes produced by its SC actors.

On the other hand, SC of FC-B can be describe by focus on quality, delivery, and low costs, rather low complexity of products, short durability, and seasonal demand. Volumes produced by FC-B are of comparable size with volumes produced by its SC partners (see *Figure 9*).

Table 6. Summary of the main attributes of SC of FC-A and SC of FC-B

Summary of the Main Attributes of SC of FC-A and SC of FC-B		
Attributes	**SC of FC-A**	**SC of FC-B**
Market/ industry/ products	Medical industry - Production of surgical and medical components/ products Predominantly large, global customers Long product life cycle/long durability of products Demanding development work Stringent quality requirements, traceability and safety Stable demand for 80-85% of products)	FMCGs industry - Production of packaging material and filling process Predominantly large, global customers Long product life cycle/ short durability of products, seasonal variations Quality, delivery, costs, and innovations, and sustainability Industry characterized by high barriers to entry, economy of scale, close proximity to customers' crucial due to high transportation costs Highly diversified market
Demand side	About 100 customers 10% of customers account for 90% of FC-A's sales	Top ten customers account for 70% of FC-B sales 80% of all customers are large organizations
Supply side	About 500 suppliers 25% most critical suppliers 80-85% are substantially larger than FC-A Fairly simple supply side in terms of number of items purchased	About 300 suppliers Direct material suppliers are very few but large companies

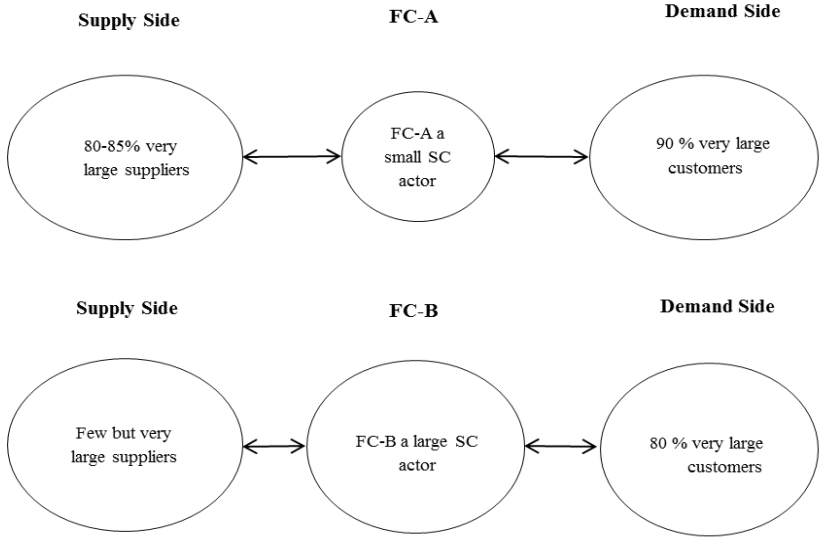


Figure 9. Size of FC-A and FC-B in relation to their SC partners (volumes)

5. Analysis

The following chapter focuses on analysis of empirical data. All information used is based on interviews with respondents. Firstly, a brief overview of the analysis process using GT methodology is presented, followed by a summary of pilot interviews. After that, empirical data from each of the SC actors involved in the study are scrutinized in terms of identifying and structuring contextual factors and their influence on level of SC Integration.

Following the GT methodology, the analysis of the collected data was conducted in several rounds. Three major rounds of analysis, *Analysis I*, *Analysis II*, and *Analysis III*, divided into six steps were carried out. In this section first brief overview is provided of the analysis before presenting it in detail in chronological order. In the first analysis of the interviews, 145 contextual factors were identified. It could be seen that each contextual factor has at least one corresponding integration activity. Furthermore, by assigning values to both the contextual factors and the integration activities, it was possible to graph the relationship between them. Interestingly enough, it has been found a linear relationship and thus a model could be created to illustrate this relationship. In subsequent rounds of analysis data reduction has been carried out to create clusters of contextual factors and corresponding integration activities. In the final version four clusters were developed with 18 contextual factors with 82 related inter-organizational integration activities. Also, a separate list has been developed with 11 clusters representing the most common SC Integration activities. In the following sections the detailed description of six step approach of the analysis is provided.

5.1 Summary of pilot interviews

Prior to the core interviews, four pilot interviews have been carried out to evaluate the relevance of the research objective and research questions for practitioners, and to gain initial insight and understanding of the concept of SC Integration.

The findings from the pilot interviews might be summarized in that the topic is highly relevant, especially the consideration of context is vital, rather than one unifying solution for all cases. Additionally, the way how to operationalize an appropriate level of integration appeared to be a critical question, as well as how to share related risk and reward, and how to measure efficiency of an integrative relationship. The current level of inter-organizational integration is mainly limited to dyadic with 1-tier customers and/or 1-tier suppliers. In industries with more complex products the level and scope of integration seems to be higher compared to industries with simple products. One of the most critical factors for successful implementation of SC Integration is level of maturity of a company in terms of internal integration of functions and top management support regarding integration both internal and external one. The interviews also confirmed the importance of contextual factors related to organizational internal and external environment that affect level and type of integrative initiatives with suppliers and/or customers.

5.2 Analysis I

In the *Analysis I* section, two first steps of the analysis, Memo writing and Open/ axial coding, are described in terms of their goals, the procedures of achieving the goals, and expected results. After that, the results of those steps with empirical data from respondents of supply chain A (SC-A) and supply chain B (SC-B) are presented.

Step 1: Memo writing

The purpose of the memo writing is to obtain initial insight into the collected empirical data in terms of identifying contextual factors and their effect on level of integration with suppliers and customers. Following the GT approach, the goal of each interview is to identify aspects that need to be clarified during future interviews. This clarification process continues until theoretical saturation has been reached. Consequently, each interview was transcribed and analyzed directly after it was conducted. Each interview was subsequently divided into sections following the natural breaks in the text. After the analysis of each section, memos were written to capture initial thoughts about the data with respect to the research purpose (all memos are part of the research databases and available upon request at the author).

Step 2: Open/ axial coding – concepts development

The first goal of this step was to identify contextual factors (i.e. internal and external environmental factors). What was also realized is that each contextual factor is related to SC integrative activities (i.e. coordination mechanisms and integration mechanisms). Thus, through the process of identifying of emerging concepts, each memo was therefore analyzed in detail to identify contextual factors and corresponding integration activities. As a result, it could have been developed an initial list of contextual factors (e.g. quality requirements, customer's demand volumes) and at least one SC integration activity related to each of the contextual factor (e.g. performance feedback, VMI consignment stock). In total we identified about 300 integration activities for the 145 contextual factors. Although, the intension was to study triadic integration, the integration activities identified in studied SCs take place solely on dyadic level.
At this stage, to be able to handle the large number of contextual factors, the idea was firstly to structure them into clusters. A set of preliminary clusters of contextual factors reflecting characteristics of studied actors of SC-A and SC-B was created.

The next step focused on developing understanding of emerged concepts. In order to identify properties and characteristics of the contextual factors and the SC Integration activities one more round of analysis of the memos had to be conducted. This round of analysis revealed that all contextual factors are characterized by values (e.g. large, important, low, initial, complex). It was also realized that each value signifies magnitude of the contextual factor. Similarly, analysis of the memos also indicated levels of strength for the SC integration activities. While the literature usually describes the level of inter-organizational relationships by labels such as arm's length, cooperation, coordination, and collaboration (e.g. Spekman, 1998) this terminology has not been found common. Rather, the practitioners used terms like high level, medium or low level of SC Integration when referring to the relationships that are used. Thus, values of low, medium or high to each SC Integration activity have been assigned.

5.2.1 Open/ axial coding of supply chain A (SC-A)

The results of the *Analysis I* will be firstly presented from the perspective of focal company A (FC-A), from the perspective of 1-tier customer and 1-tier supplier of the SC-A.

Focal Company A

Table 7 provide list of contextual factors and related SC integration activities from perspective of FC-A which will be analyzed in more details in the subsequent sections. Firstly, contextual factors, their clusters, and values will be addressed followed by elaboration on related SC Integration activities and their levels.

Contextual factors from the perspective of the focal company A (FC-A)

All the identified contextual factors relevant for FC-A listed in the Table 7 have been grouped into six initial clusters based on their conceptual similarities. Each of the clusters will be discussed in more details below:

1) Focal Company
2) Product
3) Customer
4) Supplier
5) Information Sharing
6) Environmental Uncertainty

1) Focal Company

Focal company is a contextual factor that refers mainly to Size of the focal company and Position within SC. Size represents volumes produced. Position in the SC relates to how many tiers backwards in the SC the FC-A is from the end-customer. The FC-A is of small size in terms of volumes purchased and sold in relation to majority of its suppliers and customers. Its position within the SC is not close to end-customer (in average 3 tiers or more); however it might differ depending on type of products supplied.

2) Product

Product group comprises of contextual factors referring to *Input level*, *Output level* and *Final product level*. The Input level is raw material/ components

purchased by the FC-A for further processing. Output level represents components (finished products) that are delivered to customer and final products level refers to the final product assembled by the FC-A customers.

Input level: related contextual factors are quality requirements, scale (volumes), contribution to supplier's innovativeness/ volumes, and scope of raw materials/ components used by the FC-A.

The FC-A is part of medical industry which means extremely high quality requirements on all incoming raw material/ components. Scale (i.e. volumes purchased) and scope (i.e. variety of raw materials/ components purchased) are yet of small size compared to scale and scope of majority of its suppliers which leads to lower level of attractiveness as a customer for large suppliers. However, the FC-A due to its expertise and knowledge might contribute to innovativeness of even large suppliers, and thus become an attractive customer, despite the small scale and scope.

Output level: Contextual factors related to Output level are Quality requirements/ product ownership and Contribution margins. All output (components) produced by the FC-A is owned by the 1-tier customer who is also responsible for high quality of the final products delivered to end-customers. Thus, the customer requires high quality outputs from all suppliers. Regarding the contribution margins, the FC-A have outputs generating various margins (e.g. low, medium, and high margins).

Final product level: Contextual factors related to final product assembled by the customer are Position of final product producer in SC, PLC stage, and Stage of raw materials/ components change in an already established product. In some cases, the final product producer is beyond the FC-A's 1-tier customer. Moreover, the various final products are in various stages of PLC. Both these factors may influence, for example, quality of demand forecasts as will be discussed later. There are also two main stages of raw materials/ components changes in established products, such as in initial stage and later stage. Initial stage refers to phase directly after raw material/ components has been changed while the later stage represents the mature phase when the change has been settled. Both stages have impact on SC integration.

Table 7. Identified values of contextual factors and their corresponding levels of SC Integration activities from FC-A perspective

Clusters of contextual factors/ Individual contextual factors within each cluster	Value of Contextual Factors	FOCAL COMPANY A (FC-A) Perspective					
		1-tier Suppliers			1-tier Customers		
		Level of SC Integration activities					
		Low	Medium	High	Low	Medium	High
FOCAL COMPANY							
Size (volumes – scale/ scope) purchased	Low	X					X
Position in SC	Far from end-customer					X	
PRODUCT							
Input Level							
Quality requirements on purchased products	High			X			
Volumes (scale)	Low	X					
Contribution to suppliers innovativeness/ volumes	High contribution/ Low volumes			X			
Scope of raw materials/ components used	Small	X					
Output Level							
Quality requirements/ product ownership	High					X	
Contribution margins	Low/Medium/High				X	X	X
Final Product Level							
Position of final product producer in SC/ PLC stage	Beyond 1-tier customer/ Initial stage				X		
Stage of raw material/ component change	Initial/ Late				X		X
CUSTOMER							
Level of process/ material knowledge	Low/ Good				X		X
Strategic importance	Low/Medium/High				X	X	X
Geographical proximity of customer's warehouse (VMI-consignment stock)	Long					X	
Power dominance	Low/Medium/High				X	X	X
Stage of relationship with customers	Initial/ Late				X		X
Customer's investments at supplier	Yes						X

(continued)

Clusters of contextual factors/ Individual contextual factors within each cluster	Value of Contextual Factors	FOCAL COMPANY A (FC-A) Perspective					
		1-tier Suppliers			1-tier Customers		
		Level of SC Integration activities					
		Low	Medium	High	Low	Medium	High
SUPPLIER							
Level of criticality	High			X			
Quality issues	High			X			
Geographical proximity of supplier (in context of conducting audits)	Long/ Short			X			
Cost of switching suppliers	High			X			
Supplier size (volumes)	Low/ High	X		X			X
INFORMATION SHARING							
Complexity of supply side (scope of raw mat./components used, nr of SC actors)	Low	X					
Complexity of demand side (scope of output, nr of SC actors)	High					X	
Portion of suppliers total volume purchased by FC	Small/ Large	X		X			
Level of quality requirements	High			X			
Quality of forecasts	Low					X	
ENVIRONMENTAL UNCERTAINTY							
Fluctuation of end-customer demand	Low					X	
Requirements on flexibility of SC actors	High						X
Unforeseen changes	Medium					X	

3) Customer

Customer is a higher level contextual factor referring to the following aspects depicting lower level contextual factors from the perspective of the FC-A, such as Level of process/ raw material knowledge, Strategic importance, Geographical proximity of customer's warehouse (VMI-consignment stock), Power dominance, Stage of relationship with customers, and Customer's investments at supplier. Based on the level of customers' knowledge regarding production processes and or raw materials the level of integration with suppliers may vary. Customers differ in their strategic importance for the FC-A. Three levels of importance are recognized; low, medium, and high, leading to various ways of integrating with customers. Geographical proximity of customers' warehouses might have consequences for suppliers, especially in case of VMI-consignment stock. Customers' various levels of power dominance are another contextual factor having an impact on level of integration between the FC-A and customers. Power dominance is in the context of FC-A defined as a

percentage of total supplier's turnover, level of supplier's previous experience with VMI - consignment stock, and scope and scale of items delivered to customer. Three levels of these factors have been identified; low, medium, and high. Next sub-construct is stage of relationship with customers referring either to initial stage or later stage depending on the length of relationship. Finally, customer investments at supplier have been found as additional contextual factor (sub-construct) within the construct of customer. It means that customer might in some cases invest into tools or equipment used at the FC-A plant.

4) Supplier

Supplier related contextual factors comprise of five identified lower level contextual factors; Level of criticality, Quality issues, Geographical proximity, Cost of switching suppliers, and Supplier size. Due to high quality requirements the level of criticality of FC-A's suppliers is an important factor determining corresponding level of integration with suppliers. Quality issues need to be addressed through an appropriate interaction with suppliers. Geographical proximity (i.e. long/ short distance) between the FC-A and its suppliers seems to also play a role for intensity of a relationship. High level of costs of switching suppliers in this case has consequences on integration. Lastly, supplies size (i.e. large/ small volumes) needs to be taken into consideration when the FC-A consider an appropriate level of interaction/integration with suppliers.

5) Information Sharing

Information sharing contextual factors consists of four lower level contextual factors, such as Complexity of demand side, Complexity of supply side, Size of FC in relation to size of suppliers, and Level of quality requirements. Complexity of demand side is defined as number of actors from FC-A towards end-customer and scope of output (products) delivered to the end-customer. Sub-constructs are characterized by connection via EDI, access to customers' ERP systems, and information sharing beyond 1-tier customer. Complexity of the supply side, on the other hand, refers to number of actors from the FC towards the raw material suppliers and scale of input (raw materials/ components) from suppliers. Both complexity of demand and complexity of supply side might have effect information sharing between the FC-A and its suppliers and customers. Small size of the FC-A in relation to size of suppliers is another factor influencing interaction through information sharing. Finally, as previously mentioned high level of quality requirements needs to be accounted for when determining level of integration, and specifically information sharing, between the FC-A and its suppliers and customers.

6) Environmental Uncertainty

Requirements on flexibility of SC actors, Unforeseen changes, and Stability of end-customer demand might be grouped under umbrella of the Environmental uncertainty. Requirements on flexibility of SC actors seems to be high in the context of the FC-A. At the same time, stability of end-customer demand has been assessed as relatively high. Both aspects as well as unforeseen changes are important in the context of integration with suppliers and customers.

Contextual factors of FC- A and related SC integration activities

As displayed in the *Table 7,* each previously discussed contextual factor is related to SC Integration activities which are indicated by a cross in the tables. Moreover, the empirical data suggest that there are various values of contextual factors (e.g. low, high, short, long) signifying magnitude of the factors and three levels of SC integration activities (low, medium, and high) representing strength of the integrative relationship.

The general characteristics of the three levels of SC integration activities derived from interviews are summarized in *Table 8.* The scope and stability of these characteristics may vary from case to case. The values of contextual factors will be addressed in subsequent sections.

Table 8. General characteristics of identified levels of SC Integration activities

General Characteristics of Identified Levels of SC Integration Activities (SC-A)		
Low Level	**Medium Level**	**High Level**
• Traditional order handling process • No VMI, no EDI, no access to ERP • No demand forecasts sharing, no performance feedbacks • Low amount of time, overhead costs, business review meetings • Local contracts (short-term)	• VMI • Access to internal portals (ERP) but additional data needed • Low quality demand forecasts, more frequent performance feedbacks • Medium amount of time, overhead costs, less frequent business review meetings • Local contracts (long-terms)	• VMI-consignment • Frequent performance feedbacks • Access to ERP, "e-room", EDI, demand forecasts of good quality • Cross-functional teams, frequent business review meetings, involvement in NPD projects • Supplier development programs • Frame contracts • High amount of time, overhead costs, frequent business review meetings

In the next section, based on the *Table 7*, values of identified contextual factors and corresponding levels of SC integration activities will be discussed, such as:

1) Contextual factors related to high level of integration with suppliers
2) Contextual factors related to high level of integration with customers
3) Contextual factors related to medium level of integration with customers
4) Contextual factors related to low level of integration with suppliers
5) Contextual factors related to low level of integration with customers

1) Contextual factors related to high level of integration with suppliers

The analysis of the empirical data obtained from FC-A reveals that this company is applying high level of integration with suppliers (i.e.1-tier suppliers) under circumstances given by the following contextual factors and their specific values (see *Table 9*).

Extremely high quality requirements in medical sector on purchased raw materials and components from suppliers leads the FC-A to establish, manage and maintain long-term relationships with all type of suppliers. The reason for why all suppliers (both standards and customized products) are included is high switching costs given by a very time and costs consuming process of validation and approval of raw materials and components, as well as related production processes.

Table 9. High level of integration with 1-tier suppliers and corresponding values of contextual factors

High Level of Integration with Suppliers (1-tier suppliers)	
Contextual Factors	**Values of Contextual Factors**
Quality requirements	High
Contribution to suppliers innovativeness/ volumes	High contribution/ Low volumes
Level of criticality of suppliers and new suppliers	High
Quality issues	High
Geographical proximity of suppliers	Short
Cost of switching suppliers	High
Suppliers size (volumes)	High
Portion of the suppliers total volume purchased by FC	Large

Despite low volumes of raw materials/ components purchased by the FC-A from mainly large suppliers, the FC-A is still attractive for such suppliers due to their high level of innovativeness. Suppliers may learn and develop in the area of materials and technologies through contact with FC-A which contributes to attractiveness of FC-A for large suppliers. Critical suppliers as well as new suppliers require high level of integration to comply with high quality standards of medical industry. Specifically, it means rigorous process of selecting new suppliers, regular visits (minimum once per year) of new and critical suppliers to conduct quality audits. The FC-A is applying three steps approach for suppliers that deviate from specifications given by the company: (1) Complaint is sent to a supplier, (2) FC-A requires an action plan specifying corrective actions planned to be taken by the supplier, and (3) Quality audit is conducted by the FC-A if quality issues still persist.

The FC-A has more direct contact (e.g. frequency of visits) with suppliers that are local compared to suppliers located abroad. Additional contextual factor that lead to high level of integration is supplier size (i.e. volumes). There is ongoing discussion between FC-A, customers, and suppliers (but separately) in case of large and stable volumes. Material related issues of established and new products are discussed regularly. If the portion of the suppliers total volume that is purchased by the FC-A is large, then regular updates based on demand forecasts from FC-A's customers is provided to these suppliers. It might enhance their resource and production planning.

2) Contextual factors related to high level of integration with customers

The contextual factors and their values leading to high level of integration between FC-A and its 1-tier customers (see *Table 10*). Small size (i.e. volumes produces) compared to size of the 1-tier customer is one of factors that seem to contribute to lower negotiation power of the FC-A. Consequently, the customer might require various VMI solutions with supplier (i.e. VMI-consignment stock) that might not be favorable for the supplier (considering the small volumes supplied). On the other hand, the customers provide in majority of cases the FC-A with demand forecasts.

High contribution margins on certain products seem to motivate FC-A to implement VMI-consignment stock for order handling process of these specific products with 1-tier customers.

Table 10. High level of integration with 1-tier customers and corresponding values of contextual factors

High Level of Integration with Customers (1-tier customers)	
Contextual Factors	**Value of Contextual Factors**
Size of FC (volumes)	Low
Contribution Margins	High
Stage of raw material/ component change	Late
Stage of relationship with customers	Late
Level of process/ raw material knowledge	Good
Strategic importance	High
Power dominance	High
Customers' investments at supplier	High
Requirements on flexibility of SC actors	High

In situations when a raw material or component needs to be changed in an established product or in early stage of relationship with customers, the FC-A prefers not to implement VMI-consignment stock for this particular product or customer. However, as demand and volumes for the particular product have been stabilized or relationship with new customers proceed to later stage and work well, the FC-A might consider implementing of VMI-consignment stock.

Customers that have a good knowledge of production process and/ or raw material/ components suppliers might recommend the FC-A to establish contacts with these suppliers. However, the management and responsibility of these suppliers is entirely delegated to the FC-A by the customer. The FC-A invests considerable amount of time, overhead costs into, and conduct frequent visits at strategically important customers. These customers have a high priority which is demonstrated by high level of integration. Closely related contextual factor to strategic importance is power dominance factor. Customers with high power dominance gains FC-A's high attention as they usually represent large portion of FC-A's total turnover in terms of scale and/ or scope, or they have large expertise or knowledge in a particular area critical for FC-A's. Customer's investments at supplier plant (e.g. in tools or other equipment) is another contextual factors that seem to lead to high level of integration and interactions between FC-A and investing customer.

Finally, as one of the interviewees suggested, to achieve higher level of flexibility of SC actors, it would be helpful to provide each actor with fast feedbacks on performance, suggesting higher level of integration.

3) Contextual factors related to medium level of integration with customers

As there have not been identified any contextual factors that would fit with medium level of integration with 1-tier suppliers, we will directly proceed to discuss medium level of integration with customers instead.

As shown in *Table 11*, relatively distant position of the FC-A (e.g. 5 tiers from end-customer) in relation to the end-customer might lead to low quality of demand forecasts One of the reasons is deterioration of the information quality as consequence of passing it through several tiers and no access to real customer demand backwards in the SC.

Quality requirements on products are extremely high which leads to necessity of products/ process validations. The end-products are owned by the customers; however, the customer is not involved in the validation process. Rather his responsibility is to approve and confirm the validation reports. On the other hand, suppliers might influence the customers' decision regarding approving several raw materials/ components to avoid dependency on a single input.

Table 11. Medium level of integration with 1-tier customers and corresponding value of contextual factors

Medium Level of Integration with Customers (1-tier customer)	
Contextual Factors	**Value of Contextual Factors**
Position in SC	Far from end-customer
Quality requirements/ product ownership	High
Contribution margins of products	Medium
Strategic importance	Medium
Geographical proximity of customer's warehouse (VMI-consignment stock)	Long
Power dominance	Medium
Complexity of demand side (scope of output, nr of SC actors)	High
Quality of forecasts	Low
Stability of end-customer demand	Medium
Unforeseen changes	Medium

FC-A prefers implementation of VMI without consignment stock (customer owns the stock) when contribution margins on products are medium sized. This solution might be negotiable if the FC-A has at least medium negotiating power towards a customer reflected by percentage of total FC-A's turnover, experience with consignment stock, scope/scale of items delivered to customer. Customers of medium strategic importance are given more time, business review meetings and overhead costs. FC-A has to bear additional costs related to expenses for inventorying VMI consignment stocks located abroad compared to local location.

Complexity of FC-A's demand side is large in terms of scope of output and number of SC actors. Despite of this the FC-A is not using EDI solutions with customers, data obtained from customers' ERP systems have to be supplemented by additional data manually, and the company is not sharing information beyond the 1-tier customer. The end-customer demand is rather stable (80-85% of total demand). However, quality of demand forecast provided to FC-A by customers is in general low. Specifically, smaller organization offer better quality forecasts than large organizations. On the other hand, customers bears the costs if any unforeseen situation develops related to changes in demand (e.g. order cancelations).

4) Contextual factors related to low level of integration with suppliers

Low size of input material purchased (i.e. scope and scale) makes the FC-A less attractive partners for large suppliers and has thus less negotiation power. Consequently, suppliers are not implementing VMI to handle orders rather call-offs or another more traditional way of order handling is used (see *Table 12*).

Table 12. Low level of integration with 1-tier suppliers and corresponding value of contextual factors

Low Level of Integration with Suppliers (1-tier suppliers)	
Contextual Factors	**Value of Contextual Factors**
FC's size (scope and scale) of input material purchased	Low
Geographical proximity of suppliers	Long
Supplier's size (volumes)	Low
Complexity of supply side (scope of input used, nr of SC actors	Low

Frequency of contact and meetings with suppliers located locally is higher than with those located abroad. However, the distance has no influence on decision regarding conducting of audits at suppliers. As the complexity of supply side is relatively low in terms of scope of input used and number of SC actors

involved, there are no VMI solutions used or EDI, demand forecast is shared only with large suppliers and communication is handled predominantly via e-mail or phone.

5) Contextual factors related to low level of integration with customers

FC-A prefers traditional order handling without VMI or consignment stock when contribution margins on products are low. Similarly, the implementation of VMI in initial stage of raw material/ component change in an established product is unlikely.

Position of the final product producer in the SC (beyond 1-tier customer) and the product life cycle stage (PLC) seem to have influence on quality of demand forecasts provided by customers, as well as on stability of actual demand requested by customers. Customers that have low level of production processes or raw material knowledge delegate selection of raw materials/components suppliers to the FC-A. It allocates only low amount of time, contact and other resources for customers of low strategic importance. Moreover, if the power dominance of a customer is low or the relationship with a customer is in an initial stage than FC-A prefers traditional order handling (see *Table 13*).

Table 13. Low level of integration with 1-tier customers and corresponding values of contextual factors

Low Level of Integration with Customers (1-tier customer)	
Contextual Factors	**Value of Contextual Factors**
Contribution margins	Low
Position of final product producer in SC/ PLC stage	Beyond 1-tier customer/ Initial stage
Stage of raw material/ component change	Initial
Level of process/ material knowledge	Low
Strategic importance	Low
Power dominance	Low
Stage of relationship with customers	Initial

1-tier Customer of FC- A

Table 14 provides list of contextual factors and related SC integration activities from perspective of 1-tier customer of FC-A which will be analyzed in more details in the subsequent sections. Firstly, contextual factors, their clusters, and values will be addressed followed by elaboration on related SC Integration activities and their levels.

Contextual factors from the perspective of 1-tier customer

All the identified contextual factors relevant for 1-tier customer of FC-A in *Table 14* have been clustered into preliminary four clusters, based on their conceptual similarities, as presented below. Each cluster will be closely discussed.

