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Collective decisions in product development

A case study in a manufacturing firm

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ABSTRACT

Efficient and effective product development is a key factor to sustain competitiveness. Research on decision making in product development is an underdeveloped field which could shed light on certain aspects, such as the increasingly collaborative nature of product development. Therefore the purpose of this abductive mixed methods research was to explore the decision making process in product development projects in the manufacturing industry, as they take place in social structures. A case study was performed in which data was gathered through interviews and social network analysis. Results of the thesis are threefold. First, a definition of a collective decision was created. Second, involvement in collective decisions was described as interactions occurring in tandem with an exploratory decision- and learning process. Individuals' frames of references and several group and organizational factors impacted these interactions. Third, several drivers for increasing involvement in collective decisions were identified. The main contribution of the research is the discovery of possible rationales to why collective decisions manifest. The research raises several suggestions for further research such as discovering what hampers involvement and the relationship between learning, knowledge management and decision making.

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1 INTRODUCTION

This chapter contains the background, purpose, delimitations and problem analysis of the thesis.

1.1 BACKGROUND

Product development covers the entire process of ideas transforming to product and is vital for organizations - Efficient and effective development is a key factor to sustain competitiveness (Wheelwright & Clark, 1992). Research on product development aiming to understand and improve development processes has given rise to several models and conceptions. Currently, one conventional way to depict the product development process is as a linear development funnel (Wheelwright & Clark, 1992). One normative model based on this perspective is the Stage-gate model, which is popularized by Cooper (1990). However, linear models have been heavily criticized. They have for instance been claimed to fail to depict flexibility, informality, feedback, influences and autonomy (Clark & Fujimoto, 1991; Dougherty, 1992; Griffin, 1997, McCarthy, et al., 2006; Cooper, 2008; Meier et al., 2015). Models that instead are iterative and chaotic have been presented, but they all seem to exclude different aspects of the product development process (McCarthy et al., 2006).

An alternative way to view the product development process is as a complex set of decisions (Krishnan & Ulrich, 2001; Griffin et al., 2002; McCarthy et al., 2006; Kihlander, 2011). Each decision attempts to create value and shape the product by its subsequent actions (Griffin et al., 2002). According to Sobek (2014) the impact of future decisions are made smaller as depicted by the Designer's dilemma. As such, the product inevitably converges towards completion by decisions. Other approaches to represent process management, such as value-stream mapping and swim lane diagrams, is increasingly gaining foothold through lean product development (Liker, 2006). However, those methods are designed to map activities and not the dynamics in decision making processes.

The approach of exploring product development as a decision process provides some benefits (McCarthy et al., 2006). Product development is by its nature a horizontal business process and as such related decisions are performed cross-functionally (Griffin et al., 2002). Within many companies, organizational forms such as cross-functional teams and quality circles are commonly used and researched (David et al., 1989; Griffin & Hauser, 1996; Shani et al., 2009). Therefore in contrary to linear activity-oriented models, a decisions perspective provides the freedom to follow a development process regardless of physical locations, functions and organizations. A focus on decisions also provides the ability to understand core rationales for major decisions during the product development process, and subsequently why certain activities take place or not.

It is not surprising that communication and decision making processes have great impact on an organization's ability to innovate, and it constitutes a key issue and success factor within product development (Krishnan & Ulrich, 2001; Steiber & Alänge, 2016). However as Griffin et al. (2002, p. 165) argue that "... *the very role of decision making in product development is poorly understood and little appreciated*". Thus, a better understanding of the decision process would enable companies to control the innovation process. In the light of research on general decision theories, this is however not surprising. There has been a long debate in academia whether persons are capable of making rational decisions and even whether rationality exists (e.g. Simon, 1957; March, 1997).

Nutt (1984) regards the decision activity both as a social practice and as an individual cognitive process. Hence the key to understand how decisions are made lies in understanding human behavior and social interactions. Griffin and Hauser (1996) state that informal social systems, language, organizational and team structures, incentives and rewards and stage-gate processes affect decision making in product development. According to Cross et al. (2009), much of the research on decision making has investigated group dynamics and leadership and cognitive biases. They argue that the role that informal networks in organizations and teams play in decision making processes have been largely overlooked, and that a network analysis would complement the social and psychological views. Diefenbach and By (2012) shares this thought, claiming that a network analysis might provide surprising insights into how work gets done in an organization.

1.2 PURPOSE

The purpose is to explore the decision making process in product development projects in manufacturing industry, as they take place in social structures.

1.3 DELIMITATIONS

The study of decision making is a research field that connects to many others. The cognitive logics of decision making are often studied within psychology, an area that is not touched upon in any detail in this study. Neither are mathematical models of decision making within the scope of the thesis. Instead, it is written with the intention to explore decision making from an organizational management point of view, which is the focus of the researchers' education programme.

The case study of the thesis was conducted on one single company and one single product development project, which largely place in Sweden. The study did not include decision making at a strategic level, but focused on the case project's review and in-stage decisions.

When tracing decision processes through networks, countless individuals throughout network tiers can formally and informally have influence on decisions. Therefore, explorations in networks when tracing decisions needed to be restricted, which was why only individuals within the case company were included in the data collection.

1.4 PROBLEM ANALYSIS

As stated above, product development is commonly conducted by a number of persons, e.g. in cross-functional teams (Griffin & Hauser, 1996; Shani et al., 2009), and thus product development decisions commonly involve a number of persons (Krishnan & Ulrich, 2001; Kihlander, 2011). These decisions are referred to in many ways, such as *group decision making* (e.g. Shani et al., 2009), *team-based decision making* (Schmidt & Montoya-Weiss, 2001), *collective decision making* (e.g. Deneubourg & Gross, 1989) or *joint decision making* (e.g. Scharpf, 1988), which shows the diversity of definitions. Defining a concept is an integral way for the process of understanding, according to Perelman's (1971, p.148) quote: "*When we formalize an informal argument, we must eliminate ambiguities, define terms and state assumptions based on that which we consider relevant and reasonable.*" Therefore, the first research question is:

RQ1: What is a collective decision?

Organizations are comprised various individuals and collective decision in product development are frequently subject to social interactions taking place in social structures between these. Many researchers have attempted to describe interactions occurring around decisions over time, Purser et al. (1992) and Cross et al. (2009) to name a few. The complexity of organizations and different individuals create dynamic interactions which are subject to various group effects (Shani et al., 2009). Thus whom are involved in collective decisions has an impact on its process and outcome, which groundbreaking work by Cyert and March (1963) emphasize. Therefore it is of interest to understand how involvement in collective decisions take shape (and who are involved), leading us to the second research question:

RQ2: How does the involvement manifest (in collective decisions)?

As stated, the decision making process is vaguely understood despite playing a vital role in product development and in extension innovation (Krishnan & Ulrich, 2001; Steiber & Alänge, 2016). A way to comprehend the phenomenon of collective decision making further is to depict what could be possible causes for it to manifest. A first step in order to begin to understand the answer to the question of *why* is to find drivers linked to creating collective decision.

RQ3: What seem to be drivers for involvement?

2 THEORY

The fields of decision making, social networks, and product development are relevant domains for the thesis. Social network literature is included as it is a methodology to depict social structures. Each domain is vast and contains a myriad of concepts from different researchers. As previously mentioned, much research has been conducted in the interfaces between the fields. Research about how decisions are developed and formed through networks has been conducted by e.g. Wonodi et al. (2012), Cross et al. (2009), Carlsson (2000) and Nutt (1984). Social networks in the context of product development has been researched by a great number of researchers, e.g. Steiber and Alänge (2016), Amabile et al. (2014), Chesbrough (2003), and Burns and Stalker (1961). The view of product development as a series of decisions has been discussed by e.g. Kihlander (2011), Griffin et al. (2002), Krishnan and Ulrich (2001) and Purser et al. (1992). Despite this research both within and between these fields, few attempts have been made to explore a decision making process in a product development context by investigating the social structure that it travels through when depicted by social networks. This is the focus of interest for the thesis, visualized as the intersection of all three areas in Figure 1 below.

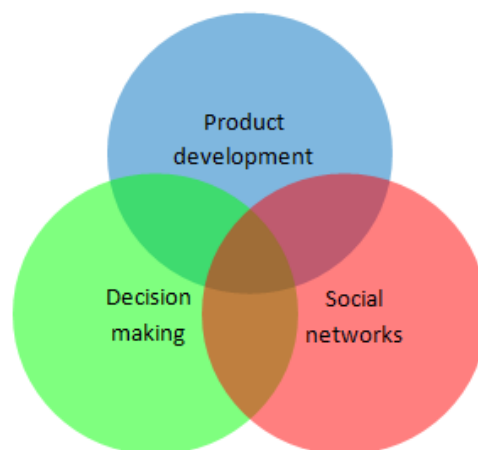


FIGURE 1 - THE THEORETICAL FRAMEWORK'S THREE RESEARCH FIELDS

First in the theory chapter, a selection of the relevant concepts within the fields of decision making theory is presented in general and further categorized into individual and collective decision making. It covers both psychologists' and sociologists' views on the subject. In this section, the definition of collective decisions is presented. Decision making and its relation to organizational learning is discussed the following section as well as social networks and a social network perspective on decision making. The final part of the theory describes decision making in a product development context.

2.1 MAKING DECISIONS

This section presents research in the field of decision making, shown as the shaded areas in Figure 2 below. Concepts of individual and collective decision making are discussed, which leads to a definition of collective decisions and thus the answer to the first research question. Thereafter, decision making is further complicated by the concepts of bounded rationality, decision making roles, communication efficiency and group dynamics.

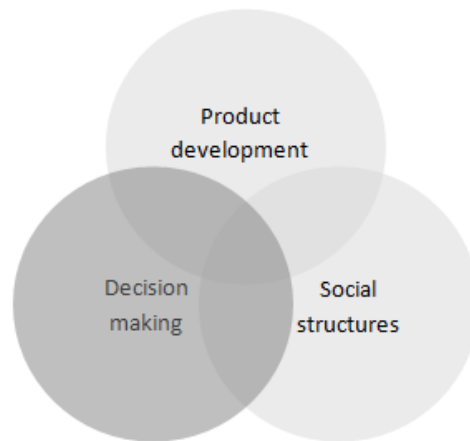


FIGURE 2 - MAKING DECISIONS

“The study of decision making ... is a palimpsest of intellectual disciplines: mathematics, sociology, psychology, economics, and political science, to name a few.” (Buchanan & O'Connell, 2006, p.33).

The phenomenon of decision making has been subject to extensive research in academia. Several different research streams have manifested in the course of time. Descriptive science is concerned with how and why people act the way they do, and the research is anchored in the field of social science (Bell & Raiffa, 1988). It focuses on thought patterns, emotions, perception and cognition (Bell & Raiffa, 1988). Normative science emphasizes coherence and rationality, and describes processes and outcome based and following various axioms depending on circumstances (Bell & Raiffa, 1988). In short, a descriptive model describes and predicts behaviour, where as a normative model describes how ideal people might behave (Bell & Raiffa, 1988). Prescriptive science takes another stance, emphasizing on how to facilitate decision making in practice incorporating both descriptive and normative streams (Bell & Raiffa, 1988). Descriptive models are evaluated by empirical validity, normative models by their theoretical adequacy, and prescriptive by their pragmatic value (Bell & Raiffa, 1988).

A research strain stemming from prescriptive modeling denoted *management science* which focused on improving decision making in organizational contexts, increasingly gained popularity in the 1960s and 1970s. Taking off with a seminal piece by Howard (1966) in which the term decision analysis was coined,

researchers such as Mintzberg et al. (1976), Nutt (1984) and March (1991) recognize the erroneous explanatory effect and applicability of normative approaches but also how to overcome them by understanding through describing processes as they take place. A large portion of the development of management science focus on, and was significantly fuelled by information systems emergence in organizations such as MRP systems which made it possible to analyze and handle large data amounts (Banker & Kauffman, 2004; Buchanan & O'Connell, 2006).

2.1.1 WHAT IS A DECISION?

Decision making is a cognitive process and thus an abstract concept. There are many propositions as to what the definition of a decision could be. In order to capture the essence of the concept, four different perspectives have been synthesized from theoretical definitions. The different perspectives portray the vast meaning of the decision concept.

2.1.1.1 OPTIONS

A definition of choice is *"the opportunity or power to make a decision"* and a definition of the act of choosing is *"the act of picking or deciding between two or more possibilities"* (Merriam-Webster dictionary, 2016). Ergo a decision could, in effect, be equivalent and requires at least two options to be a decision. At some period in time, a perceived future state is not congruent with what would be satisfactory enough not to consider other future states. A decision involves a search process to generate these options to the future state (Simon, 1957; Maylor, 2010). Great difficulty has been attached to generating these options as decision making processes are *"as much about defining the question as they are about providing an answer..."* (Nutt & Wilson, 2010, p.4). Hence rationale for what is decided between can be vague, as Nutt and Wilson (2010, p.4) further states *"one must decide whether there is a need for a decision and, if so, what that decision is about."* Bell and Raiffa (1988) summarizes by stating that decision making includes devising and generating alternatives to choose between. Bell and Raiffa (1988) states that there often lies uncertainty in which choices exist and what their consequences are.

2.1.1.2 EVALUATING AND SELECTING

Moreover, decision making involves evaluating and choosing between these options (Bell & Raiffa, 1988; Maylor, 2010). In its essence an evaluation should lead to an optimal choice, as Nutt (1984) states there is a clear link with the appraisals and a desired outcome. Evaluating options involves processing information which furthermore is linked to limitations in capacity (Simon, 1957; Galbraith, 1977; Forrester, 1984; Bell & Raiffa, 1988; Nutt & Wilson, 2010). Evaluation therefore implies not only an inherent difficulty but also uncertainty and the mechanisms are far from understood. Or as March (1978, p. 591) puts it; *"we do not have a single, widely accepted, precise behavioural theory of choice"*.

2.1.1.3 LINK TO SUBSEQUENT ACTION AND EVENTS

So decisions pertain consideration of consequences of different choices (Mintzberg et al., 1976; March, 1978; Bell & Raiffa, 1988). It should be noted that a choice not to take action is also a decision (Nutt & Wilson, 2010). Researchers elaborate the issue if consequential events of decisions should be considered part of the decision itself. Bell and Raiffa (1988) implies that a decision is a call upon to take action and both Yates (2001) and Srinivas and Shekar (1997) emphasize that decisions are commitments to action. Hansen and Andreasen (2004) imply that decisions definitely have consequences, and Nutt (1984, p.415) goes further in claiming that "*a decision ... ends with action*". Griffin et al. (2002) similarly implies that decisions need to be complete, and there are thresholds for it to lead to action.

2.1.1.4 PROCESS

As stated in the previous discussions, a decision involves generating (consciously or not) options and choosing between them. These actions are part of what authors describe as a decision making process (Mintzberg and Westley, 2001; Nutt, 2010; Bell & Raiffa, 1988). Descriptive and normative research has attempted to bring clarity to the nature of this process. Badke-Schaub and Gehrlicher (2003, p.6) exemplify the complexity by stating different process patterns as "*Leaps, Loops, Cycles, Sequences and Meta-process*". Many authors such as Mintzberg and Westley (2001) and Keeney (2004) argue that decision making processes can be linear or iterative. It can also be concurrent (Dwarakanath & Wallace, 1995) as well as contain numerous smaller decisions and actions (Bell & Raiffa, 1988; Srinivas & Shekar, 1997). By being iterative, decisions can have an emergent development, which Mintzberg and Westley's (2001) "doing first" approach to making decision exemplify as well as Hansen and Andreasen's (2004) description of a tentative decision. Implicit in this posit is that there is a temporal dimension involved; decision making processes span periods of time. A conclusion is the apparent difficulty to separate a decision making process from its outcome, hence a decision is both an outcome of a process and a process itself.

2.1.2 RESEARCH ON INDIVIDUAL DECISION MAKING

Traditional decision theory is concerned with decisions taken by individual agents, which will be the topic for this chapter. Many different factors are influencing individual decision making according to Dietrich (2010). She mentions past experience, age, perceived importance and invested time and resources among others. Moreover, Lee and Lebowitz (2015) have compiled a list of cognitive biases of individuals' minds, which prevents from making rational decisions. For instance, anchoring bias makes persons over-reliant on the first information they are presented with, since alternatives to a solution which happened to be presented first must be compared with the first one. There are however immense amounts of literature

written about individual decision making in the domain of psychology, of which this chapter will only present the most important work that is connected to organizational management theory. The two main themes below discuss researchers' views on rationality and unconscious influences.

2.1.2.1 RATIONAL DECISION MAKING

Rational decision making is the foundation of normative research on individual decision making. The axiom of rational decision making is that decisions are made to gain maximum value as mathematically described by the expected utility function (Neumann & Morgenstern, 1947).

March (1997) summarizes the concepts involved in normative standard theories of choice:

- A knowledge of alternatives - Decision makers have a set of alternatives for action
- A knowledge of consequences - Decision makers know the consequences of alternative actions, at least up to a probability distribution.
- A consistent preference ordering - Decision makers have consistent value by which alternative consequences of action can be compared in terms of their subjective value.
- A decision rule - Decision makers have rules by which they select a single alternative of action on the basis of its consequences for the preferences.

Descriptive research often question the validity of these models, but it has shown a robustness in its explanatory ability as preferences can be said to be unknown or unstable, to make something inexplicable explicable (March, 1997). Herbert Simon complicated the debate by introducing the concept of bounded rationality. According to bounded rationality, decision-makers' knowledge of alternatives and consequences are incomplete and preferences and decision rules are imperfect as they are subject to external influences and heuristics (Simon, 1957). Hence the rationality is bounded.

Still, there are many arguments that counter-claim the explanatory effect of the model. March (1997) claim that decisions are often made without regard to preferences and human decision makers routinely ignore their own fully conscious preferences. Hence decisions rules could under certain conditions be cast aside because of various influences, and instead something else leads to a chosen alternative. What March (1997) referred to is known as organizational rules and routines which is explained further in chapter 2.3

Decision making and organizational learning.

The notion of the decision making process being non-rational and part of an open system has been pursued. Nutt and Wilson (2010, p.17) utters the essence of this argument: “*Both internal and external environmental factors are believed to influence what is decided as well as how a decision is made*”. Understanding the factors that influence decision making processes is important for understanding how decisions are made. That is, the factors that influence the process may impact the outcome.

2.1.2.2 UNCONSCIOUS INFLUENCES

The acceptance among researchers of possible effects of unconscious influences on decision making dates back to Nisbett and Wilson (1977). Although still heavily debated among researchers which the meta analysis by Newell and Shanks (2014) elucidates, the article also synthesizes three issues where unconscious influences can potentially manifest. They are multiple-cue judgment, unconscious thought effect, and decisions under uncertainty (Newell & Shanks, 2014). The first will not be covered as it is not in the theoretical domain of the thesis, the second will be described below and the third is largely covered by the concept of bounded rationality.

The unconscious thought effect (UTE) theory proposes that unconscious thought leads to better complex decisions than conscious thought and converse for simple decisions (Dijksterhuis et al., 2006). Setting off a stream of research papers after its conception, the effect has been replicated several times and there are evidence pointing to that the effect exists independently of the decision domain (Baaren et al., 2011). Boundary conditions and factors especially from a descriptive point of view are far from completely identified, not surprisingly since the original experiment by Dijksterhuis et al. (2006) used a normative decision scenario with a fixed setting. Identified boundary conditions increasing the effect are that; all possible decision options are presented blocked per choice, the goal/desired outcome of the decision making was clear, a configural mindset was induced (i.e. systematic approach was encouraged), and presentation times of the decision information as well as the unconscious thought interval are short (minutes not hours) (Baaren et al., 2011). It is notable that in studies on the UTE effect, all possible decision options are laid out for the decision maker, and the exact effect on degree of complexity unknown in larger cases. Although the actual process behind the UTE effect remains largely uncharted, there could be connections to the dual process theory determining whether *System 1/2* is more effective (explained further below); the unconscious has additional cognitive capacity which could potentially be leveraged as shown under the circumstances where UTE is more efficient (Dijksterhuis et al., 2006).

Circumventing the debate altogether by hypothesizing that the mechanisms behind decision making are altogether unique in some cases is the dual processes theory. It posits that human minds have two cognitive systems functioning and reasoning in different ways, affecting how decisions are made

(Stanovich & West, 2000; Kahneman, 2011; Sloman, 1996). *System 1* refers to our intuition and functions automatically, effortless, emotional, and subconsciously (Kahneman, 2011). Under pressure system 1 tends to be used, and although fast and effortless it is severely framed by immediate available information (i.e. in the brain) in decision making (Kahneman, 2011). *System 2* on the other hand, is slow, conscious, logical, used deliberately, and can produce sequential thinking (Kahneman, 2011). System 2 requires effort and focus to be used and tire fast (Kahneman, 2011).

The prevalent view espoused by authors such as Stanovich and West (2000), Milkman et al. (2009) and Kahneman (2011) is that System 1 and System 2 are not always used when deemed appropriate to generate an optimal decision outcome, typically because of stress. Methods to switch from System 1 to System 2 thinking have been laid forth and are formal analytical processes, taking an outsider perspective (even asking an outsider), and considering the opposite outcome (Milkman et al., 2009).

2.1.3 RESEARCH ON COLLECTIVE DECISION MAKING

Interdependent decisions by multiple actors who are affecting each other which will be discussed in this section, together with other group issues. It starts with a brief summary of game theory and then discusses the concept of stakeholders. Thereafter, the answer for the first research question is discussed, on the basis of the previously presented theory. This ends with the researchers' definition of collective decision making.

The remaining part of the section presents the inter-relational aspects of decision making, starting with decision making roles. Then follows a discussion on communication efficiency and finally different group dynamic features related to decision making is presented.

2.1.3.1 GAME THEORY

Whereas individual decision making conceptually takes a singular subjective stance, the study of interdependent decision making between individuals is in the domain of game theory. Or put simply by a description "*Game theory is the study of multiperson decision problems*" (Gibbons, 1992, xi). This major theoretical framework is frequently employed to analyze decision making where more than one individual is involved (Bogetoft & Pruzan, 1991). They lean extensively on mathematical models to describe interactions, and the frameworks are in fact also viewed as analytical models designed to help us understand observed phenomena when decision makers interact (Osborne & Rubenstein, 1994). Game theory studies both cooperation and competition (Kelly, 2003), and a major assumption is that actors act rationally, in their own best interest, and have a strategic reasoning taking other's actions into consideration (Kelly, 2003; Osborne & Rubinstein, 1994). Game theory is beyond the subject of this thesis, but introduces the theoretical implication of *stakeholders*.

2.1.3.2 STAKEHOLDERS

A bridge between the model of individual rational decision making and interdependent decision making is often attributed to the seminal piece *A behavioural theory of the firm* by Cyert and March (1963). First of all it adapts the theory of individual decision making by incorporating *bounded rationality* (explained further below). It further encompasses the concept of *stakeholder groups*, which are seen as coalitions of individuals with mutual goals and interests, and the process of unifying and aggregating these intertwining goals in the organization. This often leads to *satisficing* behavior - goals arising as compromises between groups. It portrays decision making processes as heavily affected by this, especially in devising decision alternatives and solutions. These compromises are formed by what is referred to as coalitions in the organization.

2.1.3.3 RQ1: THE DEFINITION OF A COLLECTIVE DECISION

The previous theory section had the aim of presenting some of the many aspects of collective decisions which are necessary to understand when attempting to frame the concept. Some major themes have emerged: The process of choosing and coupled with this the temporal dimension, the link to action and the relation between stakeholders and decisions.

The process of choosing, according to the Merriam-Webster dictionary (2016) is "*the act of picking or deciding between two or more possibilities*", which implies generation of alternatives and evaluation among them. The aim is implicitly to choose the optimal alternative to realize a desired outcome, as stated by Nutt (1984). Furthermore, the controversies among researchers show that the concept of collective decisions does not get clearer by reasoning about consciousness or rationality. Thus, the verb *choose* is used to represent the activities included in making decisions.

As stated above, choosing is done as a process. This process can be e.g. linear, iterative (Mintzberg & Westley, 2001; Keeney, 2004), concurrent (Dwarakanath & Wallace, 1995) and consist of a number of smaller decisions and actions (Bell & Raiffa, 1988; Srinivas & Shekar, 1997). In addition, there is always a possibility of a decision to be changed, which results in a tentative decision process (Hansen and Andreasen, 2004). The complexity of the decision process is thus related to when it starts and stops, and as defining the question itself (Nutt & Wilson, 2010). Therefore, the authors consider a decision as both a process and the outcome, why a more detailed definition of the boundaries of a decision making process is impossible.

Bell and Raiffa (1988) regards a decision to contain a call for action, while Yates (2001) and Srinivas and Shekar (1997) see a decision as a commitment to action. Nutt (1984) include the action into a decision, a view which provides room for alteration. By considering a decision making process as a series of smaller decisions and actions, the question is rather whether a smaller action in larger decision is important

enough to count as an own event. Hence, insignificant actions are considered as parts of the decision making process while significant actions are regarded as separate events.

Finally, game theory introduced the concept of stakeholders into the theoretical domain of decision making, individuals whom are affected or affect decisions. As a consequence of the argumentation above, the researchers' definition of a collective decision is:

The process and outcome of a choice of action with multiple stakeholders.

2.1.3.4 BOUNDED RATIONALITY AND MULTIPLE INDIVIDUALS

Forester (1984) expands the reasoning of Simon (1957), March (1978) and others by stratifying the boundaries of rationality in four levels, arguing that different practical strategies must be adopted to manage each level depending on the context. In a perfectly unbounded environment the agent is rational in a closed system, the problem is well defined, information about the decision is perfect and available and the time available is infinite. Only then is it possible to optimize the solution in a completely rational manner.

Naturally, the reality is never perfect; it is complicated in four levels of bounds, according to Forester (1984). The first is Simon's (1957) cognitive limits, which according to Forrester make the decision maker fallible – she does not act perfectly rational because of an ambiguous scope, analytical incapacity, imperfect information and limited time. Instead of optimizing, the decision maker has to adopt a *satisficing* strategy; she has to satisfy with an alternative that is possible. The second level of bound is the *socially differentiated bound of rationality*. At this level, the decision maker is accompanied by other actors and neither are they fully rational. According to Forrester (1984), the decision maker cannot simply satisfice. Instead she has to use social intelligence networks to acquire knowledge and help, something that requires building and maintaining the social relations. At the third level, called *pluralist bounded rationality*, these other actors have their own, often conflicting, agendas. They have other definitions of the problem and the information becomes a political resource. Decision makers have to bargain and adjust to each others.

