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Fabricating an S&OP Process

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Circulating References and Matters of Concern

Lichen Alex Yu

LIMAC PhD School
Department of Operations Management

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PREFACE

Many efforts have been put into the writing of this monograph to make it a bit "surprising", "interesting" and "contemporary". Actually, I'm not sure whether I should call this part of the thesis the "Preface" because the circulation of references in generating this thesis can be traced back to 2007 when I was living in a city thousands of miles away from Copenhagen and preparing for a CPA exam in Australia, which was very much non-constructivist-based. A functionalist driven paper, written by Kim Lang-field Smith and David Smith in 2005 at the Monash University, on the use of performance measures in supply chains inspired my initial research interest on management accounting in inter-organisational relationships. Using actor-network theory (ANT) was a network effect of a series of translations between attempts to close matters of concern with regard to literature voids and a series of papers that have taken me so far. I am hereby grateful to Hopwood (1976; 1987), Mouritsen et al. (2001) and Thrane and Hald (2006) for having encouraged me to travel the long way from a summer in Sydney to a winter in Copenhagen in November 2008. I will never forget the sparkling moment of my entire career when I met Professor Jan Mouritsen at a management accounting workshop chaired by Professor Wai Fong Chua at the University of New Sales Wales. Consulting with the four papers I have just aforementioned and meeting Professor Mouritsen were the mediators in entirely transforming myself, and the final production of this monograph.

I will also, for the rest of my life, remember the warm welcome of Thomas Frandsen of the Department of Operations Management at the Copenhagen Business School who helped me settle into this tremendous city. I would also like to thank Niels Lennon, who translated the summary of this thesis into Danish. Much enjoyment has always sprung up from the working atmosphere in the PhD group at the department. Those informal conversations with Thomas Frandsen, Niels Lennon, Peter Holm Andreasen, Anne Krebs, Marta Gasparin and Linn Gevoll were like music lingering around the beams, the outcome of which turned to debunking rather than constructing most of the time though. I am extremely fortunate to belong to the Department of Operations Management at the

Copenhagen Business School, where constructing a PhD thesis has unfolded so many disputes on accounting research and ANT that have not only made this journey a joyful and glamorous experience, but also made this thesis become multiple.

I would like to give a big thank you to my parents and girlfriend in China. I could not have come this far without their spiritual supports. Keeping a long distance relationship between two hearts has been as challenging as writing a scientific thesis. “Happiness is not what you look for, but what you found” (Kay, 2011).

And lastly, a particular thanks to my friends and relatives spread over Copenhagen, Sydney, Melbourne, London, Gothenburg, Shenyang, Shanghai, Houston, Paris, Malmo, Glasgow and Singapore who have made the “peripheries” of the actor-network of this thesis.

Copenhagen, May 2013,
Lichen Alex Yu

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I would like to express my gratitude to all those who have supported me to complete this thesis. I owe my warmest thoughts to the Department of Operations Management and the Doctoral School of Language, Law, Information, Operations Management and Accounting and Culture at the Copenhagen Business School that have provided both intrinsic and extrinsic motivation, encouragement and support. I am deeply indebted to the provision of resources and data by SWEDTECH (a pseudonym), without which no constructive accounts would have been narrated at all.

I am bound to my supervisors, Associate Professor Sof Thrane and Professor Jan Mouritsen from the Department of Operations Management at the Copenhagen Business School whose stimulating inspiration and expertise have carried me forward through the time of writing this thesis, not to mention their personal support outside the boundary of their responsibilities as my supervisors.

I would like to give a big thank you to the assessment committee of this thesis, Professor Alan Lowe, Professor Johnny Lind and Associate Professor Kim Hald, for their constructive feedback which has significantly improved the quality of this thesis.

I would like to give my special thanks to Professor Christopher Chapman at the Imperial College London, Professor Wai Fong Chua at the University of New South Wales, Professor David Cooper at the University of Alberta and Professor Paolo Quattrone at the IE Business School who have given me incalculable constructive suggestions at various occasions. Finally, I could never ever forget to mention Associate Professors Sujatha Perera and Kevin Baird who, during my stay at the Macquarie University, provided invaluably stimulating suggestions to my research.

Copenhagen, May 2013,
Lichen Alex Yu

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CHAPTER 1

Introduction

Constructing a scientific fact is a process that involves a series of translations forming a reversible chain of circulating references (Latour, 1999). This applies to my theorisation, use of research methods, and empirical analysis; but the circulation of construing this thesis can be traced back to 2007 (even earlier) when I was solely a functionalist accountant preparing for one of the CPA exams in Australia. This chapter will first show you the trajectory of my travel from Sydney to Copenhagen, followed by a series of translations on closing matters of concern on the research questions of this study.

Why did I travel such a long way from the land of the kangaroo to the hometown of Anderson's Fairy Tales? What is the link between Sydney and Copenhagen? Perhaps it is decided by fate what is destined. Who designed the Sydney Opera House?

(Source of the Sydney picture above:
http://en.wikipedia.org/wiki/File:Sydney_Harbour_Bridge_from_the_air.JPG)

(Source of the Copenhagen picture above:
http://www.denmarkemb.org/denmark-general/denmark-cities/copenhagen/)

Prelude

My intention to conduct PhD research in management accounting (MA) in inter-organisational relationships (IORs) was provoked when I was reading Langfield-Smith and Smith (2005) in preparation for the Strategic Management Accounting exam (CPA) of Australia [1] in 2007. The article, which, just in time, extended my interests in performance measurement systems beyond legal organisational boundaries, explains the role of performance measures in supply chain management (SCM) and prescribes the framework for the development of these performance measures.

