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Capabilities in Context:

The Usefulness of the Concept of Episodic Network Contexts of Relationships
for Understanding how a Firm Develops a New Capability

by

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Abstract

In the paper we discuss how the development of a firm's capabilities is affected by the network context of the firm, and the network contexts of the firm's relationships. Based on a review of the concepts network context and network horizon, we discuss the criterion of relevance for defining a network context. Thereby we relate contexts to choices and episodes. Furthermore we present a case study containing seven episodes where a firm's capability is affected by different counterparts. When analysing the episodes we use the concept of *an episodic network context of a dyad*, which we define as that subset of the overall network context of a dyad which is considered relevant in relation to a single episode. Thereby we aim to show the usefulness of this new concept. Furthermore, using the new concept for analysis, we are able to propose factors influencing the ability of a firm to develop new capabilities, the use and development of which are highly dependent on the network context.

Introduction and Purpose of the Paper

Within the IMP Perspective (see e.g. Axelsson and Easton 1992; Håkansson and Snehota 1995; Ford 1997), ‘capabilities of a firm’ is not regarded as a central unit of analysis. This is not surprising since the IMP Perspective primarily focuses on relationships and networks. However, it may be more appropriate to say that firms, in general, and capabilities of firms, in particular, are units of analysis that are not interesting or important to explain *per se*. Another way of putting this is that the capabilities of a firm are interesting to study and conceptualise but only insofar that relationships and/or networks either explain or are explained, in part, by the capabilities of firms. Considering this, it should come as no surprise that the *concept* of capabilities is relatively underdeveloped within the IMP Perspective. However, there are exceptions. For example, the concept of capabilities is extensively discussed in Rosenbröijer (1998) who explicitly focuses on capability development in business networks. Furthermore, the concept of capabilities, or competence, is mentioned and discussed to some extent in e.g. Ford, Håkansson and Johanson (1986), Håkansson and Snehota (1995) and Snehota (1990) (which here will be considered as one piece of work, since these two pieces of research are obviously closely related), Ritter (1999), and Gadde and Håkansson (2001).

The purpose of the paper is to develop concepts for explaining how a firm develops a new capability. We argue that insights and concepts developed within the IMP Perspective can be used for explaining and understanding the development of a firm’s capabilities. In particular, we focus on the concepts of network horizon and network context, and discuss in what way they can be useful for understanding a firm’s capability development. Furthermore, we argue that the concepts of network horizon and network context may be modified in order to improve our understanding of how a firm develops a new capability.

The Concept of Capabilities within the IMP Perspective

Ford, Håkansson and Johanson (1986) consider capabilities as being mainly related to resources and interaction in relationships over time. In accordance with the basic assumptions of the IMP Perspective regarding resources, they claim that resources basically are passive and fragmented. Therefore, Ford, Håkansson and Johanson (1986) stress the importance of interaction with other actors as it is through interaction processes that combinations (or mixes) of resources are activated and integrated across firm boundaries. As they emphasise, “*the interaction with others is, in this way, the force that unifies the company and gives it the capability to perform its activities*” (Ford, Håkansson and Johanson 1986 [2002, p.79]). Furthermore, in such interaction processes, “*a company must be able to analyse and describe itself in terms of the needs of counterparts which it has the capability to satisfy*” (Ford, Håkansson and Johanson 1986 [2002, p.81]). In addition, Ford, Håkansson and Johanson (1986) stress that a single counterpart may be interested in relating to the firm because the firm is viewed as possessing a single capability or a combinations of capabilities which the counterpart perceives as useful towards fulfilment of one or some its needs. The *development* of capabilities of a firm is stressed as important since “*not only does interaction employ the capabilities of a company, it may also lead to their change or development over time*” (Ford, Håkansson and Johanson 1986, [2002 p.82]).

To a large extent, Håkansson and Snehota (1995) express the same view of capabilities and their development as Ford, Håkansson and Johanson (1986). However, since Håkansson and

Snehota (1995) introduce a new conceptual framework consisting of three different layers of substance and three different functions, they (1995, p.47) discuss capability development in relation to a firm's activity structure, the organisational structure, and resource collection. Thereby, they view a firm's capability development as its ability to (a) exploit the possible positive effects, and (b) to contain the possible negative effects, of business relationships on the activity structure, resource collection and organisation of the company (Håkansson and Snehota 1995, p.47). Thereby, they seem to regard the capabilities of a firm to be constituted by the following components: the productivity, innovativeness and competence of a firm. However, even if capabilities seem to be related to all three layers of a firm, the concept of capabilities is primarily discussed in relation to the resource layer and, as such, as the ability to organise useful combinations of resources controlled internally by the firm or accessed through its relationships. As Håkansson and Snehota (1995, p.142) argue: *"the type and amount of resources that can be mobilized internally or through relationships is important for what a company can do and achieve. It affects its capabilities and performance, that is, to what extent the company shall become a resource provider appreciated by others. [...] Capabilities and the capacity of the business enterprise reflect the nature and amount of resources it can access and mobilize"*. However, even if Håkansson and Snehota (1995) primarily discuss the concept of capabilities in relation to the resource layer, they do touch upon the concept of capabilities in relation to the actor layer, which concerns trust and the creation of identity. They argue that a company need actor bonds in order for it *"to be seen as an interesting (i.e. value providing) 'partner'. Actor bonds in a relationship are both a source for developing (framing) the purpose of an actor and a means to reach evolved purposes. [...] The framing process is closely interwoven with the designing of activities as well as the utilization of resources. Capabilities have to do with the competence in designing and handling activities as well as controlling and utilizing resources, not only unilaterally but also for how the own activities and resources are linked and related to those of important counterparts. A distinct identity is a condition for that to be achieved"* (Håkansson and Snehota 1995, p.203). Thereby, Håkansson and Snehota (1995) seem to argue that whether or not a firm actually has a capability matters little if counterparts do not acknowledge that the firm has the capability, i.e. a single counterpart has both (a) to be of the opinion that a firm has an capability and (b) to be interested in using the firm's capability in order for the firm's capability to be useful in relation to that particular counterpart.

We may also note that capabilities are assumed to be related to performance in the sense that capabilities concern the ability to actually carry out certain types of activities since knowledge is generated on the basis of acting (Snehota 1990, p.148). Hence, Snehota (1990) seems to share the view expounded by Loasby (1999) within the Dynamic Capabilities View that capabilities are 'knowledge how'. The distinction between 'knowledge how' and 'knowledge that' is equivalent to the respective distinctions between intellect and intelligent action, between competences and cognitive repertoire (Ryle 1949). Thereby, a firm having a capability – in the sense of 'knowledge how' – is the same as the firm actually being able to *"exercise intelligence in practice"* (Ryle 1949, p.40) within a narrowly circumscribed field – either by relying on habit or on 'intelligent capacities' (Ryle, 1949, p.41-42) the latter implying that learning and modification of capabilities can take place. Capabilities (i.e. 'knowledge how') is created through practice – and they change or improve by being used. As Loasby (1998, p.179) proposes *"effective interaction between phenomena and methods produces capability"*. Furthermore, capabilities, once created, are not permanent; they may decay due to not being utilised. Decay due to non-use of a firm's capabilities (may) come about because the capabilities are *"exposed to possible, or rather probable erosion, because of the evolutionary forces acting upon the context [...] this occurs] when alternative offerings*

exist that reduce the differential value produced for [.. counterparts] by the business enterprise in established exchange relationships” (Snehota 1990, p.181). Hence, in contexts characterised by entrepreneurial actions in relationships “only a dynamic exchange effectiveness is sustainable over time” (Snehota 1990, p.183).