The fourth level of bounded rationality is related to structural distortions and political theories which are outside the scope of this study. In addition, according to Forester (1984, p. 29) “*At each level of complexity, elements of the previous strategies may also be brought to bear.*” He furthermore proclaim the importance of understanding the context and role of decision making in organizations, stating that “*Perhaps now, we can understand still more clearly how the practicality of what we do, however differently constrained or bounded it may be, depends upon the reading of the contexts we work in*” (1984, p.30).

2.1.3.5 ROLES IN DECISION MAKING

During the decision making process, different people are concerned in shaping the decision. Rogers and Blenko (2006) presented a tool called RAPID for analyzing decision making roles in order to increase decision making efficiency. The RAPID tool is used to categorize decision makers into five roles. The *recommender* role gathers and analyzes input and then present an alternative for the others. While they gather information they also build buy in for the preferred alternative. The *agree* role has veto power over the recommender's proposition. If a debate arises, the goal is to agree upon an altered proposition, and if this fails it escalates to the person with the *decide* role. The *input* role is consulted by the agree role. Input providers are often affected by the outcome and might not execute the decided action if they are not listened to. The individual with the decision role has the formal mandate to make the decision. The last role is the *perform* role, the executive role. Rogers and Blenko (2006) state that these roles, especially the decision role, must be clear in order for all involved for a decision to be made and executed efficiently. For the same reason, there should not be too many and scattered persons with agree roles.

Cross et al. (2009) categorize five main roles that are closely related to Roger and Blenko's (2006): Decision maker, advice provider, input provider, people who need to know and people who want to know. The division is made on the basis of communication effectiveness. Only the decision makers have real influence on the decision according to Cross et al. (2009), while the other roles only provide non-necessary information. Such a division of roles might be useful when a product development project is formalized, but might be very difficult to use during the early stages of a product development project. Major decisions are often made even before the project has a formal group, and it might be very difficult to separate a non-information provider from an information provider, an influencer and even from a direct decision maker.

de Bono (2000) introduced the concept of *Six thinking hats*, providing a tool for increasing group decision making effectiveness. de Bono (2000) reasons that individuals can think in six different ways, called *parallel thinking*. All ways of thinking are subjective but complement each other when combined and thus social effects as e.g. group think could be avoided. The six different thinking hats that decision makers could ware are the managing hat which makes the wearer considers the bigger picture, the information hat for only considering facts, the emotional hat, the discernment hat for a pragmatic and realistic view, the optimistic hat and the creative hat for thinking out of the box (de Bono, 2000).

2.1.3.6 COMMUNICATION EFFICIENCY

As stated above, Cross et al. (2009) declare that only the direct decision makers should have real influence on a decision, while others only provide non-necessary information. Rogers and Blenko (2006) claim that “if there are a lot of people giving input, it's a signal that at least some of them aren't making a meaningful contribution” (2006, p. 55). However, they explain neither why this would be the case, nor

how many persons a lot are. The two articles prescribe a small group of decision-makers for the sake of efficiency.

Fonseca (2002) has a completely different view on communication. He considers misunderstandings a perception of what he calls *redundant diversity*; people talking and giving answers that provide information other than what was wanted. He sees innovation as a conversational process where misunderstandings lead to novel ideas, and that this process “*fuels and are fuelled by the search for meaning*” (Fonseca, 2002, p.87).

Fonseca (2002) claims that the more often a concept is presented, the more misunderstandings are bound to happen. This might be the explanation of why the back-of-the-napkin is such an important engineer tool (e.g. Townes, 2010); many of the best ideas often stem from informal meetings like dinners or flight trips since these conversations often contain misunderstandings. This is also in line with the idea about the importance of discussing work-related problems with a spouse, since they often respond in an unpredictable way and thus provide a different angle to the issue. The conversational process of misunderstanding creates anxiety and provocation, why it requires mutual trust (Fonseca, 2002).

However, in any group the misunderstandings will decrease as people learn to interpret the others correctly. This leads to less innovation but also less irritation. Furthermore, Fonseca (2002) observed that the informal hierarchy of the group affects and are affected by the creation of this common language. The most powerful individuals could dictate the underlying assumptions that the discussions are based on.

Fonseca (2002, p. 88) suggest that “*dissipation, in human settings such as ‘organizations’, occurs in participating in ordinary, everyday conversations... However, this is usually not all we do. In addition we engage in talk characterized by redundancy from the point of view of economic value or business purpose.*” These redundant communications, which are not intentionally sought, provide information about e.g. customer intentions, competitors or possible technological developments.

Thus, Fonseca takes a very clear stand in the importance of what Roger and Blenko (2006) and Cross et al. (2009) call unnecessary communication. Still, their message is that there is a risk for too much information, a problem recognized also by e.g. Galbraith (1977). The need for ambidexterity is evident, just as with business in general; A decision making processes need to be both efficient and open for unforeseen influences.

Working in teams is very common today and many decisions are made by groups. As the number of individuals influencing a decision increases, the potential for more information – but also the number of opinions – increases. O’Rielly et al.’s (1998) study that focused on decision making in product development proved empirically that teams make more effective decisions than individuals. Effective team decision making involves both effective problem-solving skills and effective interpersonal skills.

Examples of those are careful listening, support and encouragement of the contributions by all members (Shani et al., 2009).

2.1.3.7 GROUP DYNAMICS IN DECISION MAKING

The process of group decision making has both a formal and an informal side. Often in a project, the project manager formally makes a decision and takes responsibility for the outcome, but informally other individuals inside and outside of the group may have a strong influence. Purser et al. (1992, pp. 4-5) describe that “*a deliberation differs from a discrete decision or project milestone in that it encompasses the informal human interactions and the continuous ebb and flow of information related to a particular topic over time*”.

The leadership of a project is of great importance for a decision making process. A manager might not always be an informal leader, which could potentially lead to power struggles and hidden agendas. Such conflicts could seriously impede the decision making process (Shani et al., 2009). The leadership is affecting much of the other group dynamics and development such as social norms, task orientation and power distance. Group leadership is thus implicitly influencing a decision making process (Shani et al., 2009).

Vroom and Yetton (1972) propose a prescriptive model for choosing decision making style in a group context. They identify five different styles: the manager solves the problem herself with available information, the manager is provided information from employees and then decides, the manager obtain information and suggestions from employees individually but decides herself, the manager obtain information and suggestions from employees together but decides herself and the manager fully uses the group for making the decision together. Vroom and Jago (1988) suggest that different styles are needed depending on eight factors: the importance of the decision, the importance of employee commitment in the decision process, if the manager has enough knowledge, how structured the problem is, the commitment of employees to a decision made only by the manager, the likeliness of argumentation between employees regarding preferred solutions and whether employees have the information to make a wise decision. To decide which style to use in which setting, the Vroom and Jago (1988) provide a decision tree based on these factors. Other factors might also affect the decision making, as the will and skill of the manager to share power and the employee’s willingness to make decisions (Shani et al., 2009).

Another option for a manager is to delegate decision making authority. Delegation is a means to decentralize organizations and flatten hierarchies (Malone, 2004). According to Edvinsson and Malone (1997), there are several advantages of delegation, such as employee motivation and creativity, a possibility of concurrently work on the same problem and it provides greater flexibility. Malone (2004) claims that delegation allows more innovation and efficiency since decisions are made closer to the persons with knowledge about the problem.

For group decision making to be effective the prerequisites such as the task, goal, authority and responsibility must be made clear to all involved, according to Hubler (1980). He states that the members of a group should be made responsible for different aspects of the decision, depending on expertise and who are affected by the outcome. The reasoning resembles to that laid forth by Roger and Blenko (2006) and Cross et al. (2009).

The group members' personal attributes are also significant in understanding group decision making. McGrath (1998) groups personal characteristics in three categories: members' attributes, needs and demographic characteristics. Member attributes consist of knowledge, skills, values and cognitive and behavioral styles. The demographic characteristics are age, sex and ethnicity. These attributes is proposed to offer divergent views and experiences which provide different alternatives to decide upon, although the findings are inconsistent (O'Reilly et al., 1998; Shani et al., 2009; Roberge & van Dick, 2010).

The members' needs are their personal goals which they are hoping to fulfill when participating in a team. McClelland (1953) first presented the *achievement motive* and later the *power motive* (Hofstede, 1980). Maslow (1943) and Herzberg (1959) developed theories where the different needs were ordered in hierarchies from *lower needs* or hygiene factors to *higher needs* or *motivators*. McGrath (1998) compiled four categories of needs: need for affiliation, power, achievement and economic or material resources. According to McGrath (1998), those are motivating individuals to cooperate and are thus affecting the group development process. The degree of how strongly members identify with other members' needs and goals, the connectiveness, affects relations and the emergence of norms (O'Reilly & Roberts, 1977). Hofstede (1980) however claims that the theories of Vroom, McClelland and others are only valid in the United States since their research was done in a national cultural context which does not apply to most other parts of the world, including Sweden.

Another aspect of group decision making is the structure of the group. The number of group members might correlate positively to the number of possible alternatives generated while on the other hand correlating negatively on the evaluation and selection process, according to Shani et al. (2009). They state that most researchers agree that a group is most effective when consisting of seven to twelve members, depending on task complexity, leadership and information technology. Differentiation is another property of group structure. Horizontal differentiation is a measure of the number of functions that are represented in a group (Mohr, 1979), and vertical differentiation relates to how many hierarchical layers a group represent (O'Reilly & Roberts, 1977). The study of David et al. (1989) shows that when tasks are unpredictable, performance increases with greater horizontal differentiation. Their interpretation of this observation is that when unexpected problems appear, they need to be discussed among peers. In less complex situations, horizontal differentiation was still highly appreciated but did not lead to increased performance. On the other hand, a too high horizontal integration is unnecessary and might even impede

effectiveness. David et al. (1989) further found that when tasks are not very analyzable, greater vertical integration broadens the knowledge base and has a positive effect on performance. When dealing with less complex problems, a great vertical differentiation might instead be slowing down the process. This finding support the view by Cross et al. (2009) that unnecessary escalation of tasks makes an organization inefficient and slow.

Consensus is often the most preferable outcome of a group decision while at the same time the hardest to achieve. A consensus decision means that every member is supporting or at least accepting the decision (Shani et al., 2009). According to Yeatts and Hyten (1998), the process leading to a consensus leads to more creativity, innovation and a higher quality of the outcome due to the fact that the process becomes longer when searching for a solution acceptable to all. Consequently, a fast decision process might sometimes be preferred to a consensus. Since there is a great difference in accepting and supporting a decision, consensus can vary in unanimity. Geoff (1995) has identified six levels of acceptance of a decision: Enthusiasm, seeing it as the best choice, being able to live with it, disagreeing but still trusting the wisdom of the group, blocking the decision and needing further discussion.

2.2 DECISION MAKING AND ORGANIZATIONAL LEARNING

This section presents research in the intersection of the fields of decision making and social structures, shown as the shaded area in Figure 3 below.

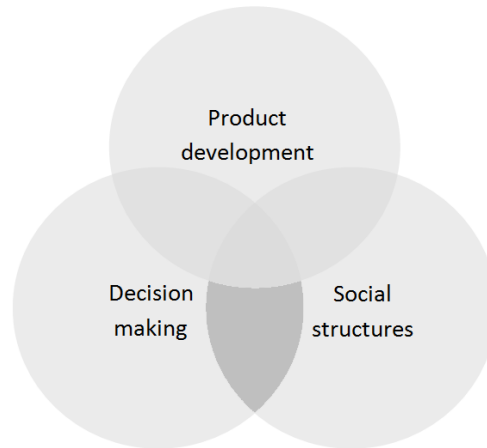


FIGURE 3 - DECISION MAKING AND ORGANIZATIONAL LEARNING

The concepts of organizational rules, routines, models of learning and their relations from an organizational view are discussed in this section. An overview of these concepts is presented in Figure 4 below.



FIGURE 4 - THE RELATION BETWEEN DECISION MAKING, MENTAL MODELS AND ORGANIZATIONAL LEARNING AND ROUTINES

2.2.1 RULES AND ROUTINES

Decision making is related to the concept of organizational rules. Behaviour and learning in organizations are largely based on rules and routines (Dierkes et al., 2003). There is no consensus on the definition of organizational routines, but routines can be seen both as recurrent interaction patterns over time or rules that govern behaviour (Becker, 2004). March (1997) and March and Simon (1958) define rules as a fixed response to a defined stimuli which simplifies the degree of choice. In line with this argumentation, rules could be said to attempt to simplify the act of decision making. In fact according to March (1997), decision makers unconsciously try to match a dilemma or problem with existing rules to find an appropriate rule to govern what action to take. Moreover, a central characteristic of organizational rules is that the concept involves participation of multiple individuals (Dierkes et al., 2003). Situations where no rules seemingly apply to govern actions can analogously be referred to as non-programmed decisions (Simon, 1960; Soelberg, 1966). According to Simon (1960) in these types of decisions human judgment, intuition, and heuristic problem-solving enter the stage. The enactment of routines is usually an unconscious process (Becker, 2008). It could also be argued that the degree of consciousness is higher in the case of non-programmed decisions because of these cognitive processes taking place. Concluding, the process of enacting routines and performing decision making is closely related.

2.2.2 RULES, ROUTINES AND LEARNING

The process that is organizational learning "*occurs when experience systematically alters an agent's behaviour and/or its knowledge*" (Argote, 2012; Minander & Andersson, 1999 in Becker, 2008, p. 152). Argyris (1977) defines organizational learning as the process of *detection and correction of errors*, thus taking a more collective standpoint of the organization. March and Simon (1958) state that creation and revision of rules can be regarded a basic outcome of organizational learning, triggered by non-satisfactory rules to achieve goals. From another perspective, Becker (2008) proposes that enacted routines cause organizational adaptation and learning, leading to organizational memory to crystallize as routines. Thus in line with arguments by Purser et al. (1992), organizational routines evolve through organizational learning. In turn this provides insights into how learning influences decision-making behavior.

2.2.2.1 SINGLE- AND DOUBLE-LOOP LEARNING

Argyris and Schön (1978) coined the term single- and double-loop learning. They proposed that when something goes wrong, the enacted rules and plans leading to the error are merely adjusted or re-tried without questioning the underlying rationale. This is single-loop learning and conversely double-loop learning occurs when underlying rationales are put under scrutiny before proceeding to action. It could be argued that both types of looped learning are triggered when no organizational rules are applicable or

produces a satisfactory outcome. What this also could entail however, is that there are limitations in how organizational learning creates and adapts organizational routines and affects decision-making.

2.2.2.2 PHYSICAL PROXIMITY

As information technology advances, physical proximity is often said to be less and less important for innovation (Morgan, 2004). On the contrary, Morgan (2004) claim that the physical distance is as important as ever. He states that even though information diffusion is easier and wider, understanding is not necessarily spread. Morgan (2004) explains this by saying that organizational learning requires diffusion of tacit knowledge. Tacit knowledge can be diffused remotely if it is codified into explicit knowledge, but only at a high cost. This is according to Morgan (2004) why understanding is often locally by transmitting tacit knowledge in social interaction during physical meetings.

2.2.3 ORGANIZATIONAL LEARNING EVOLVES MENTAL MODELS

Mental models evolve through learning (Argyris & Schön, 1978). A mental model is *"A concentrated, personally constructed, internal conception, of external phenomena (historical, existing or projected), or experience, that affects how a person acts."* (Rook, 2013, p.45). As individuals' behaviors are influenced by their mental models, consequently mental models also influence our perception and decision making. Moreover, frames of references is a concept related to mental models and could be said to be the source of which mental models are built. There are many definitions, and to clarify for the purpose of this thesis a frame of reference is *"a set of ideas, conditions, or assumptions that determine how something will be approached, perceived, or understood"* (Merriam-Webster dictionary, 2016).

2.2.3.1 SENSE-MAKING

The phenomenon of sense-making is connected both to organizational learning, mental models, and behavior. According to Weick (1995), organizations and individuals continuously "make sense" of their surroundings through interaction. Making sense in this context is to increase the (perceived) understanding of what takes place and understanding situations. Thus experiences are continuously shared by individuals through communication processes. Sharing perceptions as Weick (1995) explains it is thus a social influence process leading to individual internalization. This created mutual underlying perceptions of how to perceive situations and how to act.

2.3 SOCIAL NETWORKS

This section presents research in the field of social structures, shown as the shaded area in Figure 5 below. It begins with a presentation of social network analysis, thereafter examples of social network applications are provided. Last, decision making processes are discussed from a social network perspective.

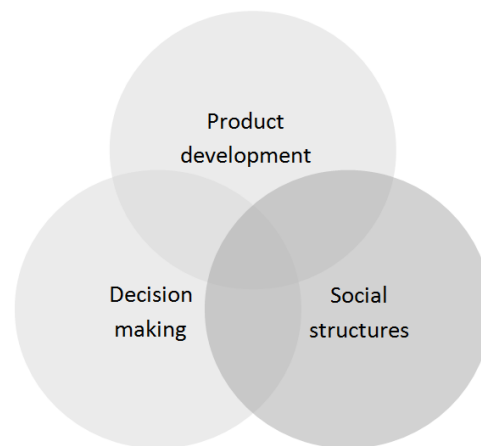


FIGURE 5 - SOCIAL NETWORKS

"A social network is a set of actors (or points, or nodes, or agents) that may have relationships (or edges, or ties) with one another. Networks can have few or many actors, and one or more kinds of relations between pairs of actors." (Hanneman & Riddle, 2005, p.17). Social network constructs attempts to depict and represent the social world whereas Prell (2012) and Scott (2011) explain; social network analysis (SNA) takes an approach to understanding it.

Diverse disciplines have intertwined over history in a non-linear fashion, resulting in the emergence of SNA as a distinct discipline first in the 1960s (Prell, 2012). SNA is now a distinct scientific paradigm enveloping, but not restricted to concepts and methodologies (Scott & Carrington, 2011; Prell, 2012). Four distinct fields contributed early to the development of what would become SNA and which are important to mention because of their heavy influence; gestalt psychology, social psychology, sociology and anthropology (Prell, 2012). Notable researchers were Lewin (1936) and Moreno (1934) who created seminal work in which they started to look at fields or spaces of social relations and its characters as networks. Moreno (1934) presented the first graphical depiction of a social network with his concept of sociograms. A more recent major contribution was the infusion of graph theory, providing a mathematical emphasis to what would become SNA (Prell, 2012).

Because of its diverse roots it is embedded in several traditional disciplines still active where it emanated from; social psychology, organizational science and economics to name a few. (Scott & Carrington,

2011). A common discussion around SNA is where theory ends and methodology begins, which could be attributed to the foundation of the construct of the network that is "*both empirically meaningful and fully mathematical.*" (Scott & Carrington, 2011; p.49). As such it is appealing to apply empirically which could help explain the diversity of disciplines it is now embedded in. In fact as Freeman et al. (1992) state, social networks are data of social structures. However they are also theoretical constructs in its own right.

Moreover, both its wide area of application and scientific roots stem from what it purposely studies; social structures. A social structure "*refers to a bundle of intuitive natural language ideas and concepts about the patterning in social relations among people*". (Freeman et al., 1992; p.12). Social structures are a way to conceptualize and analyze social life and consider relations to be the primary building blocks of the social world (Scott & Carrington, 2011; Freeman, 2004).

Freeman (2004) summarizes the key perspectives that form SNA which have been explained above:

- 1) It is motivated by a structural intuition based on ties linking social actors
- 2) It is grounded in systematic empirical data
- 3) It draws heavily on graphic imagery
- 4) It relies on the use of mathematical and/or computational models

2.3.1 SOCIAL NETWORK APPLICATIONS IN RESEARCH

There are various uses of SNA in research context in which networks can be applied to theorize around. In Formalist theories the mathematical form is of primary interest and study objects themselves and can be performed without empirical data (Scott & Carrington, 2011). Structuralist theories are the more prevalent form in which a network perspective acts as supplementary data to facilitate research and understanding. A requirement to study the phenomena of interest with a network perspective requires that it can be defined *relationally* (Scott & Carrington, 2011). Common structuralist approaches are to define concepts in network terms to infuse new understandings to create momentum in research and to deductively confirm various theories (Scott & Carrington, 2011).

There are countless research findings based on applying SNA in studies. A famous example is Granovetter's (1973) *Weak ties* theory which combined theories of cognitive dissonance and homophily to determine bridging ties for information and individuals with larger social capital. An even earlier example and seminal piece is how Barnes (1954) studied class structures in Norwegian societies. However, our aim in this chapter is to provide the underlying rationale of how structuralist theories are created.

2.3.2 SOCIAL NETWORKS AND DECISION MAKING PROCESSES

As posited in the thesis, the rationality of decision making is questionable and decisions take place in the context of social interactions. Hence regardless of who seem to be the decision makers, they are in different ways influenced by other individuals in social structures. As Nutt (1984) explicitly state that the decision activity is a social practice as well as an individual cognitive process.

2.3.2.1 NETWORK CONSTRUCTS OF INTEREST FOR THE STUDY

Communication is *"the act or process of using words, sounds, signs, or behaviors to express or exchange information or to express your ideas, thoughts, feelings, etc., to someone else"* (Merriam-Webster dictionary, 2016). Communication is hence a form of interaction and as such occurs in context of social relations which are assumed to coexist and be a prerequisite (Borgatti et al., 2009). In the communication process various influences can be expressed between participants. Mapping communication often provides a foundation in SNA research and is involved in many of the different networks below despite their different primary foci.

2.3.2.1.1 DIFFUSION OF INFORMATION TO REDUCE UNCERTAINTY

The term deliberation describes a social process in connection to decisions, taking place over time (Pava, 1986). Deliberations are *"...reflective and communicative behaviors concerning a particular topic. They are patterns of exchange and communications in which people engage with themselves or others to reduce the equivocality of a problematic issue."* (Pava, 1983, p. 58). But what occurs during deliberations? Decision making is always affected by uncertainty as future events are the output of decisions. Building further on Galbraith's (1997) definition of uncertainty, it also represents the additional information required to perform adequate decisions. Information is required for alternative generation as well as their evaluations. Therefore information needs to be attained by parties involved in decision making. Information is attained by individuals and diffused and processed between ditto, which can be depicted by networks.

2.3.2.1.2 SHARING PERCEPTIONS

Another possible explanation why individuals (and organizations) communicate and seek additional information is provided by Weick (1995). According to him, organizations and individuals continuously *make sense* of their surroundings through interaction. Making sense in this context is to increase the (perceived) understanding of what takes place and understanding situations. Thus experiences are continuously shared by individuals through communication processes. This created mutual underlying perceptions of how to perceive situations and how to act. This is also closely related to norms. Friedkin (2001) studied norm formation through influences in social networks to depict the process how shared attitudes developed. Cross et al. (2009) presents the concept of culture *carriers* which are individuals in networks pivotal to diffuse culture.

2.3.2.1.3 CONSENSUS

"How opinions are formed and how consensus is reached under such complex circumstances is the subject of a formal theory that has been under development by social psychologists and mathematicians since the 1950s (French, 1956; Harary, 1959; DeGroot, 1974; Friedkin, 1986, Friedkin, 1990, Friedkin, 1991; Friedkin and Cook, 1990; Friedkin and Johnsen, 1990)." Friedkin and Johnsen (1997) created a SNA theory attempting to explain how actors with heterogeneous initial opinions converge into a settlement of opinion through interpersonal influences, and the correlation with actors' positions in social structures. Hegselmann and Krause (2002) did the same in 2002. Siegel (2009) studied how interdependent actors participating in a process gravitate, or act towards aggregate collective action through a more indirect process of collaboration.

2.3.2.1.4 MAPPING PARTICIPANTS AND ROLES IN DECISIONS

Rob Cross has spent considerable time in studying decisions with an SNA lens. Cross et al. (2009) map decisions as they take place in networks of individuals. By mapping communications flows between participants recognized by each individual asked, participants could be stratified according to their roles in decision making. It could be information provider, advice provider, and decision stakeholders. The biggest contribution of this paper was the linking of communication to decisions, and raising the issue that communication intensity is not equal to quality in communication for the benefit of the decision outcome.

Amabile et al. (2014) studied a similar process of how employees actively seek advice from co-workers in face of problems, which are a form of decision. This mapping proved to be an excellent tool for understanding the communication and what parties are involved, (Amabile et al., 2014). Amabile et al. (2014) also elaborated on criteria when helping episodes are successful and not.

2.3.2.1.5 CAS

The combination of decision making through networks in product development has been studied by McCarthy et al. (2006). They considered the current product development frameworks too rigid to accurately model the dynamics of the process and instead introduced the Complex Adaptive Systems (CAS) framework into product development. A CAS is a system of interdependent interacting nodes, collectively producing difficult to predict outcomes especially by looking at separate nodes. It is a network model originating from domains of biology and information networking. But it is quite similar to social networks if the nodes are individuals in the network in question. The CAS can be presented as a descriptive framework for modeling organizational interdependencies by considering decision making as interactions between agents (Schoderbek, et al., 1985). Agents are partially connected units capable of autonomously making decisions and of social action (McCarthy et al., 2006). These agents are influenced by rules and formal procedures, but also by other agents. A cluster of agents can be aggregated to an agent

in a higher system, e.g. by regarding individuals as agents who form a project group which is an agent on an aggregate level. McCarthy et al. (2006) uses the CAS framework to model product development projects in the three levels proposed by Krishnan and Ulrich (2001): strategic, review and in-stage. The strategic level consists of project portfolio, project management and budget decisions; the review level illustrates go/non-go decisions typically during gates and the in-stage level maps decisions in single projects as design and problem solving (Krishnan and Ulrich, 2001). McCarthy et al.'s (2006) use of the CAS framework synthesized the fields of networks, decision making and product development but it did not completely reveal how product development decisions are formed. To do this, further elaboration on the decision making process are necessary.

2.4 DECISIONS IN PRODUCT DEVELOPMENT

This section presents research within the intersections of the fields of product development, decision making and social structures, shown as the shaded areas in Figure 6 below. First, a general presentation of decision making at different organizational levels is presented together with different views of product development project management. The second part discusses the popular Stage-Gate model.

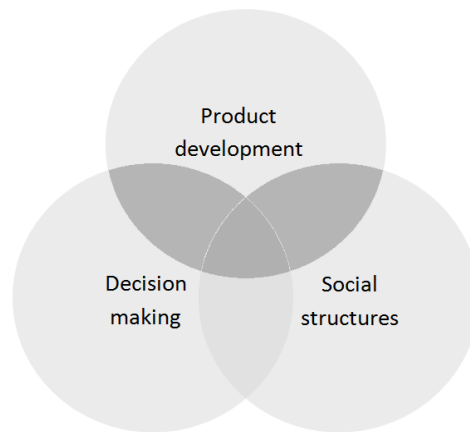


FIGURE 6 - DECISIONS IN PRODUCT DEVELOPMENT

There are many categories of decisions at different levels in any product development project. While both researchers and companies have different views, there are also some similarities. Figure 7 below represents a synthesis of some of the most common views and the relations between different decision areas. Product development decisions at a high level concern multiple projects, e.g. research and development strategy and project portfolio management. These are often made by senior management (Krishnan & Ulrich, 2001). As stated above, within single product development projects, McCarthy et al. (2006) divide the decisions into three levels: Strategic, review and in stage.