"Interest in supply chain management (SCM) increased as organisations seek opportunities to improve performance. Monitoring plays a key role in enhancing supply-chain performance by highlighting opportunities for improvement. However, evidence on the use of performance measures in SCM is scant." (Langfield-Smith and Smith, 2005, p. 39)

This stimulation on studying performance measures in SCM motivated me to consult with the MA literature on IORs. The finding was that the majority of the research in the field at that point of time was based on the theory of transaction cost economics (TCE). I was then inspired by Anthony Hopwood, the founder of *Accounting, Organisations and Society (AOS)* with a purpose to stimulate accounting research and study accounting in its organisational and societal settings. Hopwood translated my interests into the complexity, specificity and fluidity of accounting (Hopwood, 1976; 1987), which in turn led me to actor-network theory (ANT) – inspired accounting research in IORs. In fact, it was Mouritsen et al. (2001) and Thrane and Hald (2006) that motivated me to explore the performativity of accounting as a social and organisational actor, although Thrane and Hald (2006) aimed at addressing the deficiencies of ANT as an inside-out approach.

February 2008 was the point in time that could possibly have changed my entire career path. When I was attending a small MA workshop held at the University of New South Wales (UNSW), there was one professor sitting at the centre of the back row (which I

[1] Certified Practicing Accountants in Australia

later noticed is where he always sits) constantly asking provocative questions, and his presentation on intellectual capital was indeed extremely interesting and different from conventional speeches by accountants. I found out later, that this figure was Professor Jan Mouritsen. We later exchanged our research interests during autumn 2008 in Sydney. I also had intensive email communication with Associate Professor Sof Thane from the Copenhagen Business School discussing my research proposal. My coming to Copenhagen was an actor-network which was constructed by the CPA exam, Langfield-Smith and Smith (2005), TCE based accounting literature, Hopwood (1976; 1987), Mouritsen et al. (2001), Thrane and Hald (2006), and the MA workshop held at the UNSW. I would not have completed this thesis if any entity of the network was missed. Now I should turn your attention to the actual start of the thesis.

Introduction

Inspired by Otley (1994) and Hopwood (1996), accounting literature has been extending its focus to explain how the use of accounting transcends the legal boundaries of organisations. To date, two major streams of management accounting (MA) contributors have theorised accounting in inter-organisational relationships (IORs). First, are the functionalists who largely draw their ontological perception from economics based on epistemology, for instance, the theory of transaction cost economics (TCE) (Williamson, 1985; 1991), to frame the relationships between control antecedents, control archetypes and the corresponding mechanisms (Vosselman and van der Meer-Kooistra, 2000; 2009; Vosselman, 2002; Langfield-Smith and Smith, 2003; Dekker, 2004). This stream is criticised by the second stream of scholars, namely the constructivists who predominantly reflect upon the actor-network theory (ANT) (Law, 1992; Callon, 1986; Latour, 1987; 1999a; 2005a) for its detachment of accounting from social and organisational practices (Mouritsen, 1999; Mouritsen et al., 2001; 2009; Mouritsen and Thrane, 2006; Chua and Mahama, 2007). ANT inspired accounting researchers, largely following Hopwood's (1976; 1987) research, call for an urgent need to problematise accounting as both a social and organisational phenomenon and to understand the fluidity and specificity of accounting in action; they have been trying to follow accounting as an actor to explore its performative role in constructing generative paths through a variety of actor-networks (Ahrens and Chapman, 2007). This thesis agrees with the stream of ANT inspired

accounting research and shares its critical stance on how embedded accounting is within the organisational setting; but adds to it by studying the fabrication process of an accounting calculation. The fabrication of accounting is analysed in this thesis through Latour's (1999; 2005a) methodological lenses on following *circulating references* in constructing a scientific fact and tracing *matters of concern* on a seemingly taken for granted matter of fact. This requires a restoration of symmetry between humans and non-humans in generating the network. *Circulating references* translates a series of matters into corresponding forms on a string of transformations (Latour, 1999a). *Matters of concern* contrast with *matters of fact* and problematise those seemingly closed black boxes (Latour, 2005a). Rather than expressing these matters in a negative tone and claiming that these two advisory notes have been surprisingly overlooked in extant accounting literature, this thesis attempts to contribute to the accounting research community by narrating the intricate and interwoven associations between inscriptions, and attempts to close objects as *matters of concern* into facts[2]. Along with *circulating references,* every attempt to close certain *matters of concern* is translated into a form that is *stable, mobile and combinable* (Latour, 1987; Robson, 1992), but every closure attracts new entities into the network. Quattrone and Hopper (2006), therefore, see any de-*finition* simultaneously as a *de*-finition; which means that every attempt to close matters of concern makes the quasi-object multiply. Every translation makes it different from what it *was* prior to the translation. Change is, thus, not linear, but everywhere.

Under the umbrella of fabricating an accounting calculation by using ANT, one needs to pay particular attention to the studies of accounting in supply chain management (SCM). This monograph bridges an emerging research interest in the demand chain management (DCM) and operations management (OM) literature. DCM differs from SCM in that it focuses on the marketing, sales and service part of the value proposition and starts with obtaining detailed information on prospective customers (Landeghem and Vanmaele, 2002). This drifting back to IORs was an effect of *following actors* in the empirical

[2] In this thesis, for instance, narratives read "matters of concern around the S&OP process" means "the S&OP as a set of matters of concern" instead of a matter of fact. To close a matter of concern, for instance, on primary keys of the S&OP sales forecast means to close a dispute on primary keys of the forecast. Consequently it means that the S&OP sales forecast is a set of matters of concern, one of which premises on the primary keys of the sales forecast.

domain, where the case company was using a demand chain technology. An increasingly popular managerial technology, namely the sales and operations planning (S&OP) process, has been delineated to foster demand chain planning (Grimson and Pyke, 2007). The S&OP process is defined as a cross-functional process which links strategic plans to daily operational plans and enables organisations to balance demand and supply for their products and services (Gregory, 1999; Dwyer, 2000; Wight, 1999). Calculating a sales forecast is an obligatory passage point (OPP) in S&OP, and its fabrication is found to have engaged many *other* entities in the case company. The process is found to be far more fluid and complicated in the case company than is assumed in extant DCM literature. The case company implemented an S&OP process to balance its demand and supply to address the problem of availability failure. It was proposed, that a sales forecast in the S&OP process was to be followed by factories, product line planning management and suppliers, but it turned out that fabricating a sales forecast involved a series of intra-organisational tension which made its fabrication a long process. It should be noted, that because the S&OP sales forecast is proposed to be the OPP in the S&OP process, the study on fabricating the forecast cannot be separated from fabricating the S&OP process because the way a forecast is constructed largely affects the constituents making up the S&OP process.