Rosenbröijer (1998) explicitly focuses on capability development in business networks. He claims that the development of a firm’s capabilities is closely intertwined with the firm’s relationships in the sense that the development of capabilities depend on resource-related interaction, combination and confrontation processes in single relationships as well as across relationships. In order to discuss these issues in more depth, he introduces the concepts of ‘a firm’s external directed capability’ and ‘a firm’s capability connector function(s)’. Basically, he claims that the capability development of a firm depends on how (well) it handles its external directed capability in dyads and how (well) it handles its externally directed capability in triads. However, even if Rosenbröijer (1998) stresses the importance of relationships and interaction for the development of a firm’s capabilities, he employs the following definition of a firm’s capabilities: *“a firm’s ability and willingness to organise a mix of resources for productive activities, where resources are the basic elements of the activities in question, In other words, the capability of a firm is its ability and willingness to combine resources in order to perform required activities”* (Rosenbröijer 1998 , p.36). Thereby, Rosenbröijer pays less attention to the ‘willingness’ of counterparts to interact (or not) with the firm.

Ritter (1999) introduces the concept of network competence, which seems to be closely related to the concept of capabilities. He suggests that the network competence of a firm is dependent on two main aspects: *task execution*, which may be relationship-specific or cross-relational interaction processes, and *qualification*, which may be related to specialist skills or social skills. Thereby, Ritter (1999) stresses that the network competence of a firm is both related to (a) ‘being qualified’ i.e. having knowledge and possessing skills and (b) ‘using those qualifications’ for executing tasks on the basis of the qualifications. In this way, Ritter (1999) emphasises that not only ‘technical’ competences are important for networking firms – social skills and the ability to interact in relationships are of equal importance.

Gadde and Håkansson (2001) do not discuss capabilities and their development in much detail. However, they do touch upon the concept of ‘core competence’ which, in other streams of research, is often discussed in relation to the concept of capabilities. Gadde and Håkansson (2001, p.126-127) argue that suggestions for management which involve ‘focus on your firm’s core competences!’ are difficult to use as a basis for action (partly) because ‘core competences’ are difficult to identify – especially in advance or for the future. Furthermore, they argue that some of the most important competences of a firm relate to the handling of various, complex interfaces with counterparts (suppliers). They propose that *“the ability to analyse and develop complex interfaces requires the development of competencies that relate different but complementary specialities. By definition, these competencies then cannot be described as ‘core’”* (Gadde and Håkansson 2001, p.150). We may say that Gadde and Håkansson (2001) stress two aspects. Firstly, that most important capabilities of the firm may be those with relate to the firm’s interfaces (i.e. boundaries) and that it is problematic to use the metaphor of ‘core’ when that is the case. Secondly, they point to difficulties with choosing and managing capabilities – issues which are often perceived as related to *strategy*.

The Concept of Capability and its Relation to Strategy

So far, the concept of capabilities and their development has not been related (explicitly) to *strategy*. However, strategy and capability development may be related. In other streams of research, such as the Core Competence/Dynamic Capabilities View, the discussion of distinctive capabilities or core competences is often explicitly directed at providing normative implications for firms – in particular at the level of business strategy. That is, how can a firm develop distinctive capabilities, i.e. capabilities which enable the firm to achieve competitive advantage over time? Thereby, within these theoretical strands, identification and choice of (core) competences and the development and maintenance of such capabilities are perceived as a matter of strategic choice(s) and implementation of strategy.

Within the IMP Perspective, the development of capabilities may also be said to be related to a firm's strategy. Strategy in the IMP perspective refers to the emergent "*pattern of activities underlying exchange and cost effectiveness of a business enterprise*" (Snehota 1990, p.212). In short, the article "No Business is an Island" by Håkansson and Snehota (1989) sums up the basic message regarding strategy within the IMP perspective: strategy concerns the way in which a firm achieves exchange effectiveness in relation to other firms in the surrounding network – that is, how a firm can initiate and react to changes in the network in such a way that the firm keeps on being valuable to the network. Furthermore, strategy is not perceived as something which is decided upon, at one point in time, by top-management and which subsequently is implemented by subordinates. Instead, in the IMP Perspective "*the strategy concept refers to a dimension or profile of behaviour displayed by a firm, organization or enterprise*" over a period of time (Snehota 1990, p.163). Although strategic 'goals' may be set by management, the role of management is more one of providing meaning (i.e. sensemaking) to such goals so that the behaviour of individuals at many levels in the company over some period of time will be directed (or guided) in a particular direction compatible with the goals, cf. Snehota (1990, p.211).

Hence, even in the IMP Perspective, strategy and capability development seem to be closely related in the sense that both strategy and capability development (a) concern a firm's exchange effectiveness and (b) emerge in relation to counterparts, and (c) relate to the persistence of patterns of actions (performance) over time. Hence, it may be more fruitful to attempt to relate and discern between a firm's management of strategy and a firm's capability development; for example, the management of a firm's strategy may involve attempts by managers at making it appear sensible for employees of the firm to persist in performing certain types of activities, in relation to particular counterparts, for a period of time thereby possibly succeeding in creating a particular type of capability. Management may actually also attempt to do the same towards counterparts.

In short, the development of the capabilities of a firm is strongly related to the firm's relationships – what it is allowed to do in these relationships which, in turn, influences what the firms can do and the way in which the firm is attributed a meaning (identity) which, in turn, influences what the firm is allowed to do and so forth. However, what the (different) counterparts allow the firm to do depends on whether or not the counterparts perceive (or is made to perceive) the capabilities of the firm as interesting to make use of. Thereby, the ability of a firm to develop its capabilities is to a large extent related to interaction related to choices (or decisions) by the counterparts regarding 'to use or not to use the capabilities of the firm?' and 'how to use (and develop) the capabilities of a firm?'. Taking the point of view of the firm's counterparts, such choices or decisions are, in fact, their 'make-or-(where to)buy

decisions', 'how (much) to interact with this firm?' etc. Let us therefore briefly look into IMP Perspective related conjectures on choice and decision making.

Choice and Decision within the IMP Perspective?

Snehota (1990, p.72) discern between choice and decision in the following way: *“The concept of choice will be given the meaning of the outcome of a process of selection between alternative courses of action while we will use the term decision to cover a particular mode of selection, that is a way to bring about a choice”*. He argues that many choices do not involve decision-making in the sense that an *a priori* evaluation of all possible alternatives and consequences is made. Instead (individuals in) firms can rely on other criteria such as interpretation, rules or norms, and *“in an context with certain characteristics, given the bounds on knowledge and concern of the actor with some overarching goals, the reliance on other criteria is not irrational in the behavioral sense, quite contrary”* (Snehota 1990, p.87). Hence, Snehota (1990) seems to suggest that given bounds to rationality (or rather to cognition, time and available information), many choices will (and should) be made without being based on considerable calculation and evaluation. As an alternative means for arriving at a choice, Snehota (1990, p.87) suggest that actors should rely on *interpretation*. Interpretation of exchange episodes implies, for example, that a single episode is viewed in light of the relationships of which it (may) form(s) a part. Furthermore, interpretation relies on interaction – on how the different involved parties jointly may come to interpret the choice situation at hand.