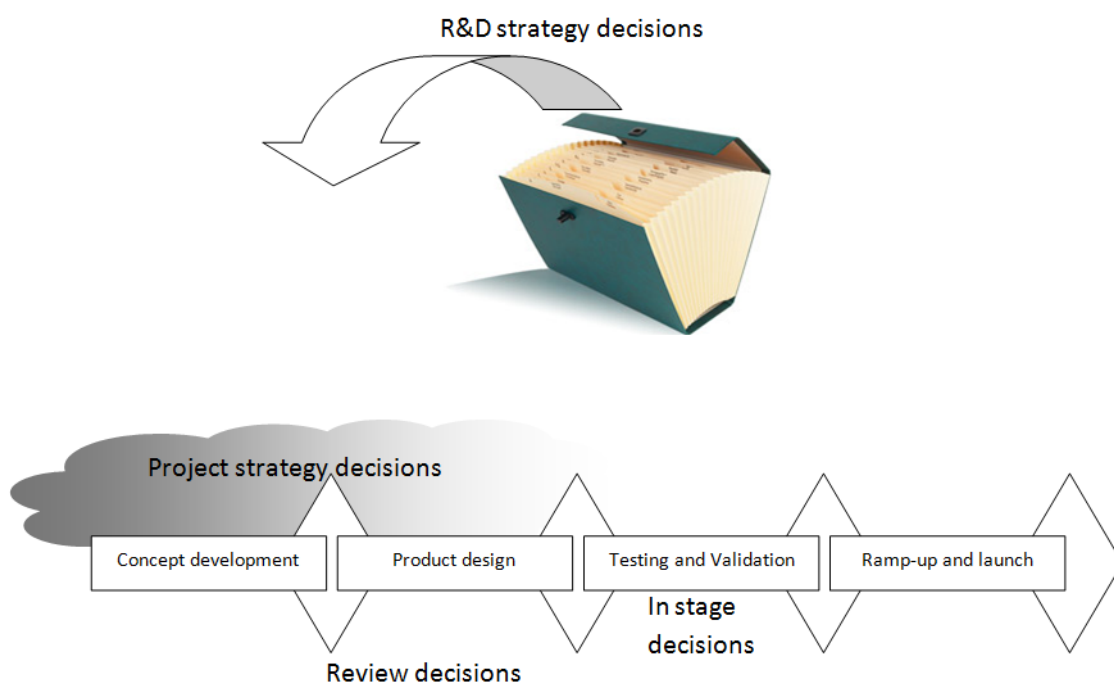


FIGURE 7 - DECISION AREAS IN PRODUCT DEVELOPMENT

Strategic decisions are handled during the early part of a project and are often made by senior management (Bonner et al., 2002). The decisions concern scope and objectives of a project, regarding, market positioning, competitor analysis and technology platforms (Bonner et al., 2002). Review decisions are often made by middle or senior managers during gates, handling go/kill/hold/recycle decisions that affect project speed (Cooper, 1990; Murmann, 1994). The timing of senior management engagement in project decision making seems to be of great importance. A study of Bonner et al. (2002) shows that early senior management involvement in e.g. project goals and evaluation criteria affects project effectiveness positively. However, they also found that senior management interventions in the latter part of projects negatively affect project performance. The explanation for this might lie in micro management.

In stage decisions relates to issues during the different project phases. Although differing in scope, complexity and organizational context, most product development projects contain a similar set of activities. The names, contents, order and relations of these activities are debated among researchers. However, many researchers include the some or all of the following four phases when categorizing product development activities: Concept development, product design, testing and validation and production ramp-up and launch (e.g. Cooper, 1990; Clark & Fujimoto, 1991; Wheelwright & Clark, 1992; Thomas, 1993; Griffin & Hauser, 1996; Krishnan and Ulrich, 2001; McCarthy et al., 2006). In stage decisions are made at the operational level (Krishnan & Ulrich, 2001), and in consideration to the frames of previous strategic and review decisions (McCarthy, 2006). Even if the order of the phases is the one most commonly represented, it is often not sequential or linear (e.g. Cooper, 2008). Projects might vary

well be in different stages concurrently, there may be sub projects and iterations between stages are common (Cooper, 2008).

The beginning of product development projects is distinguished by a high level of uncertainty, where decisions often are based on rough estimations rather than accurate information (Kihlander, 2011). As projects progress, more information is gathered to guide decision makers. But for every decision made, the scope for coming decisions are narrowed; the degree of freedom decreases. As stated above, this inversely proportionality is called *The Designer's dilemma* (Sobek, 2014) or *The Design Process Paradox* (Ullman, 1997). Kihlander (2011) recognizes this as a real problem during the concept development phase, stating that both risks and opportunities must be balanced. Verganti (1997) notes that product developers might be tempted to rush into detailed design development in search for more confident information.

Krishnan & Ulrich (2001) define key decisions in respective project phase when reviewing previous research. They identify five core decisions during the concept development. Those decisions concern target values of product attributes, product concept, product variants, architecture and industrial design. Major decision areas in the product design phase are made regarding key design parameters, components' configurations and assembly and detailed component design as material and process decisions. During the testing and validation phase, the main decisions consist of choosing prototyping plan and technologies. In the production ramp-up and launch phase, the most important questions that need decisions are what market testing and launch plan and ramp-up plan should be designed.

2.4.1 THE STAGE-GATE MODEL

The Stage-gate model emerged as a tool for handling many of the failures and uncertainties in product development. Prior to it, the perception that product development projects were uncontrollable was very common (Cooper, 1990). According to Kihlander (2011), the Stage-Gate model is one of many similar normative models, generally called consensus model (Rozenburg & Cross, 1991). These models had been used by several companies before Cooper's seminal article, e.g. by 3M as early as in 1964 (Cooper, 1990). The Stage-Gate model has however been hugely popularized and adapted into many different settings, why it is here used as an umbrella term for all models with stages and gates.

Cooper (1990) considered that development processes needed to be more effective and efficient. By frontloading and conducting pre-studies, he claimed that product development projects would need less rework and would better fit the market needs (Cooper, 1990). He thought that many of the product development failures were the results of too strong tech push, and argued that more of a market pull orientation was needed. The solution, as he saw it, was Stage-Gate models used by several American and Japanese companies. Cooper (1990) compared the product development process to production process,

arguing that the quality of the output would increase by reducing variance in the production process, and that a gate was the equivalent of a quality control checkpoint. The comparison shows clearly that the purpose of the Stage-Gate is efficiency.

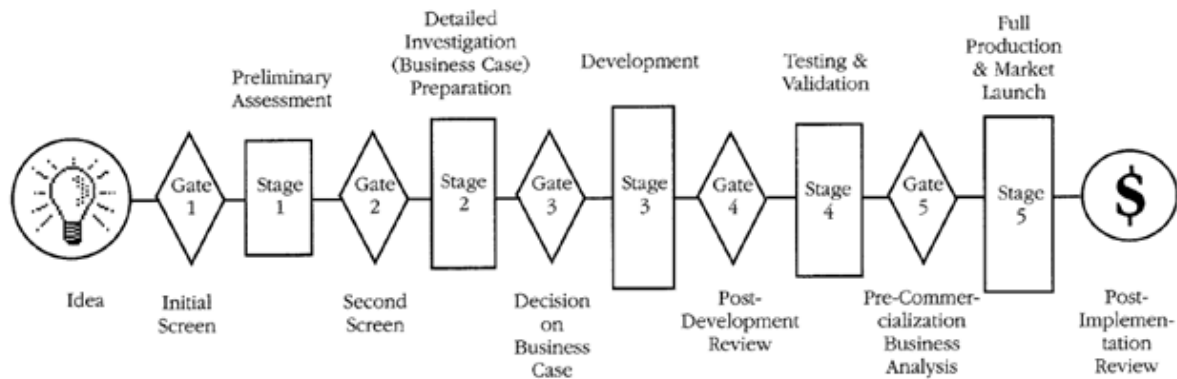


FIGURE 8 - COOPER'S (1990) STAGE-GATE MODEL

Figure 8 above depicts the typical phases in a Stage-Gate model. Most often it composes of four to seven stages and gates, depending on company and scope (Cooper, 1990). Cooper claims that even though the cost increases with every stage, the quality of the information available also increases, why risk is managed. Every stage is preceded by a gate, where the project is evaluated according to predetermined criteria. This evaluation is done by a so called gatekeeper committee consisting of senior executives. The project manager then receives a verdict in the form of a go/kill/hold/recycle decision together with an agenda for the following stage from the gatekeepers (Cooper, 1990). The project manager then receives the resources needed for the next stage and continues the project according to the new agenda.

The Stage-Gate process in Figure 8 contains the following phases (Cooper, 1990): First, an idea of a new product starts the process when submitted to Gate 1. If a go decision is made here, the project is born. This gate considers strategic alignment, feasibility, scope, synergy with current business and market attractiveness, but no financial considerations. Criteria of both *must meet* and *should meet* are used. Stage 1 is where rough technical and market assessments are conducted. The second gate is essentially the same as in the preceding, but this time based on the assessments of Stage 1. During the next stage, further customer analyses and concept testing are done together with competitor assessments, capability assessments and a thorough financial analysis. The third gate evaluates the project criteria and reviews the activities during the latest stage. The finance is the most important factor during Gate 3 since the next stage is substantially more costly than the preceding ones. In order for the project to have a relevant outcome, the definition of the project are also discussed and agreed upon. Stage 3 is where the actual development is carried out.

Different activities are carried out concurrently. Gate 4 evaluates development work quality and project economy. Test and validation plans are drawn for the next stage. Stage 4 is a stage of validation. The product, production, customer acceptance and other aspects are tested and pilot studies are carried out. Gate 5 is the last one where commercialization is decided upon. Marketing and operations plans are reviewed together with the validation results from Stage 4. The last stage is the commercialization, which is followed by a post-implementation review that should transfer knowledge and aid future projects.

According to Engwall et al. (2005), the main advantage of Stage-Gate models are increased control and the fact that the model is easily understood. Furthermore, senior executives are forced to be involved and commit to the project when acting as gatekeepers (Cooper, 1990), usually considered as a necessity in product development. Cooper (1990) also recognizes the effect that Stage-Gate models have for ensuring enough front-loading early in the project. Stage-Gate models also encourage communication between functions in organizations (Cooper, 1990; Norell, 1992; Cross, 2000; Engwall et al., 2005; Ulrich and Eppinger, 2008). Griffin and Hauser (1996) recognize the integrating effects of the Stage-Gate model, claiming that it decreases integration barriers between research and development and marketing functions. In effect, they claim, it decreases development time. However, to provide maximal advantage it should be combined with other mechanisms (Griffin & Hauser, 1996).

Even though the Stage-Gate model has been widely used during the 1990's and 2000's, several researchers have criticized it. The focus on efficiency in the new product development process leads to ignorance of other factors that are vital for innovation such as flexibility, informality, feedback and autonomy (e.g. Clark & Fujimoto, 1991; Dougherty, 1992; Griffin, 1997). Other criticisms of the Stage-Gate model is that it tends to create incremental innovations (McCarthy et al., 2006) and that it cannot handle a changing environment (Engwall, 2003). Cooper (2008) disagrees and objects much of the criticism. He claims that the Stage-Gate model has developed to include iterations and context adaptation, among many other things. Cooper (2008) also claims that the greatest misuse of the Stage-Gate model is when gates malfunction. Gatekeepers who dare not to kill projects beyond the first gate or let projects through but do not allocate funds for the proceeding stage are the two most prominent examples according to him.

As an alternative to linear models, iterative models have been developed. They are designed to better represent feedback loops and the gaps between stages and gates (McCarthy et al., 2006; Kihlander, 2011) According to McCarthy et al. (2006) these models are better suited for radical innovations. Kihlander (2011) provides an explanation for the lack of iterative models, stating that iterations are hard to visualize into process models. Even so, iterative models do not include differences in structure and behavior during the process (McCarthy et al., 2006). Kopecka et al. (2011) points out that current research have moved away from prescriptive to descriptive approaches as a way to adapt to different settings.

2.5 SUMMARY

The review of the different theoretical domains and their intersections presented above lead to the creation of a framework that would serve as a foundation for the ensuing research. The framework connects the different concepts to create a cohesive model and acted as a lens the empirical findings were viewed through.

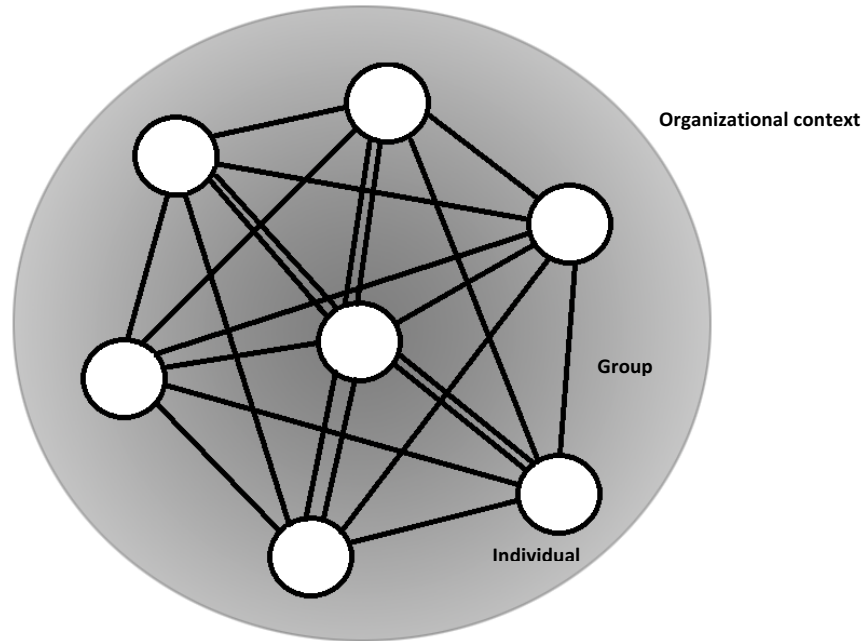


FIGURE 9 - A FRAMEWORK OF COLLECTIVE DECISION MAKING

The framework in Figure 9 maps the different decision making factors which are presented in the theory chapter and places them in relation to each other. Three separate levels of factors are visible; Individual, group and organizational context. Factors affecting decisions at the individual level are rationality, cognitive biases and unconscious thought effects. Group level factors are collective bounded rationality, stakeholder constellations, communication and group and social network dynamics. The organizational context layer contains product development management processes, cross-functional product development project teams and organizational learning. All factors play important roles for collective decision making in product development and influences comes from all levels.

3 METHOD

This section covers the chosen research strategy, design, data collection and analysis methods. It also describes the trustworthiness of the thesis and some of the ethical considerations made through the process.

3.1 RESEARCH STRATEGY

The purpose of the study and the research questions that are to be answered are explorative in nature, seeking to understand and describe phenomena. No initial hypothesis with the aim of being deduced in the research was created and as the main aim of the research was to develop theory, an approach with inductive traits was taken.

Attempting to understand decision making processes involves delving into cognitive processes. Therefore human behavior, conceptions, meaning and intention would inevitably play a major part. Therefore a phenomenological- and hermeneutic stance was adopted by the researchers as recommended by Bryman and Bell (2011). Theoretical assumptions in the symbolic interactionist perspective rooted in phenomenology assumes that individuals and society are inseparable from each other and created through social interaction (DeLamater & Ward, 2006). The researchers were aware that social interactions and phenomena was also to be studied extensively in the research. Therefore a social interactionist theoretical perspective was adopted and adhered to throughout the research as it would facilitate a boundless transition between the individual and social perspectives. According to Bryman and Bell (2011) interpretivism has its roots in these three paradigms. As such, this epistemology justly describes the view adopted by the researchers.

Active in the related social research area, Freeman (2004) states that social research can be performed in two ways. The dominant approach has been to exclusively focus on individual behavior and the other approach is referred to as structural research in which relationships and interactions between individuals are the units of analysis (Freeman, 2004). Interpretivism lies somewhere in the spectrum between these approaches delving into both. Social research is usually qualitative in nature. However structural research often involves quantitative data collection and analysis to help understand social interaction and is viewed as beneficial supplement (Scott, 2012). Structural research heavily implies those social phenomena are collective constructions inseparable from the individuals creating them (Freeman, 2004). In combination with the researchers' adoption of symbolic interactionism it was clear that a constructivist ontological approach guided the research.

Interpretivism is the main epistemological orientation of qualitative research (Bryman & Bell, 2011). Having an approach with inductive influences and an interpretivist orientation favors a qualitative strategy. However also employing quantitative methods in the study classifies this research as one of mixed methods (Bryman & Bell, 2011).

Although the research was largely inductive in nature, previous research and theories into relevant topics was delved into already in the scoping of the research area and in tandem with the formulation of the research questions. For researchers, pre-understanding is always present in one form or another. In this research, the concept framework by Gummesson (2000) describes how pre-understanding was created. Pre-understanding of the researchers could not be neglected as the research progressed - it inevitably involves pre-conceptions which closely relates to deductive reasoning. Therefore a just description of the research process was that of an abductive approach (Dubois and Gadde, 2002).

3.2 RESEARCH DESIGN

The research was of an exploratory nature. In this setting, Yin (1994) recommends the research design to be a case study. Furthermore, a case study combining qualitative and quantitative data serves a conventional approach, and case studies are also compatible with an abductive approach (Bryman & Bell, 2011). Many prominent researchers advocate multiple case studies to increase generalizability and robustness in findings (Dubois & Gadde, 2014). However these arguments are often coupled with a positivistic approach which was not adopted in the research. The available resources for conducting the research were finite, both in terms of available organizations to study and time. Consequently a single case study was chosen - increasing the number of cases would decrease the depth of exploration. As Bryman and Bell (2011) states, the benefit of a single case study is the possibility for deep understanding and in depth elucidation of the phenomenon of interest.

3.2.1 THE CASE

Having chosen a single case study, the next step was to determine the object in focus for the research. The case selection was based on efforts to maximizing possibilities for learning for of the researchers, according to a principle laid out by Stake and Kerr (1995). Several factors guided the researchers in this selection. First, a manufacturing company with product development projects was needed. Second, accessibility for the researchers was a major factor. Third, as a qualitative approach was adopted involving study of in-depth human interactions, the number of project participants couldn't be too small or too large. Fourth, a scoping in terms of how long the project had elapsed was preferred. The project would have to be short enough to avoid replacements in the project team. Fifth, having an amount of time passed was

considered preferable by the researchers as reflection by the participants would facilitate the research process. However, the risk of fading memories meant that the time elapsed could not be too long. Therefore, a suitable age of a case project was considered somewhere between two and five years since its start.

A manufacturing company with product development displayed interest in participating in the study. It was geographically placed in the vicinity of the researchers and had potential gatekeepers with keen interest in the research area. The company of interest had a project that had taken place a couple of years prior to the time of the study, therefore satisfying the age criterion. For the organization it was a large project with a core project team consisting of six members. It was seen as a project with a high level of innovation and collaboration, which the researchers believed could highlight the phenomenon of interest.

3.2.1.1 SYSTEMATIC COMBINING

As the research pertained a single case study and was abductive, systematic combining as proposed by Dubois and Gadde (2002) was chosen as research design. It is beneficial in exploratory research and where previous relevant research can be incorporated and possibly refined (Dubois & Gadde, 2002). Systematic combining is not as simple as combining a deductive and inductive approach. It implies an iterative and emergent process weaving empirical findings and theory as the analytical framework of the researchers evolve (Dubois & Gadde, 2002). In systematic combining the analytical framework plays an integral role and manifested as an early mental framing by the researchers, created by their pre-understanding (Dubois & Gadde, 2002). The best indicator of this analytical framework was the theoretical framework. Although with narrow boundaries on the outset, it gradually evolved through data collection and analysis as the whole of the research took form. The process can best be visualized by a constant match-making between the empirical world, theory, and the case took place. As pre-understanding lead to understanding, the exploratory process followed the general logic of this type of research as described by *the exploratory wheel* by Routio, (2007). Figure 10 below presents a graphical representation of Dubois and Gadde's (2002) systematic combining.

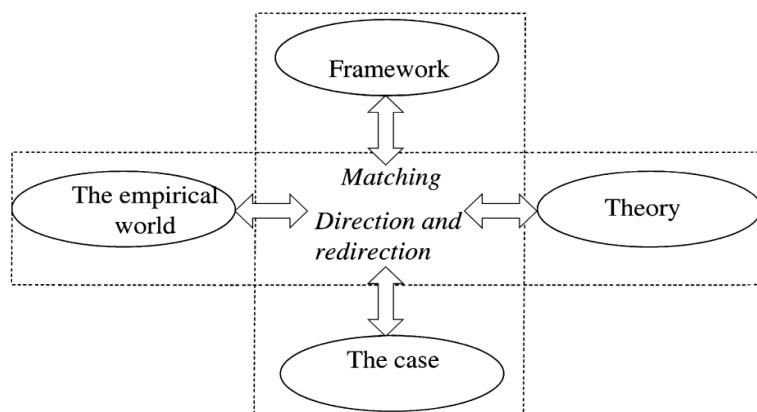


FIGURE 10 - DUBOIS AND GADDE'S (2002) MODEL OF SYSTEMATIC COMBINING

3.3 DATA COLLECTION AND ANALYSIS

Initial data collection was performed through a literature review, which continued throughout the research to form the theoretical framework.

Empirical data was foremost collected by means of qualitative interviews. Strategic sampling was used throughout the study as the researchers gained further insight in who were involved in the project. The quantitative data in the study were in the form of social network structures. Ego-centric networks are both a form of network and data collection method that originates from a set of individuals in defining networks of interest (Scott & Carrington, 2011). Thus simultaneously performed with interviews and according to SNA methodology, nodes and potential connections for an ego-centric network was constructed. The SNA data collection and analysis will be elaborated in- depth further below.

The interviews were semi-structured and recorded. An initial interview guide was devised out of the early analytical framework and transformed during the course of the research. The interviews were semi-structured and heavily influenced by the researchers adoption of a hermeneutic research approach, letting the interviewees guide the process equally as much as the researcher. In order to draw out vivid memories of past events, critical incident technique was used to illuminate specific events since it is a suitable approach according to Bryman & Bell (2011).

After the interviews had been performed a discussions took place between the researchers to air thoughts. The interviews were transcribed in order to get a complete account of the series of exchanges. Each interview was divided into two parts, each transcribed by one researcher. This was to align the researchers' interpretations of the interviewee, in order to acquire shared understanding e.g. of phrases, intonations and hesitations.

The ensuing data analysis was performed by coding as it is the starting point for most forms of qualitative analysis (Bryman and Bell, 2011). The grounded theory methodology focuses on induction and advocates an iterative research approach going back and forth between data and its analysis, and excels at capturing complexity (Bryman & Bell, 2011). In this sense it is compatible with systematic combining. Thus an emergent approach was taken to collecting and analyzing data. Open and axial coding practices proposed by Strauss and Corbin (1990) were performed, and emerged concepts and categories served as building blocks for analytical constructions. The researchers acknowledged the difficulty of the subject and their own inexperience, which lead to solely coding jointly. Thus inter-coder agreement was continuously achieved and fragmentation of data kept at a minimum. The researchers' did reflect upon their own experiences and performed self-observation as a central part in the analytical framework. Interviews were

coded and re-coded in an interweaving pattern which facilitated the researchers in detecting theoretical saturation which functioned as a signal to end further interviewee sampling.

3.3.1 SNA

In creating social networks, methodologies were adhered to that were presented in the theory chapter 2.3 *Social networks*. For more extensive explanations see Appendix 3.

As previously mentioned, ego-centric networks were created as data collection progressed. They were with a neighborhood of level $N = 1$ and these networks were joined together to create a composite network. Three building blocks collectively set restrictions when constructing networks, and having identified the nodes provided a restriction. From the results of the interviews, interaction played an important part around decision making processes and was the primary way to connect the nodes. The form of interaction was further narrowed down to communication as it was easy to grasp for both interviewees and researchers and would later on serve as a backdrop for the analysis. Communication arose during numerous different decisions during the project. Among the identified decisions some patterns were identified during the qualitative interviews. When all the project participants were asked to identify what they perceived to be the most critical decisions during the project, several of them considered one specific type of decisions important. It was the decisions concerning if component parts in the product design should be produced by tooling (moulds) or not and by which supplier. This would entail various degrees of investments depending on the part in question. All parts were considered at some point in the project, and it could also be decided that it wouldn't be produced by that method as well as delaying the decisions in time instead finding other means to produce more expensive for each part, but wouldn't require any investment. Since all perceived the decisions to be one of the more important decisions, the finding indicated that there was something worth investigating further around these decisions. Thus a second restriction was put in place mapping the network according to communication taking place around these decisions.

Further resolution into a specific tooling decision was not considered possible. The interviewees had difficulties in remembering exactly whom they communicated with and in what way for each of the separate decisions since the interviews were conducted several years after the decisions were made. However, the interviewees could easily remember which other persons they communicated with about tooling decisions in general. Mapping communication connected to a category of decisions had the effect that external contacts, as e.g. suppliers, could not be mapped, since they were different with every decision. Thus, a third restriction was made to only include the persons inside the Company.

To complement, nuance and detect different types of social structures, additional relations were mapped between the nodes already linked to communication. These multiplex relations would facilitate creating different types of social networks. Additional relations that were mapped were communication intensity regarding the decision, the interactions' overall importance for decision result and the degree of friendship between individuals. As stated above, Cross et al. (2009) consider much of the information exchange involved in decision making as unnecessary. If this would be the case, the information quality would vary and therefore be of interest when exploring the decision making process.

When two interviewees both evaluated the relation in question between them, a weighted average was used in order to triangulate the weight. A query also asked for the role of the other corresponding participant in each interaction. With this it was possible to assess the direction of the interaction in terms of “*who helped who*”. The questions were open-ended and the answer alternatives were generated by the respondents themselves. The answers were given in qualitative form, such as “*important*” and “*less important*”. However the respondents were always required to rank the different options between them. This was used to calibrate the response sets between respondents if the type of answers given differed. If any unclear conditions arose during this process, the judgment of the researchers was used to decide. In the end a generic typology was achieved. Further details about the social network analysis are presented in Appendix 4.