In the S&OP literature, Grimson and Pyke (2007), in their conceptual framework of the S&OP, propose that a consensus demand forecast should be formed in a cross functional integration process. This means that disagreements between the different voices competing to speak on behalf of the customers are to be settled in an endeavor to domesticate uncertainty in future customer demand. How these voices compete against each other is worth investigating as the literature on S&OP has been for the most part conceptual, and the implementation of S&OP has been considered just as difficult for companies because practitioners indicate that cross-functional integration is challenging (Rexhausen et al., 2012). As these multiple competing voices for customers are backed by competing calculations, accounting literature on calculative practices is used within this thesis to assist the DCM literature to explore the complexity of implementing the S&OP as a cross functional process of integration in an empirical setting. Calculations

foster modernisation (Giddens, 1990) which creates a centre of calculation (Latour, 1987) where entities can become amenable to management intervention (Miller and Rose, 1990). It is therefore, interesting to use ANT to explore how calculations backing those competing voices for customers act upon entities in the demand chain. This cannot be separated from a study on how calculations are fabricated because the many *others* constructing calculations gives them essence.

In the DCM literature, Landeghem and Vanmaele (2002) contest that most of the studies have been either deterministic or myopic in embracing the uncertainty in customer demands. These studies are often functionalist oriented. This thesis attempts to embrace such uncertainty in customer demands, but argues that this uncertainty is not an exogenous variable in DCM. Uncertainty in customer demand, tensions derived from multiple voices competing to speak for customers and fabrications of calculations, which in this case are forecasts to support those voices, are relational to each other. This thesis, thus, attempts to recognise the *relationality, performativity and heterogeneity* of actors on the demand chain to see how uncertainty in customer demand is translated into a series of tensions attributed to the competing voices for customers. This is not to say that the vast literature of DCM is misleading, but that the use of mundane managerial technologies always turns idealised technologies into new and often surprising territories, thus, constructing new theories and practices. Quattrone (2009) cogently points out that in between texts and readers exists a working time/space that attracts differences and innovation. "Accounting inscriptions mean little if not enacted through orthopraxis" (*Ibid,* p, 112). It is through the practicing of accounting inscriptions that they become performable. Therefore, the homogeneous typology of the technology attracts heterogeneity rooted in practice. The S&OP process, an increasingly DCM technology, has certain typology of an ordered abstract method, for instance of calculating an unconstrained market forecast to foster demand chain planning, that creates time/space to allow heterogeneous actors to *work* with the technology. This *working time/space,* thus, translates the homogeneous abstract method into a set of heterogeneous networking actions. The S&OP process is supposed to deal with uncertainty in future demand through integrating sales forecasting, product line planning (PLP) and supplier capacity

planning (SCP); but such heterogeneity creates other uncertainties located in different times and spaces. In particular, the purpose of integration may create tension because of competing calculations for customers. These calculations may separate integration into diverse local spaces where tension brought by competing calculations is acted upon. When a managerial technology has an abstract method to domesticate uncertainty in demand, it constructs uncertainty in practice because of the working time/space in-between; between the proposed technology and its users.

Although mainstream literature on DCM focuses on forecasting, merely focusing on how forecasts can be better calculated using modeling and how the S&OP process should be implemented as per the S&OP conceptual framework are not sufficient to account for the uncertainty in customer demand derived from the tension in creating a forecast and the struggles in the pursuit for cross-functional integration. This paper wants to add a bit of nuance to the study of the process of networking which takes place in this working time/space in order to explore the inter-relations between the fabrication of an S&OP process, competing calculations, and uncertainty in future demand and in pursuing integration. This study also wants to problematise integration because the S&OP process is proposed to integrate management processes in the DCM and in the S&OP literature (Grimson and Pyke, 2007; Lapide, 2005). As the S&OP process is fabricated by heterogeneous actors, the loci of integration may also be changed when actors are moving towards integration. In other words, fabrication of the S&OP process and fabrication of integration mutually condition each other. To study the fabrication of the S&OP process, thus, implies an exploration on the fabrication of integration. Using ANT, this accounting research does not challenge the mainstream DCM literature, but attempts to explain why implementation of an S&OP process, according to its conceptual framework (Grimson and Pyke, 2007), is difficult in a humble way that shows the performativity of competing calculations and their implications on integration in demand chain management (DCM).

On heterogeneity constructed in this working time/space, this study shows how the operationalisation of a discourse of balancing long-term demand and supply brings into the scene diverse actors comprising the S&OP sales forecast, the factory forecast, the

business cycle forecast, the financial forecast, the compensation system, the performance measurement system, product hierarchies, sales, production line managers, factory planners, customers, 6 Sigma and other discourses such as being a learning organisation. This networking process unfolds a series of translations of emergent, ongoing and multiple matters of concern around the S&OP process. Some matters of concern are closed to matters of fact, whilst others are not and attack the S&OP process in different time and space. This network also reassembles time and space across the demand chain, thus, continuously (re)framing the boundaries of planning agendas, calculations and intra- and inter-organisational relationships. These translations and reassembling are worth exploring because they impact on how a managerial technology, such as S&OP, is made convincing to organisational actors.