What Snehota (1990) suggests seems akin to Loasby's (1999) discussion of representation, framing, choice and decision. Firstly, Loasby argues that *“all action is decided in the space of representations”* which are never direct copies of reality (Loasby 1999, p.10) which means that action always relies on interpretation. Furthermore, he argues that all action – including choice and decision – requires framing (or closure) of reality – because it is impossible to oversee all possible alternatives and consequences, and because many alternatives and consequences simply are unknowable *ex ante*. Framing implies that actors choose to focus on some aspects of reality which they, for some reason or another find important, and if they encounter difficulties with 'filling the frame', they may rely on their imagination in order to fill the gaps in the frame. Being aware of the possible criticism against such views on choice and decision-making, he argues that *“it is common to find apparently irrational behaviour attributed to 'framing effects', as if 'framing' were a remediable distortion. But any action must be taken within a framework, whether this is supplied by a neural network, a precisely specified model, a familiar procedure, a novel vision, or some other means”* (Loasby 1999, p.11).

Even though Snehota's and Loasby's use of terminology differ somewhat, we argue that they basically argue that all choices or decisions rely on framing, i.e. to make a choice implies that the situation (or episode) needs to be framed by those who are responsible for arriving at a choice. Furthermore, frames only represent a small part of reality, and some parts of a frame may be filled with factors which, at the point in time of the framing, are only imagined. Thus, frames heavily influences the choice or outcome of the decision, and framing (just as interpretation) may be formed through interaction both within or between firms.

So far we have established that action, choice and decision depend on framing. This naturally lead us to the question of which types of framing and frames are discussed within the IMP

Perspective. We may start by concluding that concepts of framing and frame are not explicitly used within the IMP Perspective. However, there are a number of concepts which may be said to be frames. The concepts we have in mind here are those discussed under the following labels: network contexts, network horizons and environment. Let us, therefore, look into the meaning of these concepts.

Network Contexts, Network Horizons, and Environments

Within the IMP Perspective, networks are assumed to exist; they are also assumed to have no natural boundaries and to extend *ad infinitum*. By assuming that networks extend *ad infinitum*, it is possible to argue that industry is in fact one, single enormous network. However, within the IMP Perspective, no attempts are made at investigating industry as one network. Instead it is stressed that *arbitrary* boundaries are used for delimiting networks. Researchers as well as managers are assumed to set arbitrary boundaries (i.e. frames) around networks. As mentioned earlier, such boundaries are necessary due to the bounded rationality (or limited cognitive capacity) of human beings (and firms) which makes it impossible for anyone (individuals or firms) to oversee the 'whole network'. Therefore, the setting of arbitrary boundaries has been paid some attention within the approach. This has, for example, led to the formulation of concepts such as network horizon, network context, and environment.

Anderson, Håkansson and Johanson (1994, p.4) discuss the concept of *network context*, which they define as: "*The part of the network within the horizon that the actor considers relevant is the actor's **network context***". This view of network context seems to be based on Håkansson and Snehota (1989) and Snehota (1990, p.145) defining the context of a business enterprise as "*the portion of the market network perceived as relevant for its activities*". The context of a firm is made up by other actors and relationships. The firms and relationships, which are in focus, are firstly, the firm's direct counterparts and direct relationships. However, indirect relationships and indirect counterparts may also form part of the context due to the 'connectedness of exchange relationships'. The reason why direct relationships and counterparts are not sufficient to include is related to the 'fact', as Snehota (1990, p.145) argues, that "*other actors apart from those with whom the direct exchange relationships are maintained affect the behaviour of the business enterprise in relationships it maintains with others and on which depend the results.*" The importance of indirect relationships has also been emphasised by Easton (1992, p.15) stating that: "*Indirect relationships are another very different form of relationship though a crucial one since they provide a very direct link between dyadic relationships and networks. An indirect relationship is most simply described as the relationship between two firms which are not directly related but which is mediated by a third firm with which they both have relationships.*"

Both Snehota (1990) and Anderson, Håkansson and Johanson (1994) include in a firm's network context all actors which the firm 'considers relevant'. By using the criterion of 'relevance', it is stressed that the *network context* is a matter of the firm's 'choice' of *perspective* or *frame*. However, by stressing choice, there must be something which is disregarded – firms must be aware of more than they view as being immediately relevant to consider as a basis for their actions. This seems to be the reason why the concept of network context is suggested to be enveloped by the concept of *network horizon*. The network horizon of a firm is defined by Anderson, Håkansson and Johanson (1994, p.4) as "*how extended an actor's view of the network is*". This means that the network horizon comprises, in addition

to the network context, those other firms and relationships of which a focal firm is aware but which it does not consider relevant. Where the horizon ends, the *environment* starts. As Anderson, Håkansson and Johanson (1994, p.4), argues “*actors have bounded knowledge about the networks in which they are engaged [..]. This is due to not only the network extending farther away from the actor but also the basic invisibility of network relationships and connections*”. As Snehota (1990, p.146) claims, “*adopting the concept of context, limited by a horizon, does not preclude the possibility of there being a ‘residual’ beyond the context, beyond the horizon, and that is environment. The environment beyond the context is an entity in which actors cannot or are not identified.*” Similarly, Anderson, Håkansson and Johanson (1994, p.4) propose “*our view is that the firm is embedded within a business network context that is itself enveloped by an environment*”. Hence, the *environment* is that part of the wider network, which firms are not aware of, but which may influence a focal firm or relationship through the network horizon or context, the latter two being (perceived) subsets of the wider network. If we look at the different concepts in relation to each other, and, for the sake of simplicity, look upon industry as *one* network, the following may be concluded. The part of the overall network, which a single firm is not aware of, is its *environment*. The part of the network, which a single firm is aware of, is its *network horizon*. In addition, the part of the network horizon, which the firm considers relevant, is the firm’s *network context* (Holmen and Pedersen 2001).

So far, the concepts of environment, network horizon and network context have all been seen in relation to *a single, focal firm* and appears relatively similar to the concept of an organisation-set, as proposed by Aldrich and Whetten (1981). This may be somewhat surprising when considering that the basic unit of analysis in the IMP Perspective is the *business relationship*. As Anderson, Håkansson and Johanson (1994, p.2) mention: “*Our perspective can be usefully compared and contrasted with Aldrich and Whetten’s (1981, p.386) concept of an organization-set, which they define as ‘those organizations with which a focal organization has direct links.’ Although our perspective might be viewed as the sum total of the organization-sets for each of the two firms engaged in the focal dyadic relationship, we believe that it misses our emphasis on the dyadic relationship as the unit of primary interest within business networks, rather than the individual firms themselves.*” Hence, it seems that further clarification is needed of the concepts: environment, network horizon and network context of a relationship (or a dyad). Anderson, Håkansson and Johanson (1994) do not discuss the concepts of environment or network horizon in relation to a business relationship. However, they do seem to touch upon the concept of *network context of a relationship* in their conceptualisation of connected relations for firms in a dyadic relationship. However, how may we conceptualise a network context, horizon and an environment of a dyad, and how do they differ from the network context, horizon and environment of a firm? In this paper, we propose that the awareness, which is relevant to consider, is the awareness of those individuals who are involved in the relationship. Secondly, we propose that the *network horizon of a dyad* is equal to the sum of those parts of the two firms’ network horizons which the individuals involved in the relationship are aware of. Thirdly, we propose that the *network context of a dyad* is that *subset* of the *network horizon of a dyad* which the involved individuals from *either* or *both* of the two firms consider relevant. And fourthly, we propose that network horizons and contexts of a dyad depend on the interaction between the firms and that they may (do) change over time as a result of interaction. The network context and horizon of a dyad is depicted in figure 1.

-----Insert Figure 1 around here-----

Summing up, we propose that network contexts, network horizons and environments can be related to the concept of frames. Thereby we argue that in understanding choices or decisions made in a relationship, or in relation to a relationship, it is important to understand the above-mentioned frames used. In other words, network horizons and especially network contexts are important to relate to decision and choice.