The constructed social networks are summarized in Table 1 below:

TABLE 1 - SUMMARY OF THE SOCIAL NETWORK ANALYSIS MAPPINGS

Factor	Directed edges, Out degree node size
Importance for decision result	x
Friendship	x
Intensity of Communication	x

3.4 TRUSTWORTHINESS

This section discusses the different concepts of trustworthiness that are applicable for qualitative studies according to Bryman and Bell (2011).

3.4.1 CREDIBILITY

In order to ensure credibility, some information, e.g. dates and team members' presence at meetings was triangulated by asking the same questions to several interviewees and through observing, in accordance with Bryman and Bell (2011). In this way, some uncertainties due to fading memories were resolved. Self-observations were also used with the aim to check whether findings, like e.g. anchoring, were believable. The combination of data collection methods was also used to fill in gaps in the data, in accordance with Dubois and Gadde (2002).

Bryman and Bell (2011) furthermore state that the trustworthiness of a study lies on the foundation of what they call researchers' *good practice*. Therefore, the researchers have strived for acting according to good practice, and have sought for answers from colleagues and the supervisor when questions arise. Prior to the interviews Kvale's (1996) list of *Ten criteria of a successful interviewer* with the additions of Bryman and Bell (2011) was reviewed in order to enhance interview quality. In addition, the step-by-step guide for formulating interview questions provided by Bryman and Bell (2011) was followed: The questions emerged from research on product development, decision making and social network. Then, an exercise interview with the interview template was conducted and a few changes were made before using it for the case interviews. After each interview, it was discussed among the researcher in order to confirm issues and better remember subtle items.

3.4.2 TRANSFERABILITY AND DEPENDABILITY

The transferability of the study from the context of Swedish manufacturing was not a priority, since the purpose of the study was to *explore* the decision making processes, in manufacturing product development projects, as they take place in social structures. The transferability will therefore be revealed if further research is conducted. To facilitate this, the study had an aim of offering a thick description about the case (Dubois and Gadde, 2002). Therefore, a description of the case Company is found in Appendix 1. Moreover, the interview template and the SNA template have been provided in Appendix 7 and 8. The same applies for the study's dependability. Although, what could be said in terms of transferability is that the case company is not unique as a medium sized manufacturing company with product development controlled by a stage-gate process.

3.4.3 CONFIRMABILITY

Complete objectivity is never possible to achieve in social science (Bryman & Bell, 2011), neither in this study. Instead, the researchers have intended to act in good faith. Being two researchers gives the possibility of auditing each others, which have been used during the study. In addition, the confirmability is controlled by the opponents during the presentation of the thesis, as proposed by Guba and Lincoln (1994).

3.5 ETHICAL CONSIDERATIONS

Many ethical issues might arise during conduct of research (Bryman & Bell, 2011). In order to guide the researchers, Diener and Crandall's (1978) four main ethical principles were strived to adhere to; no harm to participants, informed consent, avoid invasion of privacy and deception. It is primary the researchers' responsibility to prevent harm to participants (Bryman & Bell, 2011). In order to do so, the interviewees are kept anonymous and the details about their identity are considered vague enough to prevent identification. Respondent validation was performed for every quote in the thesis to prevent ethical transgression. Informed consent and avoidance of deception was achieved after researchers presented the purpose of this study, and the right to not answer a question was presented to the participants prior to the interview. The interviewees were asked for consent during and after the data collection. The template for the interviews is found in Appendix 7. Prior to every interview; all conditions were presented for the interviewees. These conditions are found in Appendix 6. Moreover, they were informed that the data would only be used for this research, and in any case of disagreements about the content of the interviews; The information in question would be removed. There were events when the researchers visited the case company that information was given by employees outside interviews, from individuals maybe not aware that they potentially could be participating in the research. At these times, the researchers discussed between themselves the implications of this unawareness and attempted to solve it by asking for a real interview instead where all ethical conditions could be presented. The researchers took precautions around data management and avoided storing sensitive data on cloud services where confidentiality could be guaranteed. After the research, all transcripts and recordings were destroyed.

4 RESULTS

This section presents the empirical findings of the study. First, a discussion is presented concerning the complexity of collective decision making, which explains why a cognitive model for understanding involvement in product development decisions was created and used, which is also presented. Thereafter, the findings concerning the three remaining research questions are presented, structured according to the different themes that have emerged from the data collection. In Appendix 1, there is a presentation of the case Company, followed by a brief description of the case project.

4.1 UNDERLYING MENTAL MODELS

To ask questions about decision making in product development is to ask about intricate thoughts, perceptions and interpretations, unclear influences, unknown outcomes and social relations. For the rationale behind decisions to be understood at a deeper level, cognitive models of rationality and frames of reference were discovered, developed and served as a backdrop for the empirical findings.

4.1.1 RATIONALITY

Whether or not decisions were rational, some interviewees expressed it as such in hindsight. Quoting one interviewee regarding one major decision: "*In the end, with all the facts on the table, the decision was performed*". For some interviewees, it seemed desirable to perceive executed decisions as such. For example, interviewees had tried to use more formalized decision tools but abandoned them, claiming that they could not include the many different aspects or preferences that product design decisions often contain. On the other hand, one interviewee let his "*gut feeling*" guide in decision making, according to him. The relationship between judgment and rationality seemed unclear from the findings. Elaborate descriptions of how decisions actually happen were seldom expressed – an awareness was more or less expressed by the interviewees.

4.1.2 FRAMES OF REFERENCE AND PERCEPTIONS

The interviews show support for the notion that how a person makes decisions depends on her experiences. Among the interviewees, everyone expressed a more or less strong awareness of the frames of reference of others, while there was a wide difference in awareness of the own frame of reference. One of the interviewees explained it in the following way: "*where the deals go really depends on the project purchaser who handles it; whom you ask. Because even if you ask three or four of [the suppliers] about*

every detail, it is not for certain that you ask the same ones as your colleague would have asked. Imagine if people would have realized how important this is!" The statement visualizes the effect of differing frames of reference and also shows that this is not always evident. What seem to be most obvious to all interviewees are differences in frame of reference that could be traced to different functional points of view.

One of the interviewees was relatively inexperienced in product development during the project case. This interviewee's frame of references in the case of the specific product originated mainly from other areas. He stated that *"My feeling is that if you have worked here in 30 years, you have a strong (industry) think, that 'this is the way we have done it in the (industry's) world. You work roughly like that. However, I can look at a car and think 'What can I use here?'"* Another interviewee's comment about this is that *"The benefit with it is that someone asks questions because they don't have the experience, and then sometimes you come to ask yourself 'Why do we do it like that?' So it is always good to have someone who comes in and asks that kind of questions."* These expressions might indicate that experience of the industry was considered as more of a hinder than an advantage in product development decision making, but all interviewees state that they consider experience as a most valuable asset.

A very interesting self reflection was made by one of the interviewees about the effect of the own frame of reference on decision making: *"You don't know what the right decision is yourself. Sometimes you go in with different approaches, and sometimes you may feel that your own approach doesn't hold as well as the other approach."* The interviewee expands this argumentation when exemplifying with a more recent new venture: *"I have chosen to keep my hands from it. I have a young guy who has very limited experience of [the subject]. I only try to lead him to answer questions and help and coach him. But he must work very hard with these questions. Because If I go in I will contaminate, so to speak, what might be the truth. Because I have a certain experience that may not be totally relevant, since (the subject) is not one of my fortes. There is a risk that I go into the wrong direction, and then the facts that I have are irrelevant, they are not quite true."* Besides carefully considering the eventual blindness the own view might lead to, the interviewee clearly considers differences in frame of reference to be problematic such as when a group of persons are to make a decision in an area that is new to some of them. The interviewee furthermore thinks that the most important thing is to have a shared understanding of the bigger questions, a reasoning that allows for some difference in frames of references.

Nonetheless, the interviewees see problems in having too divergent frames of reference. An example of this was a critical episode from early in the case project when the settings were unclear. (Further details about this critical episode are described in Appendix 5.) Several team members state that they got a joint frame of references during this one customer visit, something appreciated by all who were there. It was described by one interviewee in the following way: *"All of us heard the same thing, undistorted. If I would*

have brought this [to the others] I would have been selective, consciously or unconsciously of what I want, depending on which direction I have. Now everybody heard the same thing, and that is a way of building knowledge and culture. This means that in the decisions we [then] have to make, we have the same starting point. We have understood which criteria that is important.” This suggests that frames of references can be significantly altered by one single event. However, the prerequisites remain unclear since other parts of the interviews exemplify events when this did not happen and when it instead took long time to change frames of references.

One interviewee also recognized the effect of shared frame of reference, stating that *“I think that it just happened to be a good constellation. Just that ... nobody had more information than anyone else in advance, but that everyone was pretty neutral. I think that it matters quite a lot, that you build a team in a better way like that than when someone knows everything. Then this person becomes the leader in a sense and you go and ask that person.”* This statement expresses the benefits of forming a team in which no one had a fixed frame of references or an information advantage. This is an interesting conception of the team formation, since three team members had worked together during the previous project. In another aspect, the reasoning is the same as the quote above it, since both describe critical episodes that result in shared frame of references. The quote also indicates that the interviewees shared the notion that frames of reference seem harder to change than to create.

Another phenomenon connected to frame of references was described by an interviewee. When an area where the own personal frames of reference are diffuse, active decision making can be difficult to accomplish at all: *“I have a defect. I’m aesthetically blind, you could almost say. I cannot say ‘How ugly that was!’ or ‘What a beautiful design!’ I don’t see those things. I like everything that is very clever or innovative even though it might have the wrong shape in the eyes of the beholder.”* The interviewee states that he seeks advice among colleagues to compensate for his perceived disability. Besides describing consequences of having a vague frame of reference, it shows the benefit of reflection and self-awareness when making decisions. Another interviewee linked the absence of references to greater creativity, meaning that persons who had little else to go on had to rely on their own creativity. This is however contradicted by the interviewee above, who claimed that there is no such thing as a completely novel idea; that all new is built on something already existing.

One of the most prominent examples of setting a new, joint frame of references in an uncertain environment in the case, was the way of considering customer needs. The importance of this had not been emphasized in previous projects, but seems to have become shared to different extents in the project team. The interviewee explained this by saying: *“I think that I had a pretty strong influence on the fundamental idea of working closer to the customer... if you look at [another team member], I mean that he thinks in a completely different way today.”* This statement was supported by other interviewees. They agreed that

there was a change of mindset and from whom the influence came. Thus, it seems clear that the team had a shared frame of reference, which was heavily influenced by this interviewee. In which case, the data does not give enough evidence to tell if this was a true change of frames of references in the team or if it was just a matter of complying with the manager's will.

4.1.2.1 PERCEPTION

This was evident in the question of what decision that was most critical for the case project; all members responded different matters. One interviewee formulated the answer "*from design point of view...*" expressing the consciousness of the own frame of reference. In general, all team members had different perceptions about various events and phenomena in the case project. Even a question like when the project started and ended revealed very different views. Members that initiated the project could account for its initiation several years before a team was manned, while other members saw the formation of a team as the start. Some members considered the end of the project to be when the product was launched at a fair while others believed that it still went on since components still was being designed and tweaked. The common theme is that these answers clearly follow from the personal experiences and assignments during the project.

Another example of different perceptions was shown when one interviewee stated that a specific type of decisions was decided upon by the interviewee self. Other interviewees did not recognize this interviewee to have anything to say about in these matters, that the interviewee only brought alternatives to the team meetings for the decision to be made there. They did not see the preparation and screening of alternatives as influencing the decision, but simply bringing it to the table. Likewise, the interviewee did not recognize the discussions at the meetings to have an impact on the decision in most cases.

Interviewees also in some matters displayed an unawareness of other persons' preferences. Apparent from the interviews was that it seems to be much more natural for the interviewees to not reflect over the own frame of reference but instead try to make sense of the problem at hand. Also, the more different the assignments were, the less did the interviewees seem to have shared preferences. The most obvious example of this is how different team members looked at the supply chain related tasks, as described above.

4.2 RQ2: HOW DOES INVOLVEMENT MANIFEST?

This section presents the findings are used to answer the second research question, although parts are used also for the third research question. First, the case project's main stakeholders are presented. Thereafter follow a mapping of when they are involved. The last part of the section brings up the different factors that were found to have impact on the stakeholders' interactions in decision making during the case project.

4.2.1 PROJECT DECISION STAKEHOLDERS

As stated above, it is common in product development that decisions involve multiple stakeholders. During the project course various decisions impacted and were impacted by different stakeholders.

Stakeholder groups of individuals existed at the Company, who were possible to distinguish. The most evident group from the findings was the customers which in the end will use the products. There was awareness in the project group that the customers were the end-users of the products, but also a belief that the sales units were the design engineers' customers. Another group that was affected was the suppliers. Being chosen as a supplier or not as well as the ongoing terms and forms of collaboration has implications for the suppliers.

The project participants were themselves also stakeholders, partly because decisions would impact their ongoing work in the project. The functions they belonged to were also stakeholders, and there was a significant curiosity of co-workers as to the progression of the project. Functional managers also displayed interest in the status of the project and employees had been allocated by the functional managers when staffing the project. The functional managers were expected to account for what their employees did to the company management team.

Members of the different functions sat grouped together on different departments at the headquarters. Some functions sat on the same floor, but certainly not all. However there were conference rooms throughout the headquarters where members of different functions met regularly. Moreover extracurricular activities was often kept in the functions as one of the respondents stated: *"I get the impression that people consort a bit more grouped, for instance now the designers have posted that they will, that they go out by themselves ... they used to play beach volley every other week..."* An opinion was raised that this was the way it worked, instead of everyone hanging out with everyone, and perhaps because of the large number of employees.

The prevalent view of the respondents was that the globally dispersed sales office had employees with different mindsets and ways of working compared to the headquarters and each other, even different

compared to the Nordic sales office situated at the headquarters. This could also be attributed to many factors, but physical distance contributes both within the headquarters and outside. One of the respondents reflected and stated that *"This thinking is natural that, the ones you see physically, you see these people as your group."*

There were functions that were affected by decisions in the project but were not as strongly formally represented in the project. The quality function had one participant in the project, but was not mentioned as a participant at first by some respondents when mapping the participants. This was also true for the project participant sitting remotely, who was not mentioned by all respondents at first either.

The sales function formally took part in the project through the customer prototype project running in parallel with the case project. This project required collaboration between the project team and a team from the local sales department, which was the only formal representation of the sales function. However, other global sales functions were represented by their head of departments in early customer meetings in the project. Other than that, they had no member in the project group. Since the sales department would sell the products later on, they had a significant stake in how the product ended up. However, the project champion had significant experience with sales, as he had been head of a sales department.

The assembly function was responsible for the assembly of all products at user sites when product solutions had been sold. They were not represented in the project group, but would clearly be affected by the design and configuration of the products later on. Very few of the respondents mentioned the assembly function at all when discussing decisions in the project.

The maintenance and engineering tool functions were also affected by decisions made in the project. Maintenance would ultimately be responsible for the products once the project was over, and engineering tools were responsible for software used by the sales departments to design customer solutions.

Other categories of stakeholders were the global management team, consisting of a number of the highest department managers, and the development management team, consisting of high managers. Some managers held a position in both teams. The global management team was the gate-keeper during the first two project gates and the three latter gates were held by the development management team. The project champion was a member of the development management team and did at the same time represent the development team during these meetings. The primary interest of both groups was to have solid business case for the project.

Figure 11 below shows an example of stakeholders' involvement in a decision and by which degree. The figure illustrates a social network mapping of case project stakeholders in the tooling decision. The nodes are colored according to what function they belong to, and their size by out-degree centrality. In Figure 11, the color of the arrows, or *edges*, represents communication intensity, where darker green corresponds

to a high intensity. The edges' directions tell the direction of influence in the tooling decisions, e.g. node 1 influence node 6. If individuals influenced each other equally, the edges are two-way. Most likely, every stakeholder of the decision is not represented, only the ones the interviewees said that they had personal contact with. Nodes 10, 7, and 9 displayed intensive communication around the decisions, all displaying weaker communication with the other nodes they connect to and as such formed a clique.

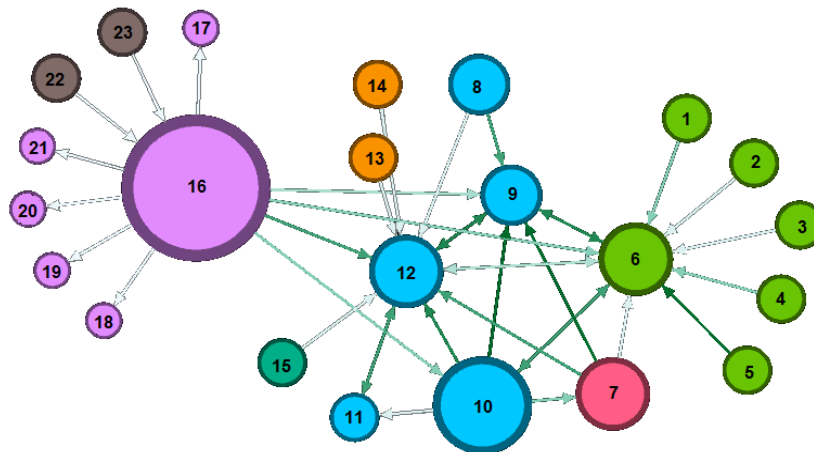


FIGURE 11 - SNA OF COMMUNICATION INTENSITY IN THE CASE PROJECT DURING TOOLING DECISIONS

4.2.1.1 DIFFICULTIES IN COMPREHENDING STAKEHOLDER INVOLVEMENT

Whether a decision affected an individual or not was largely dependent on the chosen alternative to act in any decision. Broad discussions concerning many options could envelop numerous stakeholders that in the end were perceived to be affected with the chosen option. It was not always possible to comprehend the impact of decisions by the apparent decision makers, as it was a complex task. Besides, as decisions concerned future actions, there was also a degree of uncertainty involved. One could never know for sure that the action would occur as planned. Individuals also seemed to have both a short- and long-term perspective on how decisions affected themselves and other individuals, such as the direct effect of decisions and indirect effects on individuals' careers. This increased the complexity even further.

Therefore project participants were not always aware of all the stakeholders in the different decisions they were involved in, and it did occur that decision processes took place with this unawareness. On the other hand, there were also ample individuals that displayed an interest in project decisions, e.g. by asking questions, having a vague sense of possibly being affected by decisions.

The interviews show examples of when interviewees did not see themselves influencing decisions that were not connected to their specific job tasks, even though they actively did influence. One interviewee expressed strongly that strategic and managerial decisions should be made by managers: *"I should only*

create. That is my task.” Nevertheless, the interviewee drove a personal quest with consequences on strategic level and has continued since to influence decision makers in the matter.

One example of the complexity of being aware of all influences on a decision came up during one interview. The interviewee explained that another function had drawn the components into a simulation program and identified problems with the design. The interviewee first responded that the simulation team had no influence on the design process. Then after a question whether they really did not find anything unexpected when simulating components in the program, the interviewee admitted that *“That actually did happen. That’s right! A few such things.”* The observations above show that the interviewees have difficulties in relating themselves to a decision process. Influences on decisions can be vague and arbitrary and thus be difficult to be aware of.

4.2.2 PROGRESSION OF STAKEHOLDER INVOLVEMENT IN DECISIONS

The roots to decisions in the case project were tracked through the interviews to a problem or issue raised by one individual, or a few, almost contemplating the same issue at the same time. It can best be described that the individuals had a tingling sensation. The empirical findings show that these individuals sought interaction with each other and others, and thus the number of participants in the interactions grew. This was an integral process in the decision making, and thus decisions in the case project were found to contain a considerable amount of interaction. Both form and purpose of communication as well as forum depended on the drivers for the interaction to manifest, which will be explained further in chapter

RQ3: What seem to be drivers for involvement?. The communication happened in face-to-face discussions, in meetings and short discussions between the office desks and sometimes through e-mail and telephone calls. On a related note, the frequency of communication decreased with distance, regardless of methods of communication.

The decisions were difficult to confine to single points in time by the respondents. What was viewed as formal decision points could seldom be enough to envelop the various decision processes - interactions and discussions took place concerning the decision which by their nature took time. Thus decisions could instead be narrowed down to occur during certain time periods. However when the period started and ended was hard to determine by the respondents - transition periods were instead mentioned. There was also a feeling by some respondents that during the time period it felt like a travel towards resolution. As one project member stated: *"So I think it matured over a number of weeks"*. No clear pattern of change of formal methods for decision making could be distinguished related to the number of involved stakeholders.

Frequently over the course of the time period for a decision process, an option was chosen on what action should be taken early. This manifested as a form of indefinite decision because during the progression of time the decision could be reconsidered under various interactions, often leading to a different or devised decision alternative chosen. Changed circumstances and goals for the decision in question appeared to be contributing to this. Sometimes the chosen action was commenced early on as well and it occurred that an event manifested that involved adjusting or cancelling this course of action. This was very common for design decisions in the project. However it was not always popular by all designers to adjust and go back. Quoting one of the project members: *"You can see it as a challenge as a designer and many do that - 'Wow nice now I can figure something more out'. Some people think 'hell now I've put down time, I don't have the energy to do it one more time.'"* Moreover it appeared that changing course of action in early phases was received more positive by project members than later in the project, and there seemed to be a relationship between the willingness to change and the amount of work put down into alternatives that were never fully realized. This is represented as a conceptual graph in Figure 12 below. There also appeared to be higher demands on the new alternative proposed.

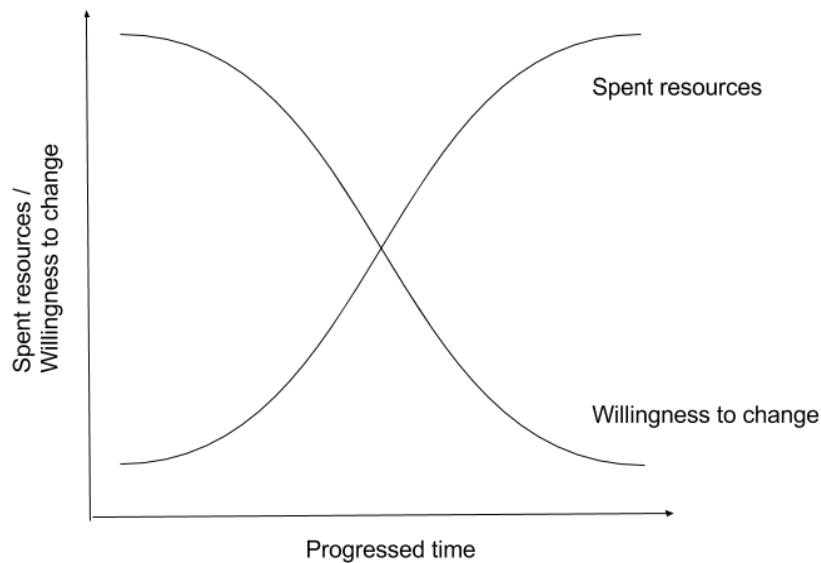


FIGURE 12 - CONCEPTUAL MODEL OF THE INVERSED PROPORTIONALITY OF WILLINGNESS TO CHANGE AND SPENT RESOURCES

The process of returning to already made product decisions and change them was an ongoing process of iteration that could progress for indefinite periods. However at times the perceived amount of work to be cast aside when changing course of action could be considered so high that it wasn't worthwhile to change anything. This created a natural dependency between decisions. Former decisions, e.g. in concept design, confined the space for future decisions in terms of what alternatives could be conceived.

However the end of the time period was restricted by deadlines when it was perceived that the decision had to be made. This was related to when alternatives to act no longer appeared feasible to choose thereafter. For example the decision to choose supplier for some parts, which included deciding to go into tooling or not, appeared to have a clear deadline. The suppliers had a lead-time for 90 days that would lead to too late delivery of certain parts to test. If the deadline was passed, late deliveries would lead to significant delays, incurred costs, and other serious implications for the project outcome. In the project the term "frozen" was used when the design was no longer allowed to change and was often mentioned in relation to constructed deadlines. Stress was also something project participants felt during the project during some periods that involved decisions, especially around some decisions with deadlines.

4.2.2.1 BROKERS

There were some individuals taking part in the project that had exclusive connection with various stakeholders outside the organization, at least from the outset. One project participant had contacts with various potential customers and advocated that the project should make efforts to cooperate with these,

thus attempting to draw in more stakeholders into the interactions. These customers stood out, as the participant stated: *"One can say it like this, there are a few in the company here in this house, that have worked globally, and have worked a lot with customers and been out and met with very many customers. I can walk into W, I walk into X, I walk into Y and Z. I meet all of these."* This also happened during the project and the project members visited many different customer organizations.

This broker also seemed to have developed these relations over time before and during the project. When asked how he could gain entry to important individuals in the largest customer organization with more than 300 000 employees the response was: *"You can say that you have an hour with these people. If you don't perform you have a lot of work to do to see them again. So we managed to get into corporate ... What I did was that I helped them develop their standards ... But you don't do it out of your companies perspective, you do it from the perspective of how the production should function."* And regarding another customer the reply was: *"He was, eh.. He owed me a few favors"*. There seems to be a degree of reciprocity in creating and maintaining these relations.

Another distinguishing factors was that the broker effortlessly leveraged the experience gained from one customer in the contact with another when developing the product concept, stating what the others had said and how they worked. A trait this broker had, according to some other team members and the researcher of this study was strong communication skills. Concluding, the brokers seemed to have an extraordinary ability to establish and maintain contacts, as well as the ability to use them to gain various advantages. The broker stated that this way to connect to outside groups when needed was spreading as a norm in the group; *"both the constructor and project leader thinks differently today ... One thing leads to the next, so to speak. When you start to change things they tag along. Then suddenly they also start to seek information and work differently"*. In Figure 11, there were also two distinguishable clusters centering on nodes 6 and 16, respectively and their function of connecting clusters are clearly visible.

In this project team there was also a lightweight broker. This individual's role was to handle the primary contact with all suppliers, however these contacts were not nearly as hard to acquire as the previous mentioned. In a sense, this lightweight broker served more as a hub, relaying communication. The role was deemed important by the lightweight broker; *"Where the business lands depend on the project buyer... So it is very crucial! If people had understood the importance..."*

4.2.3 FACTORS IMPACTING INTERACTIONS

The interviews revealed a number of factors that seem to have affected interactions around decisions during the course of the case project. These factors of personal differences and the case project team's

social characteristics are presented in detail below. The section ends with findings about how the form of interaction plays an important role in collective decision making.