1) Product
2) Supplier
3) Customer
4) Information Sharing

1) Product

Product group comprises of lower level contextual factors such as type/ volume of products/ components purchased, lead time of products/ components, product quality requirements, switching of raw material in an established product, laying down existing product, and new product development. The direct materials related to products that are purchased by the customer are standardized products/ components or customized products/ components. To produce the customized products that cannot be obtained elsewhere the customer uses subcontractors. The lead time of products/ components might vary between short and long. The quality requirements on the direct purchased material are extremely high which reflects the strict process for selecting 1-tier suppliers. Occasionally, some raw materials in established products have to be changed or the entire product has to be laid down due to low demand either for the raw material or for the final product. Finally, new product development has also been considered as a factor having influence on integration with suppliers.

2) Supplier

Supplier related contextual factors comprise of five identified lower level contextual factors; level of supplier criticality (i.e. turnover, quality, source, costs and supply problems), 1-tier supplier level of expertise, level of quality requirements on suppliers, and desired improvements for suppliers. The customer, in attempt to assign an appropriate level of integration, distinguishes between suppliers that are critical or suppliers with quality problems, and suppliers that are less critical or have less quality issues. Level of expertise of 1-tier suppliers is considered for their involvement in new product development projects meetings. In general, all suppliers have to comply with high quality requirements exercised by audits or quality contracts. The customer

representative also expressed desired requirements to enhance relationships with suppliers.

3) Customer

Customer is a higher level contextual factor referring to the following lower level contextual factors related to the customer itself: customer's level of raw materials/ components knowledge, and type of products purchased/type of contracts. There are customers with various levels of raw material/ components knowledge which affects level of integration. Moreover, type of product purchased either standardized or customized, leads to different type of contracts with 1-tier suppliers.

Table 14. Identified values of contextual factors and their corresponding levels of SC Integration activities from the 1-tier customer perspective

		1-tier Customer of FC-A Perspective					
Clusters of contextual factors/ Individual contextual factors within each cluster	**Values of Contextual Factors**	**1-tier Suppliers**			**1-tier Customer**		
		Level of SC Integration activities					
		Low	**Medium**	**High**	**Low**	**Medium**	**High**
PRODUCT Related							
Type/ volume of products/ components purchased	Standardized/ Customized	X		X			
Lead time of components/ products	Short/ Long	X		X			
Product quality requirements	High			X			
Switching of raw material/ component in an established product or laying down an existing product	Yes			X			
New product development	Yes			X			
SUPPLIER Related							
Level of supplier criticality (turnover, quality, source, costs, and supply problems)	Low/ High	X		X			
1-tier supplier level of expertise	High			X			
Level of quality requirements on suppliers	High	X		X			
CUSTOMER Related							
Customer's level of raw material/ components knowledge	Low/ High	X	X				
INFORMATION SHARING Related							
Type of suppliers (turnover, volumes)	High			X			
Demand forecast used	Medium		X				

4) Information Sharing

Information sharing contextual factors consists of two lower level contextual factors, such as type of suppliers (turnover, volumes), and demand forecast used. The amount of information shared varies between suppliers depending on size of turnover and volumes that are purchased by the customer. Commonly exchanged information between the customer and its suppliers is demand forecasts provided by the customer to suppliers. However, sharing of this information is only restricted to 1-tier suppliers.

Contextual factors of 1-tier customer and related SC Integration activities

Referring to the *Table 14*, values of identified contextual factors and corresponding levels of SC integration activities will be discussed, such as:

1) Contextual factors related to high level of integration with suppliers
2) Contextual factors related to medium level of integration with suppliers
3) Contextual factors related to low level of integration with suppliers

1) Contextual factors related to high level of integration with suppliers

The analysis of the empirical data obtained from 1-tier customer reveals that this company is applying high level of integration with suppliers (i.e.1-tier suppliers) under circumstances given by the following contextual factors and their specific levels (see *Table 15*).

Customer applies VMI solution for order handling process for customized large volumes and high turnover products/ components purchase. Tools and additional equipment used by suppliers for producing these products/ components are financed partly or entirely by the customer and he also reviews status of tools regularly. Supplier is provided with access to stock levels at the customer. Suppliers delivering products/ components with long lead time receive twelve months demand forecasts from the customer.

Due to high quality requirements the customer is applying strict process for selecting 1-tier suppliers. They are evaluated based on customer's sourcing strategy and commercial aspects such as cost, availability of resources, and quality and environmental aspects. Moreover, to ensure quality of purchased material, audits are conducted at suppliers who are critical due to price, turnover, and sourcing. Another group of suppliers requiring audits are those having quality issues.

Switching of raw material in an established product or laying down existing one require informing supplier in good time for gradual/ planned switching or stock

disposal for immediate change. Cross-functional teams are used during new product development projects involving critical 1-tier suppliers' representatives and customer's representatives (R&D, procurement, occasionally production). New product planning, updating existing products, improvements, cost reduction of products are discussed during cross-functional team meetings.

Table 15. High level of integration with 1-tier suppliers and corresponding values of contextual factors

High Level of Integration with Suppliers (1-tier suppliers)	
Contextual Factors	**Value of Contextual Factors**
Type/ volume of products/ components purchased	Customized
Lead time of products/ components	Long
Product quality requirements	High
Switching of raw material/ components in an established product or laying down an existing product	Yes
New product development	Yes
Level of supplier criticality (turnover, quality, source, costs, and supply problems)	High
1-tier supplier level of expertise	High
Level of quality requirements on suppliers	High
Type of suppliers (turnover, volumes)	High

Critical suppliers in terms of turnover, quality, sourcing, costs and supply issues receive high priority. The customer conducts audits, organize frequent business review meetings and provide supplier development programs. Suppliers with high level of expertise are involved in new project development and development contracts are used. Additionally, critical suppliers have access to customer's "e-room" to obtain information regarding stock levels, specifications, demand forecasts, etc. The customer sings quality contracts with suppliers to specify and ensure a desired (e.g. high) level of quality requirements on a supplier.

2) Contextual factors related to medium level of integration with suppliers

Customer possessing high level of raw material/ components knowledge might recommend raw material/ component suppliers to its 1-tier supplier. However, responsibility for establishment and management of the relationship is entirely delegated to the 1-tier supplier.

Sales organization provides customer with sales forecasts based on mainly historical data and potential sales for new customers. This sales forecast is than converted to demand forecast that is sent to 1-tier suppliers. It is used for suppliers to plan production (MTO) of customized products. 1-tier suppliers receiving demand forecasts from the customer are expected to forward this information to their own suppliers (see *Table 16*).

Table 16. Medium level of integration with 1-tier suppliers and corresponding values of contextual factors

Medium Level of Integration with Suppliers (1-tier suppliers)	
Contextual Factors	**Value of Contextual Factors**
Customer's level of raw material/ components knowledge	High
Type of products/ components purchased/ type of contracts	Customized (MTO)
Demand forecast used	Medium

3) Contextual factors related to low level of integration with suppliers

Standardized large volumes products/ components might be handled through "kanban" order handling process where the invoicing is conducted after consumption. For products/ components with short lead time the customer is provide 1-tier suppliers with six months demand forecasts. The customer allocates less resources to conduct audits and business review meetings at suppliers with low level of quality and supply problems or at suppliers of less importance. Performance feedbacks are not provided at above mentioned type of suppliers (see *Table 17*).

Table 17. Low level of integration with 1-tier suppliers and corresponding values of contextual factors

Low Level of Integration with Suppliers (1-tier suppliers)	
Contextual Factors	**Value of Contextual Factors**
Type/ volume of products/ components purchased	Standardized
Lead time of products/ components	Short
Level of supplier criticality (turnover, quality, sourcing, costs, and supply problems)	Low
Level of quality requirements on suppliers	High
Customer's level of raw material/ components knowledge	Low

Despite generally high level quality requirements, the customer is not conducting quality audits at 2-tier suppliers. This activity is delegated to the 1-

tier suppliers who are kept fully responsible for relationship with their suppliers. Customer possesses low level of raw material/ components knowledge pass the responsibility of finding appropriate material suppliers to its 1-tier supplier.

1-tier Supplier of FC-A

Table 18 provides a list of contextual factors and related SC integration activities from perspective of 1-tier supplier which will be analyzed in more details in the subsequent sections. Firstly, contextual factors, their clusters, and values will be addressed followed by elaboration on related SC Integration activities and their levels.

Contextual factors from the perspective of 1-tier supplier

Empirical data from an interview with respondent from 1-tier supplier has been scrutinized in terms of contextual factors and corresponding SC Integration activities. All the identified contextual factors have been grouped into three clusters below. Each cluster will be closely discussed.

1) Product
2) Industry
3) Customer
4) Information Sharing

1) Product

Product group comprises of lower level contextual factors such as product quality requirements and product characteristics. Quality requirements on raw materials and components are high. Raw material/ components characteristics consist mainly of volumes/ SKU/ product group purchased, turnover rate and demand pattern. In medical industry there is relatively low variety of raw material items/ components. The level of customization is relatively high.

2) Industry

Industry as a higher level contextual factor is characterized by *quality requirements/ level of customization of raw material/ components.* Both quality requirements and level of customization of raw materials/ components is high in medical industry.

3) Customer

Customer is a higher level contextual factor referring to the following lower level contextual factors: size of customer and frequency of raw material/

components purchase/ organizational structure. There are mainly three general size of customers in terms of volumes; small, medium, and large having effect on type of contracts. Frequency of raw material purchase and organizational structure (e.g. groups) influence not only type of contract but also type of order handling process.

4) Information Sharing

Information sharing contextual factors comprise of one major lower level contextual factor, namely customer size. Customer size in terms of volumes (small, medium, and large) has influence on type of contact used and also on scope of contact.

Contextual factors of 1-tier supplier and related SC Integration activities

As illustrated in the *Table 18*, the values of identified contextual factors and corresponding levels of SC integration activities will be discussed, such as:

1) Contextual factors related to high level of integration with customers
2) Contextual factors related to medium level of integration with customers
3) Contextual factors related to low level of integration with customers

1) Contextual factors related to high level of integration with customers

Due to high quality requirements on products, 1-tier supplier demands certain standards common in medical industry such as "medical form" prior delivery of raw material/ components. On the other hand, customers require certification along every delivery and validation of raw material/ components are applied rather than conducting of audits at suppliers. If necessary, supplier may provide 1-tier customers with assistance in formulating conditions in contracts (see *Table 19*).

With large customers in terms of volumes, turnover rate and/ or fluctuation of customer demand the 1-tier supplier prefers to implement VMI – consignment stock. This type of order handling process gives flexibility to the supplier. At the same time, the economic strong position of the supplier allows him to select this solution. VMI-consignment stock is also applied with frequent buyers. With these customers price contracts with groups are signed. These contracts are updated monthly or quarterly.

Table 18. Identified values of contextual factors and their corresponding levels of SC Integration activities from the 1-tier supplier perspective

Clusters of contextual factors/ Individual contextual factors within each cluster	Values of Contextual Factors	1-tier SUPPLIER - A Perspective					
		1-tier Suppliers			1-tier Customers		
		Level of SC Integration activities					
		Low	Medium	High	Low	Medium	High
PRODUCT Related							
Product quality requirements	High						X
Product characteristics (volumes, turnover rate, demand pattern,	Large						X
INDUSTRY Related							
Quality requirements/ level of customization of material	High						X
CUSTOMER Related							
Customer size (volumes)	Small/ Medium/ Large				X	X	X
Frequency of raw material/ components purchased/ organizational structure (e.g. groups)	Frequency Low/ High				X		X
INFORMATION SHARING Related							
Customer size (volumes)	Small/ Medium				X		
Customer size (volumes)	Large					X	

Quality requirements on raw materials/ components delivered are high in medical industry. The level of customization of materials is in general high, however, the variety of materials/ components is relatively low compared to, for example, automotive industry. Certification is commonly used to ensure high quality requirements. Supplier signs central contracts valid for entire group with large customers. Large customers have direct contact with raw material/ components supplier (producer). In case some of the existing materials are laid down, the customer should be directly informed by and discuss solutions with its supplier (producer).

Table 19. High level of integration with 1-tier customers and corresponding values of contextual factors

High Level of Integration with Customers (1-tier customers)	
Contextual Factors	**Value of Contextual Factors**
Product quality requirements	High
Product characteristics (volume, turnover rate, demand pattern, etc.)	Large
Quality requirements/ level of customization of raw materials/ components	High
Customer size (volumes)	Large
Frequency of raw materials/ components purchased/ organization structure	High

2) Contextual factors related to medium level of integration with customers

Medium sized customers do not have direct contact with the raw material/ components supplier (producer). Instead, they are purchasing materials through distributor (1-tier supplier). The 1-tier supplier uses local individual contracts with medium sized customers. The reason is that customers differ in terms of transport systems, inventory costs, labor costs, etc.

If the producer of raw material/ components decides to lay down a certain item, the information should be forwarded first to distributor (1-tier supplier) who informs the customer (i.e. FC-A). The customer (i.e. FC-A) is expected to forward this information further to its customer. Dyadic meetings (distributor and FC-A) are rather common. There is lack of communication between the producer, distributors, FC-A and customers in general. Triadic meetings are not common which might lead to not selecting the most optimal solution due to missing information regarding e.g. planned lay downs of raw material/ components, NPD project, etc. (see *Table 20*).

Table 20. Medium level of integration with 1-tier customers and corresponding values of contextual factors

Medium Level of Integration with Customers (1-tier customers)	
Contextual Factors	**Value of Contextual Factors**
Customer size (volumes)	Medium

3) Contextual factors related to low level of integration with customers

With small customers or customers purchasing less frequently (e.g. once/year) spot contracts are signed (see *Table 21*). Similarly to the medium sized

customers, the small customers do not have any contact with the producer of raw materials/ components. Instead, these customers (relevant for FC-A) establish contact with distributors (1-supplier). As mentioned above, there is lack of triadic information sharing (between producer, distributor, and customers). Dyadic meetings are more common (i.e. distributor and customer). The results of these meetings have to be forwarded to the other SC actors.

Communication with small and medium sized customers is mainly done through e-mail or phone. There is no EDI connection between the 1-tier supplier and customer (FC-A). Moreover, the supplier has no access to ERP at the customer.

Table 21. Low level of integration with 1-tier customers and corresponding values of contextual factors

Low Level of Integration with Customers (1-tier customers)	
Contextual Factors	**Value of Contextual Factors**
Frequency of raw materials/ components purchased/ organization structure	Low
Customer size (volumes)	Small

5.2.2 Open/ axial coding of supply chain B (SC-B)

In this chapter, the results of the *Analysis I* will be presented from the perspective of focal company B (FC-B), 1-tier customer and 1-tier supplier of the SC-B.

Focal Company B

Table 22 provide list of contextual factors and related SC integration activities from perspective of FC-B which will be analyzed in more details in the subsequent sections. Firstly, contextual factors, their clusters, and values will be addressed followed by elaboration on related SC Integration activities and their levels.

Table 22. Identified values of contextual factors and their corresponding levels of SC Integration activities from FC-B perspective

Clusters of contextual factors/ Individual contextual factors within each cluster	Value of Contextual Factors	FOCAL COMPANY B (FC-B) Perspective					
		1-tier Suppliers			1-tier Customers		
		Level of SC Integration activities					
		Low	Medium	High	Low	Medium	High
FOCAL COMPANY							
Market shares	Small/Large				X		X
Level of innovativeness	High					X	
Amount of cooperation projects	High						X
Level of dependency of a customer on FC-B	High						X
Delivery reliability	High						X
Supplier/customer development programs	Medium	X	X		X	X	
Criticality of relationship with customers	High					X	
Criticality of minimizing transportation costs/ inventory costs	High						X
Owner of contracts with suppliers	Local/ Central	X		X			
PRODUCT							
Criticality of input material	High			X			
Product innovations	Medium					X	
Significance of building new production site	High						X
Criticality of decreasing raw material consumption	High			X			
Quality costs	High	X					X
Lead time (due to geographical distance between FC-B and custom)	Short/ Long				X		X
Maturity level of products/ need for innovations	High					X	
New product design issues for FC-B	Large				X		
Costs/ volumes/ type of input material	High/Large/			X			
Frequency and criticality of quality issues	Low/ High	X		X			
Significance of development projects/ changes against specification/ owner of specification	High/ Changes to existing specification/		X	X			
Criticality of JIT deliveries to customer (products durability)	High						X
Profit margins/ high transportation costs	Low margins/ high costs						X

(continued)

Clusters of contextual factors/ Individual contextual factors within each cluster	Value of Contextual Factors	FOCAL COMPANY B (FC-B) Perspective					
		1-tier Suppliers and 2-tier Supplier (*)			1-tier Customers		
		Level of SC Integration activities					
		Low	Medium	High	Low	Medium	High
CUSTOMER							
Customers' product portfolio (i.e. % of FC-B's total turnover; product variety; lot sizes; turnover rate, demand pattern)	Large				X	X	X
	Medium				X		
	Small				X	X	
Understanding of demand forecast significance for suppliers	High						X
Maturity level of operations	Low/ High				X		X
Strategic importance of a customer	Low/ High				X		X
Quality of performance measures on suppliers used by cust.	Low				X		
Geographical proximity to 1-tier supplier	Short				X		
Customers' willingness to allow relationship between FC-B and 2-tier customers	Low				X		
Criticality for customer to secure raw material on one's own directly with 2-tier supplier (expertize in house) (*)	High			X (*)			
	Low				X		
SUPPLIER							
Size (i.e. volumes purchased by FC-B)	Large		X	X			
	Small	X					
Single sourcing/ multiple sourcing alternatives	Multiple				X		
Criticality of suppliers (i.e. volumes and type of input mat.) for FC-B	High		X	X			
	Low				X		
INFORMATION SHARING							
Order requirements, variety of items influence on POS data sharing	Minimum order requirements/ large variety				X		
	Large volumes						X
Fluctuation in orders from customers (due to unpredictable promotions, lack of buffer inventory in SC)	Large					X	

(continued)

Cluster of contextual factors/ Individual contextual factors within each cluster	Value of Contextual Factors	FOCAL COMPANY B (FC-B) Perspective					
		1-tier Suppliers			1-tier Customers		
		Level of SC Integration activities					
		Low	Medium	High	Low	Medium	High
ENVIRONMENTAL UNCERTAINTY							
Criticality of product availability/ demand stability	Low criticality/ Low stability				X		
	High criticality/ High stability						X
Environmental pressure by society	High						X
Supply in relation to demand (e.g. number of suppliers to a customer)	High supply- Low demand				X		
	Low supply – High D						X
Level of dependency between FC-B and customers (market, scarcity of resources, etc.)	High						X
Criticality of sourcing	Low/ High				X		X
INDUSTRY							
Profit margins/ costs of low quality/ set-up costs	Low profit margins/ high quality costs/ high set-up costs				X		

Contextual factors from the perspective of the focal company B (FC-B)

All the identified contextual factors relevant for FC-B listed in the *Table 22* have been grouped into seven initial clusters based on their conceptual similarities. Each of the clusters will be discussed in more details below.

1) Focal Company
2) Product
3) Customer
4) Supplier
5) Information Sharing
6) Environmental Uncertainty
7) Industry

1) Focal Company

Focal company as one of the main groups of contextual factors related to FC-B comprise of the following individual contextual factors: Market shares, Level of dependency of a customer on FC-B, Amount of cooperation projects with customers, Delivery reliability, Supplier/ customer development programs, Scale of customer relationship, Criticality of minimizing transportation costs/inventory costs, and Owner of contracts with suppliers.

Generally, the FC-B can be characterized by large portion of market shares as they are few competitors in the Nordic market. The level of dependency of a customer on FC-B is thus high. The level of innovativeness is relatively high as the product is very mature and needs to be continuously innovated. Amount of cooperation projects with customers influences level of mutual dependency. Deliver reliability is also expected to be high. The FC-B is not engaged in supplier/ customer development program with suppliers/ customers in terms of cross-functional teams. Scale of customer relationship refers both to relationships in established markets as well as markets outside the FC's interest. Due to low profit margins the criticality of minimizing two largest sources of costs, transportation costs and inventory costs, is high.

Finally, contextual factor related to FC-B is ownership of contracts with suppliers which might be either central (by the FC-B's central organization) or local (by the FC-B).

2) Product

Product group comprises of individual contextual factors such as Criticality of input material (i.e. volumes/ type), Product Innovations, Level of diversity, Level of consumptions of input material, Quality costs, Lead time, Maturity level of products/need for innovation, New product design issues, Costs/ volumes/ type of input material, Frequency of quality issues, Criticality of quality issues, Significance of development projects/ changes/ owner of the specification, Criticality of JIT deliveries to customer (due to low durability of products), and Profit margins/ transportation costs.

Criticality of input material refers to volume size and also to type of input (i.e. direct raw material/ components and related raw material/ components). The level of product innovation is medium in terms of frequency of new product design projects, changes in characteristics of the input material, etc. Level of diversity is high for finished items and low for incoming raw materials/components. The FC-B strives to decrease the level of consumption of input material in order to decrease the total costs. Quality costs tend to be large in case of quality issues. Length of the lead time is partly affected by the

geographical distance between the FC-B and customers. It has impact on intensity of contact with customers. The level of innovativeness is relatively high as the product is very mature and needs to be continuously innovated. Large new product design issues might have negative impact on operations planning at FC-B. Volume size of input material and its cost determines the type of order handling/ fulfillment process with suppliers. Low frequency of quality issues is related to low frequency of performance feedback given to suppliers. High level of criticality of quality issues requires high level of corrective measures taken by the FC-B. Significance of development projects/ changes related to products/ and owner of specification have impact on what actors are involved in decision making process. JIT deliveries to customer are crucial due to low durability of customers' components. The FC-B's products can be characterized by low profit margins and high transportation costs.

3) Customer

Customer as an additional main group of contextual factors containing several single contextual factors; Size of customers (i.e. percentage of FC-B total turnover), Understanding of significance of demand forecast for suppliers, Maturity level of operations, Strategic importance of a customer, Quality of customers' performance measures, Geographical proximity between the customer and FC-B, Customers' willingness to allow relationships between FC-B and 2-tier customers, and Customer securing its needed input on its own.

Customer can be clustered into three main groups based on percentage of FC-B's total turnover they account for; large customers (A-products), medium customers (B-products), and small customers (C-products). Level of understanding of significance of demand forecast for suppliers determines the FC-B's access to this information. Maturity level of operations might be significant when volumes purchased differ substantially from forecasted volumes. Level of strategic importance of a customer for FC-B influences the type and amount of efforts directed towards particular customer. It also entails level of dependency between FC-B and customers related to level of scarcity of resources. Quality of performance measure provided by customers seems to be low. Amount of information shared tent to be low when the geographical proximity between the FC-B and customers is low. The FC-B experience low willingness of customers to approve relationships between FC-B and their 2-tier customers. Finally, the customers may have different levels of competence and resources to secure input materials/components on their own.

4) Supplier

Supplier related contextual factor refers to six identified individual contextual factors: Size (i.e. volumes purchased by FC-B), Single sourcing/ multiple sourcing alternatives, Criticality of suppliers (beyond the FC-B) for FC-B's customers and Criticality of suppliers (i.e. volumes and type of input material) for FC-B.

Volumes size purchased by FC-B is a contextual factors having impact on level of relationship with suppliers. Single sourcing or multiple sourcing alternatives refer to number of potential suppliers available on the market. With several suppliers to choose among it might be easier to switch from one to another. Level of criticality of supplier (beyond FC-B) to customer might have effect on scope of SC actors involved in inter-organizational meetings. For the FC-B suppliers of direct material/ components, additional direct material, as well as suppliers of local services (i.e. spare parts) are considered as critical.

5) Information Sharing

Information sharing group of contextual factors includes: Customers' product portfolio (i.e. volumes/ lot sizes, product variety, turn-over rate), POS data sharing, Fluctuation in orders from customers.

Customers' product portfolio can be characterized by generally characterized by large purchased volumes, high variety and high turn-over of input material/ components (i.e. daily call-offs to FC-B). It has impact on amount and type of information shared between customers and FC-B. POS data sharing seems to be useful in situation characterized by large volumes according to the FC-B. However, the company is not receiving any POS data currently. Additionally, the company also experience high fluctuation in orders from customers due to unpredictable promotions and lack of buffer inventory within their SC.

6) Environmental Uncertainty

Environmental uncertainty related contextual factors are as follows: Market demand uncertainty, Environmental pressure from society, and Supply in relation to demand (e.g. number of suppliers to a customer)

The FC-B is exposed to seasonal variations in demand. Additionally, the products can be grouped based on level of demand uncertainty resulting in frequent changes in orders. Environmental pressure from society is considered to be high given the nature of products (i.e. demand on well-developed recycling system, reverse logistics). Finally, level of available capacity (i.e. supply) in relation to existing demand has impact on relations with customers.

Currently, the SC of FC-B includes few large customers accounting for 80 percent of total sales. There are very few suppliers that are available on the Nordic market for those customers.

7) Industry

Individual contextual factors within the group of factors related to industry are Profit margins, Costs of low quality, and Set-up costs. The FC-B is operating within industry that might be characterized by low profit margins, high costs of low quality and high set-up costs.

Contextual factors of FC-B and related SC Integration activities

As displayed in the *Table 22*, each previously discussed contextual factor is related to SC Integration activities which are indicated by a cross in the tables. Moreover, the empirical data suggest that there are various values of contextual factors (e.g. low, high, short, long) signifying magnitude of the factors and three levels of SC integration activities (low, medium, and high) representing strength of the integrative relationship, such as:

1) Contextual factors related to high level of integration with suppliers
2) Contextual factors related to high level of integration with customers
3) Contextual factors related to medium level integration with suppliers
4) Contextual factors related to medium level of integration with customers
5) Contextual factors related to low level of integration with suppliers
6) Contextual factors related to low level of integration with customers

The general characteristics of the three levels of SC Integration activities derived from empirical data are summarized in *Table 23*. The scope and relevance of these characteristics may vary from relationship to relationship. It means that not all attributes of a certain level of SC Integration are necessarily represented in each and every situation.

Table 23. Main characteristics of identified levels of SC Integration activities in SC-B

Main Characteristics of Identified Levels of SC Integration Activities (SC-B)		
Low Level	**Medium Level**	**High Level**
• Risk of switching • Lack of supplier development programs • Lack of cross-functional teams • Demand forecast is not provided or with low quality • No performance feedback • No POS data sharing • Lacking internal integration • MTO production strategy • Frequent changes in orders • EDI information needs to be supplemented by additional information inserted manually • Lack of strategically oriented efforts • Only dyadic integration • Primarily cost focus	• Proactivity (e.g. cost savings proposals to customers) • Survey to customers/suppliers • Information sharing and contact with customers' purchasing department • Cross-functional teams with large customers, meetings • EDI connection with selected customers (attempt to include more customers) • Technical – operational assistance • One year contracts with customers regarding securing raw material • VMI consignment but with restricted access to ERP system (FC provides assistance in stocktaking for abroad suppliers) • Despite a good communication with customers, unexpected demand changes due to promotions still occurs	• Strong mutual dependency between FC-B and customer • Customers are given high priority • Best supplier award • Performance feedback provided • JIT deliveries • Close cooperation in e.g. material development • Long-term contracts • Trust instead of quality control of incoming products • VMI consignment stock (access to ERP) • Access to customers internal portals • Location of production close to customer's site • Audits at suppliers • SC financing • Integration on strategic level • EDI connection • Forecasts provided automatically • Limited order changes with short notice • MTS production strategy • Key account manager assigned • Direct contact between customer and 2-tier supplier • Triadic meetings with 3PLs

1) Contextual factors related to high level of integration with suppliers

The FC-B prefers high level of integration with suppliers (i.e.1-tier suppliers) under circumstances given by the following contextual factors and their specific levels (see *Table 24*).