Network Contexts, Episodes and the Criterion of Relevance

So far, we have discussed network contexts and network horizons of a dyad (or a relationship) and we have argued that network contexts are important for choice and decision due to the former being frames for reaching the latter. However, within a relationship, many choices and decisions will be made – i.e. if relationships develop over time and are complex organising entities. Within the IMP Perspective, one way in which relationships are subdivided into smaller entities is by means of the concept of episodes. A relationship is regarded as being built up by single exchange episodes comprising e.g. joint development projects, product tests, negotiations of long-term contracts, education and exchange of personnel etc. (Ford 1980). We may consider how an episode is delimited. Firstly, it may be delimited in space in the sense that particular issues are addressed, by particular individuals, leading to particular minor or major decisions and choices and carrying out of actions. Secondly, it may be delimited in time in the sense that it starts when a particular issue is first addressed and ends when a particular choice is made, when a particular project starts and when it ends. In any case, the boundaries we (and managers) draw around episodes are arbitrary (as all boundaries discussed within the IMP Perspective). However, by recognising this, we may delimit an episode to comprise a particular choice or decision in relation to which the parties involved in the relationship interact. Thereby, we can link the concept of episode to the concepts of choice and decision. Furthermore, we may ask if different episodes (comprising choice or decision) within the same relationship share the same network contexts? By considering the time aspect, it seems reasonable to expect that the network context of a dyad changes over time. However, it may change in space depending on the content of the episode. In other words, we may ask if the criterion of relevance used for defining a network context needs to be substantiated by a consideration of what the network context is considered relevant in relation to. At a general level, we may frame the issue in the following way: do different episodes (choices, decision) in a relationship have different network contexts of a dyad? If this seems appropriate to assume, the implication is that it may be useful to introduce a new concept: *an episodic network context of a dyad (or relationship)*. We may tentatively define an *episodic network context of a dyad* as that subset of the overall network context of a dyad which is considered relevant in relation to a single episode. The relation between (a) episode and relationship and (b) episodic network context of relationship and network context of relationship is shown in table 1.

-----Insert Table 1 around here-----

Methodology and Empirical Basis

So far, we have discussed (a) the concept of capabilities, (b) the concepts of network contexts and network horizons of firm and dyads. Furthermore, on the basis of (b), we have introduced (c) the concept of network context of episode in relationship. The idea for connecting (a) and (c) originates from a case study carried out in primarily during 1997-1999. Thereby, our

research is based on systematic combining of a theoretical and an empirical basis (Dubois and Gadde, 2002). In research based on systematic combining, it is always difficult to choose in what sequence to present readers with theoretical and empirical aspects. However, we have chosen to present the empirical basis after the discussion of the main concepts which we have found relevant to use for understanding the empirical basis. For the case study, approx. 40 semi-structured interviews were carried out. In addition to this, a number of informal discussions were made by one of the authors while being at the focal company for 2 months. Most informants have given feedback on transcribed interviews/case descriptions. In the case study, the focal firm is Nordic VLSI. The firm is located in Trondheim, Norway, and was founded in 1983. Nordic VLSI employs approximately 80 engineers. Its customers make use of ASICs where Nordic VLSI plays an important role in the development. An ASIC (Application Specific Integrated Circuit) is a component that is developed specifically for the application of the user (Schroeter, 1992). The ASIC consists of a large number of transistors, which are considered the building stones within the 'semiconductor industry'.

The Semiconductor Industry

Insight into the semiconductor industry, of which ASICs are a part, may be advantageous to understand some of the underlying forces that influence Nordic VLSI's development of products for its customers. One of the characteristics of this industry, is the rapid technical development that has taken place since its birth with the invention of the transistor. As a consequence, semiconductors "*have found direct application in almost everything produced*" (Gruber 1994; p.1). The IC represents a further development of this transistor, while the ASIC in its turn is an 'Application Specific' version of the IC. ICs and ASICs have experienced an exponential growth in performance for several decades. This is often referred to as Moore's Law: "*Silicon technology will double the number of transistors per chip every 18 months*" (Dunlop et al. 1997, p.111). The improvement in performance is based on a number of technical breakthroughs within manufacturing processes as well as design tools, and the industry is regarded as one of the fastest growing and most technically advanced industries during the last decades (Viardot 1995). In the 1960s, the semiconductor industry was dominated by large companies handling everything from development and manufacturing of the ASICs to integration of these into other products. These companies used their own design tools for development and manufacturing of these chips. A second phase was reached in the 1970s, as these design tools started to be organised externally. A third phase was reached in the 1980s, when manufacturing started to be organised externally; and gradually the design of ASICs has also become a specialism for firms. As a consequence, in the period 1980-90 the semiconductor industry has comprised four types of firms: (1) Fabs, or semiconductor manufacturers – companies that manufacture the ASICs; (2) System firms – companies make use of the ASICs e.g. Nokia and Philips but also small firms in less high-tech industries; (3) Design Houses – companies that develop the ASICs that the system firms employ; and. (4) EDA-suppliers (Electronic Design Automation) – companies that develop the software tools employed by all types of companies within the semiconductor industry. However, there are differences between specialisation of firms, e.g. some fabs offer design services along with manufacturing ASICs, and some system firms handle the design of their ASICs internally. In addition to these four major types of companies, many specialised companies have emerged the latter years, performing parts of these four major activities, e.g. the manufacturing process has been divided into a number of activities handled by different companies that are far more specialised than the traditional fabs.

ASICs are used in a variety of products; consequently, Nordic VLSI's customers are active in very different industries. By 1999, Nordic VLSI had partaken in the development of approximately 200 different ASIC designs for a relatively large number of customers. During 1983-1993, Nordic VLSI supplied its customers with ASIC designs, and thus acted as a pure Design House.

From Design House to Turn-key Provider: New Policy

Being a Design House basically means that all Nordic VLSI's customers have handed Nordic VLSI's ASIC designs over to a fab who get its specialised suppliers to develop a mask for the ASIC, and when the mask is handed over to the fab, it is able to manufacture a prototype. Testing of prototype may lead to corrections, which in its turn lead to alterations in the masks. As soon as the prototypes have been approved, mass manufacturing can start. Until 1993, Nordic VLSI's all customers handled the direct contact with the fabs – the customers 'handled the component supply'. However, in 1993, Nordic VLSI decided on a new policy: in addition to ASIC-design, Nordic VLSI was also going to handle the component supplies for its customers. This meant that Nordic VLSI would organise the manufacturing of the ASICs and the shipment of these to its customers. Hence, Nordic VLSI's customers no longer had to handle the component supplies – instead of receiving a single ASIC-design, the customer would be supplied with its requested number of ASICs. Among other things, this would enable Nordic VLSI to generate additional revenues, i.e. also from sales of physical ASICs. Thus, Nordic VLSI set out to become a 'turn-key provider' or 'fabless companies'.

Having decided on the new policy, Nordic VLSI set out to develop the capabilities: being able to 'handle component supplies' (CS) for its customers. The rest of the case describes Nordic VLSI's development of this particular capability in relation to seven of Nordic VLSI's important customers. In accordance with the theoretical basis, the case is presented as a number of network contexts for episodes in relationships.

Episode 1 and 2: Handling of Component Supplies – the First Steps

The first two customers for whom Nordic VLSI handled CS were VingCard and Nobø. Since Nordic VLSI's handling of CS for these customers was concurrent and very similar, they are described in concert.