Furthermore, DCM literature can also simultaneously assist the accounting literature in broadening its vistas into theorising accounting in IORs. Whilst a number of accounting contributors have studied how accounting is used in managing supply chains and sub-contracting networks (Mouritsen, 1999; Mouritsen et al., 2001; 2009; Mouritsen and Thrane, 2006; Chua and Mahama, 2007; Dekker, 2003; 2004; Anderson et al., 2000; Wouters et al., 2005; Carr and Ng, 1995; Cooper and Slagmulder, 2004; Kajuter and Kulmala, 2005; Seal et al., 1999; 2004; Baimen and Rajan, 2002; Thrane and Hald, 2006; Coad and Cullen, 2006), accounting research has been rather scant on the implications of accounting in a pull system which starts with customers. In a parallel vein, the practices of customer accounting (CA) are comprised of customer profitability analysis (CPA) (Cooper and Kaplan, 1991), customer segment profitability analysis (Ward, 1992), life time CPA (Foster and Gupta, 1994) and valuation of customers or customer groups as assets (Foster et al., 1996), and more specifically the Balanced Scorecard (BSC) (Kaplan and Norton, 1992) and total quality management (TQM) (Zink, 1995), and have been studied in the accounting literature; but linking CA to DCM may contribute to theorising how accounting for customer demands affects DCM. More specifically, the following questions also become interesting to accounting researchers. In a *pull* demand chain, who quantifies the uncertain market demand? If this information is expected to flow backwards to production and suppliers, will it flow smoothly or encounter resistance? If

resistance occurs, who becomes the spokesperson for customers then? Bearing these questions in mind helped me construct research questions on multiple voices for customers and intra- and inter-organisational relationships. This thesis will show that accounting and the discourse of customers are not tightly coupled, but are loosely coupled in a network that handles conflicting interests in the demand chain. This study argues that when DCM literature attempts to engage with uncertainty in customer demand directly, rather than avoiding it, it tends to avoid discussing the tensions, conflicts and resistance brought about by quantifying customers. I want to contribute to DCM literature via an endeavour to engage with the uncertainty in customer demand in order to provide a more comprehensive process and view on quantifying customer demand.

An exploration of the fabrication of a sales forecast in a specific organisational and technological S&OP setting is in concert with ANT's slogan to travel slowly. This will enable us to problematise the interface between intra- and inter-organisational spaces. In IORs, accounting has been black boxed as an inter-organisational managerial technology either to serve functional needs, for instance, value chain analysis in Dekker (2003), or to influence intra-organisational phenomena in an unexpected manner; for instance, Mouritsen et al. (2001). But can accounting keep its identity intact along its trajectory in the S&OP process? From an ANT perspective, this fixed presumption on ontology is problematic. Accounting does not transform *others* and then rest, it transforms *others* continuously. When it does so, it also becomes something else. S&OP shows that there is a need for following accounting in the internal supply chain of the organisations because of those emerging and multiple tensions it enables, and the many *others* it attracts. Accounting and ongoing tensions between manufacturing and sales in the case company restlessly shifts the ontology of accounting and re-shapes intra- and inter-organisational spaces. We cannot presume that accounting fosters IORs. This follows Hopwood's theory (1996), that accounting research should study lateral processes where accounting plays a vital role; but it is this lateral process that this thesis wants to explore in a more detailed and local manner. To date, a number of studies have documented the use of MA in lateral cooperation between legal organisations as was just discussed, but ANT does not

presume that accounting fosters IORs, and therefore, this thesis arrives at the scene before accounting is closed into a fact, and follows how it is fabricated in the lateral process across functions inside the legal organisation (the internal supply chain). To study the lateral process, ANT says we need go a bit slower, following the construction of its making.

Last but not least, fabrication of a sales forecast in the S&OP process that attempts to translate the uncertainty in future customer demand, not only affects intra- and inter-organisational space, but also intra- and inter-organisational time. When an attempt to domesticate a *future* uncertainty is handed over to a set of *current* calculations fabricated by humans, technologies and artefacts distributed in the *past* and *present*, may be shaped and re-shaped depending on how the tensions between the competing voices for customers are translated. This thesis is then interested in a series of time and space odysseys to translate what uncertainties will be in store for future customer demand.

To summarise, under the umbrella of fabricating an S&OP sales forecast and an S&OP process by following *circulating references* and *matters of concern*, this study attempts to show how accounting and integration in DCM mutually condition each other and how tensions and resistances derived from multiple voices for customers construct an S&OP process. The focus of this paper is on the working time/space between the proposed technology as an ideal, and wherethe interest of the user lies in the inter-relations between the fabrication of an S&OP process, integration in DCM, competing calculations, and uncertainty in future demand when actors are pursuing integration. The next section will explicitly list the contributions of this thesis.

Contributions

There are two primary contributions. First, exploring the fabrication of an accounting calculation – the S&OP sales forecast – and the S&OP process through *circulating references* (Latour, 1999) and *matters of concern* (Latour, 2005a) and how attempting to restore the symmetry between human and non-human actors will add to the accounting literature; especially ANT inspired accounting literature on how a managerial technology and its central calculation are delineated, disputed, re-formulated, and taken for granted

in a fluid organisational setting that unfolds emergent, ongoing and multiple controversies. Existing ANT- inspired accounting research tends to overlook how accounting itself is fabricated. In addition, in the few examples of accounting literature, studying how accounting is fabricated, places emphasis on how diverse interests are allied to make accounting convincing. However, it tends to overlook the complex, fluid and multiple relations between actors whose interests frequently change. Fabrication is not an open and closed process, but a continuous one because relations between actors are fluid. Accounting is not only an actor, but also many things because of the emergent, ongoing and multiple translations it unfolds and the many *others* it attracts. This thesis contributes to ANT inspired accounting literature by focusing on the complexity, fluidity and multiplicity of a managerial technology, in particular, how a series attempts to close matters of concern around the managerial technology[3] to make it multiple. If a calculation and its related processes are multiple and fluid, this thesis will try to find out what they will eventually become.