The FC-B is managed by its central organization. The implication is that in case of large quality issues the problems are solved between the central organization and the particular supplier. Additionally, even the quality issues with other direct and additional material suppliers are handled centrally as they are central contracts established by the central organization. The central organization is continuously monitoring the situations at the various plants through the internal

information system. All claims, even related to the additional direct material suppliers, are registered in the internal information system.

Table 24. High level of integration with 1-tier suppliers and corresponding values of contextual factors

High Level of Integration with Suppliers (1-tier suppliers)	
Contextual Factors	**Value of Contextual Factors**
Ownership of contracts with suppliers	Centrally
Criticality of input material	High
Criticality of decreasing input material consumption	High
Costs/ volumes/ type of input material	High/ large/ Direct and additional direct material
Significance of development projects/ changes against specification/ owner of specification	High
Size (i.e. volumes purchased by FC-B)	Large
Criticality of suppliers (i.e. volumes and type of input material)	High

The FC-B maintains active contact only with the immediate suppliers of direct and indirect materials (i.e. 1-tier suppliers). Further backwards in the SC there is no relationship. The central contracts are used with suppliers of critical large volumes items that are directly related to the manufactured products. The company is constantly working in collaboration with large direct material suppliers on developing innovations to decrease consumption of such material. This represents changes in production processes for supplier so in the beginning the costs can be even higher despite the less material used as the supplier needs to make an initial investment.

The strategy of FC-B is to implement VMI consignment on high costs raw materials/ components. There are large amount of costs related to the direct and additional direct material that it is crucial to pay only for what has been used and to minimize tied up capital. VMI consignment stock is implemented with the majority of direct or additional direct material suppliers. The stock is usually in house at FC-B and payment is done after usage once per month. The FC-B is conducting weekly and monthly stocktaking of the suppliers' stock in house and sent orders or status report to suppliers. This is done in case the suppliers are located abroad.

Development projects regarding raw material/ components are generally driven by the central organization as they are specification owners. Tests of the new

material are than conducted on the FC-B level and there is ongoing discussion regarding outcomes.

The supplier base comprise mainly of few suppliers of direct material and additional direct material. These suppliers are consolidated. The reasons are huge investments in this sector. The contracts with these suppliers are long-terms which also includes prices. Suppliers are interested in integration with customers (e.g. FC-B). Both parts work jointly to find solutions for tighter SCs. It means that e.g. the JIT concept is used. The large suppliers require high quality of forecasts (fixed forecasts) and certain volumes to be purchased each month, among other criteria, in order to be able offer lower input material prices.

Usually, the FC-B has meetings on dyadic level with 1-tier customers, but often 3PLs' representatives are involved as well since they are important actors for the customer (intermediary between supplier and customer).

2) Contextual factors related to high level of integration with customers

Contextual factors indicating high level of integration with customers are listed in *Table 25* and thoroughly discussed below. The FC-B could have been seen as having more power compared to its customers as it is more difficult for customers to switch the FC-B due to lack of alternatives on the market. At the same time customers are aware of FC-B's dependency on them. The relation can be classified as mutually interdependent. In situation when markets demand is higher than the supply it is relatively easy to obtain long term contracts with customers as they want to secure their supplies. If securing of sourcing and delivery reliability becomes critical, the customers are motivated to provide high quality forecasts to FC-B.

In general, the more integrated a company is with its partners, the more cooperation project they are engaged in (e.g. mutual routines, technological cooperation), the stronger dependency as a supplier. To satisfy a customer it is important as a supplier to be innovative, propose costs savings projects, and to be proactive. Large customers completely dependent on supplies from the FC-B are highly prioritized by the company.

Ideally, due to products' attributes such as low profit margins, it is preferred to have production site close to customer. Thus, FC-B delivers their products JIT with external warehouses on the way to customers due to long distances. In order to safe transportation and inventory costs, two FC-B's production plants are located directly next to the ones of the largest customers. To further decrease costs and give more flexibility to customers, the FC-B is planning to

move part of the inventory next to another large customer as the holding costs are low in that particular location. The policy is to have stock either at FC-B plant (which is already paid back) or close to large customer, or another alternative is stock in transit.

To comply with steadily growing demand and to increase market shares it is vital to build a new production site. It requires long term contracts (e.g. 5 years) with the customer to secure the investment made by the FC-B. There is no quality control of incoming products supplied by FC-B as customers have confidence and trust in FC-B's professionalism.

In case of long lead times due to geographical distances between suppliers, FC-B and customers, close communication with customers is required. The FC-B encourages customers to be active and follow their business through internal portal and also through tailored weekly reports sent to customers. The weekly reports contains information about stock levels, location of the stock, how much it is on the way, how much it's remain to produce, the latest production date for the particular order, etc.

Both customers and FC-B avoid inventory. The strategy is JIT deliveries from production to customer. However, due to large distances between FC-B and customers and low durability of customers' products, the customers may have safety stock at their sites. The cooperation with the large customers is on more strategic, general level related to bigger projects. With largest customers there is cooperation called Supply Chain Financing which means that a bank acts as an intermediary when it comes to payments from customer to supplier. This type of transactions is mainly used only with close and well established partners. The negotiating process applied by all large customers of FC-B has been centralized in the European market.

As the FC-B's product represents the largest cost for its customers, the focus lies on its reduction. To achieve this, the FC-B has established various forms of cooperation with the large customers. Specifically, it means implementation of EDI solutions to enhance invoicing and order transmissions, as well as to provide access to FC-B's internal portal. The type of EDI that is used differs from large customer to large customer. It depends on maturity of the customer in providing high quality forecasts. It means that the customers do not change with a short notice there orders (the deviation from the forecast is lower). This is result of not always well working production lines at the customers. In such cases it is difficult to only rely on EDI. This situation probably leads to complementing the information from EDI with additional data which has to be

done manually, not through EDI. Regarding order handling process, large customers place daily orders (call-offs).

The FC-B does not need to always wait for specific orders instead MTS production strategy is used. The customers may notify the FC-B about what items are allowed to be produced according to the forecasts (MTS strategy) and what items are not (MTO strategies). Precondition is trust and well working relationship with customers. This strategy is relevant only for A-articles characterized by high volumes and regular flow.

Table 25. High level of integration with 1-tier customers and corresponding values of contextual factors

High Level of Integration with Customers (1-tier customers)	
Contextual Factors	**Value of Contextual Factors**
Market shares	Large (few suppliers on market)
Amount of cooperation projects	High
Level of dependency of a customer on FC-B	High
Delivery reliability	High
Criticality of minimizing transportation costs/ inventory costs	High
Significance of building new production site	High
Quality costs	High
Lead time (due to geographical distance between FC-B and customers)	Long
Criticality of JIT deliveries to customer (products durability)	High
Profit margins/ transportation costs	Low margins/ high costs
Customers' product portfolio (i.e. % of FC-B's total turnover, product variety, lot sizes, turnover rate, demand pattern)	Large
Customers' understanding of demand forecast significance for suppliers	High
Maturity level of operations	High
Strategic importance of a customer	High
Criticality of product availability/ demand stability	High
Environmental pressure by society	High
Supply in relation to demand (e.g. number or suppliers to a customer)	Low supply – high demand
Level of dependency between FC-B and customers (i.e. market, scarcity of resources)	High
Criticality of sourcing	High
Minimum order requirements (e.g. volumes), variety of items influence on POS data sharing	Large volumes/ low variety
Criticality of securing raw material availability for 1-tier customers	High

To avoid stock outs it is important to work with forecasts. Some customers understand the reason of providing forecasts other are not willing to provide

them. The forecasts support the FC-B to have a right mix of items in stock to secure deliveries. Therefore, the cooperation with customers is important. It takes a long time to build up a well working relationship, to get to know each other, to develop routines, and to achieve trust.

Large customers have specially trained groups that conduct detail audits of production at FC-B in order to approve it. The focus is on production, safety and cleanliness. The FC-B recognizes strategic customers. The main attributes are sales volumes and also strategic importance for the company. To access this, key account manager has been assigned for the large customers. The goal is to develop a key account plan to assess the strategic importance of the customer in future in terms of e.g. how the customer's structure fits with the company B's structure (i.e. what market they invest on, current cooperation).

Due to high environmental pressure by society the FC-B provides information to customers for the purpose of: sustainability reports, projects, providing arguments for customers' discussion with authorities, meetings, presentations, etc. At the same time customers' represent the interest of the FC-B at these meetings as well.

It would be beneficial for the FC-B to get information about the end-customer real demand; however, due to several issues (e.g. minimum order size, buffer stock, MTS-type of products, large product variety, etc.) it seems to be difficult to implement it in practice. For the large volume items the information (all POS data from end-customers and retailers) about the end-customer real demand could be helpful. The way of securing the input material (i.e. raw material) depends on size of the customer. For small and medium sized customers usually, the central organization secures the raw material. These customers usually choose to outsource this to a larger and more experienced member of SC.

3) Contextual factors related to medium level of integration with suppliers

Identified contextual factors related to medium level of integration with suppliers are summarized in *Table 26.*

The FC-B has established best supplier awards. The suppliers are judged based on several criteria – proactivity, cost savings, etc. Moreover, the company is conducting surveys of suppliers and their perception of the FC-B. The questionnaire contains two to three questions sent to suppliers twice per year. Depends on various functions within the company different answers are received. This way is very good as it provides valuable input that would have not been obtained or communicated otherwise.

Table 26. Medium level of integration with 1-tier suppliers and corresponding values of contextual factors

Medium Level of Integration with Suppliers (1-tier supplier)	
Contextual Factors	**Value of Contextual Factors**
Supplier development programs	Medium
Significance of development projects/ changes against specification/ owner of specification	Standard changes
Size (i.e. volumes purchased by FC-B)	Large
Criticality of suppliers (i.e. volumes and type of input material) for FC-B	High

The FC-B is not using supplier development practices or cross-functional teams with their suppliers. The reason is lack of knowledge and expertizes to comment on processes of its suppliers. On the other hand, when the FC-B has a brilliant idea that could be contribution both for the company itself and its suppliers they are of course willing to share their ideas. Standard changes against specification regarding "add-ons" for direct material are directly discussed between FC-B and 1-tier supplier.

FC-B has provides access to its ERP system to some of their large critical suppliers but not to all large suppliers of direct and additional material. This might be problematic when using VMI consignment with suppliers. In such case, the FC-B sent inventory status or reports to suppliers instead or suppliers might visit the site and inspect the situation. Similarly, the EDI connection is established only with one critical large supplier.

4) Contextual factors related to medium level of integration with customers

To secure a customer it is important as a supplier to be innovative (see *Table 27*), propose costs savings projects, to be proactive. In such case there is no reason for the customer to switch the supplier or at least not taking risks related to switching (i.e. lower price but risk to not be given priority which may results in supply problems).

The FC-B is also regularly surveys their customers in terms of how and why they perceive the company B as a supplier. The questionnaire contains two to three questions sent to customers twice per year. The FC-B is not engaged in development programs with customers and no cross-functional teams are used as the FC-B has a limited competency to comment on processes of their customers. On the other hand, the FC-B is prepared to share their ideas that would contribute both for the company and its customers.

The company B would like to have a closer contact with customers' marketing department not only traditionally with purchasing department. To establish this contact it is necessary to offer something interesting (e.g. innovative) to the customer. Innovations are perceived by the company B as an important enabler for such contact with the marketing department.

The FC-B would appreciate cooperation in terms of information sharing and inputs from customers' side regarding desirable innovations. This is sometimes organized in form of brainstorming meetings between the customer and the company. This is considered by the respondent to be a very fruitful way of cooperation and it could be done more often. However, today, it is mostly the FC-B who is developing the ideas on its own without closer discussion with customer in the initial stage. The drawback of this is that the company is developing something that is not interesting for the customer. Thus, the closer cooperation would help the FC-B to focus and allocate resources more effectively from the beginning of the project.

The EDI connection is currently established only with selected customers. The FC-B looks over to broaden it to connect with more customers. The reason is less administration and streamlines the communication between the FC-B and customers (e.g. in case of customer changes call-offs, the information is instantly forwarded to FC-B).

Meetings involving representatives from the large customers and the FC-B take place at least once per year in order to update regarding possible innovations. FC-B organizes meetings with customers in order to discuss what innovations can be offered. The goal is to remind customers about opportunity to profile their products with help of FC-B's product's innovations. FC-B is aware of late stage of maturity of their products and necessity to innovate them. On the other hand, large customers organize competitions to support innovations from suppliers.

The easiest type of customers, in terms of order handling process, are the medium sized customers with limited assortment and less frequent call-offs (e.g. once per week). Changes in call-offs volumes are relatively easier to handle at this customers compared to large customers that have call-offs daily. MTO production strategy is used with small and medium sized customers with products classified as B and C products (i.e. medium volumes, limited variety, small lot sizes, and low turnover rate).

Table 27. Medium level of integration with 1-tier suppliers and corresponding values of contextual factors

Medium Level of Integration with Customers (1-tier customers)	
Contextual Factors	**Value of Contextual Factors**
Level of innovativeness	High
Customers development programs	Medium
Criticality of relationship with customers	High
Product innovations rate	Medium
Maturity level of products/ need for innovations	High
Customers' product portfolio (i.e. % of FC-B's total turnover, product variety, lot sizes, turnover rate, demand pattern)	Medium
Fluctuation in orders from customers (due to unpredictable promotions, lack of buffer inventory in SC)	Large

The problem related to the fluctuation of orders is the decreasing buffer inventory in the SC and fast demand changes due to unforeseen promotions. The unforeseen promotions are result of fast decision making on customers' level in the SC which makes it difficult for the FC-B to plan for production in ahead. The communication between large customers and the FC-B is well working, however, these decisions are made quickly and the FC-B has short time to prepare. So the more stable market would be desirable according to the FC-B.

5) Contextual factors related to low level of integration with suppliers

The analysis of empirical data reveals that low level of integration with suppliers is consequence of relatively low levels of contextual factors, as summarized in *Table 28.*

Table 28. Low level of integration with 1-tier suppliers and corresponding values of contextual factors

Low Level of Integration with Suppliers (1-tier suppliers)	
Contextual Factors	**Value of Contextual Factors**
Ownership of contracts with suppliers	Locally
Frequency and criticality of quality issues	Low
Size (i.e. volumes purchased by FC-B)	Small
Minimum order requirements (volumes), variety of items	Min order requirements/ large product variety
Quality costs	High

The central organization of FC-B sings central contracts with large suppliers of direct material and additional direct material. Beside these central contracts, the FC-B uses local contracts with local suppliers. The local suppliers are thus managed on the local level by FC-B. It means that the FC-B rather than its central organization addresses and solves e.g. quality issues directly with the local suppliers. There is a minimum contact (e.g. providing performance feedback) with suppliers that have very limited amount of quality issues. Regarding the integration with suppliers it is similar to integration with customers. With the large suppliers there is established more close cooperation. On the other hand, smaller suppliers are easier to replace as there is less cooperation.

It would be helpful for the FC-B to get information about the end-customer real demand (POS data); however, due to several issues it seems to be difficult to implement it in practice. The attributes of the final products manufactured by the 1-tier customer give a rise to use of production strategy MTS. Moreover, to optimize production and keep down costs the minimum order size is applied. Large variety of items also seems to represent additional drawback for taking advantages of POS data. This may represents obstacles for rapid reaction on fast demand changes.

As the costs of low quality are extremely high, high level quality control through the whole production process is implemented. Moreover, there is incoming control of critical direct material and additional direct materials.

6) Contextual factors related to low level of integration with customers

Regarding the integration with customers it is similar to integration with suppliers. With the large customers there is established more close cooperation. On the other hand, smaller customers are easier to replace as there is less cooperation (*Table 29*).

It would be beneficial for the FC-B to get information about the end-customer real demand – POS data; however, there are several aspects such as minimum order size, buffer stock, MTS-type of products, large product variety, etc. which make it difficult to implement POS data sharing in practice. In case of short lead times, close communication with 1-tier customers is less critical. Deficiencies in internal integration at large customers seem to cause problems when design issues shorten the time window allocated for development and production of products at FC-B. As there are many small volumes items with long time between call-offs (leading to relatively high inventory levels under longer period of time – high tied up capital), VMI with min and max inventory levels is not used. Instead, the small product variants (B and C products) are produced

when needed due to uncertainty of the market demand– pull strategy (MTO and JIT).

The type of EDI that is used differs from large customer to large customer. It depends on maturity of the customer in providing high quality forecasts. Low maturity of operations means not always well working production lines at customers. It results in that the customers change their orders with a short notice (the deviation from the forecast is high). In such cases it is difficult to only rely on EDI; rather complementation with additional data inserted manually is required.

Customers that are not considered to be strategic for FC-B are those having another focus in terms of markets or growth or having mainly a focus on price compared to FC-B's own strategy. The FC-B is not receiving regular performance feedback from customers. To obtain opinion of their customers, the FC-B sends large scope survey to customers regarding satisfaction with FC-B as a supplier.

During regular meetings with customers' representatives from purchasing, the performance measures are discussed. However, the FC-B sees low value of these measures since they are based on what system generates and not on what has been actually ordered and delivered. The frequency of receiving forecasts varies from customer to customer. The availability and quality of forecasts seem to be dependent on geographical distance to supplier, as well as on level of criticality of suppliers for a particular customer. For example, when the FC-B's production site is located next to the customer's site, it makes it easy for the customer to receive its supplies instantly and thus the customer is less motivated to provide frequent and good quality forecasts.

Some customers provide forecasts only once per month which leads to huge differences in what they actually order. Moreover, they might share only sales forecasts instead of demand forecasts which is not the same and results into problems for FC-B. The quality of customer forecasts has traditionally been higher in Scandinavian. The reason might be the mutual dependency due to lack of competitors on market with some exceptions. The customers are aware that in time of huge demand growth it is important to provide reliable and timely forecasts for FC-B to secure supplies.

On the other hand, in South Europe there are several suppliers on market. It leads to higher negotiation power of customers. Consequently, they are not forced to provide high quality forecasts to suppliers. Additionally, the quality of forecasts from small customers is less important as the production planning is done mainly based on the forecasts of the large customers. For the small

customers, historical demand is more crucial than forecasts. It is less problematic as they place orders (call-offs) once a week.

Table 29. Low level of integration with 1-tier customers and corresponding values of contextual factors

Low Level of Integration with Customers (1-tier customer)	
Contextual Factors	**Value of Contextual Factors**
Market shares	Small
Lead time (due to geographical distance between FC-B and customers)	Short
New product design issues for FC-B	Large
Customers' product portfolio (i.e. % of FC-B's total turnover, product variety, lot sizes, turnover rate, demand pattern)	Small
Maturity level of operations	Low
Strategic importance of a customer	Low
Quality of performance measures on suppliers used by customers	Low
Geographical proximity to 1-tier supplier	Short
Customers' willingness to allow relationship between FC-B and 2-tier customers	Low
Single sourcing/ multiple sourcing alternatives	Multiple
Minimum order requirements (volumes), variety of items	Min order requirements/ large product variety
Criticality of product availability/ demand stability	Low criticality/ Low stability
Supply in relation to demand (e.g. number of suppliers to a customer)	High supply – Low demand
Profit margins/ costs of low quality/ set-up costs	Low profit margins/ high costs of low quality/ high set-up costs
Criticality of securing raw material availability for customers	Low

The cooperation with small customers is mainly characterized by more technical and operational assistance on daily basis in terms of daily routines, departure of trucks, etc. Moreover, the relation with small customers can be characterized as being more informal contact. There is no EDI with the smaller customer since it is too expensive and not profitable for this type of relationship due to small volumes. Generally, regarding information sharing technology in this industry the technology could be used better (e.g. e-business). Electronic invoicing and company information portal is used, however, the customers seems not be interested. They have high requirements so it would be beneficial to offer them

solution with high added value. 2001 the FC-B is implemented e-business solution with its largest customer. The system has been used for seven years and was very successful and both partners were satisfied with the results of the implementation. Unfortunately, the customer used ERP system not compatible with SAP. After implementation of SAP (same system as used by FC-B) the applied e-business solution was no longer possible. The customer preferred to not invest into the system to make it work again as they have other plans regarding using SAP for the whole group.

Contracts regarding securing raw material for the small customers are short-term; usually for one year and the FC-B is securing raw material for one year ahead for that specific customer. Regarding establishing contact with 2-tier customers, it is important to respect the relationship between the FC-B's customers and their subsequent customers. Therefore, there is very limited contact between FC-B and its 2-tier customers due to sensitivity of such relationship from the perspective of the 1-tier customer.

In situation when multiple sourcing is possible than it is easier to switch one of the suppliers. Additionally, if the level of supply is higher than the level of demand then the customer seeks for lowest cost. In this type of industry characterized by low margins, high costs of low quality, as well as set high set-up costs, the focus on internal integration is vital to achieve efficient production management, active inventory management with low tied up capital.

1-tier Customer of FC- B

Table 30 provides list of contextual factors and related SC integration activities from perspective of 1-tier customer of FC-B which will be analyzed in more details in the subsequent sections. Firstly, contextual factors, their clusters, and values will be addressed followed by elaboration on related SC Integration activities and their levels.

Contextual factors from the perspective of 1-tier customer

All the identified contextual factors relevant for 1-tier customer of FC-B in *Table 30* have been clustered into preliminary four clusters, based on their conceptual similarities, as presented below. Each cluster will be closely discussed.

1) Product
2) Supplier
3) Information Sharing

1) Product

Product group consists of lower level contextual factors, such as Volumes of products purchased/ securing capacity/ economy of scale; and Level of product specification. The purchasing of products from 1-tier suppliers is handled centrally due to large volumes. The customer anticipates one year consumption of products. To ensure availability of large amount of raw material needed to manufacture these products, direct contact between customer and 2-tier supplier is established and maintained. Doing so, economy of scale related benefits (e.g. uniform pricing) can be gained. The customer provides the FC-B with high level of product specification in terms of details to ensure high quality of products purchased. Consequently, the need for conducting audits at 1-tier suppliers might be lower.

2) Supplier

Supplier related contextual factors as a main group comprises of four identified individual contextual factors: Criticality of low tied-up capital/ profit margins; Supplier size; Strategic importance of supplier; and Geographical location of supplier/ criticality of quality controls. Due to high transportation costs and inventory costs in relation to profit margins, customer works closely with supplier to identified solutions to decrease these types of costs, e.g. location of production site of supplier next to production site of customer or JIT deliveries with elimination of buffer stock are some examples of these solutions.

The situation regarding providing the FC-B with performance feedback is not satisfactorily compared to other markets. Type of contract with large suppliers, such as FC-B is a frame agreement. Moreover, with strategic suppliers, including the FC-B, regular planning meetings and business review meetings take place. The goal of the customer is to develop and maintain long-term relationship with crucial suppliers. Geographical location of suppliers has impact on decision regarding conducting or not conduction of quality controls (i.e. audits) at 1-tier suppliers.

3) Information Sharing

Contextual factor related to Information Sharing, as one of the main groups of contextual factors, is Size of 1-tier supplier. With large 1-tier suppliers (including FC-B) there is desire to provide them with access to customer's ERP system to eliminate manual transmissions of information regarding forecasts and orders.

Contextual factors of 1-tier customer and related SC Integration activities

Values of identified contextual factors and corresponding levels of SC integration activities, as presented in *Table 30*, will be discussed below, such as:

1) Contextual factors related to high level of integration with suppliers
2) Contextual factors related to medium level of integration with suppliers
3) Contextual factors related to low level of integration with suppliers
4) Contextual factors related to high level of integration with 2-tier suppliers

1) Contextual factors related to high level of integration with suppliers

The 1-tier customer of FC-B is engaged in high level of integration with 1-tier suppliers (including the FC-B) under circumstances given by the following contextual factors and their specific levels (see *Table 31*).

Table 30. Identified values of contextual factors and their corresponding levels of SC Integration activities from 1-tier customer perspective

		1-tier CUSTOMER – A Perspective					
Clusters of contextual factors/ Individual contextual factors within each cluster	**Value of Contextual Factors**	**2-tier Suppliers**			**1-tier Suppliers**		
		Level of SC Integration activities					
		Low	**Medium**	**High**	**Low**	**Medium**	**High**
PRODUCT Related							
Volumes of products purchased	Large						X
Volumes purchased/ Securing capacity/ Economy of scale	Large/ Critical/ Important			X			
Criticality of audits/ Level of product specification	Low/ Detailed specification				X		
SUPPLIER Related							
Criticality of low tied-up capital/ Profit margins	High/ Low						X
Supplier size (volumes)	Large				X		X
Strategic importance of 1-tier suppliers	High						X
Geographical location of 1-tier suppliers/ Criticality of audits	European market – low				X		
	Asian market – high						X
INFORMATION SHARING Related							
Size of 1-tier supplier (volumes)	Large					X	

The purchasing of large volumes products from 1-tier suppliers (e.g. FC-B) is centrally handled by 1-tier customer's central organization. The organization anticipates the volumes of products needed for coming year. The agreement on price with 1-tier suppliers is also made by the central organizations.

There is no VMI consignment stock solution with 1-tier suppliers (i.e. FC-B) due to high costs committed to applying such solutions for FC-B. 1-tier customer collaborates with FC-B to streamline the process of transportation of products from FC-B production site to 1-tier customer's production site located just next door. Previously, the products were shipped to customer and the customer kept buffer stock. Nowadays, the new JIT system allows to elimination the stock. Instead, there is one truck going from FC-B's production plant to customer's production plant and circulate on 24/7 basis.

Table 31. High level of integration with 1-tier suppliers and corresponding values of contextual factors

High Level of Integration with Suppliers (1-tier suppliers)	
Contextual Factors	**Value of Contextual Factors**
Volumes of products purchased	Large
Criticality of low tied-up capital/ profit margins	High criticality/ Low margins
Supplier size (volumes)	Large
Strategic importance of 1-tier suppliers	High
Geographical location of 1-tier suppliers/ Criticality of quality controls (audits)	High (Asian market)

With large strategic 1-tier suppliers, there is established close cooperation. The reason is that e.g. FC-B is perceived as specialist in its area and the customer can learn more from the company. Moreover, 1-tier customer organizes 1-tier suppliers' events to e.g. discuss and present innovations. People from customer's various departments, procurement, production, marketing, R&D, are involved at these meetings. There are limited sourcing alternatives for the 1-tier customer on the Scandinavian market, therefor, the 1-tier customer strives to develop and maintain long-term relationships with strategic 1-tier suppliers. At the same time, the single sourcing situation is not optimal from negotiation perspective for the 1-tier customer. Audits at 1-tier suppliers e.g. in China are conducted in by the 1-tier customer itself, since regulations (i.e. ISO or similar process quality standards) are not well established there.

2) Contextual factors related to medium level of integration with suppliers

The 1-tier customer provides 1-tier suppliers with monthly rolling forecasts (except for the FC-B plant located near to the 1-tier customer's plant) and daily updated call-offs. Currently, there is no ERP access for 1-tier suppliers; however, the connection is seen as desirable to avoid manual transmission of forecasts and orders (see *Table 32*).