4.2.3.1 DIVERSITY

One interviewee made a remark about the Company's hiring process, claiming that it historically had been "*fantastically good at recruiting people who fit*" into the Company culture. Another interviewee stated that the team members possessed different traits, and that this was an advantage for the discussions. The team members seem to have been relatively coherent in demographic aspects, such as gender and nationality. The age and tenure were although varying between the case project team members. They were not a particularly motley group, nevertheless did they possess different traits and experiences.

4.2.3.2 FORMAL HIERARCHY

The interviews clearly show that the ability to influence decisions during the project is related to the formal hierarchy of the company. All interviewees described the team members in managerial positions to have great influence on decisions in general, and the formal manager in the project team could act as a judge to end discussions. Moreover, when describing whom they turned to when seeking advice in general, all interviewees stated that they went to their closest manager. The authority of the formal managers seemed to not have been challenged since there seems to have been no informal leaders. A confirmation of this observation is the fact that in the interviews expressed an appreciation of the stability of the power structure in the team.

Since the case project team had little of rivalry for power, the formal leaders seem to have had no reason for expressing their authority. As a consequence, the formal hierarchy was very much played down in the team. For those with formal power, there seems to be a norm to influence by discussions rather than giving orders. One senior team member had a semi formal role of lead engineer but expressed the wish to be seen as no more than another team member. Perhaps unconscious about it, other interviews revealed that the senior member nevertheless did have a strong power to influence decisions. A third interviewee did not recognize the project leader as a formal manager. This could be explained by the complexity of matrix organizations in general, but it could also be seen as a sign of informal spirit in the project team. This interpretation is supported by the fact that several team members describe the Company as having a flat organization, and according to all interviewees there is a real freedom for people to express their mind. There are however clear signs that this is not the case in the entire Company. It should also be stated that the will to influence in decisions does not seem to be particularly low, only that there is a norm to use other means than formal ones to influence. Moreover, the notion of a flat hierarchy on the Company was provided by an interviewee at mid level, who often mix with employees below and above the own rank. Therefore it is not surprising that another interviewee only had to refer to the functional placement in the building to describe the Company hierarchy as steep.

However, there is some evidence for a hierarchy of influence that does not entirely correspond to the formal one. As is discussed further under the following research question; when team members felt a need to anchor a decision, they went to team members in higher, but also at the same and lower positions than themselves. This will be discussed further in section 4.3.1.3 Anchoring and responsibility. One team member said about the company in general: *“It is more dependent on the individual than you might think... different persons with the same title act in different ways, they reach and succeed differently.”* Even if no obvious signs of this could be found for the case team, this statement suggests that informal hierarchies could have been present even in the absence of direct signs.

4.2.3.3 INFORMAL HIERARCHY

Across the Company, the formal structure was one, but not the only, means of communicating and influencing. As one respondent stated: *“I view it formally, I have no power to go in and tell X what to do, instead I have to influence”*. There were also informal groupings. One grouping mentioned was the old troop in the organization; *“there is a pretty large core of old people, like people ‘old in game’ who have worked here very long.”* Another potential informal grouping was the previous owner committee which consisted of 20 partners co-owning the Company before it was sold to the parent company. These partners were spread out in the company in different leading positions.

The informal hierarchy in the case project team also affected the ability to influence decisions during the project. As explained above, one interviewee thought that the fact that all were relatively new to the area helped the team formation. One interviewee gave a clear picture of the informal hierarchy when explaining the meaning of prestige. The interviewee considered prestige as a great barrier for deliberation in a development team and that it was irrational since all brilliant ideas have components of others’ previous ideas. The interviewee considered that an approach for deciding design that is free of prestige is to combine the best ideas of all members, which was also considered the general case in the project team.

In the following explanation of prestige, it is however in the point of view that some elements of the informal hierarchy are visible: *“Let’s play with the idea that we have solved four problems so far during the project. Every time we have built upon your ideas. Mine have been rejected... Then we come to a new point where we must again decide which way to go, and we have lots of ideas in the team. You have one idea and I’m starting to get angry because I can’t get my ideas through. So I don’t even listen to your ideas because this time it’s my turn! Even though my idea is bad.”* The quote defines prestige as an irrational behavior from a team member who has failed to influence a decision several times. Such irrational behavior would be easy to spot from a more influential team member’s point of view, a team member who has been more powerful. Another point of view comes from another team member when explaining how project discussions could go: *“If you think that your ideas is better than someone else’s, then you have to discuss and come with arguments until you are proved wrong, so to say.”* This could be

seen as a statement of modesty, but the assumption of the discussion ending in being proved wrong suggests that this was not a very unusual outcome.

Several patterns of the power structure in the project are highlighted by the network analysis of the tooling decisions in Figure 13 below. Like in Figure 11 (where edges represents the communication intensity), nodes are colored according to what function they belong to, and their size by out-degree centrality. In Figure 13, the color of the edges represents interaction importance regarding the tooling decisions, where darker green corresponds to a high perceived importance. The arrows' directions tell the direction of influence in the tooling decisions. One of the project members, the node with the highest level of out-bound centrality was node 16. Influences from node 16 was considered to be important by almost all nodes, Moreover, node 9, and all individuals this participant communicated with perceived the interaction as important for the decision, even though node 9 was mostly at the receiving end of the interaction. Thus, those two together with node 10 is shown to have had a high position in the informal hierarchy.

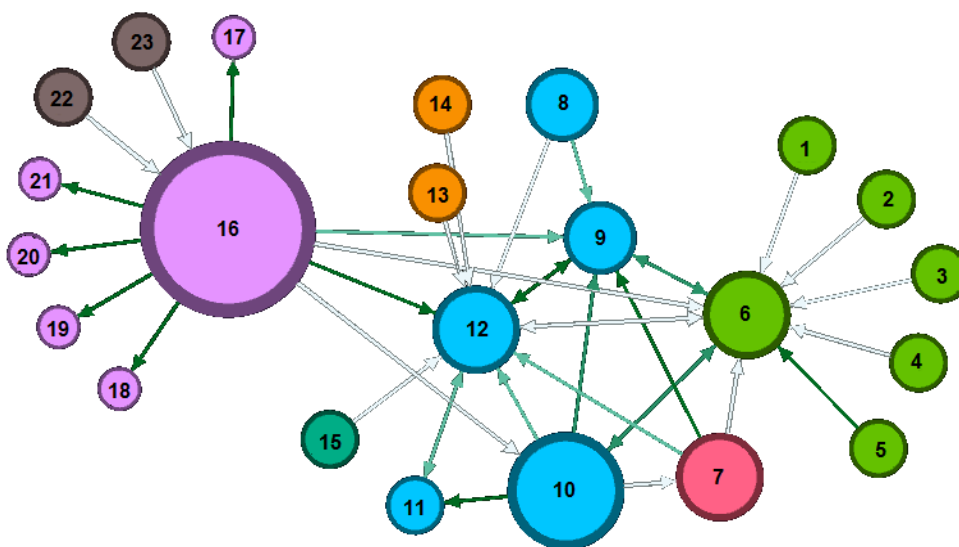


FIGURE 13 - SNA OF THE PERCEIVED IMPORTANCE OF INTERACTIONS IN THE CASE PROJECT'S TOOLING DECISIONS

The team members that were lower in the informal hierarchy seem to have adapted to the structure and have instead used other ways of influencing decisions. The data does however not show whether this was done deliberately or not. One example of such a method was to develop ideas independently in order to present them as mature alternatives. Just like one interviewee stated; the more refined the idea is when it is presented, the less room for discussion.

4.2.3.4 PROJECT TEAM ATMOSPHERE

During the project course there were six core project participants in the team. Out of these, four had been working in the organization in projects together before the case project and two of them had known each other since way back: "X and I have worked together since the 90s. So we know each other inside and

out". So already before the project some members were acquainted with each other. Two of the members had started quite recently in the organization altogether.

A strong connection between all team members was apparent. As one of the members expressed; *"We have been a very good group and it hasn't felt that anyone has been a bit outside, rather we have been a nice bunch all of us."* Some individuals in the project team expressed a sense of belonging to the team connecting them long after the project had disbanded. Despite working in many other project teams since then, some team members of the case project still expressed that other project members were preferred when it came to any new team formation.

One of the project members was situated in another country throughout the project, and it didn't emerge if this member was as closely tied to the group as the other members. The issue was raised by one respondent that this could have an impact: *"I think we still haven't solved that [the country] becomes isolated.. We haven't got the dynamics going yet that we work in a good way with multi-sites."* However when this member visited the office in Gothenburg, which happened a handful of times during the project, the members all took part in activities not related to work outside office hours.

The perception of the group atmosphere by the members was that it was relaxed. First of all in the sense that everyone's view could be expressed freely. *"I know that people say a bit cliché, 'high to the ceiling' but it is really correct. High to the ceiling, really. To be able to joke a bit raw with each other, but still that everyone has been ok with it."* Even years after the project in connection to this study, team members expressed their appreciation for each other directly in the course of the project. There was also recognition that the advantageous group atmosphere was dependent on the constellation; *"I know that our group dynamic worked so well. And if someone else would enter the group it's not certain that the group dynamics would be as good, it is hard to say"*.

Moreover, it was rare that conflicts arose in the team, and it was not tense either as expressed by one project member: *"It also didn't feel like there was tension in the air and that it could become a conflict but everyone wanted to avoid it ... It didn't feel like that. Absolutely not."* There was a high degree of collaboration and willingness to accept others' help in the project group as well; *"We have taken a lot of help and been open. I would really say that no one in the group has wanted to do tasks in their own way. And I have to say that I have been in a very good group, that hasn't been like... There are always conservative people who wants to do things their own way, but none these kinds of people have been in this project ..."*. The statement above display norms constructed by the project team which could be different from norms in the organization. Many norms took form gradually over time in the project team. One norm created and shared by the team members was the willingness to seek outside help; *"So I believe that ... a comfort has been found in seeking support from other organizations. That comes to mind, that more outside support has been taken"*.

As stated there were functional departments in the organization and project members were recruited across them through a matrix structure. A feature that demonstrated the differences was the team members' apprehension of the tasks of other functions than their own. For instance, when one of the team members replied as to the role of the supply chain function in certain decisions, the response was *"They had to ask the suppliers ... On the other hand they had nothing to say about yes or no ... did the suppliers say that they could do it. That's the only task they have really. Then they have to accept ... I mean that's what pays our salaries in the end."* The project member from the supply-chain function had a different opinion of the supply-chain role in these decisions, which was portrayed as much larger. Another matter that portrays that functions didn't have complete insight into the tasks and of other functions was that the supply-chain representative didn't know about the stage-gate model with phases and gates, which was used as an integral part in product development projects for meetings and such for project discussions at the research and development department. Moreover there were also different assessments as to the relative importance of members own functions when asked. One of the research and development project members stated that *"The best would be if the whole project teams sat in the same room as the designers, maybe. You want everyone around you"*. There could be a larger issue in the organizations related to this, that there was an embedded distinction between the functions importance. One of the project members replied when asked if the Company was a flat organization: *"No, I don't think so. Just look out how everyone is divided on the floors..."* The top floor of the headquarters was reserved for corporate management and finance departments, while testing and production resided at street level. Members from the different functions in the organization also preferred different ways of working in some aspects. According to one respondent, supply chain members preferred to systemize everything with clear processes without deviations and designers preferred to focus on product development without parallel customer projects taking attention.

There seemed to be another force at play in interactions during the project. There were drivers for project members to seek connection and interaction. Out of necessity, functions needed to collaborate and members frequently interacted in order to do so in the daily work. But under some conditions the threshold was lower to do so. In the project team members frequently sought contact with individuals outside the organization in order to facilitate the project in different ways. But in the design engineering function as a whole, there was in general a more conservative view on connecting to outside sources for assistance. This could even be said to be true for the headquarters as a group, which displayed unwillingness, because of unknown reasons, to reach out to the distant sales office. Findings show that group norms could play a part in deciding the openness of the group members.

4.2.3.5 HOW ALTERNATIVES ARE PRESENTED

It was evident that the way the interaction was made could have a great impact on the result of the decision. Two interviewees described that just a smile could make a great difference to the reception of what might otherwise have been perceived as nagging. One interviewee said: *"You learned after a while*

how you should do to increase your chances of being listened to. It is a very social act.” Evidently, the discussions changed during the case project. In discussions on which alternative to go for, the interviewees adapted their way of presenting their preferred alternative according to whom they were interacting with. One interviewee said that *“It is really varying... it is easier to convince someone of you have something in your hand, so to say. We had a 3D printer, so you printed many objects and compared those.”* This way of influencing seems to have evolved to a norm in the project team and the interviews does not reveal any occasion where influencing techniques was unacceptable and resulting in a conflict.

Another side of the same phenomenon had been noticed by another interviewee in the context of consultation: *“Day one, I don’t want perfect CAD drawings that are rendered. If you have a half sloppy presentation people dare to come in. You make a sketch and then people understand that this is far from settled so they can influence. If you come with a highly rendered presentation, then you do it more to seek confirmation.”* Thus, the degree of refinement of alternatives seems to have an effect on the decision making process.

The remote member had a comparatively formal method of presenting alternatives. He often presented a few alternatives with their benefits and drawbacks in relation to a defined set of preferences, and used this as a basis of discussion with the rest of the team. Thus, it was rather a discussion of previously defined alternatives than a deliberation.

Presentation of alternatives was also done by other members, but it does not seem to have been the default choice. The difference might very well be a result of the difficulties in having many short conversations due to the geographical distance, but also because the assignments for the remote member was deliberately made solitary. This could for instance be seen in Figures 11 and 13 regarding the tooling decisions, where the one of the nodes have few connections with the other core nodes. A similar way of presenting alternatives can be seen by the project purchaser, also presenting a number of predefined alternatives. The purchaser had a set of predefined preferences and a list of preferred suppliers decided the strategic purchasers.

4.3 RQ3: WHAT SEEM TO BE DRIVERS FOR INVOLVEMENT?

The following section presents the findings that is used to provide an answer to the third research question; why the decisions in focus contained a large proportion of interaction by several people. It covers the drivers found for more persons to get involved in a decision making process.

4.3.1 DRIVERS FOR INVOLVEMENT

The number and intensity of interactions linked to decision making in the case project was found to depend mainly on a few factors which are presented below. Table 2 below provides an overview of these factors, the characteristics of interaction and typical stakeholder involvement forums used for interaction. Further information about the forums is presented in Appendix 5. The time dimension of when the involvement drivers seem to have been most prominent in relation to each other is represented in Figure 14 below.

TABLE 2 - SUMMARY OF DRIVERS FOR INCREASED INVOLVEMENT IN DECISIONS DURING THE CASE PROJECT

Driver	Characteristics of interaction	Typical forum used
Information	Transactional	E-mail, short inquiries, Education
Analytical assistance	Discussion/Deliberation	Direct contact, Project meetings
Anchoring and responsibility	Perceived security	Stage-gates and E-mail
Stakeholder interests	Congruence	Customer prototype project, customer visits,
Delegation	Trust, Authority	-

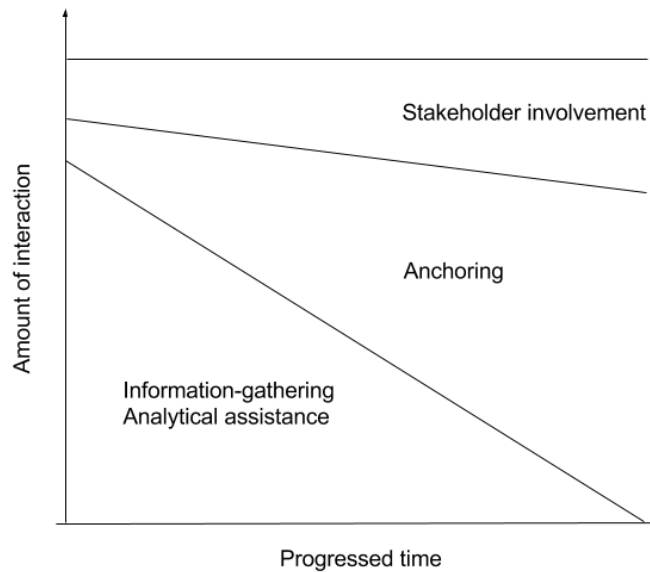


FIGURE 14 - THE RELATIONSHIP BETWEEN DRIVERS FOR INVOLVEMENT IN A TIME PERSPECTIVE

4.3.1.1 INFORMATION

Information seeking was a driver for including more people, caused by a hope for improvement of the quality of the outcome. A common reason for interaction was leveling differences in information, initiated both from receiver and sender. Examples of these interactions were consultation of a person possessing information that was considered as relevant by the decision maker. Information concerning decisions made were sent to people that were considered to be affected by the decision.

4.3.1.2 ANALYTICAL ASSISTANCE

A third cause for interactions was when decision makers requested the analytical capability of others, e.g. when acting as sounding boards. Direct contact was preferred by the team members when they sought advice or deliberated. Deliberation taking place between decision makers was the prominent reason for interaction between the project members and included information exchanges. When decisions occurred that was to be decided by several team members, some express that they chose to approach the others only after having considered individually first.

4.3.1.3 ANCHORING AND RESPONSIBILITY

One other driver for involving others in decision processes was found to be to acknowledge decisions with other persons; to make them aware of and accept the decision. This phenomenon is henceforth referred to as *anchoring*. Anchoring was done upwards in the hierarchy, but also at the same level and at levels below the anchoring interviewees. The need for anchoring seem to be related to the perceived degree of importance of the decision, formulated by one interviewee in the following way: *“So I just want an OK. Because when it is about something that will be a standard later on, which will hopefully exist for many years, then you want everybody to be on the train.”* On the question why anchoring was needed, one

interviewee answered *“I think that it is important to feel that everybody is on the train.”* This was the same interviewee who always forced for an answer when carbon copying others in e-mails.

One consistent conception from all interviews is the relation between decision making and responsibility. One interview described the company’s gate reviews as meetings where something very drastically would have to happen for a non-go decision to be made. The interviewee commented gate-meetings in the following way *“Everyone is accomplices if something goes wrong. So the management group gets informed that ‘these are the problems that we have and the risks we see’”*. There seem to be other reasons than just to get permission to move into the next stage, some connection with sharing responsibilities. Another interviewee said that *“If everybody have agreed on it and we take action, it becomes a shared responsibility, in a way”*, meaning that even if the manager with the formal mandate was active in the decision making, the responsibility was still shared.

One interviewee seems to have shown interest in sharing responsibilities whenever plausible, while others only wished to be engaged when they were interested in the outcome. The interviews did not reveal any situation where a decision maker wished to disclaim the responsibility for a decision.

Although responsible for a decision, the project members did not express any real fear of being responsible for bad decisions. Another interviewee stated that *“The decisions we make, we are responsible for... Then, if it goes wrong in any way nothing happens, I’m not getting fired.”* The interviewee thought that the environment in the project team was forgiving and that it was a necessity for innovation. On the other hand, he had a feeling that if the whole project would fail, the project manager might suffer in front of the company management. One interviewee made a comparison to experiences in Singapore: *“Over there it is like this: You don’t want to make decisions because then you are exposed.”* This is an indication that decision making might differ greatly between different national cultures, but it also identifies decision making as risk taking.

After a decision was perceived to have been made, the persons directly involved in the decision making changed their way of interacting, for what seem to be other reasons. Two purposes could be identified which were: spreading information about decisions made and acknowledging decisions. One interviewee explained that *“You cannot run to the boss and ask for permission, you get on with it, within reasonable limits. You must keep track on things, so when you say something, when you make a decision, you CC [others] and see if someone reacts.”* Another interviewee had a more active communication; always forcing the persons considered affected for an answer.

4.3.1.4 STAKEHOLDER INTERESTS

As mentioned before, stakeholders that were aware of the project displayed curiosity in the progress and initiated discussions with project participants. Uncertainty whether an individual would be affected or not was found to be a motivator for getting involved in decisions. What complicated it was that there could be both short- and long-term effects of decisions, and it was difficult to comprehend the scope of consequences. For example it could affect private life, the role as a functional representative, or the role as a project member.

Lack of interest in a particular decision or its outcome seems to have acted as a barrier for persons to involve themselves in decision making processes. Several of the interviewees gave examples where they influenced a decision less than they had the possibility to do.

Stakeholders had various interests in decisions and therefore different reasons to affect the outcome. What could be referred to as personal agendas was when stakeholders had a desire for the outcome, or actions ensuing decision, that wasn't necessarily shared by other stakeholders. At least that was what it could be perceived as by other stakeholders. Quoting one of the project members: *"X has his own agenda, he wants to do different things but maybe it isn't applicable in any project. Then he applies the idea into something were it fits about 28 percent, roughly ... He strikes on any opportunity where he can get the idea in ..."*

Similarly, another respondent emphasized the importance of performing decisions and tasks efficiently, hence viewing speed as a strong importance in the project decisions. Other participants strongly advocated creative processes which are not always compatible with the former priority. It was evident that individual preferences were not always aligned during the complete duration of decision processes when choosing what action to take or way to proceed in decisions.

There were occasions when collective goals manifested in some decisions; when all participants in the decision discussion perceived that there was an agreement on what should be achieved from the outset. Often however, discussions around different decision alternatives could lead to involvement of different personal agendas. Some form of interplay took place between different personal agendas and how these collective goals took form.

Another major finding related to this was that respondents frequently responded differently when asked which the most critical decisions in the project were, as stated above. When one respondent was asked if what he perceived to be the most critical also was perceived as such by others, the following response was given: *"Yeah I'm thinking... It's a good question... Ah it's probably the toughest decision for everyone really when I think about it. I'm thinking some decisions; I'm thinking what countries to sell in and setting prices... Those things I don't have anything to do with really. Those are decisions about what customers to target, or I don't know if it is decisions really in project either so... Yeah the most important decisions I guess, obviously, the tooling decisions"*. The respondent elaborated on other decisions, but still concluded

that the most critical decision for everyone would have been this one. Moreover, no respondent referred to a decision as the most critical that didn't involve the participation of other individuals in the decision process as well as the outcome. Some project members from the design department did raise different design issues as critical, but they were broader fundamental concept decisions that had many implications for the product design.

Furthermore, the interviews reveal a difference in preferences between two groups. The global management team and the product development unit that was responsible for the case project. At the global management level, financial metrics had top priority, while the product development unit's highest priority was a technically superior product. This had previously led to communication problem and problems of matching projects to the corporate business strategy.

4.3.1.5 DELEGATION

Delegation of decisions is found to have been another way of involving others. It seems to have been done in order for an individual to stay out of decision making processes. Still, this individual shared the responsibility rather than gave it away, and was therefore still involved.

The project champion described different reasons for letting individuals make decisions of their own, even though he sometimes considered himself forced to get directly involved in different decisions. He always had the last say in discussions and the impression from all interviews is that all team members accepted his decision and was able to let go of any rejections. He described his own leadership with the following words: *"I should not have to tell them, instead they should tell me what they want to achieve... so that they can make decisions of their own, because I ... don't have as much information as comes in every day, so I can't make decisions for them. They have to understand what the strategy is."*

The project champion had the ambition to influence the team to reason like he would in a decision process. He explains it further in this way: *"these decisions that you must make, we all have the same starting point; we have understood which the important criteria are; what we must fulfill; what stakeholders we are working for. That is how I think that a project team must be able to work, that this lies as a foundation for how they work."* Thus, he strives for his team members to act independently, but still according to the same reasoning as he has. When differences in preferences or frames of references eventually arise, the manager states that *"You cannot win every battle. Sometimes you have to let people make their own decisions. As long as it is not harmful – let them decide, because I think that you learn from making decisions as well."* Other interviewees though displayed awareness about that the freedom of making a decision could be revoked any time it was regarded to be outside the project champion's bounds of will. Thus, even delegated decisions could be seen as being made by both the person commencing the delegation and the receiver of delegation.

The project champion admits that in reality, the project manager made most of the decisions and the project manager states that in many situations, the project champion could have used his formal decision mandate but instead wished to anchor the decision in the project team. As stated above, the two have known each other for many years. They have developed a strong mutual trust and seem to share experiences. Delegation of responsibilities seems to happen more or less unconsciously, an observation that is supported by the norm of making decisions until someone reacts. In addition, the project manager claims that it would not be possible to check every decision with the stakeholders.

There seem to have existed drivers in the project for not including more persons into the decision making process, such as lack of interest or efficiency, and enablers such as trust. Nevertheless, in most situations brought up by the interviewees the decisions were made more or less collectively. The drivers for not involving others when making decisions thus seem to rather have had a mitigating effect on the strong forces for including more persons in the process.

5 DISCUSSION

There is a clear link between frames of references governing the mental models (perception) of individuals. Weicks's (1995) theory of sense making entails a process of sharing perceptions, and by deduction it therefore really is about changes in frames of references of involved individuals. An individual's frames of references are created by their experiences, which explain the connection from the empirical findings that experience affected decision making. It also links that experience induces learning, as mental models evolve through learning according to Argyris & Schön (1978). It also explains the interviewees' awareness of others' different frames of references, and also why they were different. So initially project participants had different frames of references coming from different backgrounds, which also meant different mental models (perception).

But in what way does frames of references affect decision making? The effect of different frames of references on decision making can be related to the concept of rational decision making as explained by March (1978). First, mental models determine how decision alternatives and consequences are interpreted. Second, value preferences, "*what we think we could gain by action*", root from our assumptions and attitudes, which are inherent in our frame of reference (Tversky & Kahneman, 1981). And third, decision rules, the logical computations, are guided by mental models as well as how we solved similar problems earlier. Therefore in face of an identical decision and set of available information, project members acting independently will not come to identical conclusions if they have different frames of references, which almost certainly is often the case. This effect can sometimes be subtle, as in the case when functional members to a large degree seemingly shared frames of references, but came to different conclusions such as in the case of choosing supplier as mentioned in section 4.1.2 Frames of reference and perceptions. Now bounded rationality introduced by Simon (1955) complicates matters further proposing that it is unfeasible for individuals at all to be in this identical situation. Because according to bounded rationality, actors have incomplete knowledge of alternatives and consequences and their value by which they rank alternatives and decision rules are subject to cognitive limitations (Simon, 1955). So divergent frames of references and being subject to bounded rationality causes individuals to reach different conclusions for similar decisions.

The interviewees perceived this both as positive and negative, what could be identified partly pending on the inference of the frames of references in question. A shared understanding was stressed as important to achieve a common perception, equivalent to convergent frames of references. This seemed to have happened, which brings up the question whether the socially differentiated bounded rationality was mitigated as the project progressed. The dynamics of frames of references of the project participants were altered during the project, and possible reasons will be explained further on.

5.1 RQ2: HOW DOES INVOLVEMENT MANIFEST?

This section discusses the second research question by analyzing the roles of the themes presented in the results section. First a brief discussion about the difficulties in identifying influences from and on decision stakeholders is presented. Below is a passage on the involvement of stakeholders in decision processes. The final part relates to the factors that were found to have impact on the stakeholders' interactions in decision making during the case project.