Second, studying the fabrication of an S&OP sales forecast and an S&OP process to quantify future customer demand contributes not only to accounting research in IORs, but also to literature in DCM by unmasking the tensions derived from multiple competing voices that all claim to speak for customers, and embracing the translational trajectories of uncertainties in calculating future customer demand and in pursuing integration. DCM is a situated practice, thus, *relationality, performativity* and *heterogeneity* are properties in particular organisational settings. To study how a DCM technology, which in my case is the S&OP process, is implemented to domesticate future uncertainty in customer demand; this study focuses on the working time/space (Quattrone, 2009) between the abstract ideas of the technology and its users. This contributes to ANT inspired accounting research by providing new insights into how accounting is made performable by networking actors *working* to make it heterogeneous, and how accounting and its related processes are fabricated when the loci of DCM drifts. This also contributes to the literature of DCM in problematising the often black-boxed inter-relations between the fabrication of an S&OP process, competing calculations, uncertainty in future demand

[3] Again that means the technology as matters of concern instead of a matter of fact.

and in pursuing integration. This helps explain why there are gaps between abstract ideals of a technology and its operability, and helps point out possibilities of how integration may be achieved through displacing tensions into separate times and spaces.

This focus on working time/space also provokes problematisation for the transitional jump on the use of accounting from intra- to inter-organisation relationships because this jump overlooks tensions and resistance between participating groups using accounting, whose ontology cannot be presumed. Tensions and resistances derived from multiple competing voices for customers may re-shape intra- and inter-organisational time and space, yet they have been overlooked in DCM literature which has predominantly examined the technicality of forecasts and merely proposed cross-functional integration as the necessary condition to foster DCM. Taking into account tensions between actors in creating forecasts to compete for the speaking for customers and how they shape and re-shape intra- and inter-organisational time and space, helps the DCM literature to produce more comprehensive theories on forecasting technologies and the S&OP. Moreover, extant accounting literature on IORs tends to over-emphasise the use of accounting in inter-organisational relationships. Accounting may have been initiated to manage IORs, but it becomes something else when it attracts *others*; and when it becomes something else, it re-shapes IORs and this re-shape may have implications on the convincingness of a technology where debunkers may predominantly come from intra-organisational space. Following Hopwood's (1996) call on research of lateral processes, this study argues that the internal supply chain is a lateral space that hidden controversies can be brought out by and enlightened with accounting calculations. Finally, translating uncertainty in *future* customer demand into a series of *emerging* tensions derived from competing forecasting calculations is relational to those many *others* distributed in *past* and *present* who fabricate these fabrications. Translating these tensions may also involve shaping and reshaping of intra- and inter-organisational time. To study themes on translating uncertainty in DCM, multiple accounting calculations, competing to speak for customers, intra- an inter-organisational time and space odysseys, in short, contributes to the DCM literature by exploring how and why companies are struggling with implementing the

S&OP; and to the accounting literature it gives the linkage between customer accounting and *pull* based intra- / inter-organisational relationships.

To foster the above contributions, this paper deploys ANT as a method theory (Lukka and Vinnari, 2011), but also adds to ANT inspired accounting research by giving the complexity, fluidity and multiplicity of accounting itself, following Latour's (1999; 2005a) cogent notes on *circulating references* and *matters of concern* in fabricating a technology; which in this thesis is an S&OP process. This has been overlooked by ANT scholars hitherto. Consequently, a field study in a Swedish based bearing manufacturing company has been adopted to follow the human and non-human actors over time, to detail the fabrication of a sales forecast in the S&OP process and to narrate the lateral processes of translating the uncertainty in future demand into diverse intra- and inter-organisational time and space, when and where multiple voices compete for speaking for customers. The ontology of the S&OP process will also be theorised.

Research questions and findings

The series of theoretical translations yield the following research question.

How are an S&OP sales forecast and an S&OP process fabricated?

Although the study uses ANT to explore this research question, exploring the processes and outcomes of the fabrication will provide new insights on how uncertainties in future customer demand and pursing integration are translated. As the field study continues, it is revealed that there are competing forecasts that claim to be the spokesperson of the S&OP process and customers. Studying the fabrication of the S&OP sales forecast and the S&OP process, thus, helps explore how these competing voices for customers affect the translation of uncertainties in future customers and in pursing integration. Finally, the fabrication process may also re-shape intra- and inter-organisational time and space on the demand chain because of the sheer number of actors and multiple forecasts involved. In short, although the research question is formulated using ANT language, it also aims to solve the puzzles in extant DCM literature; namely uncertainties in future demand and integration, competing voices for customers, and intra- and inter-organisational timing and spacing.

To address the abovementioned research questions, a longitudinal case study was undertaken in SWEDTECH (a pseudonym), a Swedish based bearing manufacturing company implementing the S&OP process and a combination of methods comprising of interviewing key human actors, attending meetings and studying documents. The company decided to implement the S&OP process because it had failed to supply products that customers demanded because of a capacity shortage. The company, especially the group demand chain, treated improving availability as an urgent task. Also, with the consultants showing that information across the demand chain was not integrated, the company started to implement the S&OP process whereby an S&OP sales forecast was to be followed by factories and suppliers to capture future market demand. Throughout the process ongoing tensions between humans, such as sales and manufacturing staff and non-humans, such as a variety of forecasts that support competing voices for customers were observed. Thus, the S&OP process became something else that was more than what it was intended to be, due to these ongoing translations it enabled.

This study shows how the operationalisation of an agenda to balance long-term demand and supply brings into the scene diverse actors comprising the S&OP sales forecast, the factory forecast, the business cycle forecast, the financial forecast, the compensation system, the performance measurement system, product hierarchies, sales, production line managers, factory planners, customers, 6 Sigma and visionary boundary objects in order to be a learning organisation. This network translates a series of matters of concern into inscriptions. Some matters of concern are closed to matters of fact through these circulations, whilst others are not and therefore, attack the network later. This network also reassembles time and space across the demand chain, thus, continuously (re)framing the boundaries of planning agendas, calculations and intra-/inter-organisational spaces.