Table 32. Medium level of integration with 1-tier suppliers and corresponding values of contextual factors

Medium Level of Integration with Suppliers (1-tier suppliers)	
Contextual Factors	**Value of Contextual Factors**
Size of 1-tier supplier (volumes)	Large

3) Contextual factors related to low level of integration with suppliers

Criticality of conducting audits at 1-tier supplier's production sites is lower in the European market as these suppliers are obliged to follow process quality regulations (e.g. ISO, other quality demands that need to be fulfilled by suppliers) (*Table 33*).

Large 1-tier suppliers in Scandinavian are not provided by regular performance feedback compared to other markets. It means that no specific KPI's are monitored and there are no business review meetings. However, at the 1-tier customer's plant incoming control of products is conducted. In case of quality issues, the supplier is contacted.

Table 33. Low level of integration with 1-tier suppliers and corresponding values of contextual factors

Low Level of Integration with Suppliers (1-tier suppliers)	
Contextual Factors	**Value of Contextual Factors**
Criticality of audits/ Level of product specification	Low criticality/ Detailed specification
Supplier size (volumes)	Large
Geographical location of 1-tier suppliers/ Criticality of audits	Low (European market)

4) Contextual factors related to high level of integration with 2-tier suppliers

1-tier customer possesses the resources and knowledge to hedge and secure raw material for its 1-tier suppliers (i.e. FC-B) directly with its 2-tier suppliers. The reason is mainly to ensure availability of the material as well as take advantage of economy of scale. The raw material is then used by 1-tier suppliers to manufacture products subsequently used by the 1-tier customer (see *Table 34*).

Table 34. High level of integration with 2-tier suppliers and corresponding values of contextual factors

High Level of Integration with Suppliers (2-tier suppliers)	
Contextual Factors	**Value of Contextual Factors**
Volumes purchased/ Securing capacity/ Economy of scale	Large/ Critical/ Important

5.3 Analysis II

In the *Analysis II* section, three additional steps of the analysis, Comparative analysis, Diagraming, and Conceptualizing of process, are described in terms of their goals, the procedures of achieving the goals, and expected results. After that, the results of those steps with empirical data from respondents from SC-A and SC-B are presented.

Step 3: Comparative analysis
Additionally, the aim of this step was to merge the results of analyses performed individually in step 2 in Analysis I for each company within the supply chain A (SC-A) and supply chain B (SC-B) into a summary tables to be able to compare the data for differences and similarities. As a result a set of seven clusters of contextual factors reflecting characteristics of SC-A and SC-B was created.

The above presented Analysis I revealed that all contextual factors are characterized by values (e.g. large, important, low, initial, complex). It was also realized that each value signifies magnitude of the contextual factor. To structure the data and to reduce the large variety of values, it has been assigned a generic value of low, medium or high to each contextual factor.

Step 4: Diagramming
The purpose of diagramming is to visualize potential relationships between concepts. The data graphically were plotted in a two dimensional coordinate system. The x-axis represents values of contextual factors (low, medium, and high) and the y-axis represents levels of integration activities (low, medium, and high). To account for possible variances in the pattern, two separate graphs were developed. Each graph describes the dyadic relationship between each focal company and its first tier supplier as well as between the focal company and its first tier customer.

Step 5: Conceptualizing of process
Once the data was plotted, the next step was to search for pattern in the graphs. Ideally, patterns should describe the relationship between two variables, values of contextual factors and levels of SC Integration activities. In this case, all graphs for SC-A and for SC-B revealed the same linear relationship between values of factors and levels of SC Integration activities for each dyad. A majority of the data points lies on a straight line signifying a fit between the two variables. However, there are also data points above or below the straight line which indicates irregularities - misfits. A misfit occurs when a contextual factor and its corresponding SC Integration activity/ies have different values.

5.3.1 Comparative analysis - data merging for SC-A and SC-B

In the Analysis I, contextual factors and SC Integration activities have been scrutinized separately from perspective of each studied actors of SC-A and SC-B, such as FC-A and FC-B; their 1-tier customers and 1-tier suppliers.

In the *Analysis II*, the goal is to merge these data into two comprehensive tables presented in *Appendix 5* for SC-A and *Appendix 6* for SC-B. The tables contain the identified contextual factors and SC Integration activities and their respective values and levels.

Contextual factors structuring

Merging of data for SC-A and SC-B enables precede with the analysis in that the data are compared for similarities and differences to further structure them and reduce their variety. The following set of seven clusters that characterized the contextual factors of SC-A and SC-B was created (see also *Appendix 5* and *Appendix 6*): Focal company related factors

- Product related factors
- Customer related factors
- Supplier related factors
- Information sharing related factors
- Environmental uncertainty related factors
- Industry related factors

Assigning a generic values to contextual factors and SC Integration activities

As can be apparent from the Analysis I and Appendices 5 and 6, there is large variety of values of contextual factors reflecting their magnitude (e.g. large, important, low, initial, complex). Closer analysis of the data reveal that there can be distinguished three generic values of the contextual factors: low, medium, and high. All the values of contextual factors have been thus scrutinized in order to assign the generic values according to following (see *Appendix 7* for SC-A and *Appendix 8* for SC-B):

- All values of contextual factors described by adjectives, such as *low*, *small*, or *initial*, were labeled as *low* and coded as 1.
- All values of contextual factors described by adjectives *medium*, were labeled as *medium* and coded as 2.
- All values of contextual factors described by adjectives *high*, *large*, or *late*, were labeled as *high* and coded as 3.

The remaining contextual factors with additional values (see Appendix 9) have also been scrutinized and labeled as follows:

- *Far from end-customer; beyond 1-tier customer* (in context of position of FC in SC); and *initial stage of PLC* are labeled as *high* (3) (these contextual factors requires high level of information sharing to avoid low quality of demand forecast to compensate for missing end-customer real demand information).
- *Long* (in context of geographical proximity of customer's warehouse – VMI consignment) is labeled as *high* (3). The reason is that closer relationship with suppliers might be helpful in managing the consignment stock on behalf of the customer (i.e. to conduct stocktaking).
- *Yes* (in context of customer's investments at supplier) is labeled as *high* (3) since it demonstrates relationship commitment between customer and supplier.
- *Long/ Short* (in context of geographical proximity of supplier – effect on conducting audits) is labeled as *high* (3) for both options as distance should not be the factor that determines if quality audits at suppliers should be conducted or not.

- *Yes* (in context of switching of raw materials/ components in an established product or laying down an existing product) is labeled as *high* (3). In both cases, supplier has to be informed as soon as possible.
- *Yes* (in context of new product development) is labeled as *high* (3). It might be favorable to involve suppliers in this process.
- *Low profit margins/ High costs of low quality/ High set-up costs* represent jointly a contextual factor defining the industry characteristics of FC-B. This factor is labeled as *high* (3) since it requires high level of SC Integration.
- *Minimum order requirements/ MTS/ Large variety of items* constitute a single contextual factor in the context of FC-B and it is labeled as *low* (1). The motivation is that, this contextual factor currently represent drawback in sharing POS data between 1-tier customers and 1-tier supplier (i.e. FC-B) which indicates low level of SC Integration in that matter.

Similarly, the three identified levels of SC Integration activities, such as low, medium, and high, indicating strength of integrative relationships have been coded as: low (1); medium (2); and high (3). The complete list of coded values of contextual factors and corresponding levels of SC Integration activities can be found in the Appendix 7 for SC-A, and in Appendix 8 for SC-B.

5.3.2 Diagraming of contextual factors and SC Integration activities

To visualize the potential relationship between contextual factors and SC Integration activities, the coded values of contextual factors have been plotted on *x*-axis as an independent variable. Corresponding currently applied levels of SC Integration activities for the SC-A and SC-B have also been coded and visualize on *y*-axis as a dependent variable. To account for possible variances in the pattern, four separate graphs have been created. Each graph reflects the relationship between the contextual factors and integration relevant for the dyadic relationship between each focal company and its first tier supplier as well as between the focal company and its first tier customer, as presented below.

The majority of data points are on the straight line which indicates that there seems to be match between a certain value of contextual factor and level of SC Integration activity. On the other hand, data points that are outside the line

might indicate a misfit between a value of contextual factors and currently applied level of SC Integration activities.

SC-A: Relationship between 1-tier Customers (including FC-A) and 1-tier Suppliers

The *Figure 10* depicts a relationship between two variables, values of contextual factors and levels of SC Integration activities, between the FC-A and 1-tier Supplier. The numbers in brackets represent number of data points for particular pair of the two variables obtained by plotting the two variables (contextual factors and SC Integration activities) listed in *Appendix 7.*

SC-A: Relationship between 1-tier Suppliers (including FC-A) and 1-tier Customers

The *Figure 11* depicts a relationship of values of contextual factors and levels of SC Integration activities, between the FC-A and 1-tier Customers. The numbers in brackets represent number of data points for particular pair of the two variables obtained by plotting the two variables (contextual factors and SC Integration activities) listed in *Appendix 7.*

SC-B: Relationship between FC-B and 1-tier Suppliers

The *Figure 12* depicts a relationship between values of contextual factors and levels of SC Integration activities, between the FC-B and 1-tier Supplier. The missing perspective of the FC-B's 1-tier supplier on their integration with FC-B and other 1-tier customers has been supplemented by empirical data on that perspective obtained from interviews with representatives of the FC-B. Due to this fact, only data regarding the integration between FC-B and their 1-tier suppliers are available. The numbers in brackets represent number of data points for particular pair of the two variables obtained by plotting the two variables (contextual factors and SC Integration activities) listed in *Appendix 8.*

SC-B: Relationship between 1-tier Suppliers (including FC-B) and 1-tier Customers

The *Figure 13* depicts a relationship between values of contextual factors and levels of SC Integration activities, between the FC-B and 1-tier Customers. The numbers in brackets represent number of data points for particular pair of the two variables obtained by plotting the two variables (contextual factors and SC Integration activities) listed in *Appendix 8.*

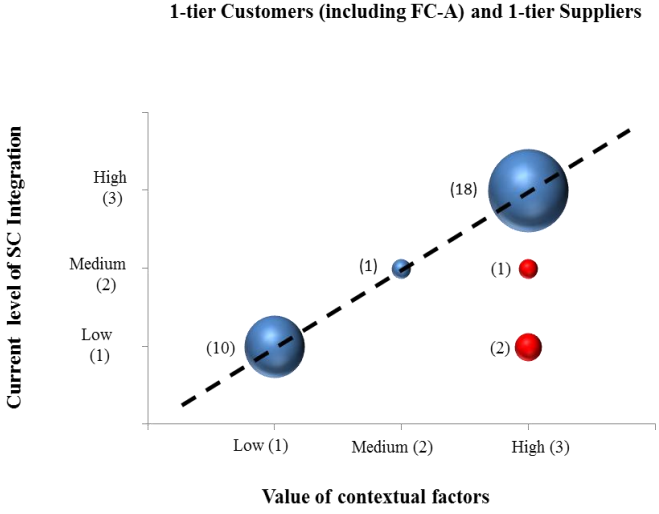


Figure 10. Relationship between values of contextual factors and levels of SC Integration activities currently applied (FC-A and suppliers)

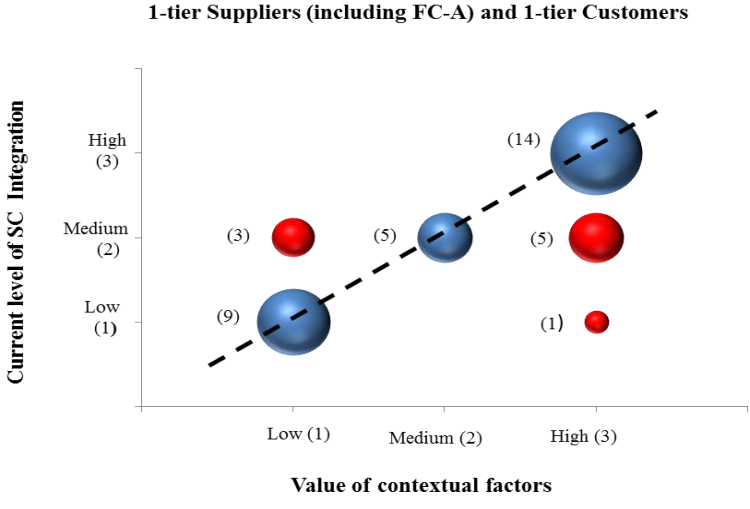


Figure 11. Relationship between values of contextual factors and levels of SC Integration activities currently applied (FC-A and customers)

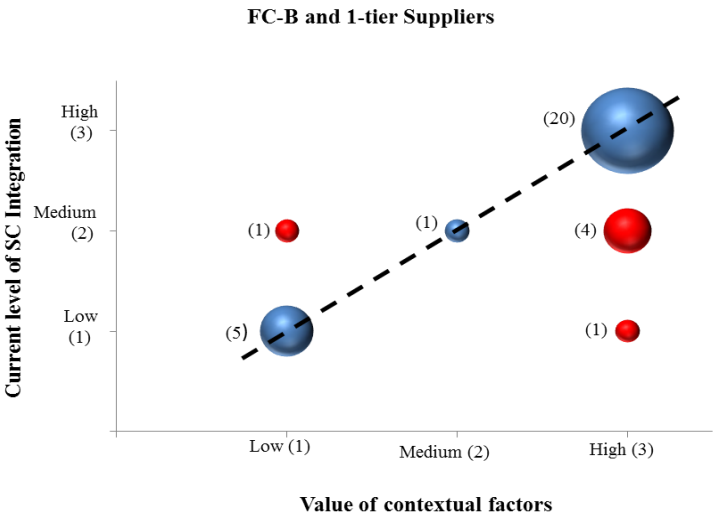


Figure 12. Relationship between values of contextual factors and levels of SC Integration activities currently applied (FC-B and suppliers)

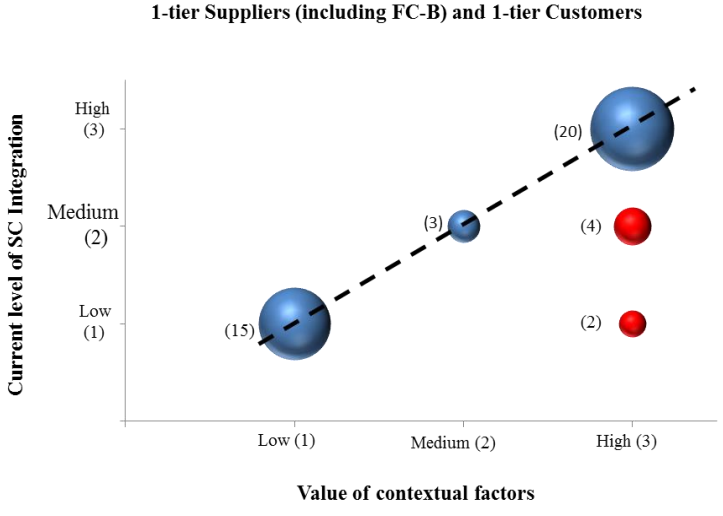


Figure 13. Relationship between values of contextual factors and levels of SC Integration currently applied (FC-B and customers)

Referring to all four graphs, the blue points suggest fit between certain value of contextual factors (low – 1; medium – 2; high – 3) and the certain level of SC Integration activities (low – 1; medium – 2; high – 3). While, the misfits

between value of contextual factors and currently applied level of SC Integration activities is depicted by the red points outside the linear line. From the available data it can be concluded that the prevailing combination of values of contextual factors and levels of SC Integration activities is both *low* and *high*. It also indicates fit between the factors and currently applied level of integration activities. *Note*: the blue points indicate fit between a value of contextual factor and a level of SC Integration activity currently applied, while the red points indicate misfit.

5.3.3 Conceptualizing of process – identifying a linear relationship

The result of plotting the empirical data suggests that there is a linear relationship between value of contextual factors and level of SC Integration activities as majority of the data points (the blue points) lies on the straight line passing through the origin (see *Figures 10, 11, 12* and *13).* The linear line signifies fit between value of contextual factor and level of SC Integration activities.

Fits between values of contextual factors and levels of Integration activities for SC-A

In the following section, the identified fits relevant for SC-A will be discussed in more details.

Relationship between 1-tier Customers, including FC-A, and 1-tier Suppliers)

As illustrated in *Figure 10*, the most common values of contextual factors and levels of SC Integration at these dyadic relationships are high value of contextual factors and corresponding high level of SC Integration activities, and low value of contextual factors associated with low level of SC Integration activities. The *Table 35* provides a summary of these values of factors and levels of integration for this particular relationship, such as:

1) Low value of contextual factors and low level of SC Integration activities
2) High value of contextual factors and high level of SC Integration activities

1) Low value of contextual factors and low level of SC Integration activities

As presented in *Table 35*, the size of FC-A in terms of frequency and volumes (scope and scale) of purchased items is relatively small in relation to its 1-tier

suppliers total volumes sold. Similarly, complexity of demand side comprising of scope of raw materials/ components purchased, as well as number of SC actors on the supply side is low. Moreover, as the size of the FC-A is small; it results into low amount of information shared with 1-tier supplier. Low size of input material purchased (i.e. scope and scale) makes the FC-A less attractive partners for large suppliers and has thus less negotiation power. As the complexity of supply side is relatively low in terms of scope of input used and number of SC actors involved, there are no VMI solutions used or EDI. Demand forecast is shared only with large suppliers and communication is handled predominantly via e-mail or phone. If the portion of the suppliers total volume that is purchased by the FC-A is large, then regular updates based on demand forecasts from FC-A's customers is provided to these suppliers. It might enhance their resource and production planning. With small customers or customers purchasing less frequently (e.g. once/year) spot contracts are signed.

Table 35. The most frequent values of contextual factors and levels of SC Integration activities

Cluster of contextual factors/ Individual contextual factors within each cluster	1-tier Customers (including FC-A) and 1-tier Suppliers			
	Values of Contextual Factor		Level of SC Integration activities	
	Low	High	Low	High
FOCAL COMPANY Related				
Size (volumes – scale/ scope) purchased	X (1)		X (1)	
PRODUCTS Related				
Quality requirements on purchased products		X (3)		X (3)
Contribution to suppliers innovativeness/ volumes		X (3)		X (3)
SUPPLIERS Related				
Level of suppliers' criticality		X (3)		X (3)
Quality issues with suppliers		X (3)		X (3)
Geographical proximity (in context of audits)		X (3)		X (3)
Cost of switching suppliers		X (3)		X (3)
INFORMATION SHARING Related				
Complexity of supply side	X (1)		X(1)	
Portion of suppliers' total volume purchased by FC-A	X(1)	X(3)	X(1)	X(3)
CUSTOMERS Related				
Purchasing frequency of raw materials/ components	X (1)	X (3)	X (1)	X (3)
INDUSTRY Related				
Level of customization		X (3)		X (3)

2) High value of contextual factors and high level of SC Integration activities

The main contextual factors having high value on the supply side are quality requirements on purchased items, contribution to suppliers' innovativeness, criticality of suppliers, quality issues with suppliers, cost of switching suppliers, and level of customization of raw material/ components delivered to FC-A (see *Table 35*). All these factors demand high level of integration. Extremely high quality requirements in medical sector on purchased raw materials and components from suppliers leads the FC-A to establish, manage and maintain long-term relationships with all type of suppliers. The reason for why all suppliers (both standards and customized products) are included is high switching costs given by a very time and costs consuming process of validation and approval of raw materials and components, as well as related production processes. Despite low volumes of raw materials/ components purchased by the FC-A from mainly large suppliers, the FC-A is still attractive for such suppliers due to its high level of innovativeness. Suppliers may learn and develop in the area of materials and technologies through contact with FC-A which contributes to attractiveness of FC-A for large suppliers.

Critical suppliers as well as new suppliers require high level of integration to comply with high quality standards of medical industry. Specifically, it means rigorous process of selecting new suppliers, regular visits of new and critical suppliers to conduct quality audits. The FC-A is applying three steps approach for suppliers that deviate from specifications given by the company: (1) complaint is sent to supplier; (2) FC-A requires action plan specifying corrective actions planned to be taken by the supplier; and if necessary, (3) quality audit is conducted by the FC-A if quality issues still persist. The FC-A has more direct contact (e.g. frequency of visits) with suppliers that are local compared to suppliers located abroad.

If the portion of the suppliers total volume that is purchased by the FC-A is large, then regular updates based on demand forecasts from FC-A's customers is provided to these suppliers. It might enhance their resource and production planning. The level of customization of materials is in general high; however, the variety of materials/ components is relatively low.

Relationship between 1-tier Suppliers, including FC-A, and 1-tier Customers)

Equally to the previously discussed dyadic relationships, these relationships can primarily be characterized both by low value of contextual factors and low level of SC Integration activities, and high value of contextual factors and high level of SC Integration activities (see *Figure 11*). The Table 36 provides a summary

of these values of factors and levels of integration for this particular relationship, such as:

1) Low value of contextual factors and low level of SC Integration activities
2) High value of contextual factors and high level of SC Integration activities

1) Low value of contextual factors and low level of SC Integration activities

The major low level contextual factors related to the demand side of SC-A and leading to low level of SC Integration are contribution margins, early stage of raw materials/ components change in an already establish product, level of process/ material knowledge of 1-tier customers, strategic importance, power dominance, early stage of relationship with 1-tier customers, customer investments at 1-tier supplier (i.e. FC-A), and initial product life cycle stage (see *Table 36*).

Table 36. The most frequent values of contextual factors and levels of SC Integration activities

Clusters of contextual factors/ Individual contextual factors within each cluster	1-tier Suppliers (including FC-A) and 1-tier Customers			
	Value of Contextual Factor		Level of SC Integration activities	
	Low	High	Low	High
PRODUCTS Related				
Contribution margins of products	X(1)	X (3)	X(1)	X(3)
Stage of raw materials/ components change in an established product	X(1)	X(3)	X(1)	X(3)
Product quality requirements		X(3)		X(3)
Product life cycle stage	X(1)		X(1)	
FOCAL COMPANY Related				
Size (volumes)	X(1)	X (3)	X(1)	X(3)
CUSTOMERS Related				
Level of process/ material knowledge of customers	X(1)	X(3)	X(1)	X(3)
Strategic importance of customer	X(1)	X(3)	X(1)	X(3)
Power dominance of customer	X(1)	X(3)	X(1)	X(3)
Stage of relationship with customer	X(1)	X(3)	X(1)	X(3)
Customer investments at supplier		X(3)		X(3)

Low level of significance of these factors results into low level of SC Integration. FC-A prefers traditional order handling without VMI or consignment stock when contribution margins on products are low. Similarly, the implementation of VMI in initial stage of raw material/ component change in an established product is unlikely. Customers that have low level of production processes or raw material knowledge delegate selection of raw materials/components suppliers to the FC-A. FC-A allocates only low amount of time, contact and other resources for customers of low strategic importance. Moreover, if the power dominance of a customer is low or the relationship with a customer is in an initial stage than FC-A prefers traditional order handling. Position of the final product producer in the SC (beyond 1-tier customer) and the product life cycle stage (initial stage) seem to lead to low quality of demand forecasts provided by customers, and instability of actual demand requested by customers.

2) High value of contextual factors and high level of SC Integration activities

The same contextual factors mentioned in the previous paragraph can also be applied for this alternative; however, the value of the factors is high. Additionally, product quality requirements and customer's investments at supplier factors should be added to the list. High values of these contextual factors imply high level of SC Integration activities (see *Table 36*).

High contribution margins on certain products seem to motivate FC-A to implement VMI-consignment stock for order handling process of these specific products with 1-tier customers.

In situations when a raw material or component needs to be changed in an established product or in early stage of relationship with customers, the FC-A prefers not to implement VMI-consignment stock for this particular product or customer. However, as demand and volumes for the particular product have been stabilized or relationship with new customers proceed to later stage and work well, the FC-A might consider implementing of VMI-consignment stock.

Customers that have a good knowledge of production process and/ or raw material/ components suppliers might recommend the FC-A to establish contacts with these suppliers. Nevertheless, the management and responsibility of these suppliers is entirely delegated to the FC-A by the customer.

The FC-A invests considerable amount of time, overhead costs into, and conduct frequent visits at strategically important customers. These customers have a high priority which is demonstrated by high level of integration. Closely related contextual factor to strategic importance is power dominance factor.

Customers with high power dominance gains FC-A's high attention as they usually represent large portion of FC-A's total turnover in terms of scale and/ or scope, or they have large expertise or knowledge in a particular area critical for FC-A's. Customer's investments at supplier plant (e.g. in tools or other equipment) is another contextual factors that seem to lead to high level of integration and interactions between FC-A and investing customer. Due to high quality requirements the customer is applying strict process for selecting 1-tier suppliers. They are evaluated based on customer's sourcing strategy and commercial aspects such as cost, availability of resources, and quality and environmental aspects. Large customers have direct contact with raw material/ components supplier (producer). In case some of the existing materials are laid down, the customer should be directly informed by and discuss solutions with its supplier (producer).

Fits between values of contextual factors and levels of Integration activities for SC-B

In the following section, the identified fits relevant for SC-B will be discussed in more details.

Relationship between FC-B and 1-tier Suppliers

Between FC-B and 1-tier suppliers, as illustrated in *Figure 12*, two values of contextual factors and levels of SC Integration activities seem to be dominant; *low* value of contextual factors and corresponding *low* level of SC Integration activities, as well as *high* value of contextual factors and associated with *high* level of SC Integration activities. *Table 37* provides a summary of these values of factors and levels of integration for this particular relationship, such as:

1) Low value of contextual factors and low level of SC Integration activities
2) High value of contextual factors and high level of SC Integration activities

Table 37. The most frequent values of contextual factors and levels of SC Integration activities

Clusters of contextual factors/ Individual contextual factors within each cluster	FC-B and 1-tier Suppliers			
	Value of Contextual Factor		Level of SC Integration activities	
	Low	High	Low	High
FOCAL COMPANY Related				
Owner of contracts with suppliers	X(1)	X(3)	X(1)	X(3)
PRODUCT Related				
Criticality of input material		X(3)		X(3)
Criticality of decreasing input material consumption		X(3)		X(3)
Cost/ volumes/ type of input material		X(3)		X(3)
Frequency and criticality of quality issues	X(1)	X(3)	X(1)	X(3)
Significance of development projects/owner of specification		X(3)		X(3)
SUPPLIERS Related				
Size of suppliers (i.e. volumes purchased by FC-B)	X(1)	X(3)	X(1)	X(3)

1) Low level of contextual factors and low level of SC Integration activities

The low value of contextual factors and correspondingly low level of SC Integration activities is demonstrated by e.g. local contracts between FC-B and 1-tier suppliers (see *Table 37*). The local suppliers are thus managed on the local level by FC-B. It means that the FC-B rather than its central organization addresses and solves e.g. quality issues directly with the local suppliers. Additionally, there is a minimum contact (e.g. providing performance feedback) with suppliers that have very limited amount of quality issues. Regarding the integration with suppliers of a small size, smaller suppliers are easier to replace as there is less cooperation.

2) High value of contextual factors and high level of SC Integration activities

The central organization of FC-B sings central contracts with large suppliers of direct material and additional direct material. The central contracts are used with suppliers of critical large volumes items that are directly related to the manufactured products. The FC-B maintains active contact only with the immediate suppliers of direct and indirect materials (i.e. 1-tier suppliers). Further backwards in the SC there is no relationship. The company is constantly working in collaboration with large direct material suppliers on developing innovations to decrease consumption of such material (see *Table 37*).