5.1.1 PROJECT DECISION STAKEHOLDERS

A large number of stakeholders were identified in the interviews, as described in the results section. However, the degree of involvement and influence different stakeholders had is in some cases diffuse. The interviews provided several examples where it was difficult to account for the specific events or interactions that caused learning. Thus, the interviewees seem to have been unaware of what influenced their decision making during the case project. Certainly, the question is very complex and the word *decision* itself seems to imply some degree of formality. In addition, if influences on influences are included, the answer would grow exponentially. The difficulty could be explained by the complexity of the diffusion of influences. Stored in the human mind as experiences or as values, they can lose the connection to their origin. If there is a long temporal distance between the influencing event and the decision it affects, it is often only referred to as an experience. The case project is now a few years old, why the interviewees could not give account for every influence in detail.

5.1.1.1 DIFFICULTIES IN COMPREHENDING STAKEHOLDER INVOLVEMENT

On several occasions during the interviews, the respondents did not recognize the influence they were having on different decisions. In some examples it was evident that the interviewees did not entirely seem to understand the influence they have had on matters. It could also be explained by memories blurring since the case project or as mere humbleness. There could also be another reason, for instance in the case where one interviewee stated that his role was to design and not to make strategic decisions and yet he deliberately tried to influence the strategy. When Rogers and Blenko (2006) describe the difference between the recommend role and the input provider role, they touch upon responsibility. Input providers may have strong influence on decisions but have no formal responsibility, in contrary to recommenders. Thus, the interviewee could see this as a way of influencing without having to account for the consequences.

5.1.2 PROGRESSION OF STAKEHOLDER INVOLVEMENT IN DECISIONS

Hansen and Andreassen (2004) describe decisions in product development as tentative, in which a preliminary decision is made and enacted early on, similar to what occurred in many decisions observed in the case project. Hansen and Andreassen (2004) go on by saying that once newly acquired knowledge clarify the consequences of ongoing actions as well as the criteria, it is confirmed that the decision was correct. The tentative decision becomes *verified* and the consideration of other alternatives is stopped. This happened frequently in the case project. Although describing an ongoing process, the concept of being verified casts doubt, as there is nothing to say that new knowledge again could be gained which would instead alter the tentative decision again, or at least raise the possibility of it, which was observed in the findings. I.e. a process of a tentative decision could also disconfirm the current action.

The term *deadline* imposed some form of end to these tentative decisions as suitable decision alternatives would be unfeasible to execute thereafter. However, if new criteria emerged during a tentative decision and alternatives to act were generated which fulfilled these criteria; a decision could still be made after what was perceived to be the original deadline. Thus *deadline* in the case was largely a theoretical construct. The related term *freezing* meant to stop changes to a product, simply deciding not to make any further changes.

In the case project, the tooling decisions were the type of decisions that most interviewees considered important. The explanation might very well lie in the apparent freezing character of the decisions. The stress that the interviewees related to the deadlines might also explain the unanimity of the perception of the tooling decisions' importance. Moreover, the deadline existed for team members from all functions.

Depicting decisions as tentative creates the picture of singular decisions occurring over the course of time. But another perspective is that at each point in time an altering of course of action is made, a separate decision in itself is performed. Still the empirical findings confirm the interviewees view it as one linked issue. This brings about an interesting question that will be followed up later – Why is it so?

The continually adjusting approach that tentative decisions implies can be compared to Mintzberg and Westley's (2001) *doing first* approach where decision making is a gradually exploratory/experimentation process of choosing actions to take. In the case there was a high level of uncertainty - a new industry was entered which entailed a new platform product development project. As such it would deter a *thinking first approach* which wasn't dominant in the project either - few attempts to structure and plan decision making was seen. However strains of *see it first* approaches were found which is fittingly to creative problem solving such as in product development according to Mintzberg and Westley (2001). Building experience plays an integral part in progressing during a doing it first approach (Mintzberg and Westley, 2001). This is however not surprisingly, as experimentation leads to learning and knowledge building which in turn leads to choosing a better informed approach. However, not all stakeholders were equally

participating in the decision process, why they seem to have learned to different extents. This seems to be linked to the communication intensity regarding the decision in question. E.g. project participants were intensely involved in discussions throughout the project which changed their mind-sets in comparison to individuals involved in simple information transactions.

However an interesting notion is that Mintzberg and Westley (2001) compare their *doing it first* classification with Weick's (1995) sense making process. Weick (1995) arguments that people make sense of their environment by interacting with it, i.e. giving meaning to their experiences. Now Weick (1995) emphasizes that sense making is a social process – individuals influence each other and the sense making process cascades back and forth all the time. This is the process described as a *conversational discussion* by Fonseca (2002).

The empirical findings revealed resistance from participating individuals to alter course once a decision had been made, as tentative decisions and doing first approach describes. One explanation to why many decisions are perceived as one tentative event can be found in the concept of path dependency. A loose definition of path dependency is that available options are constrained or affected by previous choices (McLean & McMillan, 2009). Although Sydow et al. (2009) take a wide scope of organizational path dependence, the outcome of path dependency according to them is the same, a decreased scope of action. Path dependency could therefore exist because of interactions and laid down resources as a result of tentative choices as time progresses, which links the decisions and actions together. Thus for every time the course of action is altered, inertia increases and the likelihood of changing action is decreased. Moreover, a decision coming to resolution also seemed caused by actions related to drivers for involvement which will be discussed further in section 5.2.1 Drivers for involvement.

An interesting linkage between the designers' paradox (Ullman, 1997) and decreasing willingness to change as resources are spent could be discussed further. As they appear similar, are tentative decisions and a series of decisions taken as time progresses similar - decisions constricting each other?

5.1.2.1 BROKERS

Granovetter (1973) argues that some individuals acts as bridges between social clusters, connecting otherwise distant groups which by their nature are not homogenous with each other. The broker individual in the project displayed the same characteristics, connecting diverse groups of stakeholders into the interactions around decisions. That the connections stood out as being the sole connections between the Company and different stakeholders strengthens the observation further. That the ties were weak too can be concluded by observing that daily interaction did not take place during the project.

In a sense, collective decisions were made larger with more individuals involved. The drivers for involvement of further individuals in decisions, already identified, could be said to be fuelled further by

the broker. These brokers play a crucial role in diffusions of information throughout networks between clusters (Granovetter, 1973), and are more likely to gain important information.

The related theory of structural holes by Burt (2009) further state that these brokers are more likely to leverage this information benefit to gain social advantage, which can be seen by the brokers own apprehension of the leveraging power in having these relations. Through these connections, perhaps not as obvious, the broker could also be said to connect different clusters of customer stakeholders together with each other, which is visualized the way sales presentations was developed in-between customer visits. As such, the broker identified served as broker between many different clusters.

What was more interesting was that in the project group there seemed to develop a norm of connecting to outside sources throughout the project, apart from the company norms. Undeniably this behaviour seemed to stem from the broker. The broker in the case team had a high position in the informal hierarchy of the team, something that might have aided him in convince the other team members to accept the influences from other stakeholder clusters. Exactly what role the broker played in this development could be elaborated on further.

The individual identified as lightweight broker can be characterized as someone with a higher degree of centrality but not a broker by Granovetter's (1973) and Burt's (2009) theories, since the connections weren't as unique at all. Furthermore, the lightweight connector in the case team did not seem to have such a high position in the team's informal hierarchy

5.1.3 FACTORS IMPACTING INTERACTIONS

This section discusses further the different factors that were found in the empirical data. The order of this section is identical with the one in the results section. First is a short section about the diversity among the case project team members, and then follows a review of the team's power structure and atmosphere. Lastly, thoughts about how and why different ways of interacting in decision making could be used to achieve different results.

5.1.3.1 DIVERSITY

Coherent groups are perceived as well functioning and efficient since no big arguments arise, but gifted with less creativity (Roberge & van Dick, 2010). This is in line with the observations of Fonseca (2002), who appreciate the irritations in divergent groups for their innovative effect. O'Reilly et al. (1998) found that the capability of separating task conflicts from relationship conflicts is influenced by the group diversity. This might explain why there were few conflicts in the case project team.

In the case project core team's six members, five were Swedes and five were male. Three were middle-aged and three were younger. Of the employees working closest to the team, most were middle-aged Swedish men. The conclusion is that the team was not very diverse. The notion of diversity is however relative. Coherence can thus be hard to see from inside, why interviewee statements are not enough for determining the degree of diversity in the case project team. Nevertheless, no conflicts were mentioned, which is consistent with the findings of O'Reilly et al. (1998). A possible explanation might be that the frames of references might have been converging.

In terms of how long the case project team members have worked at the Company, the diversity is greater. The most recently employed had only been there a couple of months while the two team members had been working at the Company for well over 20 years. According to O'Reilly et al. (1998), tenure diversity leads to increased conflict levels, something which cannot be verified by the findings.

5.1.3.2 FORMAL HIERARCHY

David et al. (1989) found that a large horizontal differentiation acts to increase problem solving efficiency in a group if the tasks are unpredictable. If not, they state, horizontal differentiation is still appreciated although without improving efficiency. The case project had included the purchasing function from the start of the project and this was considered as valuable by all team members. The quality department was not represented in the core team but had a relatively high involvement, which was also appreciated by the team members. The sales department was also connected to the project via the customer project. Nevertheless, no other functions were represented. The sales department had no application engineer inside the case project team. Neither was there any representation from the assembly or the maintenance function. David et al. (1989) do state that efficiency is not gained if the task is simple, but the case project was a product platform development project which as stated above contain a considerably amount of uncertainty.

David et al.'s (1989) findings regarding vertical differentiation show that complex problems are more easily solved when personnel from several hierarchical levels are involved. However, if the problem escalates too many levels the result is inertia (David et al., 1989; Cross et al., 2009). Three hierarchical levels were represented in the case project group. The level above the project champion was the corporate management level, which was represented at the gate meetings. Thus, the case project team can be considered to have had a large vertical differentiation. The complexity of a product platform development must be considered as high, why according to David et al., (1989) the project team's vertical differentiation was suitable. By considering the function of the case project champion, this also seems plausible. He had the authority to make important decisions and had close personal relations with most senior managers at the Company, thus providing him with input from most parts of the company.

Vroom, Yetton and Jago's (1972; 1988) prescriptive models of to which degree a manager should allow for group decision making focus heavily on whether the group will comply or not. For instance, a

decision of low technical importance where employee commitment is unimportant should be made by the manager alone. The occasions when the project champion ended discussions by making a decision himself seems to have been few. Even so, this seems to have been preceded by team deliberation with the intent to reach a consensus. While the Vroom, Yetton and Jago (1972; 1988) models default principle is that the manager decides alone, the case project's default principle seems to have been to strive for consensus to some of Geoff's (1995) degree. One possible explanation for this might be the trend of flattening hierarchies since the models were proposed. Another factor might be that the Swedish national culture according to Hofstede (1980) has a slightly smaller power distance than the American. Regardless of why, the decision making process was perceived by all team members to have provided enough room for expressing their minds. A more authoritarian decision making, as proposed by Vroom and Jago (1988), might eventually have been beneficial for efficiency but would go against the Company's corporate culture, lead to unnecessary escalation and alternatives from fewer persons. Hofstede (1980) also flags for the problems of validity of the work of Vroom caused by the American context. See Appendix 2 for a graphical representation of Vroom, Yetton and Jago's (1972; 1988) prescriptive models with the case characteristics mapped out.

5.1.3.3 INFORMAL HIERARCHY

The formation of the case project team contained few conflicts, which by one interviewee was due to the relative equality in knowledge of the new field. This equality was verified by another team member, although he explained that the participants of the pre-study had gained a large portion of knowledge prior to the formal project start. This calls for complementary explanations for the unproblematic team formation. Another reason might have been that the existing formal hierarchy; the project champion was the highest formal manager, and the project manager and the lead engineer was appointed leader positions. The three of them had considerable experience from earlier development projects and knew each other well before the case project. Moreover, the fact that two members were recently employed when the project began suggests an initial hierarchy where they are less influential. As described above, the remote member seems to have been aware of the slim chances to influence by social interactions.

In the interviews there is an appreciation of the stability of the group, everyone has accepted their role and wishes to preserve them in order to focus on other things. The feeling of social security could have allowed team members to come up with inferior solutions and still be accepted and respected by the others.

Several team members state that there were very few occasions during the project when prestige appeared, a problem that seems to have been less uncommon in other constellations. Prestige was explained by one interviewee as the phenomenon when individuals did not want to reject own ideas even after they have been deemed as inferior to others. This is what Forester (1984) refers to as pluralist bounded rationality. By applying the lens of McClelland (1953), Herzberg (1968) and McGrath (1998),

this could be seen as dynamics of individual needs. A strong need for power might push individuals to insist on their own ideas. This might also happen if there is a strong need for personal achievement in combination with a lack of affinity with the group's final solution, e.g. due to a low connectiveness in the group. In the case team, there might instead have been individuals who had a strong need for affiliation to the others or a strong need for collective achievement.

Amabile and Cramer (2011) have found that the greatest individual need is to experience achievement; the biggest wish of employees is to simply make progress in their work. The finding is furthermore consistent with the proposals of Herzberg (1968). Although according to Hofstede (1980), Herzberg's research about *job enrichment* is done in an American context and differs widely from the Swedish *group work-forming* culture which instead promotes social factors. However, Amabile and Cramer (2011) state that one of the greatest barriers for progress-making is interpersonal conflicts and that the role of management is to prevent conflicts. In the case project team, the project champion had the ultimate decision mandate and did sometimes use it to end discussions. Since all team members accepted these interventions, they can be seen as a way of preventing conflicts from getting personal and thus helping team members to concentrate on their work.

Another explanation of the behavior that was regarded as prestige might have been a consequence of differing frames of references. If the references are unknown for the rest of the team, the reasoning and motives of a stubborn team member might be discarded as an act of prestige or personal insecurity.

5.1.3.4 PROJECT TEAM ATMOSPHERE

The case project team's atmosphere had several implications for the decision making interactions. The team was said to have an allowing atmosphere, which could have resulted in team members expressing their preferences or needs. This would have increased the connectiveness (the degree of how strongly members identify with other members' needs and goals) in the team and minimizing the existence of hidden agendas, a very harmful phenomenon for group decision making according to Shani et al. (2009).

According to O'Reilly and Roberts (1977), a high connectiveness also has a positive effect on group members' relationships. In addition, McGrath (1998) agrees that personal needs and goals make group members cooperate to achieve shared goals. The case project team members seem to have had a great understanding for each others' preferences; their personal needs and goals. Thus, the high connectiveness might have made the team develop norms that hindered arguments sprung from different mental models to become unconstructive or personal. Moreover, the lack of conflict among the team members is a clear signal that the teamwork was efficient, according to Shani et al. (2009).

The open atmosphere implies that regarding smaller, day-to-day decisions, the involvement drivers information sharing and analytical assistance was active among the team members, which was apparent from the interviews.

Nevertheless, it was evident in the interviews that there was room for further understanding of other team members functionally connected needs and frames of reference. Although, the downside of such understanding, according to Fonseca (2002), is that fewer misunderstandings occur. When less redundant diversity is shared, fewer new creative ideas are shaped.

5.1.3.5 HOW ALTERNATIVES ARE PRESENTED

This section discusses the different ways of interacting in decision making and what consequences they have.

5.1.3.5.1 ALTERNATIVES' DEGREE OF REFINEMENT

One of the findings regarding involvement in decision making is that the degree of refinement dictated how freely alternatives could be discussed. The more refined the alternative was perceived, the less radical changes were discussed. This relation was used by most team members, even though it might have been unconsciously by some.

There are several examples where an alternative was refined in advance in order to steer a discussion. While some interviewees seem to have preferred an initial deliberation, others prepared their alternatives before presenting them to the others. The difference of preferred way of engaging a decision seems to be related to position in the informal hierarchy; the interviewees with lowest position leaned to more often develop an alternative prior to a discussion. Since their possibility to influence the group was lower in general, this was one possible way of steering discussions. This observation connects to Fonseca's (2002) observations of how individuals with the highest social status could control the discussion. Another reason for the different ways of discussing alternatives could be personal attributes. Some team members were more talkative while others were more thoughtful.

There are at least two factors that could explain why it would be beneficial to refine an alternative in advance. First, the person presenting, or recommender, might leverage the anchoring bias (Lee & Lebowitz, 2015). The audience has to compare every other idea with the one first presented and the effect is a tentative decision which is hard to change. Secondly, all interviewees described a constant stress, why it may seem neat to not disagree when a refined alternative is on the table. One rather common norm in groups is to not criticize ideas if nothing better can be presented, something which would provide the recommender with further advantage.

When the same method was used by the remote member, it seems to have other reasons. Because of the low frequency of communication and the lack of face-to-face interactions, the ability to effectively influence in discussions seems to have been very low. Convincing methods like talking to the other team members individually beforehand were not available. In the interview, the remote member indicated an awareness of these restrictions. Morgan's (2004) research could shed further light on this finding; only information is not always enough for making the other team members understand the reasoning during a

deliberation. Video conferences are sometimes not enough for diffusing tacit knowledge. As stated above, the inequality in information and the different intensity of communication is likely to have impaired the possibility to gain a high informal position in the group, further decreasing the ability to influence decisions.

The other effect of this causation does not seem to have been as obvious by the interviewees. Only one interviewee explained how this was deliberately used to get better feedback on designs. As a technique for shaping more creative discussions, this might provide some insight to why back-of-the-napkin or back-of-the-envelope drawings have been so successful (e.g. Townes, 2010). These rough sketches and calculations made by the simplest of tools give discussions an arena of great freedom, just like the interviewee described.

Thus, it seems to be very rewarding for decision makers in product development to have the ability to match alternatives' degree of refinement to the purpose of the interaction.

5.1.3.5.2 INITIAL SELECTION OF ALTERNATIVES

As presented in the findings, a similar preparation in advance of a team discussion was made by the project purchaser. Upon deciding which supplier to contract for manufacturing a component, a number of possible suppliers were presented. The team discussed these alternatives based on preferences such as cost, dependability, delivery precision and quality. The decision was perceived by most members to have been made by the team as a whole during the discussion. Some members considered the project purchaser to have what in the words of Rogers and Blenko (2006) would be something of a mix of recommended, input and perform roles; the purchaser compiled a list of supplier candidates and data of their performance based on the set of preferences. In fact, only a subset of all possible suppliers was presented. The purchaser had previously excluded other possible suppliers according to e.g. previous experiences and purchasing colleagues' perceptions. Still, this selection was not noticed by the other team members. They saw the purchaser as a provider of information and executor who had very little influence on the decision. Furthermore, the palette of possible suppliers was controlled by strategic purchasers, thus they had very strong influence on the decisions without being recognized by the team members from other functions. These very different perceptions of the project purchaser's role can be explained by the reasoning of Tversky and Kahneman (1981); by considering the differing frames of references. The other team members' previous experiences have shaped their frames of references so that they act as a filter on how they perceive the environment.

Of course, the pre-selection must have been a necessity since it would have cumbersome to compile a list of the complete set of possible suppliers, and also would have been a very tedious task for the team to decide upon every alternative.

5.2 RQ3: WHAT SEEM TO BE DRIVERS FOR INVOLVEMENT?

This section discusses the third research question; why the decisions in focus contained a large proportion of interaction by several people. It covers the drivers found for more persons to get involved in a decision making process. The section's second part discusses the relation to learning and resolution of decisions.

5.2.1 DRIVERS FOR INVOLVEMENT

Below the drivers for involvement of more persons are discussed in detail. The order is equivalent to the order of the corresponding section in the results chapter.

5.2.1.1 INFORMATION

A quote by (Galbraith 1973, p. 4) points at the importance of information and interactions on decision making: *“the greater the task uncertainty, the greater the amount of information that must be processed among decision makers during task execution in order to achieve a given level of performance”*. One issue that can be apprehended by this quote is that organizational configuration heavily impacts on information diffusion and processing in organizations. Moreover, it complicates who are involved by stating the information is processed between decision makers.

According to Galbraith (1973) uncertainty is a measure of the missing information required to perform a task. Galbraith's theory can also be viewed from the perspective of making decisions - For a decision, uncertainty equals information required to reach a perceived satisfactory conclusion for a plan for future action (or non-action). Thus it is a relative concept from the decision makers' point of view, analogously with cognitive bounded rationality (Simon, 1958; Forester, 1984).

Now according to Galbraith (1973), the total amount of information required is determined by goal diversity, level of goal performance, and division of labor. The decision making in the case project affected and required various stakeholders, as product development is by its nature a horizontal business process (Griffin et al., 2002). As referred to in earlier discussions, groupings had divergent frames of references and different knowledge bases acquired from functional tasks. Put simply, product development brings uncertainty to decision making in the project in itself. However, the determinants of uncertainty need to be complemented to encompass the concept of uncertainty as induced by complex environments such as product development. That is, uncertainty manifested by the impossibility to describe an existing state as well as possible future outcome, not stemming from the three drivers mentioned first. There are several co-coordinating mechanisms organizations can employ to communicate, direct and cluster information where it is useful and to reduce uncertainty, such as close to the project participants involved in the decision making (Galbraith, 1973). Existing rules and procedures for how to act to increase independence in the project was non-applicable as the project itself and many

decisions pertained novel unchartered areas. Formal decision making methods could be considered a way to create procedures that could potentially reduce the need for interaction, but weren't used extensively in the project. Perhaps the project group instead resorted to deliberations as a way to seek external information in the process. And as discussed in the previous RQ, working with low level of refinement in alternatives before presenting to external parties itself invited more participants. Moreover, goal setting, another steering mechanism, didn't exist in the project as goals were emergent and manifested through continuous interactions with stakeholders, notable from stage-gate meetings and customer visits. However the project team was quite small, equating to a narrow span of control for the project leader and champion. This facilitated immediate communication in the project group. So lack of co-coordinating mechanisms fueled the project participants need for acquiring information. Moreover what Galbraith doesn't discuss, the uncertainty induced by complex external environments, further induced the need for information in itself. Galbraith (1973) also mentions mechanisms to increase information processing – through lateral relations and vertical integration. Lateral relations in form of cross-functional teams and IT systems were prevalent in the project and organization and facilitated information processing. However it also entailed participation of more individuals as well. Another mechanism to increase information processing, vertical integration, would involve even more individuals in the decision making process.

5.2.1.2 ANALYTICAL ASSISTANCE

Information processing is closely related to the other observed driver for interaction - increased analytical capability. It is not entirely separable from information diffusion and processing, often occurring simultaneously. The difference is subtle, but we define analytical assistance to be required by decisions characterized more by problem-solving, where information is available but can't be made sense of. For example, creativity and divergent thinking are important components in devising alternatives (de Bono, 2000), facilitated by analytical assistance. Analytical capability can be operationalized further, out of which analytical capacity is another emerging concept. By involving more individuals, the total capacity to solve problems is increased which could be necessary for solving complex tasks. Who to turn to might perhaps depend on how close the relation is, according to the findings from the social network analysis, which is in line with the findings of Amabile et al. (2014). In the case of the tooling decisions, a weak correlation was found between the degree of friendship and the perceived importance of consultative interactions, which is described in further detail in Appendix 4.

Analytical assistance is not the same as group intelligence. Group intelligence is a popular concept, entailing that groups converge to superior solutions to decisions independently but by aggregating and choosing the most frequent solution (Surowiecki, 2005). However analytical capacity in the sense of the case required reciprocity to contextualize and collectively see *the larger picture*. The outcome of reciprocal analytical assistance is inevitably also transference of frames of references and mental models, stemming partly from experiences of the involved. Additional outcomes from both information gathering

and analytical assistance were that the two first of Forester's (1984) levels of bounded rationality is mitigated, or rather bounded from an organizational perspective and not a more fragmented one.

5.2.1.3 STAKEHOLDER INTERESTS

Game theory raises the issue of interdependent decision making and studies both cooperation and competition related to decision making (Kelly, 2005). From a process perspective, this arguably describes intersecting stakeholder interests, which by the reasoning of Forester (1984) equals to pluralist bounded rationality. The reason for increased stakeholder involvement in decision making seems to be two-fold. From a pull perspective, stakeholders are brought into the process by decision makers. Conversely from a push perspective, stakeholders engage the process by their own initiative. From the former perspective, this occurs through both a conscious and unconscious process. Deliberately it occurs when decision makers apprehend or speculate that in order to follow through and realize potential decision alternatives, action and participation is required by stakeholders that would play a part.

Furthermore although not observed in empirical findings, it could be argued to be a way for decision participants to gain leverage for opinions by involving like-minded. From an unconscious perspective, it manifests through transgressions of actions by decision makers, as exemplified in empirical findings when interviewees at first didn't realize they affected stakeholder. In the latter perspective, stakeholders' approaches to decision processes can be traced back to their own interests and needs. As mentioned earlier, McGraths (1998) categories of needs provide some rationales for why participation is desirable for stakeholders, seeing potential to improve their situation by participating in the decision process.

Either way, additional stakeholders get involved in the interaction around the decision making process. In this ensuing interaction different stakeholder attempt to affect the decision making process. The result is in line with Galbraith's theories around goal formation in tasks with high uncertainty (Galbraith, 1973). At some moment in time, a coalition forms just as Cyert and March (1963) describes, dominantly influencing the decision process. In turn leading to satisficing behavior in the decision making process.

What was found in the interviews was differences in interests between the technological excellence oriented product development unit and the finance oriented global management team were found in the interviews. This could be explained by the different environments the two groups operated in. The product development unit has a history of strong technological push approach while the global management team seems to have had more of a market pull approach. Each way forming the respective frame of reference and thus separate preferences. The manager responsible for the project had previously worked both in product development and sales units and seems to have created his frame of reference from both experiences. This gave him a set of preferences that resembled to both the global team's and the development's interests.

5.2.1.4 ANCHORING AND RESPONSIBILITY

The rationale for anchoring seems to be found in emotional aspects. One interviewee expressed that the “*feeling*” that the other stakeholders had accepted a decision was most important. Another interviewee used the term “*accomplice*” for a person a decision was anchored in; thus implying that there was a risk of being caught. The rationale seems to be to gain social security by being part of a group of decision makers when the decision is criticized. At the heart of this urge seems to be the basic feeling that it is easier to cope with criticism if there are others who are also criticized. It provides the anchoring decision maker with a sense of security; it satisfies the need for affiliation that McGrath (1998) describes. By self-observation, the researchers can verify the existence of such a need.