The main finding of this thesis is that when actors are fabricating the S&OP process, local actors create emergent, ongoing and multiple matters of concern around the S&OP process. The group demand chain, the actor who is responsible for guiding the

implementation of the process, delegates the attempts to close these matters of concern to local actors located in separate times and spaces. As a result, constituents of the S&OP process are dispersed in diverse local times and spaces rather than being coordinated in a single time and space by the group demand chain. When local actors are closing these matters of concern, they create new properties on the S&OP process and new management possibilities in relation to integration. These new management possibilities may include, for instance: generating different primary keys of forecasting in different divisions, mobilising relations between inscriptions in different settings, using mean error to evaluate forecasting accuracy, connecting different visualisations such as ABC analysis and items with high growth rate and value to collaborators' intelligence, creating new potentials for more consistent decision making and more proactive customer service, creating new actions to help the under-estimated sales forecast and transforming the minimal configurations of the S&OP process. Consequently, integration on the demand chain becomes uncertain because actors are always creating new possibilities to move towards integration, but will never arrive at the destination of integration because there are always emergent matters of concern around the technology to foster integration. To integrate is, thus, to postpone integration. Because constituents of the S&OP process are separated in diverse times and spaces, to integrate is also to separate constituents of integration.

Conclusion

Theorisation is a drift.

> *"When things are drifting, they may have no devices such as maps or a clock to give them a conception of time and space. They cannot accurately define their location or the time, though they are likely to continually try to do so. This does not mean that they will not act purposefully – they may try to create a shard idea of the 'right' direction."(Quattrone and Hopper, 2001, p. 426)*

Just as the above quote suggests, my theorisation in this thesis started with a "map" in Australia, but as new actors emerged, this "map" soon lost its influence for it could not keep me on the conduits it pinpointed to me from the outset. A series of these "maps" became loosely coupled to reassemble time and space, but in the end they indeed created

the research question. The "right" direction was constructed. The notion of drift contributes to generating theories on the fabrication of a technology, but interestingly it also contributed to making the research questions multiple. At the very beginning my research question was only concerned with accounting and IORs, but turning my attention to fabrication of accounting in an S&OP setting drifted the research questions back to IORs; but this time the focus is on DCM, which is an area that has not been studied in accounting literature on IORs. Searching for concrete research questions brings about new entities into the network of research interests, thus, making the boundary of the research domain fluid and multiple.

This chapter has very briefly described the trajectory of fabricating the research interests in this monograph. A paper by Langfield-Smith and Smith (2005) initiated a series of matters concerning the relation of MA research on IORs. Concerns in TCE-inspired accounting research were translated into a motivation to deploy ANT to follow the legacy of Hopwood (1976; 1987). Concerns in ANT inspired accounting research were translated into a motivation to follow *circulating references* (Latour, 1999) and *matters of concern* (Latour, 2005a) to describe the fabrication of an accounting calculation. The trajectory of theorisation was transformed again when the case company was planning to introduce a DCM technology, namely S&OP. Consulting with extant DCM literature drifted me back to IORs, but this interest in IORs differs from the one in the beginning. It is also larger than the original one for it contains an attempt to follow a fabrication of a calculation. Experiences, motivation, theorisation and contributions are a collective whole where translations can also be described as *circulating references.*

The remainder of the monograph is organised as follows. Chapter Two will review the domain literature on fabrications of accounting, and under this umbrella, I will also discuss theorisations on translating uncertainties in future customer demand and integration, calculative practices on competing voices for customers and accounting in IORs. Chapter Three will discuss the method theory to be deployed in this thesis, ANT, and some of its methodological lenses. Chapter Four will explicitly list the research questions, followed by an elaboration on the research methods in Chapter Five. Chapter

Six will present the empirical analysis on fabricating a sales and a factory forecast in the S&OP process. Chapter Seven will describe a series of episodes centred on closing the debates on forecasting accuracy between sales and manufacturing. Finally, Chapter Eight is a discussion of my narratives which will conclude the monograph.

CHAPTER 2

Literature Review: Domain Theories

Writing a monograph is indeed a long, but jolly journey of developing theoretical thoughts. When doing a paper based PhD, the process may be to just finish one paper and then go on to the next one. I have in various occasions discussed with my colleagues about theorising. Through constructing this literature review during this three-year period theorisation has never stopped. Every paper I have read, every sentence I wrote, every word I exchanged with my supervisors and other scholars and every minute I was in the case company have all had a part in offering a theory to this thesis. The literature review should not have been put in Chapter 2 only, but spread over the entire thesis. In the actor-network of this monograph, the literature review, theorising, the choice of methods, empirical analysis and discussion have constructed associations with each other. The essence of each of these entities is dependent upon the others. Although this is a separate chapter which reviews the extant literature, the theorisation continues after concluding this chapter.

Every page of written dialogue is part of theorising, but just reading some of the extant literature does not identify the research gaps that simply sit there. Combinability (Robson, 1992) between different papers will yield different realities of research gaps. A literature review constructs the network of theorisation.

Introduction

This chapter will review extant domain literature on management accounting (MA) in inter-organisational relationships (IORs), fabrication of accounting inscriptions, demand chain management and forecasting, in order to delineate the research interests of this thesis. The end of this chapter generates a closure to the formulation of research questions.

Fabrication of accounting in inter-organisational relationships[4]

I will first discuss MA in IORs because the reversible chain of the circulating references of my theorising can be traced back to Langfield-Smith and Smith (2005), which is an inter-organisational accounting paper.

Accounting literature has touched upon inter-organisational relationships (IORs), and this field has been proliferating following Otley's (1994) and Hopwood's (1996) directional calls.

"The scope of the activity management control is enlarged and it no longer confines within the legal boundaries of the organisation." (Otley, 1994, p.293)

"The papers that follow at least start to move in a different direction, opening up to examination of some of the accounting and informational consequences of more explicit concerns with the management of the supply chain and a more conscious questioning of what activities reside within and without the enterprise." (Hopwood, 1996, p. 590)

Studies in this field up until now can be summarised in two dominant categories, the functionalist and the constructionist approaches. In retrospect, the functionalist perspective, dominated by the theory of transaction cost economics (TCE), illustrates the theoretical implications of establishing structural governance mechanisms in response to transactional characteristics (Vosselman and van der Meer-Kooistra, 2000; 2009; Vosselman, 2002; Langfield-Smith and Smith, 2003; Dekker, 2004). Drawing from TCE,

[4] Fabrication is more than mere construction. Discussions on fabrication will take place in the next chapter as it is more related to ANT; the method theory deployed in this thesis.

management accounting contributors have suggested three control patterns, or what Caglio and Ditillo (2008) referred to as control archetypes; namely market-based, bureaucratic and alternative models whose titles have been variously reassembled. These control archetypes are supposed to be deployed in contexts featured by various transactional, environmental and party characteristics (Caglio and Ditillo, 2008). Spekle (2001) developed nine control archetypes by focusing on uncertainty, output measurability and asset specificity. Hakansson and Lind (2004) [5] concentrated on similarities and complementarities of activities in the network. Van der Meer-Kooistra and Vosselman (2000) and Langfield-Smith and Smith (2003), in addition to output measurability, incorporated the level of social embeddedness and party characteristics.