VingCard is the world-leading manufacturer of card operated locking systems for the hotel and cruise industries. For example, within the cruise industry, VingCard has developed a combined card solution where the key card also serves as a charge card, boarding-pass and a gangway-access control. These new solutions have required an alteration of the traditional, mechanical products that VingCard has manufactured, i.e. an ASIC has become an important technical solution in its products.

Nobø manufactures heaters and adjacent equipment for households and professional markets. For example, Nobø has developed Orion 512 as a central control unit for controlling among other things the heaters in a building, Nobø has launched heaters equipped with ASICs.

Traditionally, Nordic VLSI had worked with customers who held considerable capabilities within the field of ASICs and CS. However, as ASICs increasingly found use within new fields, a new type of customer emerged: customers employing ASICs for the first time. VingCard and Nobø represented this type of customer, and both had very limited capabilities concerning ASICs and CS. However, from the time of the establishment of relationships with these two customers, Nordic VLSI had decided on the new policy and wanted to handle CS for both of them – even if it was not clear that Nordic VLSI was in a much better position to develop CS capabilities than the two customers. In any case, neither VingCard nor Nobø had relationships to other firms which could handle CS. Nordic VLSI had the intention to handle CS, and for the first time it established a relationship with a fab for the handling of CS – after all, its customers had handled CS and all contacts with fabs earlier on. However, Nordic VLSI saw it as a possibility that they could use Alcatel Microelectronics as a fab and develop a relationship to this fab.

As Nordic VLSI's had been given the opportunity to handle CS, several challenges arose. The processes of struggling with the challenges and solving them developed Nordic VLSI's capabilities concerning CS. In the following, a number of such challenges are pointed out as central ones in the development of these capabilities:

The ASIC design is developed on basis of product specifications; these had traditionally been supplied by Nordic VLSI's customers. In this case, the customer had first made contact with a fab to receive their 'blue book' containing information concerning the fab's manufacturing process to which the product specifications needed to be adapted. Nordic VLSI's need to develop these capabilities was initiated by VingCard and Nobø, while the continuation of the development of these capabilities took

place in Nordic VLSI's relationship with Alcatel Microelectronics. Nordic VLSI's customers had traditionally handled the interface between the ASIC and the adjacent technologies. With VingCard and Nobø, this situation changed due to two reasons. Firstly, Nordic VLSI was now assigned to develop the product specifications as well as supplying the ASICs. Secondly, VingCard and Nobø held limited capabilities for handling the interfaces with adjacent technologies. Hence, Nordic VLSI was considered to be in the best position to handle these interfaces. Similarly, Nordic VLSI was considered to be in the best position for handling the testing of the prototypes. The development of these capabilities were therefore in a sense initiated by VingCard and Nobø through their signalling limited capabilities within this field, while Nordic VLSI itself developed the required capabilities concerning handling this interface. Following this, Nordic VLSI developed capabilities concerning prototyping and testing through its relationship with Alcatel Microelectronics.

Handling CS made Nordic VLSI become aware of challenges related to 'design for flexibility' – as Nobø desired to implement minor alterations in the software of its heater system to cope with different requirements in different geographic markets. This software was stored in the ASIC. Through dialogues with Alcatel Microelectronics, Nordic VLSI became aware of the high costs related to such alterations. Therefore, Nordic VLSI developed 'design for flexibility' capabilities, i.e. how to design ASICs which could be changed without resulting in insurmountable changes in manufacturing and, hence, costs of the physical ASICs.

Similarly, As Nordic VLSI's revenues now were related to the price per unit of physical ASICs, it needed to incorporate 'design for manufacturing' issues into its design of ASICs. For example, testing of ASICs is part of the manufacturing process, and through its relationships to Alcatel Microelectronics, Nordic VLSI developed capabilities for designing ASICs which could be tested at lowest possible costs.

Following the discovery of instability in Nobø's ASIC, Nordic VLSI and Alcatel Microelectronics co-operated in the search for the cause of this. Through this search, Nordic VLSI developed insight into Alcatel Microelectronics's manufacturing process e.g. how manufacturing of ASICs was divided into batches that could vary slightly, thus potentially causing instability for the ASICs. On the basis of this, Nordic VLSI developed capabilities concerning 'design for robustness'.

So, as Nordic VLSI handled the CS for the first time with VingCard and Nobø, the initiation of the development of several capabilities took place in the relationships with these customers through the detection of certain challenges. The relationship with Alcatel Microelectronics was of great importance in the solving of these challenges, and thus for the development of the required capabilities.

Episode 3: Disagreements: Who handles Component Supplies? Nordic VLSI, not Nordic VLSI

Traditionally, CelsiusTech had operated within the defence market, however it started the development of an intelligent cruise control (ICC) comprising a radar for estimating the distance between vehicles. The ICC is a safety feature intended for the automotive industry. An essential part of this product is the ASIC that converts and processes data collected by the radar. CelsiusTech held capabilities within use of ASICs and CS for ASICs for products manufactured in small-series. However, it was not familiar with ASICs produced in large-series. Therefore, CelsiusTech saw the benefits of letting Nordic VLSI handle CS. Nordic VLSI was assigned to develop this ASIC and to handle CS and, once again, Nordic VLSI involved Alcatel Microelectronics as its fab.

Originally, CelsiusTech planned to be responsible for development and commercialisation of the ICC. However, it soon realised the differences between the defence market and the automotive industry and started a search for a partner who was familiar with this industry and who could handle manufacturing and marketing of ICC. The partner (Puloe) which became involved had considerable capabilities about the automotive industry and ASICs, and it put forward several new requirements to CelsiusTech's suppliers. One of these new requirements concerned Nordic VLSI's handling of CS. Puloe was not confident with development and manufacturing of the ASIC taking place at two different companies. As CelsiusTech points out, if this partner had been involved earlier in this process, Nordic VLSI would most likely not have been involved at all. In addition, according to Puloe, Nordic VLSI had not substantiated its value creation in relation to handling CS. On basis of this, Puloe required that Nordic VLSI should not handle CS.

Due to a strategic reorientation at headquarters of Puloe, it stopped having the automotive industry as its priority area. CelsiusTech started looking for a new partner and found Eyvumow who shared the assessment of Puloe that CS should not be handled by Nordic VLSI. Eyvumow had considerable capabilities regarding ASICs and wanted to handle CS – in addition to marketing. Through its relationship with the fab TVAEI-Micro, Eyvumow made estimations which showed that they could achieve a lower price per unit for the ASICs than Nordic VLSI, and on basis of this Eyvumow demanded to handle the component supplies. Nordic VLSI therefore developed certain capabilities through its relationship with these companies. Nordic VLSI experienced that a documentation of value creation was required in order to be allowed to handle the component supplies. To Nordic VLSI, it was essential to experience this, as it through its policy intended to handle component supplies not only for new customers with limited capabilities within the field of ASIC, such as VingCard and Nobø, but as well for its established customers with considerable capabilities within this field.

Episode 4: Disagreement: Who Handles Component Supplies? Nordic VLSI? Okay then...

Vingmed develops ultrasound equipment and equipment for diagnosis of heart diseases. Vingmed has so far developed and sold two generations of ultrasound scanners. The second generation, launched in 1994, is called System FiVe and contains two ASICs which Nordic VLSI had designed. Vingmed possessed considerable capabilities for developing product specs for ASICs and for handling their interfaces with adjacent technologies. Furthermore, Vingmed had handled the CS through its relationship to one of its suppliers, Lovsup, and through its direct relationship to a fab, Nevse.