Anchoring seems to have been a widespread norm at the Company, and it seems unlikely to be so if it would not have worked. There seems to be an ethic duty to take responsibility for decisions that was passively agreed to. And it is very likely more difficult for a dissatisfied stakeholder to criticize a larger group of people than a smaller group. This being said, it is not possible to tell from the findings in this study whether the anchoring individuals had contemplated over why they wanted to e.g. send carbon copies to others or what they wanted to achieve.

So what are the prerequisites for anchoring? It would be reasonable to think that more is required than only the need for a feeling of security or affiliation. The receiving side of anchoring, the potential accomplices, would probably not accept their role if they had nothing to gain. It might also be considered impractical to never agree on decisions without knowing every detail themselves. It might be a favor between friends, or many other reasons. However, it seems reasonable to presume that some level of trust in the anchoring decision maker is needed from the potential accomplices’ side. If the decision seems completely unreasonable it would surely not be accepted, which indicates that some form of understanding is needed. If the frames of references would be very differing, a considerable amount of trust would be needed to accept the anchoring.

Modern information communication technology might be another prerequisite for anchoring. By carbon copying many recipients in an e-mail, a decision could easily be anchored to many others without requiring much attention. If the recipients were instead to be asked personally, they would be forced to answer actively and not just refrain from objections. Even so, one interviewee described that he always forced the carbon copied recipients for an answer. The reason for this could be that the need for affiliation is high and that the social status was relatively low.

An example of anchoring was the gate-meetings. The main function of the gate-meetings seemed to be to spread information about decisions. But as a secondary role, the gate-meetings served as anchoring platforms. It was during the gate-meetings that the project management board members were said to have been made accomplices. As one interviewee stated, it was highly unusual for a project to be stopped. This

is another indicator of their anchoring function. The combination of information diffusion and anchoring seems to be a common mix. Perhaps information diffusion draws attention from anchoring.

The project champion was keen on having all team members to accept the decisions made, even though he could have made them solely. This might very well be a way of creating compliance with the decision or to test the alternative on the team members who actually had the deepest knowledge about the matter. Although, it could also be explained as anchoring. Thus, it implies that anchoring goes beyond hierarchy.

Whether anchoring really work or only provides a false impression of security could not be explained from the empirical data. This might be because the team felt united in different issues and also because no decisions that were considered greatly dissatisfying were made during the case project.

There might be a national cultural dimension of anchoring. One interviewee stated that Singaporeans were afraid of making decisions since they would then be “*exposed*”. According to Hofstede (1980), Singapore national culture is distinguished by a large power distance and extraordinary weak uncertainty avoidance. Hofstede (1980) states that this means e.g. a high willingness to take risks, something that contradicts Hofstede’s (1980) findings. On the other hand a high power distance means e.g. fear for others, which might very well be a reason for anchoring.

5.2.1.5 DELEGATION

According to Edvinsson and Malone (1997), delegation increases employee motivation and creativity, provides a possibility of concurrently work on the same problem and greater flexibility. These advantages were also mentioned in the case interviews. Furthermore, Malone (2004) claims that delegation allows more innovation and efficiency since decisions are made closer to the persons with knowledge about the problem. Thus, it is a way of providing information and analytical assistance. Wheelwright and Clark (1992, p. 130) share this conception, stating that “... *we think that the only viable long-term solution is for middle management to do more of the day-to-day planning and decision making. Senior management does not have the time, patience or inclination to run individual projects or to micro-manage the development process. This they must delegate.*“

The basis of these statements is that decisions should be made by the persons with the greatest knowledge about the problem, and an underlying assumption is that this knowledge often resides at the lower levels. Vroom and Jago (1988) instead reasons that if decisions do not require employee commitment it should be made by the manager. This default mode seems likely to fill managers’ desks with decisions and slowing down decision making, which is exactly what e.g. Galbraith (1977), Wheelwright and Clark (1992), Edvinsson and Malone (1997), Cross et al. (2009) and Steiber and Alänge (2016) warns for.

Edvinsson and Malone (1997) state that adequate information and trust are prerequisites for delegating decisions, which is verified by the findings of this study. The project champion and the project manager knew each other very well and had a great mutual trust for each other. Regarding the information about

decisions, the champion did not only see it as a prerequisite but also as a reason for delegating responsibility. As stated above, the champion was aware of the inadequacy of his frames of reference in some areas and thus saw it as a necessity to delegate tasks to those more knowledgeable in the matter. However, the champion did not always agree with the decision maker. This could be interpreted as a contradiction by the project champion; that he after all did not fully believe that his team members always had the best solutions for a problem.

The champion stated that he needed from his team members to act independently. Therefore he sometimes allowed them to make decisions that he was convinced were bad so that they would learn. Steiber and Alänge (2016, p. 114) quote a mid-level leader at a company in the Silicon Valley who claims that he trusts his employees in the same way as the case project champion “... *I don't have to see what they see. Someone said 'I have a great idea and I have a team that believes deeply in this concept and I want to try it' ... I said 'let's go.' I am supportive, even if I don't see what they see. Because if I start to put my judgment on top, I will become a lawyer, I will inhibit that innovation*”. This manager seems to completely trust his employees. But Steiber and Alänge (2016) continue by stating that another Silicon Valley manager saw it as a duty to coach employees with unrealistic ideas. Thus, he did so to say put his judgment on top. This shows the necessity in not always completely letting employees act however they see fit. In fact, adding this judgment is a way of adding more analysis and information to the decision. But what would be the correct amount of trust is of course different for every situation.

One question that could be raised is how free the team member with delegated decision authority really is. As stated above, the interviewees seem aware of that their freedom could be revoked whenever the project champion disagreed. Although he stated that he refrained from doing so, it was known that he could. This knowledge could surely have prevented team members from making decisions that would be revoked. In this way, only the awareness of the champion's frame of references make team members act according to them, without having to understand or share them. The effect is that the bounded rationality of the project champion still inflicts on the decision making in some degree. On the other hand, if team members could make decisions without regard to managers' wishes the organization would dissolve.

5.2.2 LEARNING AND RESOLUTION OF DECISION

As elaborated upon earlier in the analysis, learning implies not only knowledge, but changes of frames of references and mental models. Participation in sessions of analytical assistance in discussions and deliberations seemed to be the primary determinant of learning for stakeholders. This is in line with argumentation from Purser et al. (1992) who argue that deliberation plays a vital role in learning in product development projects. Thus not all stakeholders took part in a learning process throughout the project.

Not all forums (for discussions) are beneficial for learning. There were episodes along the project that statutes both successful and unsuccessful examples. The customer visit at the large customer served as a turning point the project participants. Afterwards, several major changes were made to the product concept and long afterwards the participants remembered the episode as a major learning session. It fitted several factors according to Purser et al. (1992) for successful learning in deliberations; small informal forum, lack of functional competitions, active inquiries and strive of understanding the complete product system and finally no time pressure. The opposite situation could be observed at the educational sessions at institutes, and it was doubtful according to interviewees, if any learning occurred at all. Further details about these forums are provided in Appendix 5.

Other drivers than analytical sessions for getting involved also play a part in the learning process. Information gathered by central decision makers provides fuel for discussions. If the senders of information are solely senders, it is doubtful if they at that time take part in the learning process. Moreover it is probable that stakeholders getting involved in the decision process regardless of pull or push, will also take part in further information exchange and discussions. The drivers for anchoring and delegation require a certain coherence of frames of reference between parties in order to function as desired. This will involve an exchange in which frames of references are developed into sufficient alignment.

Each of the drivers for collective decision making above contribute to finalizing decision processes. It could be argued that every time a new stakeholder is involved, more personal needs must be handled and that the decision process makes another iteration. However, the result is that for each involvement the decision gets more refined and thus it comes closer to completion.

Gathering of information reduces uncertainty around decisions, according to Galbraith (1973), why it brings decisions closer to resolution. Analytical assistance, such as in deliberation are interactions with the outcome is more defined or fewer alternatives. For every stakeholder involvement because of their interest, some sort of compromise is eventually achieved and thus the decision is more likely to be executed in the way that was wished, in line with descriptions of organizational decisions by Cyert and March (1963). Regarding both stakeholder involvement and anchoring, both result in a feeling of safety for the decision makers, meaning that they dare to decide. Finally, if a decision is delegated, it is likely due to time or competence constraints. Thus it vouches for the decision to be made and executed at all.

In one sense, it seems perfectly natural that every action and interaction is intended to bring the decision maker closer to a point in time when an acceptable choice is perceived to have matured.

6 CONCLUSION

The conclusions of this thesis are divided into three parts. The first summarizes answers to the research question, the second contributions the thesis has made to research, and the third suggestions for further research in light of the thesis results.

6.1 RÉSUMÉ OF RESEARCH QUESTIONS AND ANSWERS

The thesis set out to answer a set of research questions in order to fulfill the purpose of the study. A summary of the questions and accompanying answers given through the research are presented below.

RQ1: What is a collective decision?

In the theoretical section a review of what the meaning of the word decision actually contains was presented. Together with clarifying what a stakeholder is in the context and theoretical domain of decisions, a definition of a collective decision could be created:

The process and outcome of a choice of action with multiple stakeholders.

RQ2: How does involvement manifest?

Expanding on theories by Weick (1995) and Argyris & Schön (1978), frames of references are created and altered by individuals' experiences. This also explains why no individuals in an organization have identical frames of references. There is a clear link between and individuals' frames of references and their mental models, and the latter is closely connected to how individual decision making is performed. Increasingly divergent mental models cause individuals to act differently in face of identical situations, a highly unlikely situation in itself, according to the theory of bounded rationality (Simon, 1955). One effect of this is that individuals in the organization perceived each other's actions in proportion to the differences in frames of references and perceived similar frames of references important to create a common understanding regarding issues. In the case it appeared that this was achieved as, and possibly some mitigation of bounded rationality.

A large amount of stakeholders were identified, but their degree of involvement in decisions was hard to determine in the research. The nature of influences in itself made it difficult to track, and it did not completely correspond to formal hierarchies. It was also difficult because interviewees themselves were at times unaware of their participation and influence in decisions – even the word *decision* itself was vague for interviewees.

PROGRESSION OF STAKEHOLDER INVOLVEMENT IN DECISIONS

In collective decisions observed in the project, a choice of action was taken and acted upon but reconsidered and adjusted as time progressed in an exploratory fashion. The description fit both Mintzberg and Westley's *doing it first approach* as well as Hansen and Andreassen's (2004) tentative decision. Adjustments in action was triggered by experience and subsequent learning for participants involved in this process, partly as a result of being in uncertain environments. and congruent with Weick's (1995) theories of sense making, describing it all as a social practice of interaction. Furthermore, the degree of learning for stakeholders seemed to depend on degree of involvement in communication around decisions. Increased resistance to alter course of action was observed as time progressed, decreasing the likelihood of altering a decision. This was attributed to resources laid down and performed actions – decisions coming to resolutions was caused by a number of drivers for involvement in ditto which was presented in RQ3. In a way, path dependency seemed to manifest to some degree, also explaining the interviewees' perception of separate decisions being one linked issue.

BROKERS

One individual participated in the project that fitted the description of Granovetter's (1973) broker, and increased the number of participants in collective decisions in the project. In a sense, he was acting as a booster for the drivers identified in RQ3. This individual also was aware of the strong social influence his position actually brought him and it is possible that his extrovert approach was converted to a norm in the project team.

FACTORS IMPACTING INTERACTIONS

There were several factors that impacted interactions around decisions. Although the researchers appreciate the relativity of the concept, the team seemed more coherent than diverse, even with a wide span of ages between members. This explains that few conflicts occurred but possibly decreasing creativity. Coherence could also be related to team members' converging frames of references throughout the project.

David et al. (1989) propose a large horizontal and vertical differentiation to increase problem solving efficiency in groups for unpredictable tasks, such as the case project. However, many – but not all – functions whom were stakeholders had an obvious participation in project decisions. Moreover, there are risks with too large vertical differentiation as inertia could be induced in decision making. But there was a sufficient balance in the project largely attributed to the case project champion referred to as the broker earlier, whom had a wide network. Decisions in the project team were preceded by members expressing themselves freely and deliberations and consensus was often intended to some of Geoff's (1995) degree. This could be because of a flatter hierarchy, but also in-line with corporate culture of inferring that corresponded to Swedish national culture, which would be in line with the works of Hofstede (1980).

Formation of the case project team contained few conflicts, possibly due to everyone's lack of knowledge in the new field. Another complementary explanation could be that the team consisted of two sub-groups. One with senior members with considerable experience especially in collaborations with each other, whom were appointed to leading positions, and one sub-group with newly hired employees. Moreover, team stability could also have been due to the fact that everyone had found their role and were content with it. This could have led to the open atmosphere in the project.

There was a lack of individual prestige in the group which is tied to personal needs, possibly because of the members' strive for collective achievement, group connectiveness or because of their similar frames of references. It seemed to mitigate pluralist bounded rationality as proposed by Forrester (1984). According to Amabile and Cramer (2011) and Herzberg (1968), individuals need to experience achievement in their work, which could be contended in Swedish culture where instead social factors are promoted, according to Hofstede (1980). Nevertheless, Amabile and Cramer (2011) state that an important role for management is to prevent progress-stopping conflicts. In the project the project champion played a part in ending discussions before leading to this.

The case project team's atmosphere had several implications for the decision making interactions. Interviewees did not completely understand each other's frames of references. However, an allowing atmosphere could have resulted in free expression of preferences and needs, reducing hidden agendas and also creating connectiveness. There was also an understanding of each other's needs and goals as well as existing collective goals related to the project, which fused the team together and prevented eventual conflicts potential different mental models might give rise to in decision making.

There were other phenomena of interaction observed which impacted decisions. A higher degree of refinement of a decision alternative proposed by an individual steered the type of feedback it gained. It could be used by individuals as a way of increasing influence in decisions, preferably by individuals with lower positions in the informal hierarchy, or by a remote member to mitigate disadvantages of geographical distance. Accordingly, a lower degree of refinement invited more feedback in general. Another observed phenomenon was when a member excluded some alternatives in advance according to their own frames of references before presenting them all to other members, whom were unaware of the alternatives they were never presented and thus the members influence on the decision.

RQ3: What seem to be drivers for involvement?

Galbraith's (1973) concept of uncertainty is transferrable to decision making, in which information is needed to reach perceived satisfactory outcomes. However Galbraith's concept of uncertainty needs to be widened to include uncertainty induced by complex environments. The fact that the project was in product development and with team members divergent frames of references increased uncertainty. This

uncertainty was not extensively reduced by organizational mechanisms, leading to decision makers' information gathering. Galbraith (1973) also recommends mechanisms to increase information processing, of which lateral relation was in use but vertical integration was limited in the project, but which in itself would increase number of decision stakeholders anyhow.

Related and often in tandem with information processing is obtaining analytical assistance, which was observed as a reciprocal interaction between individuals in which cognitive capacity was increased to aid decision making. Social network analysis findings showed that decision makers turn to individuals they are more acquainted with. An outcome could be transference of frames of references between participants and decreased bounded rationality, in favor of an organizational perspective.

Pluralist bounded rationality explains why stakeholders have separate interests in decisions, whom were brought into decision making processes either by push or pull. By push stakeholders bring themselves into decision making processes driven by their own agendas, and in pull they are brought in because they are needed to execute decisions. Either way, diverse stakeholder interests converge leading to satisficing outcomes as explained by Cyert and March (1963).

Anchoring was a widespread emotional action performed by stakeholders, in which they brought in individuals in the process with the aim to gain support and social security through affiliation as described by McGrath (1998). Some prerequisites are likely for anchoring to be established such as trust, a degree of commonality in frames of references and insight into the issue. It could also be a part of an exchange of favors. Modern IT technology could also be a prerequisite and even an amplifier for stakeholder anchoring. Gate meetings served as a prime example where anchoring took place, possibly clouded by the information sharing nature of the meetings.

Delegation occurred when stakeholders assigned decision rights to other individuals, thus bringing them into the collective decisions. There are several benefits with decentralization such as increased analytical capability, flexibility, efficiency, and possibly superior decisions if delegated to individuals closer to the problem. It was observed that a manager's own understanding of lack of information and frames of references was a driver for delegation, in which someone more suitable should make the decision. But it was also at times performed to initiate a learning process for employees to create independence in the future. Trust seemed to be a vital prerequisite for successful delegation, and the question of how freely individuals really could act with delegated authority is interesting, as it could be revoked if the frames of references of the manager wasn't understood and acted upon by the recipient.

LEARNING AND RESOLUTION OF DECISION

Another discovery in the thesis was that the process of learning changes frames of references and mental models. Participating in analytical sessions related to decisions seems to be the primary determinant for learning to happen, why some stakeholders learned more than others. Not all interaction forums are beneficial for learning, as events in the project demonstrated. Furthermore, being drawn into collective decisions because of other drivers also facilitates learning for participants, possibly except for senders in information transactions. A final observation made was that, increasing the number of stakeholders in decisions seemed to contribute to decisions coming to an end, which could of course have been the purpose to include them from the beginning.

6.2 CONTRIBUTIONS OF THE RESEARCH

The thesis explored collective decision making processes in product development, which hadn't been done before in a case study of one project. By adopting a descriptive research approach, possible rationales to why collective decisions manifest were discovered.

6.3 SUGGESTIONS FOR FURTHER RESEARCH

The method of studying an already performed case project had several implications for the research. The benefits of reflection and hindsight for the interviewees were perhaps not as large as the drawback of not remembering events and the inevitable risk of reconstructions of past events for various purposes. For further research similar to this thesis, the researchers recommend a research design involving direct presence of researchers as events unfold in projects, i.e. action research or ethnography. If a more comprehensive social network analysis would have been conducted, it could have provided possibilities to identify how social relations changed from one decision to another. This could answer questions of how different parts of social networks are activated depending on the decision and expertise needed, and how interactions in decision processes affect social relations among decision stakeholders.

An issue that was expected but of which no evidence was found in the empirical data was the relationship between participation or influencing and the will to execute the chosen alternative. It would seem plausible that a stakeholder is more likely to act as was decided. Observations in some form would provide a suitable data collection method for such findings, since interviews might provide a more politically correct picture. Another phenomenon that was not observed was usage of crowd intelligence methods to draw more individuals into decision making in product development.

Moreover the researchers were not able to connect the drivers for collective involvement and stakeholders by stratification into functions or in other ways. This could be studied in the future to determine when different types of competences are drawn into decision processes.

The research discovered that participants in decisions went through a process of learning connected to gaining experience. The scope of the thesis did not include studying this further in-depth, hence a suggestion for further research is to study the relationship between knowledge management, learning and decision making.

The third research questions answered why more individuals are involved in decision making. Another interesting question would be to find out what hampers or prevents involvement? I.e. isolation tactics and withholding of information.

By conducting further studies with the same purpose as for this thesis, but in slightly different contexts, it would be possible to draw conclusions about the transferability and dependability of our findings. A feasible continuation would be to first study further Swedish manufacturing companies, since many of the findings are believed to be related to national and industrial cultures.

The researchers understanding of decision making processes has become larger, but so has the respect for the complexity of the phenomenon become. To conclude we once again cite Nutt & Wilson's (2010, p. 4) understanding of decisions, they are *"as much about defining the question as they are about providing an answer."*

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8 APPENDICES

This chapter contains the eight appendices that complement the report.

8.1 APPENDIX 1: DESCRIPTION OF THE CASE COMPANY

The company studied, henceforth called the Company, is a global actor in a business to business industry. Rather recently, the Company was bought by a large global company, henceforth called the Parent company, as a part of its strategy to be able to offer customers an integrated solution consisting of different product categories. The industry is relatively stable and mature; novel products are often derivatives of previous ones.

The Company produces no components itself, instead it relies on external suppliers for manufacturing of its designs. The headquarters are located in Gothenburg and an assembly plant lies in Central Europe. A number of sales offices are spread in different regions around the world. The sales offices provide integrated solutions for their customers, consisting of the Company's products but also partners' and sometimes competitors' products. The Company provides these sales offices with a catalogue of platforms and products that sales engineers pack into complete offerings. At times, custom made products are integrated into the standard catalogue, although this is unusual.

The headquarters include the top management and support functions, such as finance, HR and IT departments. The quality, logistics, procurement and R&D functions are also located in the company headquarters. R&D consists of maintenance design and product development departments, where the majority of the engineers develop new products or platforms, while one employee is dedicated to future research. Co-located with the headquarters is a regional sales office, still movement of engineers between the R&D and the sales office is unusual.

The Company differentiates itself from its competitors by its heritage. The brand is strong and the sales offices seem to recognize business opportunities in services as set-up and configuration of complete solutions. Otherwise, the main business strategy is to maintain high margins of in-house products.

The Company offers products that are essentially the same as when it started. New platforms have been developed but innovation at average has been incremental. The Company spends about 0.7 percent of the annual revenue at R&D, which is about a third of the average ratio for European companies in the industrial sector of the 1 000 public companies that spend the most on R&D (Jaruzelski et al., 2015).

Product development projects are conducted in cross-functional teams with structures that are somewhere between lightweight or heavyweight (Wheelwright & Clark, 1992), depending on project scope and context. Projects are controlled by a project management control system with six stages and gates, a system that was relatively new during the case project. All projects do not go through every step, e.g.

derivative projects might skip initial stages. The gate decisions determine pre-study, project team formation, manufacturing and supply operations, production ramp-up and market launch. The first two gates are held by the global management team and the following is the project management board's responsibility.

Every month there is a meeting, led by the development department manager, where resources and budget of every project are reviewed. One example of the decisions made here is whether project engineers are busy enough or can be tied to other projects. At the end of every week, there are minor review meetings where the project managers present the time and scope of every project, also held by the development department manager.

In the Company there is some self criticism about the focus on incremental R&D projects and the current lack of breakthrough projects. There is a growing concern for what might come with the Internet of Things or Industry 4.0 initiatives. The Parent company has stated that innovation is a high priority but have not interfered in the Company's R&D strategy. Neither have the Parent company offered financial support for innovation.

The Company is a clearly technology driven organization, where designs historically have emerged from the R&D department. The different functions are separated physically and the employees do not seem to blend in the shared kitchen area. The view on time is different between functions. The pace is faster at the sales offices while there are longer time-spans at the R&D department. The hierarchy between functions is not official but clearly visible, e.g. in the location of different departments. The corporate management is located at the top floor, with the financial function close by. Five floors below, at ground level, lies the production unit. The Parent company has not made any major effort to change the company culture and no Parent company employees have been located at the Company.

8.1.1 THE PROJECT

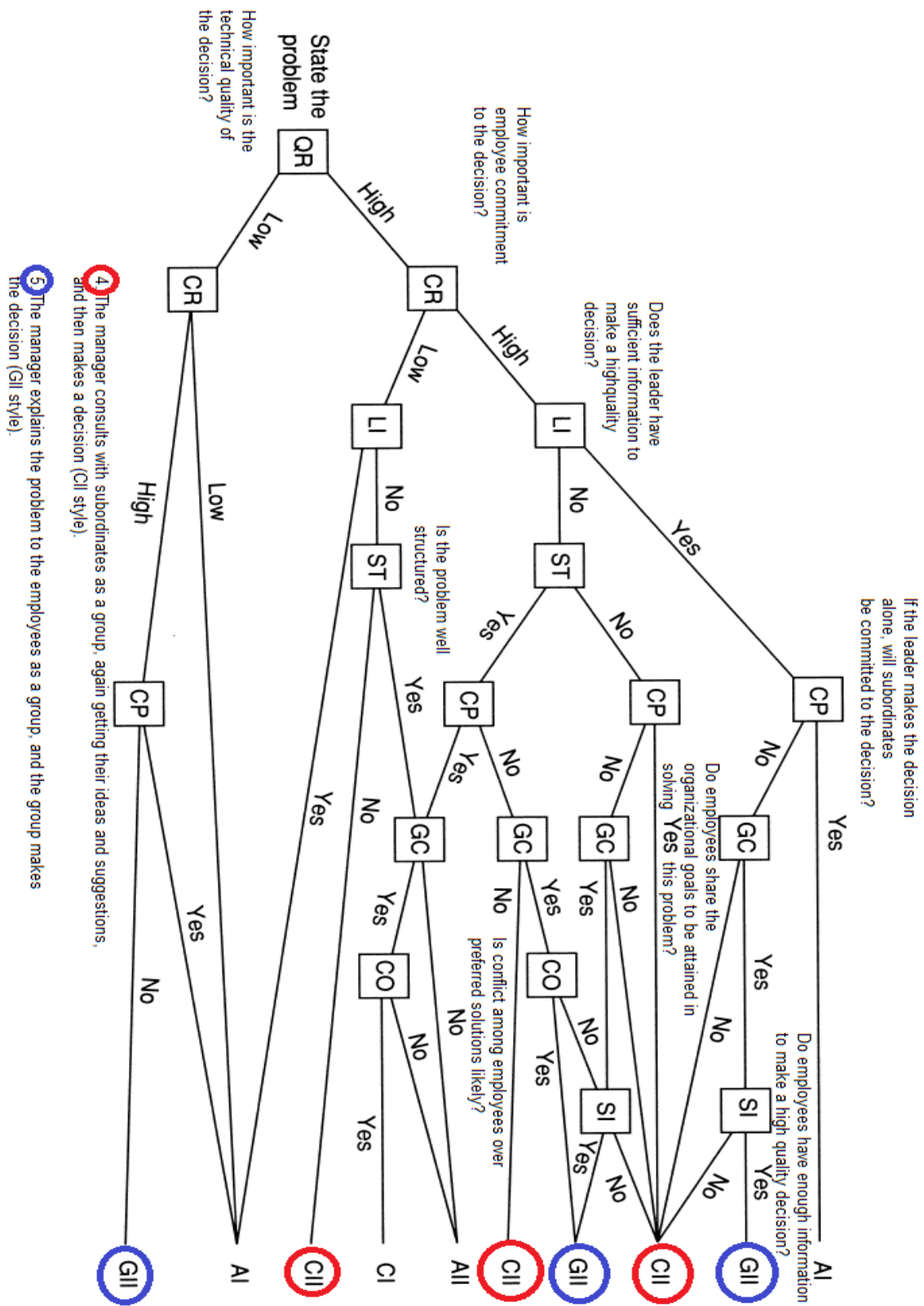
The case project was the result of a strategic decision of the team of owners during the preparations for the sale of the Company, which was performed a few years prior to the study. In the position as a supplier of production line equipment for manufacturing companies, the management team saw customers frequently moving production abroad or outsourcing production. A strategy of entering market segments that would not disappear because of outsourcing was therefore decided. Henceforth, the Company needed a new product line and therefore also new competence and information about the new environment.