The resulting propositions, despite being inconclusive, have established a normative framework through which MCSs in IORs can be formulated. The market-based control patterns are considered appropriate under the circumstances where uncertainty is high to low (Spekle, 2001), asset specificity is low (Meer-Kooistra and Vosselman, 2000; Langfield-Smith and Smith, 2003), task programmability and output measurability are high (Meer-Kooistra and Vosselman, 2000; Langfield-Smith and Smith, 2003) and activities are complementary and dissimilar; [6] however, serving a common product (Hakansson and Lind, 2004). The bureaucratic patterns should be considered when uncertainty is moderate (Meer-Kooistra and Vosselman, 2000), asset specificity is medium (Meer-Kooistra and Vosselman, 2000; Langfield-Smith and Smith, 2003), output measurability is high and transactional repetitiveness is low to medium (Meer-Kooistra and Vosselman, 2000; Langfield-Smith and Smith, 2003) and activities are complementary and similar (Hakansson and Lind, 2004). The alternative patterns are the control archetypes on which consensuses have not been formed (Caglio and Ditillo). A hybrid form of an exploratory pattern of control should be adopted when uncertainty is high, task programmability is low and asset specificity is moderate (Spekle, 2001). In contexts where there are high uncertainties or risky environments, competent parties with

[5] Although they did not solely take the TCE perspective, one of their analytical lenses, through the notion of similarities and complementarities of activities, has TCE characteristics.
[6] These are developed by Richardson (1972), where complementary activities are activities that belong to different production phases requiring some coordination. Similar activities are activities that require identical capabilities.

mature experience in the network and symmetrical bargaining powers, a trust based pattern featured by intensive informal personal consultation and communication, should be developed (Meer-Kooistra and Vosselman, 2000; Langfield-Smith and Smith, 2003). In situations where coordination activities are complementary, but dissimilar, and are decentralised to seek a suitable, but not necessarily optimal solution, a relationship or cooperation mode of control will be considered (Hakansson and Lind, 2004).

Consequently, a variety of inter-organisational cost management (IOCM) technologies to serve a number of functional needs have been studied. total cost of ownership (TCO) has been employed in screening and managing suppliers (Carr and Ittner, 1992; Ellram and Siferd, 1998; Degraeve et al., 2000). TCO information can be used to foster cooperation (Ittner et al., 1999). Value chain analysis (VCA), by looking beyond the legal boundaries of the firms, serves to analyse where cost can be reduced and differentiation opportunities can be exploited (Dekker, 2003). Target costing (TC), through functional analysis, opens a systematic discussion for the functionalities of products (Mouritsen et al., 2001). With regard to open book accounting (OBA), it was found that sharing of accounting information, which is useful for cost reduction (Cooper and Slagmulder, 1997; 1999), planning and control, is seen as a prerequisite for cooperation and trust generation (Kulmala, 2002). Lifting the use of OBA to the next level, Kajuter and Kulmala (2005) developed a contingency model incorporating exogenous environmental, endogenous firm-specific and network-specific factors as prerequisites for implementing and utilising OBA. Recently, it was suggested that the impacts of OBA on supplier's relationship satisfaction are dependent upon the level of relational social norms and opportunistic buyer behaviour (Windolph and Moeller, 2011). Indeed, they (*Ibid*) indicated that OBA may negatively impact relationship satisfaction, hence, causing a risk to cooperation.

In this stream of research, accounting is largely determined by its contexts, the boundaries which are treated as black boxes, i.e. matters of fact. The limitation is that they cannot account for the fluid process of constructing collectives, whereby unexpected entities emerge and bring about ongoing controversies, rendering the rational dichotomy of design and implementation of management controls problematic (Justesen and

Mouritsen, 2011). In other words, the linear one to one relationship between accounting controls and its functional needs has been scrutinised for its generalisation across settings that omits localities and particularities (*Ibid*). The constructivist perspective, largely inspired by the actor-network theory (ANT), which is also the methodological lens this thesis will deploy, conjectures that the separation between control antecedents, characterised by uncertainties, asset specificity and transactional frequency, and controlling mechanisms is misleading in guiding organisations on how to control frameworks for managing IORs. This perspective is shared with Latour (2005a) who also claims that there is no macro-context covering the micro locals. The macro-context is instead localised.

It can be argued that the emergence of ANT inspired accounting research is partly attributed to a series of directional calls made by Hopwood, and is consistent with his input in laying the foundation for one of the leading accounting journals, *Accounting, Organisations and Society (AOS).* The first appearance of Latourian interests was reflected upon by Hines (1988). By 2008, the majority of the Latourian ANT inspired accounting research had been published in AOS (Justesen and Mouritsen, 2011). Interestingly, tracing early ANT inspired accounting studies published in AOS to the journal's founding aspirations helped me identify a void in this stream of research. How accounting is fabricated in action has largely been overlooked; even in ANT inspired accounting literature.

"There is now an urgent need for research which can provide a basis for seeing accounting as both a social and organisational phenomenon. More explicit consideration needs to be given to questions of power, influence, and control...And every opportunity should be taken to move beyond static forms of analysis to study the complexities of the evolving dynamic processes of accounting in action." (Hopwood, 1976: 3).