The strategy of FC-B is to implement VMI consignment on high costs raw materials/ components. There are large amount of costs related to the direct and additional direct material that it is crucial to pay only for what has been used and to minimize tied up capital. VMI consignment stock is implemented with the majority of direct or additional direct material suppliers. In case of large quality problems, audit might be conducted at 1-tier suppliers. Development projects regarding raw material/ components are generally driven by the central organization as they are specification owners. The supplier base comprise mainly of few large suppliers of direct material and additional direct material. The contracts with these suppliers are long-terms which also includes prices. Suppliers are interested in integration with customers (e.g. FC-B). Both parts work jointly to find solutions for tighter SCs. It means that e.g. the JIT concept of SC financing is used.

Relationship between 1-tier Suppliers, including FC-B, and 1-tier Customers

Similarly to previous case, there are two values of contextual factors and levels of SC Integration activities; low value of contextual factors associated with low level of SC Integration activities, and high value of contextual factors and corresponding high level of SC Integration activities (see *Figure 13*). *Table 38* provides a summary of these values of factors and levels of integration for this particular relationship, such as:

1) Low value of contextual factors and low level of SC Integration activities
2) High value of contextual factors and high level of SC Integration activities

1) Low level of contextual factors and low level of SC Integration

Low level of SC integration is applied with smaller customers. They are easier to replace as there is less cooperation. In case of short lead times, close communication with customers is less critical (see *Table 38*).

The cooperation with small customers is mainly characterized by more technical and operational assistance on daily basis in terms of daily routines and more informal contact. There is no EDI with the smaller customer since it is too expensive and not profitable for this type of relationship due to small volumes. Due to large amount of small volumes items with long time between call-offs, VMI is not used. Instead, the small product variants (B and C products) are produced when needed by using pull strategy (MTO and JIT). Low maturity of operations means not always well working production lines at customers.

Table 38. The most frequent values of contextual factors and levels of SC Integration activities

Clusters of contextual factors/ Individual contextual factors within each cluster	1-tier Suppliers (including FC-B) and 1-tier Customers			
	Value of Contextual Factor		Level of SC Integration activities	
	Low	High	Low	High
FOCAL COMPANY Related				
Market shares	X(1)	X(3)	X(1)	X(3)
Amount of cooperation projects		X(3)		X(3)
Level of dependency of a customer on FC-B		X(3)		X(3)
Delivery reliability		X(3)		X(3)
Criticality of minimizing transportation costs/inventory costs		X(3)		X(3)
PRODUCT Related				
Significance of building new production site		X(3)		X(3)
Quality costs		X(3)		X(3)
Lead time (due to geographical distance between FC-B and customers)	X(1)	X(3)	X(1)	X(3)
Criticality of JIT deliveries to customer (product durability)		X(3)		X(3)
Low profit margins/ high transportation costs		X(3)		X(3)
CUSTOMER Related				
Customer's product portfolio (i.e. % of FC-B's turnover, product variety, lot sizes, turnover rate, demand pattern)	X(1)	X(3)	X(1)	X(3)
Understanding of D forecast significance for suppliers		X(3)		X(3)
Maturity level of operations	X(1)	X(3)	X(1)	X(3)
Strategic importance of a customer	X(1)	X(3)	X(1)	X(3)
Quality of performance measures on suppliers used by customers	X(1)		X(1)	
Geographical proximity to 1-tier supplier	X(1)		X(1)	
Customer's willingness to allow relationship between FC-B and 2-tier customers	X(1)		X(1)	
Criticality for customer to secure raw material on one's own directly with 2-tier supplier	X(1)	X(3)	X(1)	X(3)
SUPPLIER Related				
Single sourcing/ multiple sourcing alternatives	X(1)		X(1)	
INFORMATION SHARING Related				
Minimum order requirements (e.g. volumes), variety of items, influence on relevance of POS data sharing	X(1)	X(3)	X(1)	X(3)
ENVIRONMENTAL UNCERTAINTY Related				
Criticality of product availability/ demand stability	X(1)	X(3)	X(1)	X(3)
Environmental pressure by society		X(3)		X(3)
Supply in relation to demand (e.g. number of suppliers to a customer)	X(1)	X(3)	X(1)	X(3)

It results in that the customers change their orders with a short notice (the deviation from the forecast is high). In such cases it is difficult to only rely on EDI connection with large customers; rather complementation with additional data inserted manually is required.

Customers that are not considered to be strategic for FC-B are those having another focus in terms of markets or growth or having mainly a focus on price compared to FC-B's own strategy. With those customers level of integration is negligible. The FC-B is not receiving regular performance feedback from customers. Moreover, in some cases the performance feedback provided might be misleading as it is not based on actual orders eventually sent to FC-B, but on orders originally generated by ERP system. The availability and quality of forecasts seem to be dependent on geographical distance to supplier, as well as on level of criticality of suppliers for a particular customer. The shorter the distance the lower quality of forecasts as they are less needed due to access to instant deliveries from a supplier. There is very limited contact between FC-B and its 2-tier customers due to sensitivity of such relationship from the perspective of the 1-tier customer. Large customers prefer to secure their needed input material (i.e. raw material) on their own directly with their 2-tier suppliers.

From 1-tier customer's perspective, in situation when multiple sourcing is possible, it is easier to switch one of the suppliers. Additionally, if the level of supply is higher than the level of demand then the customer seeks for lowest cost, rather than long-term contracts. It would be helpful for the FC-B to get information about the end-customer real demand (POS data); however, due to several issues it seems to be difficult to implement it in practice. The attributes of the final products manufactured by the 1-tier customer give a rise to use of production strategy MTS. Moreover, to optimize production and keep down costs the minimum order size is applied. Large variety of items also seems to represent additional drawback for taking advantages of POS data. This may represents obstacles for rapid reaction on fast demand changes, and thus, the full potential of having access to POS data can be realized. FC-B usually applies MTO strategy when criticality of product availability for a customer, and demand stability are low.

2) High level of contextual factors and high level of SC Integration

The FC-B could have been seen as having more power compared to its customers as it is more difficult for customers to switch the FC-B due to lack of alternatives on the market (see *Table 38*). At the same time customers are aware of FC-B's dependency on them. The relation can be classified as mutually

interdependent. The more integrated a company is with its customers, or SC partners in general, the more cooperation project they are engaged in (e.g. mutual routines, technological cooperation), the stronger dependency as a supplier. The cooperation with the large customers is on more strategic, general level related to bigger projects. With largest customers there is cooperation called Supply Chain Financing.

In situation when markets demand is higher than the supply it is relatively easy to obtain long term contracts with customers as they want to secure their supplies. If securing of sourcing and delivery reliability becomes critical, the customers are motivated to provide high quality forecasts to FC-B. Some customers understand the reason of providing forecasts and are willing to provide them. Ideally, due to the products' attributes of FC-B such as low profit margins, it is preferred to have production site close to the customer. In order to safe transportation and inventory costs, two FC-B's production plants are located directly next to the ones of the largest customers. To comply with steadily growing demand and to increase market shares it is vital for the FC-B to build a new production site. It requires long term contracts (e.g. 5 years) with the customer to secure the investment made by the FC-B. There is no quality control of incoming products supplied by FC-B as customers have confidence and trust in FC-B's professionalism.

In case of long lead times due to geographical distances between suppliers, FC-B and customers, close communication with customers is required. The FC-B encourages customers to be active and follow their business through internal portal and also through tailored weekly reports sent to customers (e.g. information about stock levels, location of the stock, how much it is on the way, how much it's remain to produce, the latest production date for the particular order, etc.). Both customers and FC-B avoid inventory. The strategy is JIT deliveries from production to customer. For the large volume items the access to POS data would be helpful for FC-B. If securing of sourcing and delivery reliability becomes critical for the customer, they are motivated to provide high quality forecasts to FC-B. Maturity level of customer's operations seems to have effect on amount of orders' changes with short notice. Well working production lines may lead to less "last-minute" changes of orders. The way of securing the input material (i.e. raw material) depends on size of the customer. For small and medium sized customers usually, the central organization secures the raw material. These customers usually choose to outsource this to a larger and more experienced member of SC. The FC-B does not need to always wait for specific orders instead MTS production strategy is used with some of the large customers. The customers may notify the FC-B about what items are

allowed to be produced according to the forecasts (MTS strategy). Precondition is trust and well working relationship with customers. This strategy is relevant only for A-articles characterized by high volumes and regular flow.

The type of products of FC-B and its 1-tier customers might be subject of high environmental pressure by society and authorities. Thus, the FC-B assists large customers in providing information for the purpose of: sustainability reports, projects, providing arguments for customers' discussion with authorities, meetings, presentations, etc. At the same time customers' represent the interest of the FC-B at these meetings as well.

Misfits between values of contextual factors and levels of Integration activities in SC-A

Recalling the *Figures 10, and 11,* while majority of the data points lie on the linear line signifying fit between value of contextual factor and level of SC Integration activities, there are also data points (red points) above or below the straight line which indicates irregularities – misfits. A misfit occurs when a value of contextual factor or factors differs from level of corresponding SC Integration activity/ies. The identified misfits in SC-A are presented in *Table 39* and in SC-B in *Table 40*. They will be discussed in more details below:

- Despite small volumes delivered to 1-tier customer, the supplier (i.e. FC-A) might be required to implement VMI-consignment with large customers. As more appropriate would be to adapt traditional order handling process (see *Table 39*).
- For suppliers far from end-customers are high quality forecasts and timely information an important input in case when real end-customer demand is not available.
- To avoid quality issues, if high product quality is required, performance feedback should be provided as soon as deviation from required specification occurs. This would allow disclosing and fixing sources of problems in a good time. Currently, no regular feedback is provided or only quarterly feedbacks are available in the best case.
- For products that are in the early stage of product life cycle it might be difficult to do high quality forecasts due to demand uncertainty, however, timely and correct information about end-customer real demand provided to suppliers could mitigate the uncertainty.

Table 39. Misfits between values of contextual factors and levels of SC Integration activities in SC-A

Misfits between values of contextual factors and levels of SC Integration in SC-A		
Contextual Factors (values: 1-low; 2-medium; 3-high)	**Current level of SC Integration** (level: 1-low; 2-medium; 3-high)	**Desired level of SC Integration** (level: 1-low; 2-medium; 3-high)
Small volumes delivered to some of the large 1-tier customers. (1)	VMI consignment with large 1-tier customers. (3)	Traditional order handling process instead of VMI consignment. (1)
Far position of supplier in SC in relation to end-customer's position in SC. (3)	No POS data available to suppliers. (1)	High quality of forecasts and timely demand related information. (3)
High product quality requirements. (3)	No regular performance feedback or mainly quarterly feedbacks from large customers. (2)	Regular monthly performance feedbacks or feedbacks provided as soon as deviation from required quality occurs to disclose and to fix sources of problems in good time. (3)
High demand uncertainty/ criticality of demand forecasts for products in early stage of PLC. (3)	No POS data available to suppliers. (1)	Timely and correct information about end-customer real demand. (3)
High criticality of having VMI located abroad/ limited ERP access. (3)	Supplier must invest resources to conduct personal stocktaking. (2)	Customer might may conduct stocktaking instead and forward the information to supplier electronically. (3)
Low criticality of having VMI located abroad/ limited ERP access. (1)	Supplier must invest resources to conduct personal stocktaking. (2)	Traditional order handling solution. (1)
High complexity of demand side (scope of output, number of SC actors). (3)	Lack of access to end-customer real demand data, limited EDI connection, customers' internal portals information available needs to be complemented by additional data inserted manually by suppliers due to changes in orders and lower quality of demand forecasts. (1)	Close collaboration with customers (e.g. EDI connection, access to ERP systems, information sharing beyond 1-tier customer high quality of demand forecasts, etc.). (3)
Criticality of 2-tier supplier for a customer. (3)	Customer might recommend to its 1-tier supplier a suitable 2-tier supplier, however, establishing and management of such relationship is entirely delegated to the 1-tier supplier by the customer. (2)	It might be favorable to employ triadic information sharing or having triadic meetings. Doing so, miscommunication and additional costs might be avoided when e.g. 2-tier supplier lays down raw materials/ components that are planned to be used by the customer. (3)

- Close cooperation can be required if a "VMI-consignment warehouse" owned by a supplier is located abroad at a customer. Customer can provide assistance to a supplier in e.g. stocktaking; otherwise, the VMI solution seems to be costly and time consuming for the abroad located supplier.
- The high complexity of demand side (scope of output, number of SC actors) would require closer collaboration with customers (e.g. connection via EDI, access to customer ERP systems, information sharing beyond 1-tier customer, high quality of demand forecasts, etc.). In comparison, the current situation might be characterized by lack of access to end-customer real demand data, and limited EDI connection. Moreover, available information from customers' external portals needs to be complemented by additional data and inserted manually into the suppliers' system by suppliers. The reasons are mainly changes in orders and lower quality of demand forecasts.
- Customer might recommend to 1-tier supplier a suitable raw material/ components supplier (2-tier supplier). Establishing and managing of the relationship is, however, entirely delegated to the 1-tier supplier. Still, it might be favorable to have triadic information sharing or meetings. Especially, in cases of, for example, laying down raw material/ component items by the 2-tier supplier or during new product development projects to avoid miscommunication and thus additional costs.

Misfits between values of contextual factors and levels of Integration activities in SC-B

Figures 12, and 13, similarly as in the case of SC-A presented above, also exhibit data points (red points) indicating irregularities – misfits between value of contextual factors and corresponding level of SC Integration activities currently applied. The misfits are presented in *Table 40*, and will be discussed in more details below:

FC-B is aware of late stage of maturity of their products and necessity to innovate them. The FC-B would appreciate cooperation in terms of information sharing and inputs from customers' side regarding desirable innovations. This is sometimes organized in form of brainstorming meetings between the customers and the company. This is considered by the FC-B to be a very fruitful way of cooperation and it could be done more often. However, today, it is mostly the FC-B who is developing new ideas on its own without closer discussion with customer in the initial stage. The drawback of this is that the company is

developing something that is not interesting for the customer. Thus, the closer cooperation would help the FC-B to focus and allocate resources more effectively from the beginning of the project.

The FC-B would like to have a closer contact with customers' marketing department not only traditionally with purchasing department. To establish this contact it is necessary to offer something interesting (e.g. innovations) to the customer. Innovations are perceived by the FC-B as an important enabler for such contact with customers' marketing department.

As the costs of low quality are extremely high, high level quality control through the whole production process is implemented. Moreover, there is incoming control of critical direct material and additional direct materials. However, rather than conduct incoming quality control of critical input materials and allocate resources for that internally, it might be more efficient to let only the 1-tier supplier be fully responsible for required quality prior deliveries to the FC-B. Doing so, duplication of resources might be eliminated.

Deficiencies in internal integration at large customers seem to cause problems when design issues shorten the time window allocated for development and production of products at FC-B.

The EDI connection is currently established only with selected customers. The FC-B looks over to broaden it to connect with more customers. The gains are expected to be less administration and streamlining the communication between the FC-B and customers (e.g. in case of customer changes call-offs, the information is instantly forwarded to FC-B). Generally, regarding information sharing technology in this industry the technology could be applied more extensively (e.g. e-business) to take advantage of its benefits. Electronic invoicing and company information portal is used, however, the customers seems not be interested. They have high requirements so it would be beneficial to offer them solution with high added value. In 2001, the FC-B actually implemented e-business solution with its largest customer. The system has been used for seven years and was very successful and both partners were satisfied with the results of the system. Unfortunately, the customer used ERP system not compatible with supplier's ERP system. After implementation of identical ERP system by customer, the applied e-business solution was no longer possible. The customer preferred to not invest into the system to make it work again as they have other plans regarding using the type of ERP system for the whole group of the customer.

FC-B provides access to its ERP system to some of their large critical suppliers but not to all large suppliers of direct and additional material. This might be

problematic when using VMI consignment with suppliers. In such case, the FC-B sent inventory status or reports to suppliers instead or suppliers might visit the site and inspect the situation. Similarly, the EDI connection is established only with one critical large supplier. To provide access to FC-B's ERP system would be desirable.

The problem related to the fluctuation of orders is the decreasing buffer inventory in the SC and fast demand changes due to unforeseen promotions. The unforeseen promotions are result of fast decision making on customers' level in the SC which makes it difficult for the FC-B to plan for production in ahead. The communication between large customers and the FC-B is well working, however, these decisions are made quickly and the FC-B has short time to prepare and react accordingly. So the more stable demand would be desirable for the FC-B.

In this type of industry characterized by low margins, high costs of low quality, as well as set high set-up costs, the focus on internal integration is vital to achieve efficient production management, active inventory management with low tied up capital.

Large 1-tier suppliers are not provided by regular performance feedback compared to other markets. It means that no specific KPI's are monitored and there are no business review meetings. However, at the 1-tier customer's plant incoming control of products is conducted. In case of quality issues, the supplier is contacted.

The 1-tier customer provides 1-tier suppliers with monthly rolling forecasts (except for the FC-B plant located near to the 1-tier customer's plant) and daily updated call-offs. Currently, there is no ERP access for 1-tier suppliers; however, the connection is seen as desirable to avoid manual transmission of forecasts and orders.

Table 40. Misfits between value of contextual factors and levels of SC Integration in SC-B

Misfits between values of contextual factors and levels of SC Integration in SC-B		
Contextual Factors (value: 1-low; 2-medium; 3-high)	**Current level of SC Integration** (level: 1-low; 2-medium; 3-high)	**Desired level of SC Integration** (level: 1-low; 2-medium; 3-high)
Late stage of maturity of products and necessity for innovation (3)	Occasional brainstorming meetings between customers and suppliers which is considered to be very fruitful way of cooperating. However, suppliers mainly develop ideas on their own in the initial stage. Suppliers have traditionally contact mainly with customers' purchasing department. (2)	Regular or more frequent brainstorming meetings and closer cooperation regarding innovations and NPD. Closer cooperation in the initial stage of project would help suppliers: a) to focus and allocate resources effectively from the very start, and b) to work on innovations that are in line with customers' wishes and expectations. Closer contact with customers' marketing department would be very helpful for suppliers in developing innovations. (3)
High costs of low quality (3)	Although suppliers should be responsible for delivering raw material/ components of required quality still customer is conducting incoming control which might lead to duplication of resources in SC (1)	It might be more efficient to let only the supplier to be fully responsible for required quality prior deliveries to customer. Doing so, customers do not need to allocate resources for incoming goods quality control. This, however, entails well established relationship and trust. (3)
NPD related issues(3)	Deficiencies in internal integration at customers might have negative affect on NPD activities at suppliers. (1)	Enhancement of internal integration at all involved SC partners desirable to achieve more efficient operations. Lacking internal integration of one actor may negatively affect performance of other actors. (3)
Criticality of less administration and streamlining of information sharing between suppliers and customers (3)	EDI connection only with some customers, e-business solutions not applied (2)	IS technology could be applied more extensively externally, e.g. e-business solutions, broaden EDI connection with customers. (3)
VMI consignment stock (3)	Limited access to ERP system for majority of suppliers using VMI consignment stock, instead customer conduct stocktaking and inform suppliers about the stock levels. (2)	Suppliers using VMI consignment stock with customers should have access to customers ERP system to be able monitor stock levels on their own. (3)
High demand uncertainty (3)	Unforeseen promotions used by customer might cause problem in production planning (1)	Despite well working communication between suppliers and large customers, more stable demand (i.e. elimination of promotions) would lead to increase ability of suppliers to plan for production in advance. Criticality of stable demand (3)

6. Model Development and Results

In this chapter, the Analysis III will be described to arrive at a final model of contextual factors and Inter-organizational Integration with customers and suppliers. Additionally, results derived from the previous analyses will be delineated and the model will be accompanied by two lists: (1) Identified relations of values of contextual factors and corresponding levels of Inter-organizational Integration activities, and (2) Levels of Inter-organizational Integration activities. Finally, a step-by-step approach illustrating application of the model will be presented.

6.1 Analysis III

In the *Analysis III* section, the final step of the analysis, Integration categories, is described in terms of its goal, the procedures of achieving the goal, and the expected results. After that, the results of those steps with empirical data from respondents from SC-A and SC-B are presented.

Step 6: Integration categories
As the purpose is to build theory, in the final step of the analysis, it was necessary to create a more general representation of the results from the four previously developed graphs. Thus, one final graph for all data points was developed. As only dyadic integrative relationships were identified in the studied SCs, the term of SC Integration activities (used until now in the study) was replaced by Inter-organizational Integration since it reflects the actual practice in a more accurate way. The final graph (model) illustrates the linear relationship between two variables, values of contextual factors and levels of Inter-organizational Integration.

Additionally, two concluding lists were compiled, such as (1) Identified relations of values of contextual factors and corresponding levels of Inter-organizational Integration activities, and (2) Levels of Inter-organizational Integration activities. The first list consists of distinctive contextual factors with corresponding integration activities, sorted into clusters. In the analysis of the original list of contextual factors (*Appendix 5*, and *Appendix 6*), it was apparent that many factors were conceptually similar. Thus, reduction of data could be conducted by collapsing conceptually similar contextual factors into a single factor. This procedure resulted in the final list of 20 factors. Moreover, the previous clustering was reevaluated after the data reduction and a final set of four clusters was developed: (1) Product related factors; (2) Demand related factors; (3) Supply related factors; and (4) Inbound logistics and outbound logistics related factors. A similar but separate analysis was carried out for the integration activities. Thus, the second list could be created containing eleven clusters of Inter-organizational Integration activities divided into three levels. The clusters are: (1) Order handling process; (2) Information sharing; (3) Allocation of resources to maintain relationship with supply chain partners; (4) Contracting; (5) Supplier development programs; (6) Cross-functional teams; (7) Production strategy; (8) Inter-organizational activities on strategic, tactical, and operational level; (9) Interdependence between supply chain partners; (10) Internal integration; and (11) Trust.

6.1.1 The model of contextual factors and Inter-organizational Integration

The *Figure 14* depicts the linear relationship, identified in the previous four graphs (*Figures 10, 11, 12, and 13),* between values of contextual factors (low, medium, and high) and levels of Inter-organizational Integration (low, medium, and high) with customers and/ or suppliers. The straight line passing through the origin signifies fit between value of contextual factors and levels of integration. On the other hand, points outside the straight line, in *Figure 14*, indicate misfits between values of contextual factors and corresponding currently applied levels of integration. It means that inappropriate level of integrative activities is applied considering the value of contextual factors. *Tables 39* and *40* provide examples of misfits. To achieve fit between the value of the contextual factors and the level of integration, the integration should either increase or decrease accordingly or the value of the factor should be reevaluated.

The value of contextual factors as well as level of Inter-organizational Integration is not static; rather, their characteristics may change over time and

should therefore be considered as dynamic. The value of contextual factors may increase or decrease. In order to achieve fit between the level of the contextual factors and the level of Inter-organizational Integration, the current level of integration with suppliers and/ or customers should either increase or decrease accordingly, to arrive at the requisite level of integration.

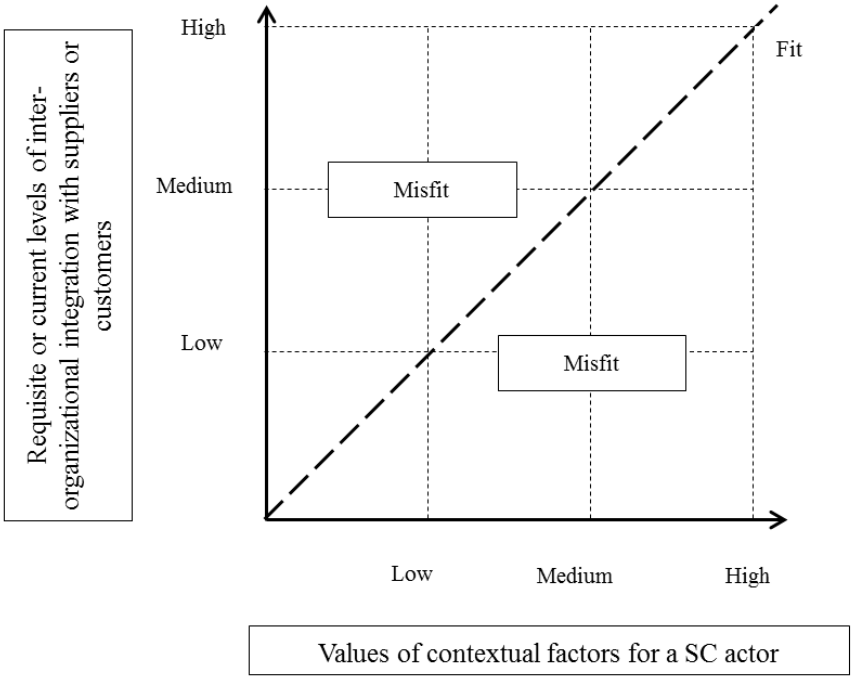


Figure 14. The proposed model of contextual factors and Inter-organizational integration

Each of the contextual factors can have various values, representing magnitude of the factors, depending on organizational internal and/ or external context. Ideally, to each value of contextual factors the organizations seek to find an appropriate level of integration with suppliers and/or customers. As illustrated in *Table 41*, organizations attempt to implement low level of Inter-organizational Integration as reaction on contextual factors of low value, medium level of integration for factors of medium value, and high level of integration for factors of high value. It means that even low level of integration with suppliers and/ or customers is appropriate as long as it is in line with organization's own context.

Table 41 represents the first list supplementing the model and consisting of the final set of contextual factors grouped into following four clusters which are result of reduction and relating of previously developed clusters in *Appendix 5 and 6.*

- Product related factors
- Demand related factors
- Supply related factors
- Inbound logistics and outbound logistics related factors

The table below illustrates 18 contextual factors, their values, clusters and corresponding levels of Inter-organizational Integration activities with suppliers and customers that can be considered as representative for both SCs approached in this study, as they appeared most frequently. Out of the 18 contextual factors, the following factors can be considered as the most frequent ones: volume purchased/ sold; contribution margins; strategic significance of customers/ suppliers; and supply/ demand uncertainty.