A first development project resulted in a product which was not perfectly adapted for the new market segment. The case project was the second initiative of the new strategy, with some of the project team members having worked together in a first project. One team member made customer visits and gathered information about customer needs during the following year after the first project. This was after some

time formalized into a pre-study for the case project. It continued after the formal project start, and some visits were made by several of the team members. The project was scheduled to end after one year with the product launch during a big industry fair. The project was finished roughly on time, although some components and other things were not completed for the fair. Still today, some minor tweaks and improvements are being made.

The case project is considered to be a commercial success and is seen as a reference project at the Company. Several persons in connection to the project have expressed pride of the product.

8.2 APPENDIX 2: THE DECISION MAKING MODEL OF VROOM, YETTON AND JAGO



4 The manager consults with subordinates as a group, again getting their ideas and suggestions, and then makes a decision (CII style).

5 The manager explains the problem to the employees as a group, and the group makes the decision (GII style).

8.3 APPENDIX 3: DEFINING A SOCIAL NETWORK

Social network constructs are defined by the building blocks they are comprised of; a set of actors and relations and/or activities between them and it is common to combine restrictions on all the three sets (Freeman et al., 1992; Scott and Carrington, 2011). By defining the sets, the boundary of a network is determined, which is a complex issue in SNA (Prell, 2012; Scott, 2012). Another perspective of defining the network is fixing certain features of the network while leaving remaining features to vary (Freeman et al., 1992).

Two fundamental conceptualizations exist as to what a network is (Scott, 2012). Nominalists view networks primarily as models and seek to establish ties between a set of nodes, and networks are created when you define them (Scott, 2012). Ergo a network is defined first and foremost by establishing theoretical ties (Scott, 2012). Nominalists frequently refer to the same set of nodes when discussing multiple networks and often different types of ties are considered simultaneously (Scott, 2012). The Nominalist stance recognizes that although natural boundaries indeed exist, boundaries should be constructed to serve the purpose of the study and its analysis (Scott, 2012; Freeman et al., 1992). Nominalists recognize the cognitive limitations of each separate actor in networks to recognize their participation of networks.

Realists on the other hand attempt to identify boundaries that are perceived (organized, recognized) by participants, often corresponding to actual boundaries of social groups and organizations (Scott, 2012). The realist perspective define a network as a set of interconnected nodes which by definition cannot be disconnected, arguably replacing the conception of sociological groups and more closely resemble obvious human networks (Scott, 2012).

In the summary below a realist approach conventionally corresponds to focus on membership and attribute criterion of certain types, see below. Nominalists stress devising formal criterion on all three building block categories in order to identify boundaries.

The three sets of building blocks are presented in Table 3 below:

TABLE 3 - SUMMARY OF NOMALIST BUILDING BLOCKS

Building block	Definition	Method of restriction
<u>Actors:</u>	Individuals or entities sharing attributes, traits, or social position (Freeman et al., 1992; Scott and Carrington, 2011). Hanneman	This is the most common approach (Freeman et al., 1992). Borgatti et al. (2009) identifies three approaches to define actors according to similarities: by spatial and/or

	(2005) lays forth another non-exclusive restriction closely related to the realist view; by what is known a priori to be a network by identifying boundaries imposed or created by the actors themselves.	temporal location, membership, or attributes.
<u>Relations:</u>	A set of different types of social relationships which could exist between actors (Freeman, 1992).	When used methodologically a researcher often begin with an initial small set of nodes (seed-nodes) and expand the set of nodes by tracking relations, similar to the snowball method in classic research methodology (Scott and Carrington, 2011). This is a common approach in the study of ego-centric networks (Scott and Carrington, 2011). Relations can be grouped into kinship, affective ties, cognitive awareness, and relationships by roles (Borgatti et al., 2009).
<u>Event/Activities:</u>	Actors are included or not by participation in certain defined events or activities (Freeman et al., 1992).	<p>Borgatti et al. (2009) recommends identifying interactions and behaviour such as speaking with, helping, or inviting. Flows are another measure to track activities. Flows are based on exchanges or transfers between nodes (Borgatti et al., 2009).</p> <p>The systems theory domain suggests categorizing flow into two types; material and information. The former which can be displaced and is conserved and the opposite is true for the latter (Hanneman & Riddle, 2005).</p> <p>Interactions and flows usually occur in context of social relations, and interaction- and affective based measures are frequently used as proxies for one another and their co-existence is assumed or studied. (Borgatti et al., 2009).</p>

8.3.1.1 TYPE OF MODES

In a one-mode network one set of nodes are interconnected (Scott & Carrington, 2011), i.e. individuals to individuals or organizations to organizations. Multi-mode networks contain multiple sets of nodes exclusively connecting between each other, so no pair of nodes in one set can be tied to each other (Scott & Carrington, 2011). This is not to be confused by multiplex networks, where nodes are connected by multiple sets of types of ties (Hanneman & Riddle, 2005).

8.3.1.2 CONNECTIONS

Connections can be binary and with single/multi- or no direction to explain causality or direction depending on what the tie symbolizes, and with varying strength (Scott & Carrington, 2011).

8.3.1.3 CLUSTERS

Clusters, or cliques, are structural divisions within a social network apparent by the existence of denser or well-connected groups of nodes in the network. Observations of the converse situation is referred to as cleavage (Scott & Carrington, 2011).

8.3.1.4 DENSITY

The density of a social network is the ratio of actual and possible ties.

8.3.1.5 CENTRALITY MEASURES

A number of centrality measures for SNA are described below, although only some are used in this social network analysis.

8.3.1.5.1 BETWEENNESS

Is equal to the number of shortest paths from all nodes that pass through the node of interest (Hanneman & Riddle, 2005).

8.3.1.5.2 CLOSENESS

Closeness is based on a measure of the distance between the node of interest and another node, measured in number of nodes between them through the shortest path. The average distance between the node and all other nodes it connect to is closeness (Hanneman & Riddle, 2005).

8.3.1.5.3 DEGREE / DISTRIBUTION

The number of ties a node has with other nodes is the degree of the node (Scott & Carrington, 2011). For directed social network analysis, degree can be divided into in degree and out degree. Out degree means that only the outbound ties are counted, while in degree only considers ties that are directed towards the node. The size of the nodes in figures 11 and 13 relates to out degree since that gives the effect of showing nodes that were influencing others as bigger. Thus, the figures clearly show the most influential nodes as the biggest, which is in line with the intention of the SNA.

8.3.2 ASSUMPTIONS AND GUIDING PRINCIPLES OF NETWORK ANALYSIS:

- Causation is not located in individuals, and individuals are not solely shaped by their attributes, but also by interactions in social structures (Scott & Harrington, 2011). As such, individuals are described by their relations and not attributes (Hanneman & Riddle, 2005).
- SNA analysts study patterns in a holistic manner, i.e not relations independently but relations in context of other relations (Scott & Carrington, 2011; Hanneman & Riddle, 2005).
- A major emphasis on degree of embeddedness in networks, nodes are not considered discretely bounded or mutually exclusive members of networks (Scott & Carrington, 2011; Hanneman & Riddle, 2005).

8.3.2.1 NETWORK THEORY

Network theory is to study *"proposed processes and mechanisms that relate network properties to outcomes of interest"* (Scott & Carrington, 2011, p.40). Put simply; what kind of social networks relate to phenomenon of interest? (Scott & Carrington, 2011). The ties themselves and the dynamic is stressed to understand, understanding the reasons for causation caused by network properties rather than confirming the existence of ditto (Scott & Carrington, 2011).

Borgatti et al. (2009) proposes four categories of mechanisms of network attributes or positions that can cause particular outcomes:

- Transmission: Networks are considered to be pipelines through which phenomenon flow through, e.g information. Coleman (1988) studied the diffusion of norms. By studying the structure of networks, natures of flow can be explained and consequently their effects (Scott & Carrington, 2011).
- Adaptation: By discovering patterns in which nodes who share similar positions in networks cause their freedom of action and behaviour to be similar.
- Binding: Collective or streamlined actions are induced because of network structures.
- Exclusion: When the presence of one tie prevents other ties to establish.

8.3.2.1.1 EXAMPLES OF THEORETICAL CONSTRUCT METHODOLOGY BASED ON THE FOUR MECHANISMS

Below two examples of models are presented.

8.3.2.1.1.1 NETWORK FLOW MODEL (NFM)

Scott & Carrington (2011) presents their Network flow model which is a model based on transmission and adaptation and enables a conceptualization of theories.

The model posits three layers:

- Deep layer: This layer acts as a platform for theorizing. Flows of resources occur between nodes and length of paths indicate disconnection. Although what flows can change, it is not transformed completely to something else.
- Middle layer: This layer creates axioms derived from underlying layer. Clusters slows network flows by increasing path lengths and betweenness, centrality and other fundamental network properties also have an impact on flows.
- Surface layers: This layer ornaments basic theory from underlying layer with variables drawn from the immediate empirical context and which serve as an interface to general social theory.

In NFM, the methods of restriction for social networks presented in the earlier chapter are sequenced and logical orderings are assumed to be imposed. I.e if individuals share similarities it is more probable that they share social relations, and sharing social relations implies interactions are taking place. By initially focusing on social relations primarily and interactions secondarily, identification of these ties determine the "backcloth" of similarities which leads to identifying the nodes, and finally the flows can be identified (Scott & Carrington, 2011). As such, NFM actually guides the creation of theoretical social networks by identifying the building blocks which then can be used to shed light on the theories at hand. Granovetter's (1973) strength of weak ties model and Burt's (2009) structural holes theory are examples of results that are consistent with the network flow model.

8.3.2.1.1.2 NETWORK ARCHITECTURE MODEL

The Network architecture model (Scott & Carrington, 2011) is based on the mechanisms of adaptation and binding. Nodes and clusters of nodes are assumed to serve different roles in networks, but together act collectively for a mutual outcome. Although not conflicting with transmission in networks, focus is instead on propagation and autocorrelation which implies that the nodes states are affected by states of other connected nodes (Scott & Carrington, 2011). Ties bind nodes together for various reasons, creating common outcomes (Scott & Carrington, 2011). Organizations constitute good examples of this.

8.3.2.2 THEORIES OF NETWORK

Theories of network consider the converse causality compared to network theories. What are the causes of network positions and structures? (Scott & Carrington, 2011). I.e. the antecedents of network structure.

8.4 APPENDIX 4: SNA FINDINGS

Here are the findings from the social network analysis presented. The data is only depicting social relations in relation to the tooling decisions during the case project. Therefore, these findings are not generalizable to other decisions. The findings are only used for graphical representation and for bringing up questions out of the patterns that were distinguishable.

Figure 15 below illustrates a social network mapping of case project stakeholders in the tooling decision. The nodes are colored according to what function they belong to, and their size by out-degree centrality. The colors of the edges represent friendship, where darker green corresponds to a closer friendship. The arrows' directions tell the direction of influence in the tooling decisions, e.g. node 1 influence node 6. Most likely, every stakeholder of the decision is not represented, only the ones the interviewees said that they had personal contact with.

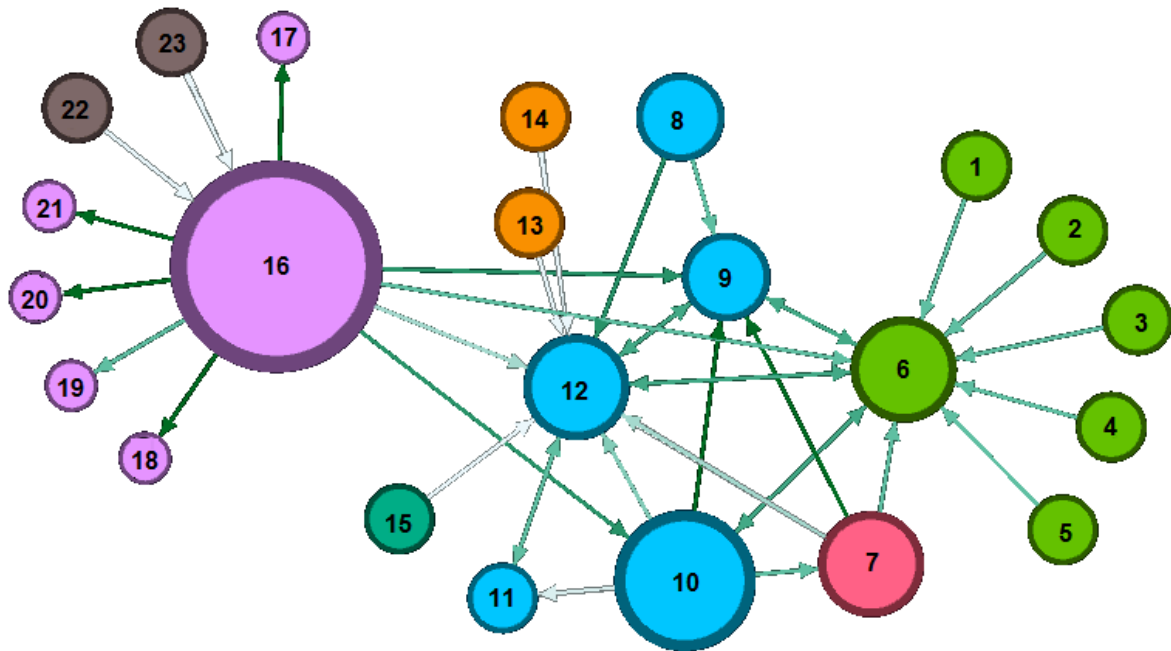


FIGURE 15 - SNA OF THE FRIENDSHIP OF DECISION MAKERS IN THE CASE PROJECT'S TOOLING DECISION

Table 4 contains the three correlation measurements that were made from the data. The two correlations that were found are weak and the causality is unknown.

TABLE 4 - SUMMARY OF THE CORRELATIONS BETWEEN FACTORS OF EDGES IN THE SOCIAL NETWORK ANALYSIS

Factors	r-value	Relationship
Comm. Int. / Importance	0,339685	Weak correlation
Friendship / Comm. Int.	0,123077	No correlation
Importance / Friendship	0,385636	Weak correlation

The two correlations are represented in Figures 16 and 17 as scatter plots with correlation lines.

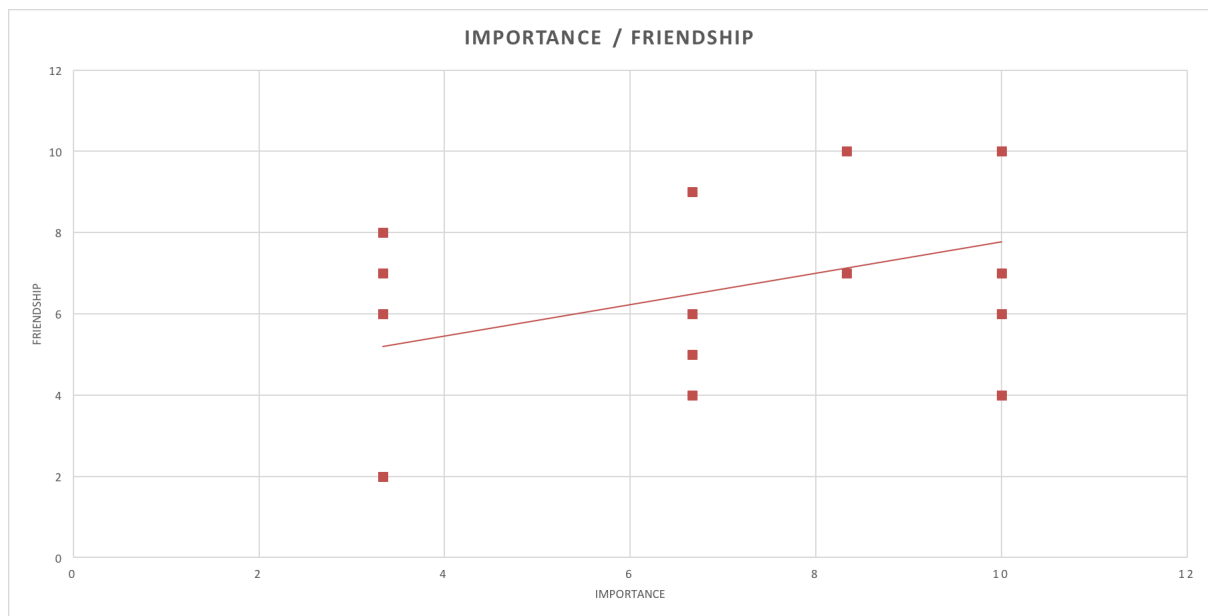


FIGURE 16 - CORRELATION DIAGRAM OVER PERCEIVED IMPORTSANCE OF THE INTERACTION AND FRIENDSHIP

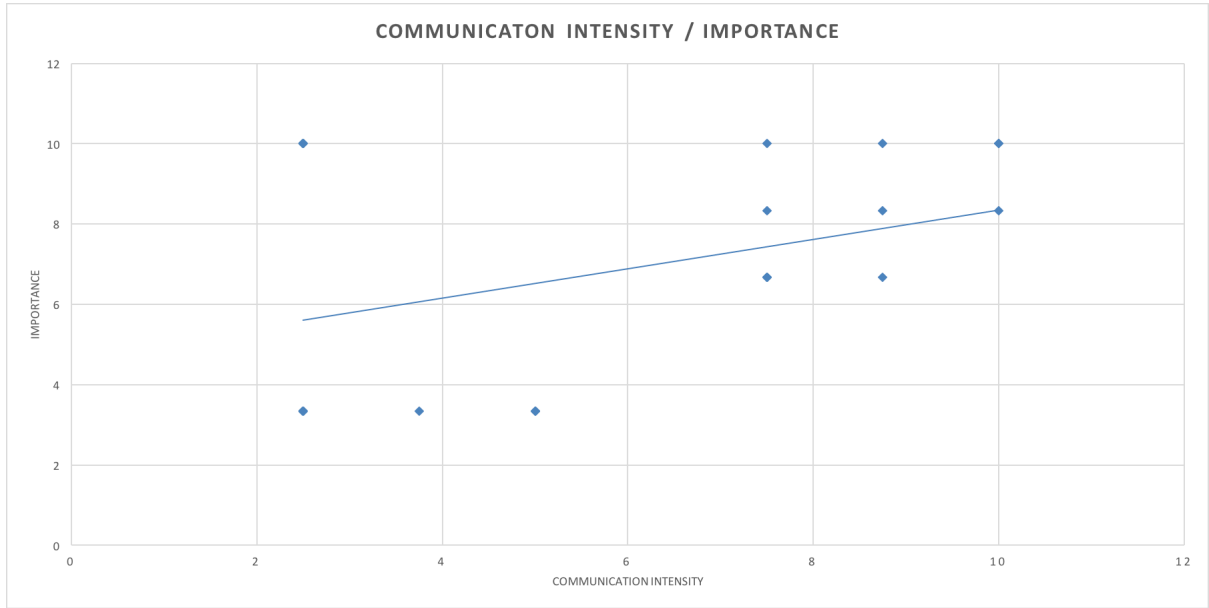


FIGURE 17 - CORRELATION DIAGRAM OVER COMMUNICATION INTENSITY AND PERCEIVED IMPORTANCE DURING THE INTERACTION

8.5 APPENDIX 5: STAKEHOLDER INVOLVEMENT FORUMS

There were several forums that were mentioned by the interviewees where interactions took place that seemed to have a strong impact on collective decisions. At these forums, communication between the project team and various stakeholders took place.

8.5.1 INTERNAL

Below the internal stakeholder involvement forums are listed and briefly described.

8.5.1.1 OFFICE CHATS

Daily micro-interactions took place, as mentioned earlier, at the departments and office landscapes at the Company. These were often spontaneous with different duration and very low degree of formality. Coffee breaks were occasions where stakeholders frequently met and discussed various issues ad-hoc.

8.5.1.2 STAGE-GATES

The Company had a relatively new stage-gate system in place at the time of the project. The gate decisions concerned various issues for the project such as project team formation, manufacturing and supply operations, production ramp-up and market launch. The first two gate decisions were held by the global management team and the following is the project management board's responsibility. The project champion prepared and sent out information to the participating managers ahead of the meeting. He was the only participant from the project team. See Figure 11 for a depiction of participating interaction concerning the tooling decision.

8.5.1.3 PROJECT MEETINGS

Almost every week throughout the project there was a formal meeting taking place, serving as a formal forum for project participants. It was held at the headquarters. The team members from the design department and the project leader were often present. The remote member was present through video link. Representatives from quality and supply-chain functions were although more frequently present in the later stages of the project. During the meetings an assessment of the progress was made and pressing issues were brought up and discussed

8.5.2 EXTERNAL

Below the external stakeholder involvement forums are listed and briefly described.

8.5.2.1 PROTOTYPE CUSTOMER PROJECT MEETINGS

Early on in the project it was decided that a customer project would be executed in parallel with the development. A couple of months into the case project a suitable customer project was selected and was

executed. An application engineer and salesmen from the sales division were responsible for the customer contact, and design engineers from the project team did not visit the customer.

8.5.2.2 CUSTOMER VISITS

In the pre-study phase numerous customer visits occurred, both with current and potential customers. An understanding of the customer needs was attained by the project champion and the product concept took form during these visits through feedback and discussions. It was driven and generally performed by the project champion. However at times the lead design engineer from the project participated as well as various sales managers. One visit at a major customer set itself apart from the others, in which some of the design engineers, the project leader, and the project champion took part in. The visit was appreciated by the employees present whom afterwards expressed an understanding of what was important for that particular customer. It leads to large portions of the concept being scrapped and altered. The visit was referred to as a critical episode under *Frames of references and perceptions*.

8.5.2.3 EDUCATIONS FROM INSTITUTES

Another initiative from the project champion was to visit an institution working with standards in the industry the new product targeted. This was not conventional at the Company. When one participant was asked if collaborations like this usually coincided with projects, he replied: *“I don’t think we have done this in other projects, because in other projects you have possessed the knowledge yourself. So now I think, I would say that if we have changed our way of working at least in these parts, it is that we have sought more external help.”* This institution performed an education lasting for a couple of days abroad at a foreign location. Most of the project members participated, as well as some members from the sales organization. The learning from the education was described by one interviewee as the “school theoretical” picture, to set it apart from how the reality looked in the industry. There were doubts raised as to the positive effects of these educations. As the project champion stated: *“So now we thought that ‘NOW we’ll be ambitious, so let’s book this course in design for the food industry. So we spent a lot of money and flew in people from all over the world to (city)... Afterwards my thoughts were in line with something like ‘How much did people really get?’. Because we had lived with this in many years (core participants in the project)... So we built our competencies so we were completely on another level.”*

In the later stages of the project, product tests test for adherence to certain hygiene quality standards was performed. Beyond assuring that the products had satisfactory quality it also gave certificate to show for it.

8.6 APPENDIX 6: CONDITIONS OF INTERVIEWS

Before the interview:

We are performing a thesis project where we try to explore how decisions are made in product development. We have a suspicion that the decision in reality is not made according to the models and descriptions that are often mentioned in school. We therefore want to know how the decision making in product actually looks like - how and when decisions are actually made. What influences affect the decision-making process and in what way?

- The interview will take one hour.
- It is OK to ask, skip, pause or stop the interview at any time
- What we hope to get out of this interview: Your reflections on decision making in product development projects as a remote team member
- What we hope that you get out of this interview: Hopefully this will give you a possibility to reflect upon your work in a way that you usually don't have time to do
- The material from this interview will be erased when the study is complete.
- You will get a draft of the thesis and have possibility to comment on it.
- Your name and the Company's will be anonymous.
- Your answers will only be used for this study.
- Is it OK with you that we record the interview?
- Is there anything else that you wonder or are you ready to get started?
- Order: The case project, some questions about a specific area, the project group and lastly your contacts

Afterwards:

- Do you have anything to add the interview?
- What we are going to do now: Look for interesting aspects, compare with theory and other interviews
- THANK YOU!

8.7 APPENDIX 7: INTERVIEW TEMPLATE

Projektet:

1. Hur kom projektet till?
2. Vad resulterade projektet i?
3. Hur länge pågick projektet?
4. Vilka faser gick projektet igenom?
5. När kom du in och vem placerade dig?
6. Var det vanligt att stöta och blöta med kunder?
7. Hur många arbetsuppgifter hade du förutom [projektet]?
8. Har andra externa företag varit inblandade?

De viktigaste frågeställningarna:

9. Vilka är de viktigaste eller mest kritiska frågeställningarna som kom under projektets gång?

Det här blir lite "per frågeställning" från och med här

10. Vad gällde frågeställningen egentligen, varför kom det upp på agendan?
11. Hur bestämde ni er för vad ni skulle göra? (öppen fråga med flit!?)
12. När och hur började ni fundera över hur man skulle lösa detta?
 - a. Varifrån fick du idéer till att lösa frågeställningen/problemet?
13. När och hur kom man fram till vad som var det rätta att göra?
14. Var och när skedde diskussionerna?
15. Vilka var med i diskussionerna?
16. Upplevde du att alla som medverkade på ett eller annat sätt framförde olika eller annorlunda synsätt?
17. Har du upplevt att ni kom fram till någonting utan att märka hur?
18. Kände ni er trygga i ert val?
19. Var det stressigt - togs beslutet under tidspress?
20. Hur stor enighet rådde kring valet när det gjordes?
21. I efterhand när det hade gått lite tid, rådde en stor enighet kring att det var rätt val?
22. Fanns det individer som berördes av beslutet som ej var delaktiga i beslutsprocessen? Följdfråga:
Hur reagerade de på beslutet?
23. Ledde beslutet till handling?
24. Tog ni hjälp av beslutsverktyg eller formella stegordningar? E.g AHP, brainstorming.

Frågor om projektgruppen

25. Vilken roll hade du i projektet?
26. Vem gjorde vad, kort?
27. Var någon som medverkade i projektet periodvis frånvarande?
 - a. Hur fortskred projektet då?
28. Fanns det några särskilda grupperingar? (Inte bara i sakfrågor utan även socialt?)
29. Fanns det några andra som hade åsikter om projektet?
30. Hur gjorde du för att påverka i frågor som var viktiga för dig?
31. Fanns det personer i gruppen som många lyssnade till?
32. Hur öppen och ärlig upplevde du klimatet i gruppen?

Kultur

33. Hur är det att jobba på företaget?
34. Upplever du företaget som traditionsbundet?
35. Är atmosfären sådan att det finns en öppenhet för nya förslag?
36. Trivs medarbetare?

8.8 APPENDIX 8: SNA INTERVIEW TEMPLATE

Decision						
No	Name	Frequency	How important was the interaction for the end result?	Role in interaction	How close relation?	Method of communication
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
We are going to map who communicated with who in connection with [this] issue.					1 = Shallow acquaintance	
It will look like this [paint a small network]					5 = Close friends	
We are also interested in how the contacts between these nodes looks [pointing to contacts] so we will ask a little bit about them too.						
Now that we ask we take your perspective and ask who you communicated with						
To make it easier for us we will only talk about one person at a time						