Some time after Nordic VLSI had developed the ASICs for VingCard and Nobø, Vingmed initiated the development of redesigns of its two ASICs. A redesign is a new version of the ASIC and is often motivated by new technical opportunities. Due to Nordic VLSI's new policy, handling of CS was of great importance in the negotiations concerning these redesigns. Nordic VLSI made clear that they wanted to handle CS. Vingmed already had the required capabilities for handling CS and wanted to handle this for as well the redesigns. After all, these capabilities represented investments, and Lovsup and Nevse also expected to be involved in the CS of the redesigned ASICs. However, Vingmed accepted that Nordic VLSI would handle CD. There were several reasons for this. Firstly, it wanted to use Nordic VLSI for making the redesigns because they regarded Nordic VLSI as very competent within the field and because Nordic VLSI had made the original ASIC designs for System FiVe, which was very successful. Furthermore, Vingmed considered it too risky to involve a (new) unfamiliar design house with whom it would have first to learn to co-operate. At the time Vingmed decided to make the redesigns, its relationship with Nordic VLSI had developed over a relatively long period of time and Vingmed valued the knowledge-based adaptations made between parties through the development of the original ASIC designs.

Once again, Nordic VLSI involved Alcatel Microelectronics in the manufacturing of the ASICs. At the same time, some important changes were made in the organising of this manufacturing process. Nordic VLSI had since the development of the ASICs for VingCard and Nobø developed considerable capabilities within 'design for manufacturing'. This time, Nordic VLSI was of the opinion that it was appropriate to involve Delta as a separate company in the continuous testing that every single ASIC undergoes subsequent to its manufacture. Nordic VLSI claimed that it through this involvement of Delta was able to reduce the price per unit for the ASICs. In this manner, Alcatel Microelectronics experienced that it through the partaking in the development of Nordic VLSI's capabilities within this field, actually became partly superfluous.

Episode 5: Component Supplies??? Don't even try....

SensoNor is one of the world's leading manufacturers of electronic sensors based on silicon micromechanical technology. SensoNor's most important market is the automotive industry to which it supplies crash sensors for airbags and tire pressure systems and SensoNor has used ASICs in many of its products. Nordic VLSI is SensoNor's largest supplier of ASIC designs, and SensoNor is one of Nordic VLSI's most important customers. Manufacturing of sensors holds many similarities with manufacturing of ASICs. Therefore, SensoNor has handled the CS for all ASICs designed by Nordic VLSI itself through its direct relationships with fabs. Gradually, SensoNor has started to believe that it

no longer is an 'ideal' customer for Nordic VLSI, since Nordic VLSI now has the policy of handling ASIC design and CS, and so far it has not involved Nordic VLSI in the handling of CS for its ASICs. Nordic VLSI seems to have accepted this, and Nordic VLSI has subsequent to its policy concerning CS established Business Unit Sensor ASIC that solely handles SensoNor as the customer.

Episode 6: Nordic VLSI handles Component Supplies – but in a New Way

Q-Free is one of the world's leading suppliers of intelligent transport systems and road-toll collection systems. The electronic transponders for automatic payment of road-toll fare had traditionally been based on micro controller technology; however, Q-Free's wanted to substitute this with ASIC technology and contacted Nordic VLSI.

At this point in time, Nordic VLSI had established a business unit for handling CS: BUFS. This business unit handles all component supplies, and also co-ordinates procurement and use of design tools. BUFS co-operates with and keeps the direct contact with the fabs, e.g. provides requirements concerning development, prototyping, testing and manufacturing. Gradually, it has even started to offer handling of CS for ASICs which are not designed by Nordic VLSI, e.g. for pure design houses. BUFS was responsible for the development of the ASIC for Q-Free and for handling CS. Usually, BUFS would take over the responsibility for the ASIC when it reached its manufacturing stage, while another business unit would hold the responsibility for the development. This new way of organising was done due to several reasons. The expected volumes of the ASICs as well as the requirements concerning punctuality were both high. Therefore, the handling of CS was considered particularly important. Furthermore, the complexity of the ASIC was expected to be low. Generally, Nordic VLSI had take into consideration that handling of CS was highly integrated with the development of the ASIC design.

By the time of the initiation of the development of this ASIC, Nordic VLSI had developed considerable capabilities concerning handling of CS. Consequently, Nordic VLSI was able to divide the manufacturing of ASICs into three different activities performed by different firms. Once again, Delta was to handle the testing of the ASICs, while ESM and ASAT were assigned to handling wafer manufacturing and encapsulation, respectively. According to Nordic VLSI, there were basically two reasons for this division of the manufacturing process. The first argument was price, as Nordic VLSI experienced that it was able to obtain a lower price per unit by handling the CS in this manner. The second argument concerned the overall trend of specialisation that took place in the semiconductor industry, where Nordic VLSI experienced that the number of companies that specialise in either wafer manufacturing, encapsulation or testing had increased.

Episode 7: Involved in, but not in Charge of, Component Supplies

Nordic VLSI had designed an ASIC for data converting purposes together with a university. Alcatel Microelectronics was involved as the fab and had developed a prototype. In connection with the introduction of this ASIC, one of Nordic VLSI's marketing leaflets for the converter reached TRV who made contact with Nordic VLSI. TRV develops, manufactures and markets high-performance data conversion and signal conditioning products. Since then, Nordic VLSI has designed several ASICs for TRV. TRV and Nordic VLSI basically operate within the same field of technology; however, they do have their own different sub-specialisms which complement each other. TRV has handled the CS for the ASICs Nordic VLSI designs. However, one of Nordic VLSI's designs was particularly complex and due to Nordic VLSI having established a relationship with Alcatel Microelectronics, it suggested that TRV could use Alcatel Microelectronics as its fab for this ASIC. However, TRV had a relationship with the fab, Newport, and wanted to continue to use this fab. However, after some time, TRV agreed with Nordic VLSI that Newport could not handle the manufacturing of this ASIC. Therefore, TRV and Nordic VLSI searched for a new fab, which could handle manufacturing. Nordic VLSI then partook in the search and selection of Alfa as a fab that seemed able to fulfil the high requirements which manufacture of this ASIC required. As such, Nordic VLSI did not handle CS for TRV, but TRV has involved Nordic VLSI in its handling of CS. As a consequence, Nordic VLSI has developed capabilities within the process of evaluating different fabs' manufacturing processes.

Analysis – Capability Development and Episodic Network Contexts of Dyads

The empirical basis was partly structured in accordance with the theoretical frame presented earlier. However, at this point, we more explicitly relate a number of episodes and episodic network contexts of dyads to the development of Nordic VLSI's capabilities regarding 'handling of component supplies'. The analysis is summarised in table 2.

-----Insert Table 2 around here-----

For each of the seven episodes identified above we identify the network context of the relationship. These are shown in the second row in table 2. The seven different network contexts vary with regard to size from three to seven actors, and apart from Nordic VLSI, some of them e.g. Alcatel Microelectronics take part in more than one episode. However, none of the contexts (when the focal dyad is included) are similar. When it comes to which firms are considered for handling the component supplies (see table 2, third row), we can see that Nordic VLSI is taken into account in all but one episode. (It should however, be noted that besides the seven relationships investigated, Nordic VLSI has been involved in numerous other designs of ASICs where Nordic VLSI was not considered for handling CS). Therefore, our analysis primarily shows the existence of variation regarding whether or not Nordic VLSI is considered for CS. In the fourth and fifth row of table 2, the decision regarding which firm is going to be in charge of handling the CS and main factors influencing the decision are presented. In relation to the first issue we can observe that Nordic VLSI is not always allowed to have this responsibility even though they have a new policy stating that component supplies is part of the product offered to the customers. Thus, it is a condition for the development of Nordic VLSI's capability regarding 'handling of component supplies' that Nordic VLSI is allowed or requested by a customer to do so. Having a policy is not the same as being given 'network permission' to carry it out. As shown in the table (a) the different customers' own capabilities regarding ASICs and CS, (b) the customers' other relationships and the third parties' capabilities regarding CS, and (c) the customer's overall relationship to Nordic VLSI which are the main factors influencing whether or not Nordic VLSI are allowed to develop its CS capability. In short, episodic network contexts of dyads influence the capability use and development of a firm.