While the *Table 41* illustrates values of contextual factors and corresponding levels of inter-organizational Integration activities that are appropriate to apply in order to achieve fit between context and integration with suppliers and/ or customers, the second table (*Table 42*), supplementing the model, specifically focuses on providing a set of integration activities that define each of the integration levels (low, medium, and high). Similarly to the contextual factors, it is result of reduction and relating of the large number of identified integration activities presented in *Appendix 5 and 6.*

Table 41. Identified relations of value of contextual factors and corresponding levels of Inter-organizational integration activities

Cluster of contextual factors	Contextual factors	Value of contextual factors	Level of Inter-organizational Integration activities	Inter-organizational Integration activities with customers and suppliers
Product related factors	• Product quality requirements	High	High	Long term relationship with suppliers Frequent performance feedbacks Audits at suppliers, certification Frequent business review meetings Supplier development programs Trust instead of quality control of incoming goods/ products
		Medium	Medium	Regular perform. feedback only from large customers or in case of quality issues Supplier sends survey to customers regarding satisfaction Quality contracts with suppliers Certification of suppliers
		Low	Low	No audits at suppliers No performance feedback
	• Profit margins/ cost of low quality/ set up costs	Low/ high/ high	High	High level of internal integration to achieve efficient production management, active inventory and low tied up capital Limited quality control of incoming goods to avoid duplication of resources; trust between actors instead
	• Perishability of products	High	High	JIT deliveries Safety stock at customers when long distances between supplier and customer
Demand related factors	• Volumes sold (% of suppliers total turnover purchased by a customer) • Contribution margins of products sold • Frequency of selling • Market shares of customer	High	High	VMI-consignment stock Regular demand forecast sharing Regular performance feedback, audits Central contracts, long-term contracts SC financing EDI, "e-business" system JIT strategy Integration on strategic level with suppliers Direct contact of customer with its 2-tier supplier to secure raw material availability
		Medium/ Low	Medium/ Low	Local individual, short-term contracts No EDI, no access to ERP at customer, contact via e-mail No regular performance feedback provided by customer, no audits Integration on operational level

(Continued)

Cluster of contextual factors	Contextual factors	Value of contextual factors	Level of Inter-organizational Integration activities	Inter-organizational Integration activities with customers and suppliers
Demand related factors (cont.)	• Demand uncertainty	High	High	EDI Access to customers' internal portals High quality of demand forecasts
		Low	Low	No EDI; no access to customers' internal portals Demand forecasts not needed
	• Strategic significance of customers • Level of dependency on customers • Amount of cooperation projects	High	High	Frequent meetings with customers Large portion of time, costs, support allocated to customers Focus on value adding to projects Stronger mutual dependency between suppliers and customers Contact with customers purchasing and marketing functions Key account plan to assess the strategic importance of customer
		Medium	Medium	Moderate amount of time, costs and support allocated to customers Moderate mutual dependency
		Low	Low	Low amount of time, costs allocated No mutual dependency Low level of strategical efforts
Supply related factors	• Volumes purchased (% of suppliers turnover purchased by a customer) • Frequency of purchasing • Market shares of suppliers	High	High	Frequent meetings between customers and suppliers Regular performance feedbacks VMI consignment stock EDI, access to "e-room" portals(stock levels, specifications, forecast, etc.) and ERP Purchasing centrally handled Frame agreements type of contracts with specification of annual demand Regular forecasts updates to suppliers
		Low	Low	Communication via e-mail, phone No access to customers' ERP Switching suppliers No regular forecasts updates to suppl.
	• Supply uncertainty • Lead time	High	High	Long term contracts with suppliers High quality of customers' demand forecasts When long lead time, requirements on communication with customers (access to internal portals, tailored weekly reports to customers)
		Low	Low	Short term contracts Limited demand forecasts Short lead time lead to low integration

(Continued)

Cluster of contextual factors	Contextual factors	Value of contextual factors	Level of Inter-organizational Integration activities	Inter-organizational Integration activities with customers and suppliers
Supply related factors (cont.)	• Strategic significance of suppliers	High	High	Rigorous process of suppliers' selection Long-term relationships Central contracts Regular visits and audits of critical suppliers High costs of switching critical suppliers Business review meetings and planning Cross-functional teams from suppliers and customers Suppliers development programs
		Low	Low	Less business review meetings Less audits No performance feedbacks
Inbound logistics and outbound logistics related factors	• Criticality of minimizing costs (i.e. transportation costs, inventory costs) due to low profit margins	High	High	JIT deliveries to minimize time in stock Distribution center location: close to customer Supplier location: close to customer

As illustrated in *Table 42*, generally it can be concluded that *low level* of Inter-organizational Integration activities might be described as being more transactional type of relationship with actors attempting to minimize the amount of mutual interaction and contact. *Medium level*, on the other hand, demonstrates stronger intensity of contact and higher level of interface between SC actors (i.e. dyadic relationships between suppliers and customers). However, one actor seems to still be more proactive in its interaction with the other SC partner who might be more reactive. Finally, the *high level* of integration activities indicates high level of mutual interaction being characterized by proactivity of both involved actors. The different activities defining the three levels of Inter-organizational Integration have been finally grouped into eleven clusters, such as:

- Order handling process
- Information sharing
- Allocation of resources to maintain relationship with SC partners
- Contracting
- Supplier development programs
- Cross-functional teams
- Production strategy
- Inter-organizational activities on strategic, tactical and operational level
- Interdependence between SC actors
- Internal integration
- Trust

Order handling process
High level of Integration activities might be implemented by using VMI consignment stock with suppliers and JIT deliveries. Low level of integration can be characterized by traditional order handling process, lacking access to ERP system of customers, no VMI and EDI solutions.

Information sharing
High level of Integration activities in terms of information sharing might be defined by performance feedback provided regularly and frequently, EDI connection, limited changes in orders with short notice, and access to customers' internal portals (e.g. ERP, e-room, etc.). While, low level of integration may be demonstrated by e.g. no performance feedbacks and demand forecasts provided, and no POS data access.

Allocation of resources to maintain relationship with SC partners
The more important the SC partner is the more resources in terms of time, overhead costs, and meetings are allocated to maintain the relationship.

Cross-functional teams
Yet another aspect of Inter-organizational Integration is cross-functional teams. Lack of those suggest low level of SC Integration, whereas, meetings between critical SC partners representatives from various functions on regular basis is one of feature of high level of inter-organizational integration.

Table 42. Levels of Inter-organizational integration activities

Levels of Inter-organizational integration activities		
Low Level	**Medium Level**	**High Level**
Order handling process		
Traditional order handling process (no VMI, EDI, access to ERP) Frequent changes in orders	VMI or VMI consignment but with restricted access to ERP system (customer provides assistance in stocktaking for abroad suppliers)	JIT deliveries VMI consignment stock (access to ERP)
Information sharing		
No demand forecasts sharing or of low quality No performance feedbacks No VMI, no EDI, no access to ERP, no POS data sharing Communication via e-mail, phone	Restricted access to internal portals (ERP) Customers internal portals information are supplemented by additional data inserted manually Low quality demand forecasts, more frequent performance feedbacks Information sharing and contact with customers' purchasing department EDI connection with selected customers (attempt to include more customers) Despite a good communication with customers, unexpected demand changes due to promotions still occur	Frequent performance feedbacks Access to ERP, "e-room", EDI, or internal portals Demand forecasts of good quality Monitoring of performance of all direct material suppliers
Allocation of resources to maintain relationship with supply chain partners		
Low amount of time, overhead costs, and business review meetings	Medium amount of time, overhead costs, less frequent business review meetings	High amount of time, overhead costs, frequent business review meetings
Contracting		
Local contracts (short-term) Primarily cost focus of contracts	Local contracts (long-terms) One year contracts with customers regarding securing raw material	Frame contracts Long-term contracts
Suppliers development programs		
Lack of supplier development programs Risk of switching suppliers		Supplier development programs Long-term relationship with suppliers Regular visits at new and critical suppliers Audits Best supplier award Supplier events to encourage innovations, NPD projects, etc.

(Continued)

Levels of Inter-organizational integration activities		
Low Level	**Medium Level**	**High Level**
Cross-functional teams		
Lack of cross-functional teams	Cross-functional teams with large customers, meetings	Cross-functional teams, frequent business review meetings, involvement in NPD projects Critical 1-tier suppliers' representatives and customer's representatives
Production strategy		
Predominantly MTO		MTS production strategy
Inter-organizational activities on strategic, tactical and operational level		
Selection of 2-tier suppliers (raw material suppliers) delegated to 1-tier supplier Lack of strategically oriented efforts	Technical – operational assistance Proactivity (e.g. cost savings proposals to customers)	Customer might recommend 2-tier suppliers (raw mat.) to its 1-tier supplier Investments into tools/ equipment used by supplier Integration on strategic level Close cooperation in e.g. material development SC financing Key account manager assigned Location of production close to customer's site Audits at suppliers
Interdependence between supply chain actors		
Low customer power – traditional order handling process preferred by supplier	Medium power dominance – VMI preferred by supplier	High power dominance – suppliers might be required to apply VMI consignment Risk of switching suppliers low due to costly and time consuming revalidation of products/ processes Strong mutual dependency
Internal integration		
No access to POS data and frequent changes in orders compared to forecasts due to complex organizational structure and needing internal integration on the demand side of SC Lacking internal integration		
Trust		
		Trust instead of quality control of incoming products

Production strategy
High level of Integration activities in terms of production strategy might be demonstrated by applying MTS strategy. It means that customers might allow letting the supplier to produce certain items against forecasts and stock them before they are requested. This require long-time to build up such relationship to get know each other, to develop routines and achieve trust. However, a good relationship is not only precondition for using MTS strategy in the studied cases, it is also other factors that have to be taken into consideration such as stable demand, and criticality of availability of items, etc. MTO strategy, on the other hand, is used when demand is unstable, items are less critical in terms of availability, and relationship with suppliers is in an initial stage.

Inter-organizational activities on strategic, tactical and operational level
Inter-organizational activities enabling high level of Inter-organizational Integration activities might be SC financing, assigning a key account manager for a strategic customer, location of production site close to customer's one, and customer providing suppliers with tools and equipment needed for production of customized products.

Interdependence between SC actors
High level of Integration activities is characterized by strong mutual dependency between SC actors. The dependency might be result of timely and costly process of products/ processes revalidation for a customer when switching a supplier. Another example can be under circumstances of high power dominance of customer over supplier which may require supplier to make investments/implementations that might not be cost-effective. When the power of customer is low, the interdependency between supplier and customer is not mutual. It allows the supplier to apply traditional order handling process and maintain arm's length type of relationship with the less powerful customer.

Internal integration
Low level of an organization's internal integration seem to have negative impact on its suppliers and customers regardless how well external integration is working between those SC actors. The negative impact might be e.g. no access to POS data, or frequent changes in orders compared to forecasts with short notice.

Trust
Trust is related to high level of integration. In studied context it is demonstrated by relying on suppliers in terms of ensuring required product quality without necessity of incoming control.

6.1.2 A step-by-step approach to applying the model

The goal of this section is to describe a step-by-step approach that practitioners can use in applying the proposed model. A general description of each step will be offered.

There are three main applications of the model, (1) to facilitate identification of a requisite level of inter-organizational integration taking into consideration organization's context, (2) to serve as a diagnostic tool for evaluation and analysis of current level integration with selected or all supply chain partners, and (3) to support benchmarking of comparing stage of integration between different companies in the same industry sector. The model is also applicable in situation when value of contextual factors of level of integration changes over time and the reconsideration of the applied level of integration need to be carried out.

General description of applying the model

Referring to the first use of the model, the following four steps deal with identifying a requisite level of Inter-organizational integration activities taking into consideration a specific organizational context:

1) Select contextual factors relevant for supply chain actors for decision regarding level of integration with each supplier and/ or customer or clusters of suppliers and/ or customers. As a guideline for practitioners, *Table 41* provides a list of contextual factors that can be relevant to start with. Additional factors reflecting organization's internal and external context can be considered.

2) Assign value to contextual factors (low, medium or high) according to analysis of organization's internal/ external context.

3) With help of the model (see *Figure 14*) determine a requisite level of integration with the particular supplier/s or customer/s that corresponds to value of particular contextual factors. *Table 41* and *Table 42* contain integration activities suitable for particular value of contextual factors.

4) There are cases when the contextual factors have contradicting values (e.g. high volume/ low value products). In such situation the values of factors need to be combined to identify a value that should be assigned to a new contextual factor which constitutes a combination of the original factors.

The model can also be used as a diagnostic tool to reconsider currently applied level of integration in order to react on changes in types or values of contextual factors, or to only revise the appropriateness of existing levels of integration with customers and suppliers. In such case, the goal can be to identify and to analyze misfits between value of contextual factors and levels of applied integration to determine appropriate corrective actions:

5) All contextual factors and their values relevant for a certain supplier and/ or customer, or clusters of suppliers and/ or customers should be entered in a table together with corresponding levels of currently applied integration. The data can be represented graphically, as illustrated in *Figure 10, 11, 12, 13*, to provide support for analyzing the situation. If the value of factors is equal the current level of integration activities there is a fit (represented by the straight line), and it can be concluded that a suitable level of integration is applied considering the context. In the case of misfit (data outside the straight line), corrective action should be taken, as described in step 6.

6) The red points indicate misfits between currently applied level of integration activities with customers' and suppliers' contextual factors, while the blue points represent fits. The graphs offer a holistic overview over how many integrative relationships are in line with suppliers'/ customers' own context and how many need reconsideration.

7) The fit can be achieved by increasing or decreasing the levels of integration or re-evaluating the value of contextual factors. However, in certain situations (e.g. under power asymmetry between supply chain partners) the misfit must be accepted by the less powerful actor. *Table 39* and *40* provide a list of misfits identified in data of this study. An example is the misfit of contextual factor "High demand uncertainty/ criticality of demand forecast for products in early stage of PLC" with the value *high* and currently applied integration level *low* "No POS data available to suppliers". The requisite level of integration, according to the model, is *high*, which could be operationalized by "Timely and correct information about end-customer real demand".

7. Discussion and Conclusions

This chapter presents the outcomes of systematic comparison of results obtained from analysis of empirical data with the theoretical frame of reference. Moreover, results of the study are summarized to revisit answers to the research questions and research objective, and some reflection regarding the Grounded Theory methodology are presented.

The main result of our study is a model that describes the linear relationship between contextual factors and inter-organizational integration activities. The findings suggest that the main assumption of a fit between context and integration of the Structural Contingency Theory (e.g. Donaldson, 2001) is applicable also from an inter-organizational perspective.

The proposed model extends the concept of fit between contextual factors and a specific organizational aspect demonstrated by Alexander and Randolph (1985). The model takes an inter-organizational perspective and focuses on relationship between values of contextual factors and levels of inter-organizational integration. The model can be applied to both external and internal contextual factors in relation to inter-organizational integration of an organization.

Recalling the notion of fit between value of contextual factors and level of inter-organizational integration, it can be stated that even low levels of integration can be appropriate as long as they are consistent with the values of relevant factors representing organizational context. This finding seems to be more realistic compared to the optimistic view in some supply chain management literature claiming that "the more integration the better performance of the supply chain" (e.g. Frohlich and Westbrook, 2001; Stank et al. 2001; Gimenez and Ventura, 2005).

Furthermore, the proposed model adds to existing models and frameworks in SC Integration literature such as Kraljic's (1983), Fisher's (1997), Lee's (2002), Christopher's et al. (2006), and Van Donk and Vand der Vaart's (2005). The model accounts for integration with both suppliers and customers and provides guidelines regarding what specific levels of integration activities to establish with each supplier and customer, considering the organization's own context.

The model is based on a broad range of contextual factors, rather than on only single contextual factors or limited sets of factors, presented in previous research (e.g. Dyer et al. 1997; Stonebraker and Liao, 2004; Boon-itt and Wong, 2010). It might serve as a diagnostic tool for evaluation if currently applied level of integration is appropriate to the corresponding values of contextual factors. The model assists in identifying misfits between value of contextual factor and currently applied level of integration and provides an opportunity to adjust or reevaluate current levels of integration to regain fit. A list of identified misfits has been compiled including value of contextual factors; currently applied level of integration with suppliers or customers and a requisite level of integration being consistent with value of contextual factors (see *Table 39* and *Table 40*).

The reasons for misfits seem to be twofold. The first reason for misfit can be caused due to dynamic nature of the value of contextual factors, as well as level of integration with suppliers and/ or customers. Their characteristics may change over time which means that the value of contextual factors may increase or decrease. In order to achieve fit between the value of the contextual factors and the level integration, the integration should either increase or decrease accordingly to regain a fit. The second reason for misfit that was observed is power asymmetry of the involved actors. According to theory, under circumstances of downstream channel power it should result in lower level of SC Integration mostly on operational level between the powerful customer and less powerful supplier. While in reality the customer may have significant influence on supplier to adopt integrative practices (i.e. EDI) (Richey et al., 2009), supplier is still willing to agree to take the work rather than expect high margins/ profitability from the relationship (Cox, 2004).

Although, the intention of this work was to study integration of triads, in the SCs studied this scope of integration has not been found. Recalling Mentzer's et al. (2001) definition of supply chain, consisting of three or more units (i.e. triads) involved in material, financial and information flows, the term *SC Integration* as it had been used throughout this thesis should be reconsidered and replaced by the term *Inter-organizational integration*, as it more accurately reflects the actual practice of integration, being predominantly dyadic.

This finding corroborates previous SC Integration research claiming that the dyadic integration is the most common (e.g. Näslund and Hulthen, 2012; Childerhouse et al. 2011; Stonebraker and Liao, 2004). The prevailing reason for companies' not integrating beyond dyads, according to this study, is that SC actors prefer to delegate responsibilities to their partners rather than managing

relationships further upstream and/ or downstream in supply chains. In some cases, there is an attempt to triadic integration but it is restricted only to occasional meetings, usually between a supplier, a customer and a 3PL company. Moreover, large customers might have direct contact with their 2-tier suppliers to secure e.g. availability of a critical raw material for their 1-tier suppliers.

To structure the identified contextual factors and related integration activities, two tables supplementing the proposed model have been developed: (1) Identified relations of values of contextual factors and corresponding levels of Inter-organizational Integration activities (*Table 41)*; and (2) Levels of Inter-organizational Integration activities (*Table 42*). These tables can be considered as structured lists of predefined contextual factors and related Inter-organizational integration activities that can aid in the process of implementing or evaluating integration with suppliers and/ or customers.

The first table contains the 18 most frequently appearing contextual factors, identified in the data from both SCs. The factors are grouped into four clusters based on their conceptual similarities: Product related contextual factors; Demand related contextual factors; Supply related contextual factors; and Inbound logistics and outbound logistics related factors. The classification is similar to Duncan's (1972) existing classification. Out of the 18 factors, the following four are the most frequent regardless the different SCs context studied: Volume purchased/-sold; Supply/-demand uncertainty; Strategic significance of customers/ suppliers; and Contribution margins of products. Referring to the previous research, volumes and uncertainty as contextual factors of inter-organizational integration have been previously studied by Van Donk and Van der Vaart (2005); and strategic significance of input by e.g. Power (2005); Kraljic (1983); Zhao et al. (2011). The fourth factor, Contribution margins of products as a contextual factor, has not been addressed in the reviewed literature and its identification might be considered as one of the results of this study.

The contextual factors have been assigned values signifying their magnitude by practitioners. The analysis of empirical data (i.e. contextual factors and values) revealed that the large number of values of contextual factors can be reduced into three generic values (low, medium, and high), making the information more comprehensible. Additionally, to each of the contextual factors there has been identified at least one corresponding currently-applied Inter-organizational integration activity. These activities also have three main levels (low, medium, and high), representing the strength of the integrative relationship with SC partners. The division of integration activities into eleven clusters, depending on

their conceptual similarities, is illustrated in the second table: (1) Order handling process; (2) Information sharing; (3) Allocation of resources to maintain relationship with supply chain partners; (4) Contracting; (5) Supplier development programs; (6) Cross-functional teams; (7) Production strategy; (8) Inter-organizational activities on strategic, tactical, and operational level; (9) Interdependence between supply chain partners; (10) Internal integration; and (11) Trust. Each cluster comprises three sets of activities depending on levels of integration.

The inter-organizational activities presented in both tables are similar to coordination mechanisms and integration mechanisms that have been previously discussed in existing research (e.g. Lambert et al. 1996; Romano 2003). It needs to be pointed out that criticality of internal integration for efficient inter-organizational integration should not be overlooked. Regarding the levels of inter-organizational relationships as defined in literature - arm's length, cooperation, coordination, and collaboration (e.g. Spekman et al. 1998; Lambert et al. 1998; Sahin and Robinson, 2002) - these terms are not being used in the SCs studied. Rather, practitioners distinguished between low, medium, and high levels of integration when referring to strength of inter-organizational relationships. This terminology corresponds to terms used by Lambert et al. (1996).

This study has been conducted by using Grounded Theory methodology. The main challenge in applying this method, encountered by the author, was related to collecting of the empirical data. The data were collected through open ended and unstructured interviews with only "grand tour" questions that cover the topic of interest (following the GT methodology by e.g. Corbin and Strauss, 2008). However, this approach might be difficult in organizational settings when interviewing higher level managers. In some cases their overall workload negatively affected attention to questions and also the time they could allocate for the interview. Managers often prefer to be asked specific questions rather than talk freely on pre-defined topics. This might represent a challenge when applying GT in the field of logistics/ SCM compared to other disciplines.

Final remark can be made regarding the observed usefulness of GT method in this study. It can be concluded that the results would most likely be different when using more hypothetical-deductive methods. Some issues, regarding e.g. terminology, or use and understanding of theoretical concepts by practitioners, that have been brought up in this study could have been overlooked, when using another method, due to influence by the previous research.

8. Contributions, Research Credibility and Future Research

In this chapter, theoretical and practical contributions are presented. Additionally, criteria for judging the quality of research applying the Grounded Theory method are addressed. Finally limitations of this study and future research opportunities are discussed.

8.1 Theoretical contributions

The theoretical contributions of this study include an addition to Structural Contingency Theory by applying it in inter-organizational context and demonstrating its applicability beyond the intra-organizational environment where the contingency theory has its original focus. The proposed linear model, with its concept of fit/misfit, attempts to describe and explain the relationship between contextual factors and level of inter-organizational integration with both customers and suppliers. The model can be regarded as an extension of more limited models and frameworks presented in the literature.

Another contribution is the supplemental lists of identified structured contextual factors and levels of Inter-organizational integration activities that might assist in implementation or analysis of integration. The significance of the list is in its comprehensiveness - various contextual factors have been previously studied in relation to inter-organizational integration, but the results are often fragmented as the focus of research commonly lies on only single or limited number of factors.

An abstract terminology (low, medium, and high) free from intuitive connotations, for describing levels of integration is used as it more accurately reflects the actual practice. Using these terms in future research might potentially decrease conceptual confusion caused by the use of imprecisely

defined terms (e.g. cooperation, coordination and collaboration) interchangeably.

One intention of this study was to identify and analyze integration of triads in the studied SCs. However, this scope of integration has not been found, which is in line with previous research indicating that triadic integration is uncommon. To reflect the actual situation in more accurate way it is suggested to use the term Inter-organizational integration, implying dyadic scope of integration, rather than the term Supply chain integration.

Finally, using Grounded Theory methodology for collecting and analyzing empirical data might be considered a methodological contribution in the area of logistics/- SCM where Grounded Theory is not a dominant approach.

The primary objective of this method is to explore, to extend and to gain understanding and insight about a phenomenon with attempts to develop theoretical concepts from empirics. In the area of Supply chain management in general, and in Supply chain integration in particular, characterized by discrepancies, contradictions and ambiguities among existing knowledge, this method seems to be highly relevant. The issues where Grounded Theory can be appropriate include the lack of consistent terminology, absence of a unifying definition, inconsistency between proven benefits and still limited implementation of the Supply chain integration in practice, and limited insight regarding the circumstances for integration. A broader application of the method in the field of logistics/ SCM could contribute to developing theoretical concepts, holistic frameworks and empirically based models.

8.2 Practical contributions

Many organizations face complex external and internal environments, and the level of successful implementation of integration seems to be rather low. As discussed previously, the literature lacks of a unifying model of Inter-organizational integration providing practitioners with guidelines or recommendations regarding what type of link to establish with their suppliers and/or customers considering their circumstances.

From a managerial perspective, the model can assist practitioners in identifying appropriate levels of integration depending on organizational context. The model can also provide support in detecting specific cases when the level of

integration is inappropriate (indicated by the misfit). The model in combination with the lists of contextual factors and integration activities can then be used to develop corrective actions in order to regain the desired fit. These corrective actions will, ideally, improve efficiency and effectiveness of the organization. Furthermore, assuming increased application of the model, benchmarking is yet another potential function of the model. One of the results and contributions of this study is the step-by-step approach, presented in *Chapter 6*, which might be used by practitioners to guide application of the proposed model.

8.3 Research credibility

Corbin and Strauss (2008) suggested ten criteria for judging the quality of research when using Grounded Theory method; see section 3.4. Those criteria have been fulfilled as follows:

1) *Fit:* the results of the analysis and the final model have been discussed with all participants in this study to obtain their opinion regarding the plausibility of the model. Both scholars and a consultant with significant experience and knowledge within the topic area have also reviewed the results of the analysis.
2) *Applicability:* the model provides managers with general guidelines for how to implement an appropriate level of inter-organizational integration given a certain context.
3) *Concepts:* the two main concepts of the model, context (i.e. values of contextual factors) and levels of Inter-organizational integration, as well as the relationship have been described.
4) *Contextualization of concepts*: the concept of context has been a major topic in this thesis and its effect on integration has been addressed thoroughly.
5) *Logic*: in this study the attempt was to provide a logic step-by-step description of both the data collection and the analysis in order to avoid any missing links in how the results were developed.
6) *Depth*: the results have been thoroughly discussed, compared and motivated.
7) *Variation*: the variation in the findings is demonstrated by misfits between levels of contextual factors and levels of integration.

8) *Creativity:* the topic of inter-organizational integration in relation to context is not new. However, it is believed that applying Structural Contingency Theory in a Grounded Theory project is not only a creative approach but also leads to theoretical and methodological contributions.

9) *Sensitivity:* throughout the process of collecting data and conducting analysis the attempt was to avoid influence by previous research, and thus to follow the methodological steps for Grounded Theory research.

10) *Evidence of memos:* how the memos were developed was discussed. Furthermore, the memos, as well as all tables etc. in the analysis are recorded in databases that are available upon request.

A notable challenge that the author experienced was related to the process of analyzing the collected empirical data. Specifically the interpreting and coding of qualitative data could obviously result in another conclusion by other researcher. This fact was acknowledge by Corbin and Strauss (2008) who noted that different researchers do not focus on the same elements of data and interpret and recognize meaning in data differently. Therefore, this subjective aspect of the method would preferably require more than one researcher when interpreting and coding the data to develop concepts in order to enhance the quality of conclusions.

Additionally, it can be demanding to recreate the exact chronological sequence of steps describing the process of the analysis as some steps have been conducted simultaneously, several ideas have been tested and then eliminated before the final model has been constructed. Therefore, it might be useful to document each step thoroughly as it has been carried out during the course of the whole process from data collection to the last step of the analysis.

Finally, from a methodological point of view, the Grounded Theory methodology proved to be useful for developing theory in this study, and therefore the increased application of this method in logistics/- SCM research can be recommended.

8.4 Limitations

The sample of this study has been intended to contain two supply chains comprising a focal company, 1-tier customer, and 1-tier supplier. One of the goals has been to investigate the triadic scope of integration, and not only

dyadic as is common in previous research. Unfortunately, only one of the two supply chains studied has been covered; the other one could not have been scrutinized from the perspective of the 1-tier supplier of focal company B. Respondents have been contacted several times; however, due to internal reasons they choose not to participate in this study. The missing data have been supplemented by information received from focal company B instead. Considering the similar pattern observed regarding the studied phenomenon, by each of the respondents approached in this study, it is unlikely that the answers from the 1-tier supplier would alter the results.

An additional limitation is related to the concept of performance, which represents one of the key elements in Structural Contingency Theory. In the study, focus has been deliberately on the concept of fit between context and Inter-organizational integration. The main reason was the necessity to delimit the scope of the research to make it manageable in the allocated time. However, the links between context, inter-organizational integration and performance can be addressed in future research.

There are some difficulties related to using Grounded Theory methodology when collecting rich and useful qualitative data in organizational settings. The reason is that interviews are supposed to be open, with only a couple of themes to guide the interviews. These might be problematic for busy practitioners who prefer rather structured questions due to the lack of time they can spend giving interviews.

8.5 Future research opportunities

Three major ways of proceeding with this research will be delineated in this section.

Firstly, future study, building on the results from this research, can focus on investigating which factors make organizations decide not to extend their integration initiatives beyond dyadic relationships. Empirical data could be collected from representatives of practitioners, consultants, and academicians.