In the last row of table 2, different sub-capabilities Nordic VLSI has developed regarding 'handling of CS' in the seven episodes are identified. The necessity of developing these capabilities has, in several situations, been pointed out by Nordic VLSI's customer, while the continued development of these capabilities sometimes has taken place together with a supplier, e.g. Alcatel Microelectronics and/or internally in Nordic VLSI. Furthermore, the different episodic network context of the focal relationships has been important for developing different sub-capabilities of Nordic VLSI's overall capabilities concerning handling of CS. As Nordic VLSI's capabilities concerning handling component supplies are developed gradually over a considerable period of time, it becomes evident that these are connected in a manner where capabilities developed in previous situations are incorporated and taken into account in subsequent episodes. For example, Nordic VLSI's changes in its working method due to the handling of CS for VingCard and Nobø influenced the development of the ASIC for Vingmed. Similarly, Nordic VLSI's changes in its way to organise the manufacturing of the ASICs for Vingmed were built upon in the way manufacturing was organised for Q-Free. We can also observe that to have competent customers does not necessarily lead to learning for Nordic VLSI, for example in the episode

with SensoNor, the latter is more competent than Nordic VLSI but does not involve Nordic VLSI in handling CS. However, if the customer is competent and involves Nordic VLSI, it may lead to learning, as illustrated in the episode with TRV. Actually, less competent customers implies that Nordic VLSI learns more. How Nordic VLSI's capability regarding component supplies developed over time in relation to their customers and some of the customers' counterparts is tentatively depicted in figure 2.

-----Insert Figure 2 around here-----

Theoretical Conjectures with Implications for Managers

In this paper, our discussion has concerned the issue of how a firm's capability can develop over time in relation to the network context of firms and dyads. In relation to this discussion we will suggest the following theoretical conjectures:

- The capabilities of a firm represent its ability to organise and mobilise useful combinations of resources which are either controlled internally by the firm or accessed through the firm's relationships. The capabilities of a firm need to be recognised by counterparts in order for the capabilities to be exercised and developed (and thereby possibly become useful) for the counterparts. Thereby, the capabilities of a firm represent its 'knowledge how' – both in organising useful combinations of resources and in getting counterparts to acknowledge the (possibly 'imagined, deemed possible' (cf. Shackle 1972)) capabilities and thereby allow the capabilities to be (tentatively) exercised.
- Interaction in relationships shapes the capabilities of a firm and lead to change or development of the capabilities over time. The capabilities of a firm are created through practice; they develop by being used and decay if they are not. Furthermore, the use of the firm's capabilities – and thereby their maintenance and development – depends on whether or not (and how) the counterparts who (may) use the firm's capabilities take an interest in alternative offerings which they perceive as having higher differential value than the firm's capabilities. That is, if more than one alternative is considered, comparisons are made within particular episodic network context of the relationship in which choices are made which impacts on the capability development of the firm(s).
- The development of a firm's capabilities can be influenced by the way in which strategy is managed by the firm. Managers need to provide a frame of understanding (a) for individuals within the firm as well as (b) for individuals in their counterpart firms. Policy decisions have to be supplemented by the ability to create and convey a 'convincing' episodic network context (frame) in relation to counterparts.
- The development of a firm's capabilities is affected by the network context of the firm and its various relationships. However, it is important to ask which criterion of relevance is used for defining a network context. At a general level, we frame the issue in the following way: do different episodes in a relationship have different network contexts of a dyad? We argue that this seems appropriate to assume, which implies that it may be useful to use the concept of *an episodic network context of a dyad (or relationship)*, which we tentatively define as that subset of the overall network context of a dyad which is considered relevant in relation to a single episode.
- More research is required to assess and develop the relevance of the concept of episodic network contexts of dyads, e.g. example, differences between these and episodic network contexts of each of the firms in the dyad. Furthermore, more research is needed to further understanding of the interplay between capability development and network contexts.

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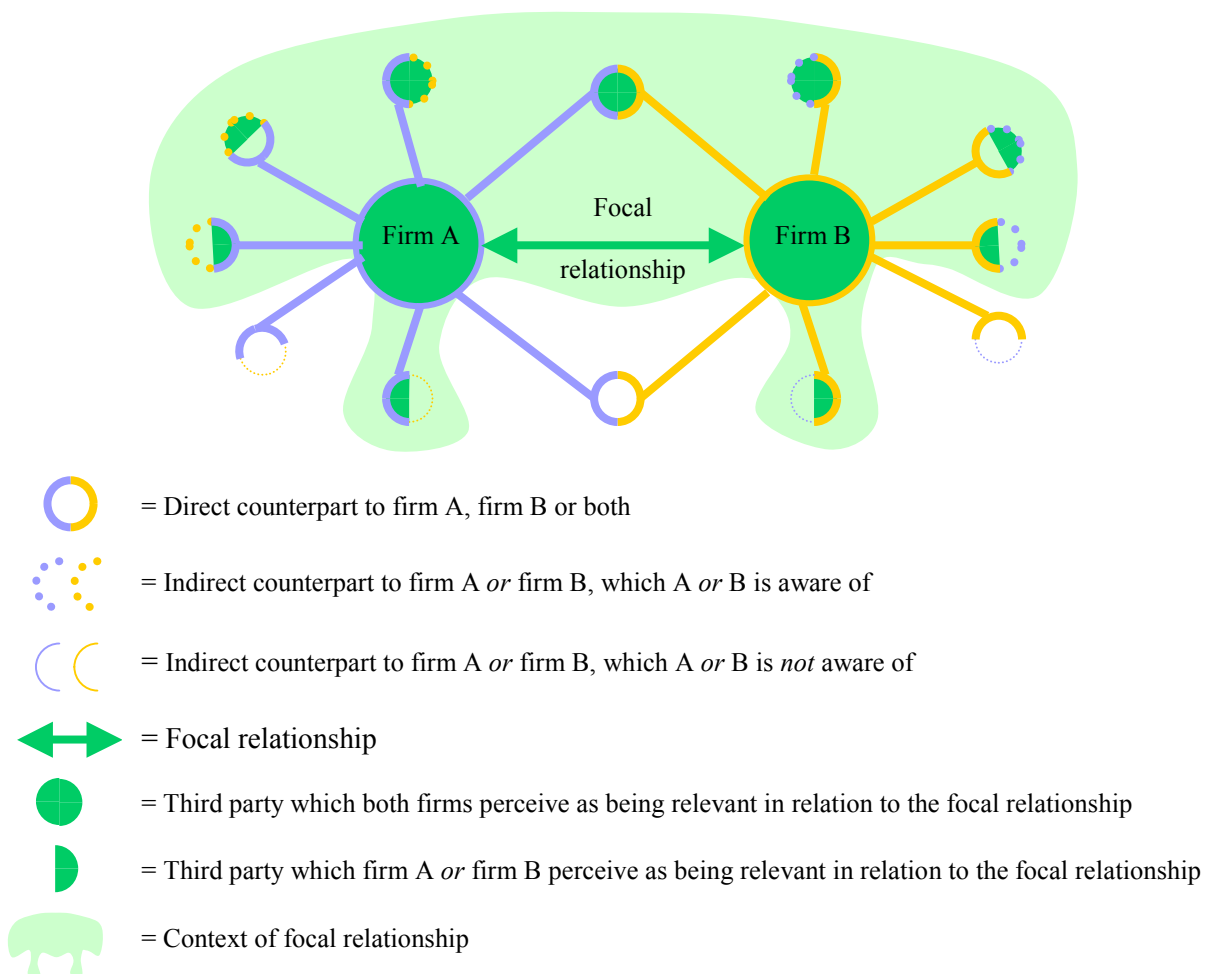


Figure 1: Network Context and Horizon of a Dyad

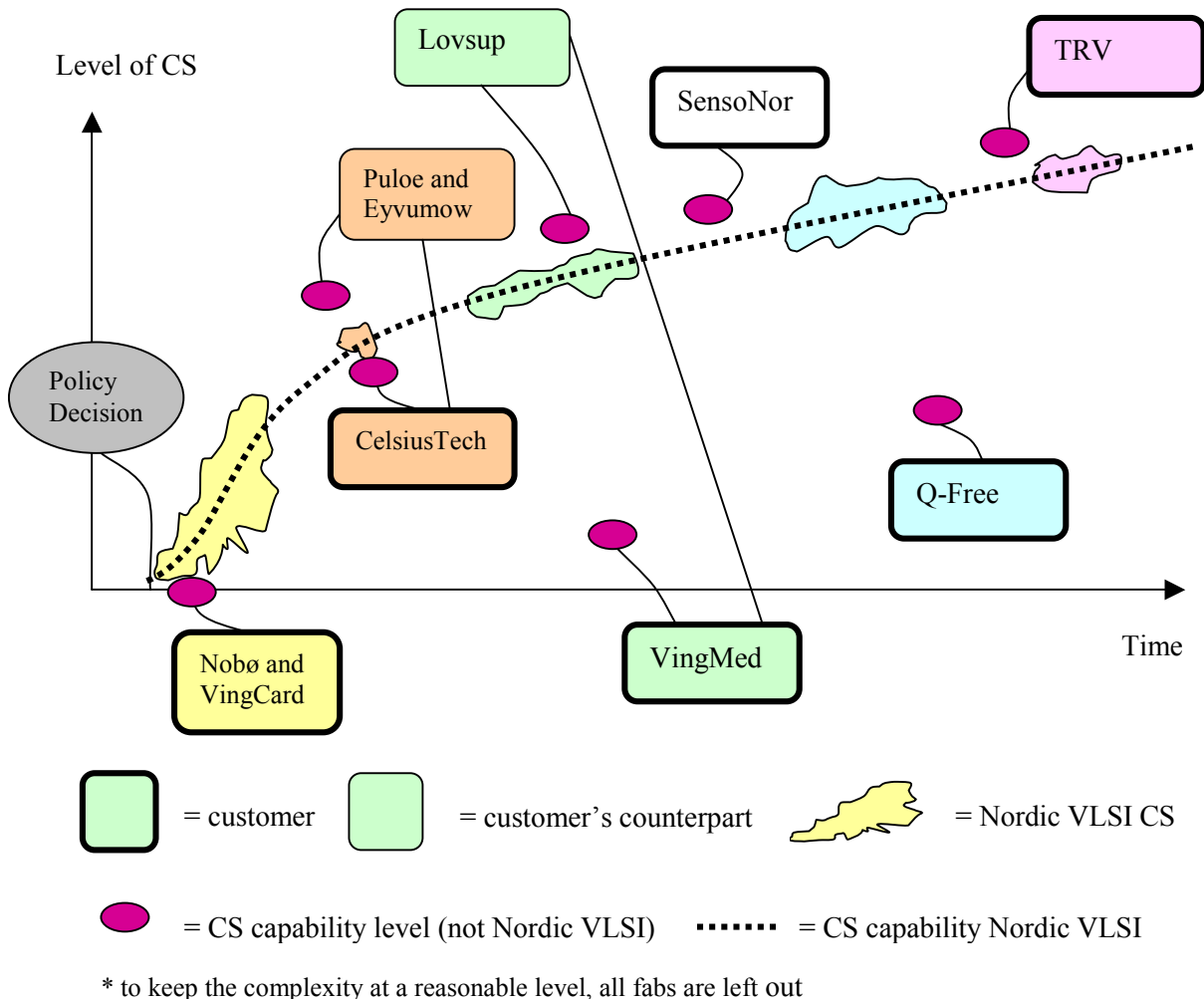


Figure 2: The Development of Nordic VLSI's CS Capability over Time*

	Frame
Episode	Episodic Network Context of Relationship
Relationship	Network Context of Relationship

Table 1: Episode, Relationship and Network Context

Main focus in episode in relationship with	ASIC for heater control system Nobø	ASIC for locking system VingCard	ASCI for intelligent cruise control CelsiusTech	ASIC for ultrasound scanner Vingmed	ASIC for electronic sensor SensoNor	ASIC for toll collection system Q-Free	ASIC for data converter TRV
Network context	Nobø, Alcatel Microelectronics	VingCard, Alcatel Microelectronics	Alcatel Microelectronics, Puloe, Eyvumow, TVAEI-Micro	Alcatel Microelectronics, Delta, Nevse, Lovsup	An unnamed fab	ESM, ASAT, Delta	Alcatel Microelectronics, Newport, Alfa
Parties considered for handling Component Supplies (CS)	Nordic	Nordic	Nordic, Puloe, Eyvumow	Nordic, Vingmed	SensoNor	Nordic	Nordic, TRV
Decision regarding handling CS	Nordic handles CS using Alcatel Microelectronics	Nordic handles CS using Alcatel Microelectronics	Eyvumow handles CS using TVAEI-Micro	Nordic handles CS using Alcatel Microelectronics and Delta	SensoNor handles CS through an unnamed fab.	Nordic handles CS using ESM, ASAT and Delta	TRV (involving Nordic) handles CS using Alfa
Main factors considered for the decision	Neither Nobø nor VingCard has ASIC capabilities or capabilities for handling CS via other firms	VingCard has no ASIC capabilities and no capabilities for handling CS via other firms	CelsiusTech has ASIC capabilities for defence industry but not for automotive industry. Puloe and Eyvumow have capabilities for CS. Eyvumow has relationship to TVAEI-Micro	Vingmed has ASIC capabilities and relationship to Lovsup who has CS capabilities and relationship to Nevse. Vingmed sees it as beneficial for their relationship to Nordic that Nordic handles CS	SensoNor has ASIC capabilities, capabilities for handling CS, and relationship to an unnamed fab.	Q-Free has no CS capabilities, nor relationships to other firms that have	TRV has ASIC capabilities, CS capabilities, and relationship to Newport
Development of the following of Nordic VLSI's capabilities concerning the handling of CS	- develop product specification from 'blue-book' - interface between ASCII and adjacent technologies - prototyping and testing - 'design for flexibility' - design for manufacturing' - design for robustness'	- develop product specification from 'blue-book' - interface between ASCII and adjacent technologies - prototyping and testing - 'design for flexibility' - design for manufacturing' - design for robustness'	- develop understanding that documentation of value creation is of critical importance	- divide the 'manufacturing' process into two activities; a) manufacturing and b) continuous testing	- Nordic neither develops nor use capability	- divide the 'manufacturing' process into three activities; a) wafer manufacturing, b) encapsulation and c) continuous testing - BUFS handles both development and manufacturing	- select and assess competence of new fabs (Newport, Alfa)

Table 2: Development of Nordic VLSI's Capabilities for Handling Component Supplies