Secondly, in order to gain more insight and understanding of the concept of Inter-organizational integration it is desirable to further investigate, by using statistical methods, the notion of fit between a certain value of contextual factors, and the corresponding level of inter-organizational integration in relation to performance. Doing so, the identified contextual factors could be potentially confirmed as being inter-organizational contingencies. Moreover,

the practical implications of such a study would be validation of the model which would increase applicability of such models as supporting tools for designing and managing inter-organizational integration in practice. Challenges related to such a study can be to carefully identify and narrowly delimit and specify indicators of context (e.g. volumes), of inter-organizational integration (e.g. VMI), and of performance (e.g. KPIs). The criticality lies in ensuring that the performance of the SC is not the result of any factors other than those that are being measured.

Finally, another way to proceed with the topic in future would be to focus on intra-organizational integration as it proves to be a critical prerequisite for efficient inter-organizational integration. Specifically, the concept of Sales & Operations Planning can be closely scrutinized in terms of cross-functional integration between sales function and purchasing function in an organization to e.g. eliminate internal Bullwhip effect. Moreover, R&D and manufacturing functions and their integration with other functions in organizations with innovative products might also be relevant to study.

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Appendix 1. Contextual factors of high level of SC Integration

Contextual factors/ Reference/Environment	Level of integration	Coordination/ integration mechanisms
High level of SC integration		
Task uncertainty		
High technological uncertainty (Boon-itt and Wong, 2010)	Collaboration	- Information sharing to major suppliers through IT - High degree of joint planning - Suppliers provide production plan information - Supplier involved in NPD process
Environmental turbulence (Stonebraker and Liao, 2004)	Higher	NA
Complex, rapidly changing SCM environment (Power, 2005)	Cooperation	- Sharing of information/assets - Areas of common interest - Mutual competitive advantage - Trust, interdependence - Technology implementation
Competition; quantity of slack resources		
High competitive intensity (Richey et al., 2009)	SC integration	NA
Highly competitive industry (computer) (Bagchi and Skjoett-Larsen, 2002)	Higher degree of integration	*Higher degree of information integration* - ERP and Supply Chain Planning systems: - Extensive use of EDI/Internet/ XML links within SC - Strategic suppliers have access to production plans, materials requirements, sales forecasts and orders - CPFR/ VMI/ CRM with key suppliers/customers *Higher degree of organizational integration* - Integrated across SC/ process oriented - Multiple contact points at all management levels - Teams across the SC – regular interaction - Measurement of performance of SC processes - Performance data shared across the supply chain - Focus on end-customer value
Scarcity of resources (during long-term economic expansion) (Dyer et al., 1998)	Strategic partnership (collaboration)	- Multiple functional interfaces (e.g. engineering-to-engineering) - Capabilities benchmarking - Knowledge sharing routines) - Supplier performance on non-contractibles (e.g. innovation, quality, responsiveness) is vital - Self-enforcing agreements necessary (e.g. trust, stock ownership, etc.)

(Continued)

Contextual factors/ Reference/Environment	Level of integration	Coordination/ integration mechanisms
High level of SC integration		
Task uncertainty		
Unpredictable market demand	Close coordination	- SC process integration
Shortening of PLC	NA	- SC process integration
Long-term value creation (quality, new technologies) (Dyer, et al. 1998)	Strategic partnership (collaboration)	- Multiple functional interfaces (e.g. engineering-to-engineering, manufacturing-to-manufacturing, etc.) - Capabilities benchmarking - Substantial assistance (knowledge sharing) - Supplier performance on non-contractible (e.g. innovation, quality, responsiveness) is vital - Self-enforcing agreements necessary (e.g. trust, stock ownership, etc.)
Low uncertainty in volume, high uncertainty in mix/ specification (Van Donk and Van der Vaart, 2005)	High level	- Agree on reservation of capacity
High uncertainty in volume, high uncertainty in mix/ specification (Van Donk and Van der Vaart, 2005)	High need for, but relatively low possibility for integration with all buyers (shared resources represent a barrier as planning the capacity needed is difficult for a supplier, if buyers are not able to predict future demand)	- SC planning and control - Information sharing vital - Supplier orchestrate links with buyers - Buyers should provide the supplier with information - Suppliers should increase flexibility
Highly strategic nature of input (Power, 2005; Kraljic, 1983)	Highest level of integration (collaboration)	NA
Task interdependence		
Strategy (total cost reduction) (Morash and Clinton, 1998)	Operational SC integration	*Strategic level*: - SC reengineering, JIT *Tactical level:* - Standardize and simplify SC practices *Operational level:* - Adjust delivery schedule, recover from operating problems, etc.
Strategy (differentiation) (Morash and Clinton, 1998)	Collaborative	*Strategic level:* - Customer input into corporate strategies, form strategic alliances with customers/ suppliers *Tactical level:* - Cross-functional teams, visit customers/suppliers - Share performance results

(Continued)

Contextual factors/ Reference/Environment	Level of integration	Coordination/ integration mechanisms
High level of SC integration		
Task interdependence		
Complex-product industries (Dyer et al., 1998)	Strategic partnership (Collaboration)	- Multiple functional interfaces - Capabilities benchmarking - Knowledge sharing routines - Supplier performance on non-contractibles (e.g. innovation, quality, responsiveness) is vital - Self-enforcing agreements necessary (e.g. trust, stock ownership, etc.)
Very short PLC (electronics, electrical products) (Zhao et al., 2011)	Close cooperation	- Design product with customers - Implementing IT with major customers for ordering - Information sharing (POS, demand forecast, inventory, production plans) and communication with major customer - Quick ordering system with major customer - Provide feedback to major customer - Regular contacts with major customer
Key input: raw material (mechanical, engineering, textile and apparel industry) (Zhao et al., 2011)	Close cooperation	- Information sharing with major supplier - Establishment of quick ordering system with major supplier - Strategic partnership with major supplier - Stable procurement with major supplier - Participation in process of procurement and production - Participation in design stage - Major supplier shares: production schedule, capacity, inventory - Focal company shares with major supplier: production plan, demand forecast, inventory, - Provide support in process improvement to major supplier

(Continued)

Contextual factors/ Reference/ Environment	Level of integration	Coordination/ integration mechanisms
High level of SC integration		
Innovative and unique products with higher complexity (Lamming et al., 2000)	Very close relationship	- Sharing of know-how - Sharing of production technology - SC broader upstream (powerful suppliers) - Few sources for each component
Innovative and unique products with lower complexity (drugs, sem-conductors, communication technology, etc.) (Lamming et al., 2000)	Very close relationship	- Sharing of know-how - Sharing of production technology - SC comprises of fewer companies (strong focal company controlling the entire SC) - Relatively small SCs (few components) - Regulation, high levels of process technology – supply important but difficult to control
Additional contingency – resource dependence		
Organizational Power		
-Interdependence between buyer and supplier, - Buyer dominance over supplier*:* (High levels of global volume with regular and standardized demand requirements from suppliers operating in highly competitive markets with low switching costs for the buyer) Cox (2004)	Implementation of SCM practices	Supplier development: - Long-term operational relationship with extensive and close working between buyer and supplier

Appendix 2. Contextual factors of low level of SC Integration

Contextual factors Reference/ Environment	Level of integration	Coordination/ integration mechanisms
Low level of SC integration		
Competition; quantity of slack resources		
More stable and relatively less competitive industry (health industry) (Bagchi and Skjoett-Larsen, 2002)	Arm's length relationship	*Lower degree of information integration* - MRP II systems - E-mail/ Fax/ phone - Internet/ Extranet only used for limited purposes - Only bar-coding of finished products *Lower degree of organizational integration* - Fragmented logistics activities - Few contacts points between companies in the SC - No cross-functional teams - Measurement of delivery service and inventory levels in some parts of the SC
Excess of suppliers capacity (declining industry) (Dyer et al., 1998)	Durable arm's length relationship	- Single functional interface (i.e. sales to purchasing) - Minimal assistance (inter-firm knowledge sharing) - Contract to enforce agreement
Task interdependence		
Proactive strategy (prospector) (Stonebraker and Liao, 2004)	Less integrative efforts	NA
Low uncertainty in volume and low uncertainty in mix/specification (Van Donk and Van der Vaart, 2005)	Necessity to integrate is absent	- Simple ordering procedures - Optimize inventories and physical flow
High uncertainty in volume and low uncertainty in mix/specification (Van Donk and Van der Vaart, 2005)	Little integrative practice necessary	- practice to improve physical flow of goods (i.e. attuning delivery sizes or packaging customization)

(Continued)

Contextual factors/ Reference/ Environment	Level of integration	Coordination/ integration mechanisms
Low level of SC integration		
Task interdependence		
Short-term cost reduction (Dyer et al., 1998)	Durable arm's length relationship	- Single functional interface (i.e. sales to purchasing) - Minimal assistance (inter-firm knowledge sharing) - Contracts to enforce agreement
Long distance among SC members (Cooper et al., 1997)	Arm's length relationship	NA
Consistent suppliers quality/ service abilities (Cooper et al., 1997)	Arm's length relationship	NA
Standardized products (simple product industries) (Dyer et al., 1998)	Durable arm's length relationship	- Single functional interface (i.e. sales to purchasing) - Minimal assistance (inter-firm knowledge sharing) - Contract to enforce agreement
Longer PLC (metal, mechanical, engineering, textile, apparel industry) (Zhao et al., 2011)	Less integration	NA
Standardized input (components for electronics, electrical products) (Zhao et al., 2011)	Less integration	NA

(Continued)

Contextual factors/ Reference/ Environment	Level of integration	Coordination/ integration mechanisms
Low level of SC integration		
Task interdependence		
Functional products – higher complexity (Off-road cars, etc.) (Lamming et al., 2000)	Less integration	- Sharing of cost information - Sharing of staff - SC broader upstream (powerful suppliers) - Few sources for each component
Functional products - lower complexity (canned soft drinks, window wipers, etc.) (Lamming et al., 2000)	Less integration	- Sharing of cost information - Sharing of staff - SC comprises of fewer companies (strong focal company controlling the entire SC)
Downstream channel power (Richey et al., 2009)	Lower level	Significant influence on adoption of integrative practices (i.e. EDI, RFID) on upstream suppliers

Appendix 3. Introduction letter, project description, and interview guide

LETTER OF INTRODUCTION

Hej,

mitt namn är Hana Hulthén och jag är doktorand på avdelningen för Teknisk logistik vid Lunds Tekniska Högskola.

Mitt forskningsområde är integration i försörjningskedjor (Supply Chain Integration). Jag arbetar med att utveckla konkreta riktlinjer och normativa rekommendationer för företags externa integration. Specifikt undersöker jag hur företagets kontext påverkar affärsrelationer och omfattning av integration i försörjningskedjan.

I dagsläget saknas det samlad kunskap kring ämnet och det som finns är ofta fragmenterad. Dessutom påstås det ofta att ”ju mer integration desto bättre prestanda.” och en universal lösning som ska gälla alla är det som oftast föreslås i teorin.

I dessa rekommendationer tas ofta inte hänsyn till att företagen är påverkade av flertalet externa och interna faktorer (t.ex. typ av företag, produkt, konkurrensnivån i industri m.m.) och att dessa spelar roll när det gäller typ och nivå av integration. I bilagan till detta brev bifogar jag vår projektbeskrivning.

Jag vore mycket tacksam om jag skulle kunna ta del av dina erfarenheter och tankar kring detta område. Jag planerar att genomföra ett flertal intervjuer med relevanta respondenter från industri.

Skulle vi kunna boka tid för ca en timmes intervju? Du kan bestämma tiden som bäst passar för dig.

Med vänliga hälsningar
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PROJECT DESCRIPTION

Type of work: Licentiate thesis

Subject area: Supply Chain Integration (SC Integration)

The overall purpose: to enhance the knowledge regarding organizational context and its effect on Supply Chain Integration.

Research objective: to develop a model of contextual factors and Supply Chain Integration that can provide support for practitioners regarding what level of integration to establish with suppliers and customers.

Research questions:

- **RQ1:** What are the contextual factors related to Supply Chain Integration and how they can be structured?
- **RQ2:** What is the relationship between contextual factors and level of Supply Chain Integration?

Respondents/data collection: Open ended interviews with supply chain managers, Logistics Managers, purchasers, sales managers and manufacturing managers from industry with experience and knowledge of the subject area.

Background to the project and problem discussion

Companies experience many challenges including turbulent economic environment, demanding customers, increased complexity of products, and advancement in information and communication technology, among others. These factors contribute to a higher degree of outsourcing, vertical disintegration and increased globalization which intensified dependency on inter-organizational relations.

Inter-organizational relationships require management and coordination to become an effective tool in today's competitive environment as organizations are forced to rely on number of external suppliers to deliver value to customers. Thus, management and coordination of activities intra-organizationally within a single firm, as well as inter-organizationally among organizations, known as Supply Chain Integration is considered to be important.

In literature, it is commonly stated that SC Integration leads to lower costs, higher quality and enhanced service level, to name but a few positive outcomes. Common assumption seems to be that the more integration, the better performance.

However, SC Integration is more "*rhetoric than reality*" in most industries and seamless integration of products, services and information flows from source of raw material to end customer is difficult to achieve in practice. Majority of companies experience difficulties to implement SC Integration. Therefore, questions have been raised regarding the nature of SC Integration and the extent to which it can be accomplished. Instead of all-encompassing integration, selectivity in terms of what type and level of integration should be applied to each supply chain link has been suggested.

Practical implications of this study

As managers face various internal and external factors associated with, for example, the company, industry, competitive environment, and nature and type of products, the importance of organizational *context* needs to be taken into consideration when assigning a preferable degree and scope of SC Integration. This knowledge may prevent practitioners from developing integrative relationships if the gains are only marginal.

Previous research does not provide clear recommendations for practitioners in this question and the existing knowledge is often very fragmented. Therefore, a unifying framework of SC Integration that would offer a systematic approach with specific guidelines on *who, how* and *when* to integrate should be developed to support practitioners through the integrative process.

INTERVIEW GUIDE

The interview (approx. one hour) will be guided by the following broad questions in order to cover the main aspects of the subject of this study.

Background

Name:

Company:

Job title

Years with company:

Previous experience:

Interview questions

1) How would you describe the current situation regarding integration with your suppliers/ customers? (i.e. How do you collaborate with your suppliers/ customers on operational, tactical and strategic organizational level?)
2) What are the factors that influence how much or little do you collaborate with your suppliers/ customers? (i.e. Why do you collaborate with some suppliers/customers more than with others?)
3) How could be improved the current situation concerning the integration with your suppliers/ customers?
4) Can you please mention one example of successful integration with your suppliers/ customers suppliers?

Appendix 4. Research database

- Interview guide
- Letter of introduction
- Description of the research project
- Recorded interviews
- Transcribed interviews
- Memos to interviews (Word files)
- Analysis of all memos (Excel files)
- Executive summary of results

Appendix 5. Contextual factors and levels of SC Integration of SC-A

Clusters of contextual factors/ Individual contextual factors within each cluster	Values of Contextual Factors	PERSPECTIVE of FOCAL COMPANY A (FC-A)					
		1-tier Suppliers			1-tier Customers		
		Level of SC Integration activities					
		Low	Medium	High	Low	Medium	High
FOCAL COMPANY Related							
Size (volumes)	Small	No VMI; demand forecast sharing only with large suppliers; less negotiation power					VMI-consignment with some customers; Demand forecasts sharing with 1-tier customer; less negotiation power
Position in the supply chain	Far from end-customer					Low quality of demand forecasts, no end-customer real demand data	
PRODUCT Related							
Purchased raw Materials/ components Level (Input)							
Quality requirements	High			Long-term relationship with all suppliers			
Volumes (scale)	Low	Less attractive for large suppliers					
Contribution to supplier's innovativeness/ volumes	High/low			Attractiveness for large suppliers			
Scope of raw materials/ components used	Small	Communication via e-mail, phone					

(Continued)

		PERSPECTIVE of FOCAL COMPANY A (FC-A)					
Clusters of contextual factors/ Individual contextual factors within each cluster	**Values of Contextual Factors**	**1-tier Suppliers**			**1-tier Customers**		
		Level of SC Integration activities					
		Low	**Medium**	**High**	**Low**	**Medium**	**High**
PRODUCT Related							
Components Level (output)							
Quality requirements/ product ownership	High					No participation in validation; No regular perform. feedback (only from large customers or in case of quality issues); survey to cust.; influence on cust. reg. approve of more mater.	
Contribution margins	Low/Medium/ High				No VMI	VMI	VMI consign
Final product level							
Producer/ PLC stage	Beyond 1-tier customer/Initial stage				Uneven D - low quality of demand forecasts		
Stage of raw material/ component change	Initial / Later				No VMI		VMI

(Continued)

Clusters of contextual factors/ Individual contextual factors within each cluster	Value of Contextual Factors	PERSPECTIVE of FOCAL COMPANY A		
		1-tier customers		
		Level of SC Integration activities		
		Low	Medium	High
CUSTOMER Related				
Level of process/material Knowledge	Good/ less good	Selection of 2-tier suppliers (raw mat. suppliers) delegated to FC-A		Customer might recommend 2-tier supplier (raw mat.) to FC-A
Strategic importance	Low/ Medium/ High	Low amount of time, overhead costs, frequency of meetings, no VMI	More time, meetings, Costs, VMI	Large portion of time, costs, meetings, support, value adding to projects, etc.
Geographical proximity of customers' warehouse (VMI consignment)	Long		Leads to additional costs (time, regulations)	
Power dominance (% of total FC's (supplier's) turnover, low FC's (supplier's) previous experience with consignment stock, scope/scale of items delivered to customer.	Low/ Medium/ High	Low customer power: traditional order handling process	Medium power dominance: FC-A prefers VMI	High power dominance: Subcontractor might be forced to implement VMI-consignment
Stage of relationship with customer	Initial/Later	No VMI only if customer is more powerful than FC-A		In later stage VMI might be considered by FC-A
Customer investments at supplier	Yes			Investments into tools/equipment used by FC-A

(Continued)

		PERSPECTIVE of FOCAL COMPANY A					
Clusters of contextual factors/ Individual contextual factors within each cluster	**Value of Contextual Factors**	**1-tier Suppliers**			**1-tier Customers**		
		Level of SC Integration activities					
		Low	**Medium**	**High**	**Low**	**Medium**	**High**
SUPPLIER Related							
Level of criticality	High			Rigorous process of selecting suppliers; long-term relationships; regular visits of new and very critical suppliers; audits			
Quality issues	High			Deviation from specification: three steps used by subcontractor: (1) complaint; (2) action plan; and (3) audit			
Geographical proximity of supplier	Long/ Short			Conducting audits: proximity has no influence Less direct contact (long distance); More direct contact (short distance)			
Cost of switching suppliers	High			Switching less probable due to costly and time consuming revalidation of raw materials/components and processes			
Supplier size	Small/ Large	Small volumes: no demand forecasts from subcontractors		Large and stable volumes: ongoing discussion between subcontractor, customers and suppliers (but separately) reg. material issues			

(Continued)

Clusters of contextual factors/ Individual contextual factors within each cluster	Value of Contextual Factors	PERSPECTIVE of FOCAL COMPANY A					
		1-tier Suppliers			1-tier Customers		
		Level of SC Integration activities					
		Low	Medium	High	Low	Medium	High
INFORMATION SHARING Related							
Complexity of demand side (many actors)	Large					No access to end-customer real demand data; No connection via EDI; It might lead to low quality of demand forecasts; Customers' internal portals information need to be complemented by additional information	
Complexity of supply side (scope of raw mat./components used)	Low	No EDI, VMI used, instead traditional order handling					
Portion of suppliers total volume purchased by FC	Small/ Large	Less critical to provide regular forecast update		Regular forecasts updates			
Level of quality requirements	Very high			Monitoring performance of all direct mat. suppliers (quarterly feedbacks)			
Quality of forecasts	Mainly low					Large org.: low quality Medium org.: better quality	

(Continued)

Clusters of contextual factors/ Individual contextual factors within each cluster	Value of Contextual Factors	PERSPECTIVE of FOCAL COMPANY A					
		1-tier Suppliers			1-tier Customers		
		Level of SC Integration activities					
		Low	Medium	High	Low	Medium	High
ENVIRONMENTAL UNCERTAINTY Related							
Requirements on flexibility of SC actors	High						Fast feedback on performance of each actors important
Unforeseen changes	Medium					Customers guarantee to purchase certain volumes	
Fluctuation of end-customer demand	Low					Stable demand of 80-85% of products. Despite that forecasts provided by customers of lower quality; Difficult for subcontractor to implement VMI with consignment stock	

(Continued)

		1-TIER CUSTOMER PERSPECTIVE (Supply Chain A)					
Cluster of contextual factors/ Individual contextual factors within each cluster	**Value of Contextual Factors**	**1-tier suppliers**			**1-tier Customers**		
		Level of SC Integration activities					
		Low	**Medium**	**High**	**Low**	**Medium**	**High**
PRODUCT Related							
Type/ volume of products/ components purchased	Standardized/Customized	Standardized: "kanban" order handling process used for large volumes		Customized: large volumes and high turnover – VMI (customer owns stock); access to stock level information; financing of tools or sharing with subcontractor; customer review status of tools regularly			
Lead time of components/ products	Short/ long	Provides 1-tier supplier with demand forecasts for 6 (short lead time)		12 months (long lead time) for components			
Product quality requirements	Very high			Strict process of selecting 1-tier suppliers; audits at critical suppliers or those having quality issues			
Switching of raw material in an established product or laying down existing product				Gradual/planned switching: inform supplier in good time; Fast change: stock disposal despite costs			
NPD				Cross-functional teams: critical 1-tier suppliers' representatives and customer representatives			

(Continued)

		1-TIER CUSTOMER PERSPECTIVE (Supply Chain A) Cont.		
Clusters of contextual factors/ Individual contextual factors within each cluster	**Value of Contextual Factors**	**1-tier Suppliers**		
		Level of SC Integration activities		
		Low	**Medium**	**High**
SUPPLIER Related				
Level of supplier criticality (turnover, quality, source, costs, and supply problems)	Low/High	Supplier with low quality/supply problems and less critical suppliers: less business review meetings, audits, no performance feedbacks; incoming goods control		Supplier with quality/supply problems and critical suppliers: high priority, audits, business review meetings, development programs
1-tier supplier level of expertize	High			Suppliers are involved in NPD projects; development contracts used
Level of quality requirements on suppliers	High	In majority of cases the 1-tier customer is not conducting audits at 2-tier suppliers (distributors)	Quality contracts with suppliers	
Desired improvements for suppliers			Desired improvements: more active suppliers in identification of cost savings while keeping high product quality	
CUSTOMER Related				
Customer's level of raw materials/ components knowledge	Low/ High	Low level: supplier's responsibility to find raw material/ components suppliers	High level: customer might recommend raw material/ components suppliers. Establishing and managing of relationship is entirely delegated to 1-tier suppliers.	

(Continued)

		1-TIER CUSTOMER PERSPECTIVE (Supply Chain A) Cont.					
Clusters of contextual factors/ Individual contextual factors within each cluster	**Value of Contextual Factors**	**1-tier Suppliers**			**1-tier Customers**		
		Level of SC Integration activities					
		Low	**Medium**	**High**	**Low**	**Medium**	**High**
INFORMATION SHARING Related							
Type of suppliers (turnover, volumes)	High			Critical 1-tier suppliers have access to "e-room" (stock levels, specifications, forecasts, etc.)			
Demand forecast used			Demand forecasts from customers; suppliers expected to forward it to their suppliers				

(Continued)

Clusters of contextual factors/ Individual contextual factors within each cluster	Value of Contextual Factors	1-TIER SUPPLIER PERSPECTIVE					
		2-tier Suppliers and 1-tier Suppliers			1-tier Customers		
		Level of SC Integration activities					
		Low	Medium	High	Low	Medium	High
PRODUCT Related							
Product quality requirements	High				1-tier supplier requires from customer "medical form" prior delivery of certain items; uncommon to conduct audits at 1-tier supplier or 2-tier supplier by customer	Using certification along every delivery; validation of raw mat., environmental declaration instead of audits at suppliers	1-tier supplier may provide assistance in formulating conditions in contracts.
Product characteristics (volumes/SKU/ product group, turnover rate, demand pattern	Large						VMI-consignment as it gives flexibility to supplier
INDUSTRY Related							
Quality requirements/ level of customization of raw materials/ components	High				Certification	Certification	Certification
CUSTOMER Related							
Size of customer.	Small Medium Large				Local individual contracts with small sized customers (Different transport. systems, inventory costs, labor costs, etc)	Local individual contracts with medium sized customers	Central contracts with large cust. valid for whole group (exception)
Frequency of raw material/ components purchased/organization structure (group)	Frequency Low/ High				Purchasing only once/ year: spot contracts with supplier	Frequent buyers (VMI-consignment), price contracts with groups (monthly, quarterly, etc.)	Frequent buyers (VMI-consignment), price contracts with groups (monthly, quarterly, etc.)

(Continued)

Clusters of contextual factors/ Individual contextual factors within each cluster	Value of Contextual Factors	1-TIER SUPPLIER PERSPECTIVE					
		2-tier Suppliers and 1-tier Suppliers			1-tier customers		
		Level of SC Integration activities					
		Low	Medium	High	Low	Medium	High
INFORMATION SHARING Related							
Customer size (volumes)	Small Medium Large				Small/ medium sized cust.:No EDI, No access to ERP at cust. instead e-mail; No direct contact with 2-tier supplier instead with 1-tier.		Large customers: direct contact with 2-tier customer (producer)
Customer size (volumes) cont.	Small Medium Large	Lack of communication between the producers, distributors, FC-A, other customers regarding laying down raw material items/ components, and during initial stage of NPD (confidentiality). Triadic meetings not common (producer, FC-A, customer). Consequences might be not selecting the most optimal solution due to lack of information about e.g. planned lay down of raw material/ components, etc.). Dyadic meetings (distributor and FC-A or FC-A and customer) are more common. Results from meetings need to be communicated further.					
						Customer purchasing small volumes should be informed and solution is found with distributor.	Customer purchasing large volumes should be directly informed and solution is found with producer.
Customer size (volumes) cont.	Small Medium Large		Small/ medium customers should inform FC-A and/or distributor about changes in raw mater. No regular perf. feed. from customer	Large customers should inform producer directly about changes in raw mater. Regular performance feedback from customers			

Appendix 6. Contextual factors and levels of SC Integration of SC-B

		PERSPECTIVE of FOCAL COMPANY B (FC-B)					
Clusters of contextual factors/ Individual contextual factors within each cluster	**Value of Contextual Factors**	**1-tier Suppliers**			**1-tier Customers**		
		Level of SC Integration activities					
		Low	**Medium**	**High**	**Low**	**Medium**	**High**
FOCAL COMPANY Related							
Market shares	Large (few suppliers on market)						Large market shares of a FC lead to customer's dependency
	Small (several suppliers on market)				Lead to low level of cooperation (replace-ability)		
Level of innovativeness	High					Cost savings proposals for customers, proactivity (minimize risk of switching)	
Amount of cooperation projects	High						Stronger mutual dependency between supplier and customer
Level of dependency of a customer on FC-B	High						Giving a high priority and responsibility at the FC
Delivery reliability	High						Demand forecast significance for FC

(Continued)

		PERSPECTIVE of FOCAL COMPANY B (FC-B)					
Clusters of contextual factors/ Individual contextual factors within each cluster	**Value of Contextual Factors**	**1-tier Suppliers**			**1-tier Customers**		
		Level of SC Integration activities					
		Low	**Medium**	**High**	**Low**	**Medium**	**High**
FOCAL COMPANY Related							
Supplier/ customer development programs	Not engaged		Regular survey of supplier satisfaction (sharing ideas between FC and suppliers only when FC will benefit; Best supplier award; No supplier development through cross-functional teams as each possess their unique expertise			Regular survey of customer satisfaction (sharing ideas between FC and customers only when FC will benefit; No cross-functional teams to improve performance as each possess their unique expertise	
Criticality of relationships with customers	High (Established markets)					Info sharing and contacts mainly with purchasing department. Desire to establish contact with marketing dep. (proactivity in innovations can enable such contact)	
Criticality of minimizing transportation costs/ inventory costs	High						JIT deliveries to minimize time in stock, no VMI (large nr of small volume items; customer avoids inventory). Warehouse location: close to customer or at FC, stock in transit

(Continued)

Clusters of contextual factors/ Individual contextual factors within each cluster	Value of Contextual Factors	PERSPECTIVE of FOCAL COMPANY B (FC-B)					
		1-tier Suppliers			1-tier Customers		
		Level of SC Integration activities					
		Low	Medium	High	Low	Medium	High
PRODUCT Related							
Criticality of input material	High (direct and related raw material)			Central contracts			
Product innovations	Medium					FC-B and large customers at least once/year to share info reg. desirable innovations – brainstorming meetings – could be conducted more frequently to help FC to allocate resources	Long-term contracts between FC and customer due to huge investments covered by FC. Customer has to guarantee market (sales volumes) and infrastructure of operations
Criticality of decreasing of input material consumption	High			Close cooperation in material development			
Quality costs	High	Stringent quality controls internally during production process					No quality control of incoming products – trust between FC and customer

(Continued)

Clusters of contextual factors/ Individual contextual factors within each cluster	Value of Contextual Factors	PERSPECTIVE of FOCAL COMPANY B (FC-B)					
		1-tier Suppliers			1-tier Customers		
		Level of SC Integration activities					
		Low	Medium	High	Low	Medium	High
PRODUCT Related							
Lead time (due to geographical distance between FC-B and 1-tier customer)	Long/ Short				Low integration when short lead time		Requirements on communication with customers (internal portals, tailored weekly reports by FC-B)
Maturity level of products/ need for innovations	High					Large customers encourage innovativeness; meetings by FC to present innovations to customers (less often)	
New product design issues for FC-B	Large				Need for internal integration at customer: marketing-purchasing dep. to postpone launching date, lacking internal integration, personal turnover		
Costs/volumes/type of input material	High/large/direct and additional direct material			VMI – consignment stock in house (at FC-B)			

(Continued)

Clusters of contextual factors/ Individual contextual factors within each cluster	Value of Contextual Factors	PERSPECTIVE of FOCAL COMPANY B (FC-B)					
		1-tier Suppliers			1-tier Customers		
		Level of SC Integration activities					
		Low	Medium	High	Low	Medium	High
PRODUCT Related							
Frequency and criticality of quality issues	High			Audit at 1-tier suppliers by FC-B			
Significance of development projects/ changes/ owner of specification	High (development project – raw material characteristics)			Involved actors: central organization and 1-tier supplier			
	Medium/minor "add-ons" changes to existing materials		Locally between FC-B and 1-tier supplier directly				
Criticality of JIT deliveries to customer (due to low durability of products)	High						Strategy: JIT, safety stock at customers when long distance between FC and customer.
Profit margins/ high transportation costs	Low margins/ high transportation costs						Location of production close to customer's site

(Continued)

		PERSPECTIVE of FOCAL COMPANY B (FC-B)					
Clusters of contextual factors/ Individual contextual factors within each cluster	**Value of Contextual Factors**	**1-tier Suppliers**			**1-tier Customers**		
		Level of SC Integration activities					
		Low	**Medium**	**High**	**Low**	**Medium**	**High**
CUSTOMER Related							
Customers' product portfolio (i.e. % of FC-'s B total turnover; variety; lot size; turnover; demand pattern)	Large volumes (A products, high variety, large lot sizes, high turnover – daily; seasonal demand pattern)				No POS data sharing, "e-business" system used successfully (due to compatibility issues cancelled); call-offs changes by 1-tier customer are difficult to be managed by FC-B	EDI connection only with selected customers; the FC-B plan to include more customers	SC financing to reduce costs of products; Integration on strategic level: larger projects related to SC payments; EDI solutions (i.e. FCs portal – info about inventory, production and order status, electronic invoicing); centralized negotiation process; Continuous forecasts; daily call-offs; JIT – pull strategy, combination of min stock level and yearly alert on re-order point; audits by customers on production processes, safety etc.; MTS (stable demand items produced on stock) without receiving orders – it requires long time to build up such relationship (get know each other, develop routines, and achieve trust)
	Medium volumes (B products, limited variety, small lot sizes, low turnover – once a week)					MTO (call-offs changes by 1-tier customer are relatively easy to manage due to small volumes)	

(Continued)

Clusters of contextual factors	Value of Contextual Factors	PERSPECTIVE of FOCAL COMPANY B (FC-B)					
		1-tier Suppliers			1-tier Customers		
		Level of SC Integration activities					
		Low	Medium	High	Low	Medium	High
CUSTOMER							
Customers' product portfolio (i.e. % of FC-'s B total turnover; product variety; lot size; turnover rate; D pattern)	Small volumes (C products, limited variety, small lot sizes, low turnover – once a week)				MTO (call-offs changes by 1-tier customer are relatively easy to manage due to small volumes); no VMI; no audits by customers; Integration on operational level: technical and operational assistance (daily routines, trucks departure planning, etc.); Short one year contracts (FC-B might secure material for these customers		
Understanding of demand forecast significance for suppliers	High						Provide suppliers with forecasts automatically
Maturity level of operations	High						Limited changes with short notice as result of well working operations; providing good quality forecasts; EDI solutions
	Low				Frequent changes in orders compared to forecasts due to deficiencies in operations. EDI info needs to be supplemented by additional info inserted manually		
Strategic importance of a customer	High (sales volumes, fit with FC-B's own strategy – market, costs)/ Low (deviating interests)				Low strategic importance: Low level of strategically oriented efforts		High importance: Key account manager assigned, key account plan to assess the strategic importance of customer

(Continued)

		PERSPECTIVE of FOCAL COMPANY B (FC-B)					
Clusters of contextual factors/ Individual contextual factors within each cluster	**Value of Contextual Factors**	**1-tier Suppliers and 2-tier Supplier (*)**			**1-tier Customers and 2-tier customers (**)**		
		Level of SC Integration activities					
		Low	**Medium**	**High**	**Low**	**Medium**	**High**
CUSTOMER Related							
Quality of performance measures on suppliers used by customers	Low				Instead PM – FC-B sends surveys to customers		
Geographical proximity to 1-tier supplier	Short				Low quality of forecasts or no forecast provided at all (due to easy access to products)		
Customer willingness to allow relationship between FC-B and 2-tier customers	Low (**)				Low due to perceived high level of sensitivity of such relationship for 1-tier customer		
Criticality for customer to secure raw material on one's own (expertize in house)	High (large volumes, expertize in house) (*)			Direct contact between 1-tier customer and 2-tier supplier			
	Low (medium/ small volumes, lack of expertize)				1-tier customer outsource this activity to 1-tier supplier (FC-B)		

(Continued)

		PERSPECTIVE of FOCAL COMPANY B (FC-B)					
Clusters of contextual factors/ Individual contextual factors within each cluster	**Value of Contextual Factors**	**1-tier Suppliers**			**1-tier Customers**		
		Level of SC Integration activities					
		Low	**Medium**	**High**	**Low**	**Medium**	**High**
SUPPLIER Related							
Size (i.e. volumes purchased by FC-B)	Large		Implementation of ITS: EDI connection but not with all large direct and additional direct material suppliers				
	Small	Low level of cooperation (replaceable suppliers)					
Single sourcing/ multiple sourcing alternatives	Multiple sourcing				Easier for customer to switch supplier		
Criticality of suppliers (i.e. volumes and type of input purchased) for FC-B	High (3PL companies)			Triadic meetings: 1-tier customer, FC-B, and 3PL involved			
	Low (with direct material 2-tier suppliers)				Dyadic meetings: 1-tier customer, FC-B, and none 2-tier supplier		

(Continued)

		PERSPECTIVE of FOCAL COMPANY B (FC-B)					
Clusters of contextual factors/ Individual contextual factors within each cluster	**Value of Contextual Factors**	**1-tier Suppliers**			**1-tier Customers**		
		Level of SC Integration activities					
		Low	**Medium**	**High**	**Low**	**Medium**	**High**
SUPPLIER Related							
Criticality of suppliers (i.e. volumes and type of input purchased) for FC-B cont.	High (direct material)			Access to ERP system and FC-B internal portal; performance feedback and regular quarterly meetings with FC-B; reporting of quality issues and determining corrective actions at meetings; larger problems solved directly between central org. and particular supplier; central org. monitors situation through internal IS			
	High (additional direct material)		No access to FC-B's internal ERP system; FC-B conducts stocktaking on behalf of suppliers, place orders and reports to suppliers				
	High (local service, spare parts suppliers)			Regular meetings			

(Continued)

		PERSPECTIVE of FOCAL COMPANY B (FC-B)					
Clusters of contextual factors/ Individual contextual factors within cluster	**Value of Contextual Factors**	**1-tier Suppliers**			**1-tier Customers**		
		Level of SC Integration activities					
		Low	**Medium**	**High**	**Low**	**Medium**	**High**
INFORMATION SHARING Related							
Order requirements, variety of items influence on POS data sharing	(supplier have a minimum order requirements; large variety of items – difficult to plan production)				Low usefulness of POS data sharing		
	(supplier is supplying large volume items to customer)						High usefulness of POS data sharing
Fluctuation in orders from customers (due to unpredictable promotions, lack of buffer inventory in SC)	Large					Despite a good communication of FC with customers it is difficult to plan ahead production and respond in case of rapid decisions made by customers regarding promotions	

(Continued)

Clusters of contextual factors/	Value of Contextual Factors	PERSPECTIVE of FOCAL COMPANY B (FC-B)					
		1-tier Suppliers			1-tier Customers		
		Level of SC Integration activities					
		Low	Medium	High	Low	Medium	High
ENVIRONMENTAL UNCERTAINTY Related							
Criticality of product availability/ demand stability	Low criticality/ low stability B and C products – unstable demand items or items with planned changes				B, C products – MTO - customers do not allow production against forecasts; EDI less advantageous (manual adjustments)		
	High criticality/ high stability (A products)						MTS (customer allow production against forecasts)
Environmental pressure by society	High						Sustainable reports, projects; providing arguments for customers' discussion with authorities; customers represents interests of FC-B as well
Supply in relation to demand (e.g. number of suppliers to a customer)	High supply – Low demand				Focus on lowest cost		
	Low supply – High demand						Long term contracts to secure supply
Level of dependency between FC-B and customers (market, scarcity of resources, etc.)	Few large suppliers similar to FC-B, limited capacity on supply market/ Few large customers						Power interdependence of FC-B (as FC-B is aware of it needs the customers); long term contracts; tighter SC integration (JIT)
Criticality of sourcing	High/ Low				Low quality / no forecasts		High quality of forecasts

(Continued)

		PERSPECTIVE of FOCAL COMPANY B (FC-B)					
Clusters of contextual factors/ Individual contextual factors within each cluster	**Value of Contextual Factors**	**1-tier Suppliers**			**1-tier Customers**		
		Level of SC Integration activities					
		Low	**Medium**	**High**	**Low**	**Medium**	**High**
INDUSTRY Related							
Profit margins/ costs of low quality/ set up costs	Low profit margins/ high costs of low quality/ high set up costs				Need for high level of internal integration at SC actors to achieve efficient production management and active inventory and low tied up capital		

(Continued)

		PERSPECTIVE of 1-TIER CUSTOMER of FC-B					
Clusters of contextual factors/ Individual contextual factors within each cluster	**Value of Contextual Factors**	**2-tier suppliers**			**1-tier Supplier**		
		Level of SC Integration activities					
		Low	**Medium**	**High**	**Low**	**Medium**	**High**
PRODUCT Related							
Volumes of products purchased	Large						Purchasing of products: centrally handled by the customer's central organization who assess the volumes needed for coming year; agreement on pricing with 1-tier suppliers
Volumes of products purchased/ securing capacity/ economy of scale	Large volumes/ critical to secure capacity/ take advantage of economy of scale			Direct contact with 2-tier suppliers to secure raw material for the 1-tier suppliers			
Criticality of audits (quality control)/ level of product specification	Low due to very detailed product specification				Audits at 1-tier suppliers: not common; customer specifies in great details (product specification) what is required		

(Continued)

Clusters of contextual factors/	Value of Contextual Factors	PERSPECTIVE of 1-TIER CUSTOMER of FC-B					
		2-tier suppliers			1-tier Supplier		
		Level of SC Integration activities					
		Low	Medium	High	Low	Medium	High
SUPPLIER Related							
Criticality of low tied-up capital/ profit margins	High criticality of low tied-up capital/ low profit margins						Order fulfillment process: No VMI – consignment; JIT (circulating container 24/7; location of FC-B next to customer plant)
Supplier size (volumes)	Large				Performance feedback: Not satisfactorily compared to other markets (no KPI, no review meetings/ problem solving meetings); there is incoming control, if problems occur the supplier is contacted		Type of contracts: Frame agreements (yearly demand)
Strategic importance of 1-tier supplier	High (single sourcing)						Regular planning/ business review meetings: close cooperation with the main suppliers (more important). The reason is that e.g. FC-B is perceived as specialist in their area and the customer can learn more from them; customer organizes suppliers' events to discuss, present innovations. People from customer's various departments are involved at these meetings: procurement, production, marketing, R&D. Customers strive to build long-term relationship with strategic suppliers. At the same time, single sourcing not optimal for customer due to less negotiation power towards suppliers.

(Continued)

		PERSPECTIVE of 1-TIER CUSTOMER of FC-B					
Clusters of contextual factors/ Individual contextual factors within each cluster	**Value of Contextual Factors**	**2-tier suppliers**			**1-tier Supplier**		
		Level of SC Integration activities					
		Low	**Medium**	**High**	**Low**	**Medium**	**High**
SUPPLIER Related							
Geographical location of suppliers/ criticality of quality controls (audits)	Europa/ low criticality of conducting audits				Audits at 1-tier suppliers: The European suppliers are obliged to follow regulations (ISO, other quality demands that the supplier has to fulfill). It means that audits are not needed for these suppliers		
	Asia/ high criticality of conducting audits						In China, regulations are not well established, thus, the customer conduct audits at suppliers on its own.
INFORMATION SHARING Related							
Size of suppliers (volumes)	Large					Monthly rolling forecasts; updated call-offs daily; continuous never ending supply, currently no ERP access for 1-tier suppliers (i.e. FC-B), however; the connection is seen as desirable to avoid manual transmission of forecasts, orders.	

(Continued)

Appendix 7. Coding of contextual factors and SC Integration relevant for SC-A

Clusters of contextual factors/ Individual contextual factors within each cluster	Value of Contextual Factors	FOCAL COMPANY A (FC-A) Perspective					
		1-tier Suppliers			1-tier Customers		
		Level of SC Integration activities					
		Low	Medium	High	Low	Medium	High
FOCAL COMPANY							
Size (volumes)	Low (1) Large (3)	X (1)		X(3)			X (3)
Position in SC	Far from end-customer (3)					X (2)	
PRODUCT							
Input Level							
Quality requirements	High (3)			X (3)			
Volumes (scale)	Low (1)	X (1)					
Contribution to suppliers innovativeness/ volumes	High contribution (3)/ Low volumes (1)			X (3)			
Scope of raw materials/ components used	Small (1)	X (1)					
Output Level							
Quality requirements/ product ownership	High (3)					X (2)	
Contribution margins	Low (1)/Medium (2)/ High (3)				X (1)	X (2)	X (3)
Final Product Level							
Position of final product producer in SC/ PLC stage	Beyond 1-tier customer (3) /Initial stage (3)				X (1)		
Stage of raw material/ component change	Initial (1)/ Late (3)				X (1)		X (3)
CUSTOMER							
Level of process/ material knowledge	Low (1) /Good (3)				X (1)		X (3)
Strategic importance	Low (1)/Medium (2)/High (3)				X (1)	X (2)	X (3)
Geographical proximity of customer's warehouse (VMI-consignment stock)	Long (3)					X (2)	
Power dominance	Low (1)/Medium (2)/High (3)				X (1)	X (2)	X (3)
Stage of relationship with customers	Initial (1)/ Late (3)				X (1)		X (3)
Customer's investments at supplier	Yes (3)						X (3)

(Continued)

Clusters of contextual factors/ Individual contextual factors within each cluster	Value of Contextual Factors	FOCAL COMPANY A (FC-A) Perspective					
		1-tier Suppliers			1-tier Customers		
		Level of SC Integration activities					
		Low	Medium	High	Low	Medium	High
SUPPLIER							
Level of criticality	High (3)			X (3)			
Quality issues	High (3)			X (3)			
Geographical proximity of supplier (in context of conducting audits)	Long (3)/Short (3)			X (3)			
Cost of switching suppliers	High (3)			X (3)			
Supplier size (volumes)	Low (1)/High (3)	X (1)		X (3)			X (3)
INFORMATION SHARING							
Complexity of supply side (scope of raw mat./components used, nr of SC actors)	Low (1)	X (1)					
Complexity of demand side (scope of output, nr of SC actors)	Large (3)					X (2)	
Portion of suppliers total volume purchased by FC	Small (1)/ Large (3)	X (1)		X (3)			
Level of quality requirements	High (3)			X (3)			
Quality of forecasts	Low (1)					X (2)	
ENVIRONMENTAL UNCERTAINTY							
Fluctuation of end-customer demand	Low (1)					X (2)	
Requirements on flexibility of SC actors	High (3)						X (3)
Unforeseen changes	Medium (2)					X (2)	

(Continued)

Clusters of contextual factors/ Individual contextual factors within each cluster	Value of Contextual Factors	1-tier CUSTOMER Perspective					
		1-tier Suppliers (FC-A)			1-tier Customers		
		Level of SC Integration activities					
		Low	Medium	High	Low	Medium	High
PRODUCT Related							
Type/ volume of products/ components purchased	Standardized (1)/ Customized (3)	X (1)		X (3)			
Lead time of components/ products	Short (1)/ Long (3)	X (1)		X (3)			
Product quality requirements	High (3)			X (3)			
Switching of raw material/ component in an established product or laying down an existing product	Yes (3)			X (3)			
New product development	Yes (3)			X (3)			
SUPPLIER Related							
Level of supplier criticality (turnover, quality, source, costs, and supply problems)	Low (1)/ High (3)	X (1)		X (3)			
1-tier supplier level of expertise	High (3)			X (3)			
Level of quality requirements on suppliers	High (3)	X (1)		X (3)			
CUSTOMER Related							
Customer's level of raw material/ components knowledge	Low (1)/ High (3)	X (1)	X (2)				
INFORMATION SHARING Related							
Type of suppliers (turnover, volumes)	High (3)			X (3)			
Demand forecast used	Medium (2)		X (2)				

(Continued)

Clusters of contextual factors/ Individual contextual factors within each cluster	Value of Contextual Factors	1-tier SUPPLIER Perspective					
		1-tier Suppliers			1-tier Customers (FC-A)		
		Level of SC Integration activities					
		Low	Medium	High	Low	Medium	High
PRODUCT Related							
Product quality requirements	High (3)						X (3)
Product characteristics (volumes, turnover rate, demand pattern, etc.)	Large (3)						X (3)
INDUSTRY Related							
Quality requirements/ level of customization of raw materials/ components	High (3)						X (3)
CUSTOMER Related							
Customer size (volumes)	Small (1)/ Medium (2)/ Large (3)				X (1)	X (2)	X (3)
Frequency of raw material/ components purchased/ organizational structure (e.g. groups)	Frequency Low (1)/ High (3)				X (1)		X (3)
INFORMATION SHARING Related							
Customer size (volumes)	Small/ Medium (1)				X (1)		
Customer size (volumes)	Large (3)					X (2)	

Appendix 8. Coding of contextual factors and SC Integration relevant for SC-B

Clusters of contextual factors/ Individual contextual factors within each cluster	Value of Contextual Factors	PERSPECTIVE of FC-B					
		1-tier Suppliers			1-tier Customers		
		Level of SC Integration activities					
		Low	Medium	High	Low	Medium	High
FOCAL COMPANY							
Market shares	Small (1)/Large (3)				X (1)		X (3)
Level of innovativeness	High (3)					X (2)	
Amount of cooperation projects	High (3)						X (3)
Level of dependency of a customer on FC-B	High (3)						X (3)
Delivery reliability	High (3)						X (3)
Supplier/customer development programs	Medium (2)		X (2)			X (2)	
Criticality of relationship with customers	High (Established markets) (3)					X (2)	
Criticality of minimizing transportation costs/ inventory costs	High (3)						X (3)
Owner of contracts with suppliers	Local (1)/ Central (3)	X (1)		X (3)			
PRODUCT							
Criticality of input material	High (3)			X (3)			
Product innovations	Medium (2)					X (2)	
Significance of building new production site	High (3)						X (3)
Criticality of decreasing input material consumption	High (3)			X (3)			
Quality costs	High (3)	X(1)					X (3)
Lead time (due to geographical distance between FC-B & cust.)	Short (1)/ Long (3)				X (1)		X (3)
Maturity level of products/ need for innovations	High (3)					X (2)	
New product design issues for FC-B	Large (3)				X (1)		
Costs/ volumes/ type of input material	High/Large/ Direct mat.(3)			X (3)			
Frequency and criticality of quality issues	Low (1)/ High (3)	X (1)		X (3)			
Significance of development projects/ changes against specification/ owner of specification	Standard “add-ons” changes (2)/ High (development project) (3)		X (2)	X (3)			
Criticality of JIT deliveries to customer (products durability)	High (3)						X (3)
Profit margins/ high transportation costs	Low margins/ high costs (3)						X (3)

(Continued)

Clusters of contextual factors/ Individual contextual factors within each cluster	Value of Contextual Factors	PERSPECTIVE of FC-B					
		1-tier Suppliers and 2-tier Supplier (*)			1-tier Customers		
		Level of SC Integration activities					
		Low	Medium	High	Low	Medium	High
CUSTOMER							
Customers' product portfolio (i.e. % of FC-B's total turnover; product variety; lot sizes; turnover rate, demand pattern)	Large (3)				X (1)	X (2)	X (3)
	Medium (2)					X (2)	
	Small (1)				X (1)		
Understanding of demand forecast significance for suppliers	High (3)						X (3)
Maturity level of operations	Low (1)/ High (3)				X (1)		X (3)
Strategic importance of a customer	Low (1)/ High (3)				X (1)		X (3)
Quality of performance measures on suppliers used by cust.	Low (1)				X (1)		
Geographical proximity to 1-tier supplier	Short (1)				X (1)		
Customers' willingness to allow relationship between FC-B and 2-tier customers	Low (1)				X (1)		
Criticality for customer to secure raw material on one's own directly with 2-tier supplier (expertize in house) (*)	High (3)/ Low (1)			X (*) (3)	X (1)		
SUPPLIER							
Size (i.e. volumes purchased by FC-B)	Large (3)		X (2)	X (3)			
	Small (1)	X (1)					
Single sourcing/ multiple sourcing alternatives	Multiple (1)				X (1)		
Criticality of suppliers (i.e. volumes and type of input mat.) for FC-B	High (3)		X (2)	X (3)			
	Low (1)				X (1)		
INFORMATION SHARING							
Minimum order requirements (e.g. volume), variety of items influence on POS data sharing	Min. order requirements/ large variety (1)				X (1)		
	Large volumes (3)						X (3)
Fluctuation in orders from customers (due to unpredictable promotions, lack of buffer inventory in SC)	Large (3)					X (2)	

(Continued)

Clusters of contextual factors/ Individual contextual factors within each cluster	Value of Contextual Factors	PERSPECTIVE of FC-B					
		1-tier Suppliers			1-tier Customers		
		Level of SC Integration activities					
		Low	Medium	High	Low	Medium	High
ENVIRONMENTAL UNCERTAINTY							
Criticality of product availability/ demand stability	Low criticality/ Low stability (1)				X (1)		
	High criticality/ High stability (3)						X (3)
Environmental pressure by society	High (3)						X (3)
Supply in relation to demand (e.g. number of suppliers to a customer)	High supply-Low demand (1)				X (1)		
	Low supply – High demand (3)						X (3)
Level of dependency between FC-B and customers (market, scarcity of resources, etc.)	High (3)						X (3)
Criticality of sourcing	Low (1)/ High (3)				X (1)		X (3)
INDUSTRY							
Profit margins/ costs of low quality/ set-up costs	Low profit margins/ high costs of low quality/ high set-up costs (3)				X (1)		

(Continued)

Clusters of contextual factors/ Individual contextual factors within each cluster	Value of Contextual Factors	PERSPECTIVE of 1-tier CUSTOMER of FC-B					
		2-tier Suppliers			1-tier Suppliers		
		Level of SC Integration activities					
		Low	Medium	High	Low	Medium	High
PRODUCT Related							
Volumes of products purchased	Large (3)						X (3)
Volumes purchased/ securing capacity/ economy of scale	Large/ Critical/ Important (3)			X (3)			
Criticality of audits (quality control)/ level of product specification	Low/ Detailed specification (1)				X (1)		
SUPPLIER Related							
Criticality of low tied-up capital/ profit margins	High/ Low (3)						X (3)
Supplier size (volumes)	Large (3)				X (1)		X (3)
Strategic importance of 1-tier supplier	High (3)						X (3)
Geographical location of 1-tier suppliers/ Criticality of quality controls (audits)	Europa – low (1)				X (1)		
	Asia – high (3)						X (3)
INFORMATION SHARING Related							
Size of 1-tier supplier (volumes)	Large (3)					X (2)	

Appendix 9. Coding of additional contextual factors

Clusters of contextual factors/ Individual contextual factors within each cluster	Value of Contextual Factors	PERSPECTIVE of FOCAL COMPANY A (FC-A)					
		1-tier Suppliers			1-tier Customers		
		Level of SC Integration activities					
		Low	Medium	High	Low	Medium	High
FOCAL COMPANY							
Position in SC	Far from end-customer (3)					X (2)	
PRODUCT							
Position of final product producer in SC/ PLC stage	Beyond 1-tier customer/ Initial stage (1)				X (1)		
CUSTOMER							
Geographical proximity of customer's warehouse (VMI-consignment stock)	Long (3)					X (2)	
Customer's investments at supplier	Yes (3)						X (3)
SUPPLIER							
Geographical proximity of supplier(in context of conducting audits)	Long/ Short (3)			X (3)			
		PERSPECTIVE of 1-tier CUSTOMER of FC-A					
PRODUCT Related							
Switching of raw material/ component in an established product or laying down an existing product	Yes (3)			X (3)			
New product development	Yes (3)			X (3)			
		PERSPECTIVE of FC-B					
Profit margins/ costs of low quality/ set-up costs	Low/ High/ High = High			X (3)			X (3)
Minimum order requirements/ MTS/ large variety of items	Low	X (1)			X (1)		