It is the "urgent need" to study accounting "in action" that inspired Latourian interests in accounting research. Following science in its making as opposed to science already made

is the pioneering belief of ANT (Latour, 1987), but it was not until Hopwood (1987) that ANT inspired accounting research started to sparkle with its popular term, performativity.

"Both a fluidity and a specificity have been introduced into our understanding of accounting in action. The significances attached to accounting have been shown in the process of their reformulation...The mobilising vehicles for these changes have been seen as residing in a very diverse number of organisational processes and practices and, not least, in accounting itself." (Hopwood, 1987: 231)

This fluidity and specificity have become the onotological properties of study that ANT inspired accounting research in IORs follows. This stream of contributors has largely traced the performativity in accounting and its translational process in shaping and re-shaping inter-organisational space where intra- and inter-organisational phenomena, such as strategising and innovation management are transformed anew (Mouritsen, 1999; Mouritsen et al., 2001; Lowe, 2001; 2009; Mouritsen and Thrane, 2006; Chua and Mahama, 2010).

Mouritsen et al. (2010) thoroughly reviewed the literature that has used ANT to study IORs. They summarised two attributes which theorise accounting in ANT inspired accounting research. First, accounting is a network effect of interactions between multiple entities which make up the network. In order to understand accounting, focus should be placed on the loci of accounting in a large set of associations between constituents of the network. Second, accounting calculations are not "inert objects". They do not have any essence until they circulate in a network, whereby they are engaged to produce effects. As mediators, accounting calculations not only represent, but also transform the meanings of actors, create new identities and re-shape the boundaries of networks. In order to theorise accounting, emphasis should be place on the performativity of accounting. These two attributes have been ubiquitous in the existing ANT inspired accounting research in IORs.

Mouritsen (1999) indicates that competing accounting calculations shape the inter-organisational strategies. On the one hand, a contribution accounting inscription encourages managers to transform fixed costs into variable ones, which leads to a decision for outsourcing. However, on the other hand, the inscription of activity-based costing (ABC) opens the black box of fixed costs, which can then be traced to specific activities. This encourages a decision for insourcing. In this case, accounting translates into decision making for IORs.

Mouritsen et al. (2001) trace the trails left by inter-organisational open-booking accounting (OBA) and target costing (TC) and find their unexpected feedback on intra-organisational a phenomena. OBA reveals that customisation in hardware is too costly, and as a result, software becomes the source of differentiation in LeanTech. Inter-organisational accounting transforms intra-organisational strategy, structure, technologies and core competencies.

Mouritsen and Thrane (2006) use self-regulating mechanisms and orchestration mechanisms, to trace their performance of generating network boundaries. Self-regulating mechanisms are of an unobtrusive nature. Operationalised through pre-set transfer prices, they enable network partners to enrol projects and attract customers without having debates on the revenue distribution. Consequently, IORs are primarily coloured by knowledge and competence, rather than financial concerns. Orchestration mechanisms, on the contrary, are obtrusive and mobilised in narrow time and space because partners are considered smaller than the network enterprise. The network can decide its centre and periphery, and because of this some partners may be forced to exit.

Chua and Mahama (2007) trace the agency of accounting in defining the boundary, power, and identities of other actors in the network; which at the same time also gives accounting its essence. In OzCom, a fixed price schedule and business process indicators offer a space for organising discussions between the buyer and its suppliers. Accounting, however, introduces unexpected frictions. Accounting inscriptions visualise the exploitative nature of some of its suppliers, thereby re-shaping the IORs.

In O'Leary and Miller (2007), a road map makes the coordination between fast chip technology producers, users and investors, which is made possible by stipulating the timing and cost of new releases. This makes the future stable and visible so that even though the technology only rests on a diagram, it has a strong voice made by the roadmap which has a shaped collective. Accounting in this sense domesticates future investments.

These studies, in principle, aim to construct an actor-network that accounts for the associations between heterogeneous entities through a series of translations via a number of full-blown mediators that liberate the multiplicities of taken for granted technologies (Latour, 2005a), thus, localising the macro contexts that cover accounting controls and embedding those accounting controls into organisational practices. The linkage between accounting and its context is not linear, where the macro covers the micro, nor is it the other way around. The construction instead results in a constellation where accounting localises the context. ANT inspired accounting scholars trace the performativity of accounting through shaping boundaries for decision making, intra-organisational phenomena, the relationship between the network and its partner firms, buy-supplier relationships and future technological markets, while accounting simultaneously is a network effect.

There is, however, a void, in theorising accounting in ANT inspired accounting literature. In tracing the actor-networks where accounting, as a non-human actor, attracts heterogeneous entities' interests, accounting itself has tended to be treated as a black box; even though it is realised as a network effect. More emphasis has been placed upon how accounting conditions *others,* but how accounting and *others* mutually condition each other has been overlooked. How *"a fluidity and a specificity have been introduced into our understanding of accounting in action"* (Hopwood, 1987, p. 231) has been rather scant, even in ANT inspired accounting research. In other words, although ANT inspired accounting contributors deny accounting as an "inert object", the inner fabrication of accounting itself, which depends on *others,* has been overlooked in the extant literature. This has been both a theoretical and a methodological surprise, although Latour (2005a)

advocates the ontological advice on actors, that attachments come first, and actors second (*Ibid*). For accounting to become an actor, its fabrications, its gatherings and its relationship with attempts to closing itself as matters of concern have to be accounted for. In other words, the first motivation driving this paper's research interests, thus, becomes the intention to trace the fabrication of an accounting calculation as an actor-network. Mouritsen and Thrane (2006), by inferring that the structural based TCE inspired accounting research only pays attention to the boxes, conjecture that the process rooted ANT inspired accounting contributors can illuminate the arrows between the boxes. This monograph alleges that even the boxes are not well theorised, because each box is an actor-network waiting for fabrication. According to Hopwood (1987), *"The significances attached to accounting have been shown in the process of their reformulation...The mobilising vehicles for these changes have been seen as residing in a very diverse number of organisational processes and practices and, not least, in accounting itself (p. 231)."* There is an inseparable association between accounting's performativity and itself. Following a fabrication of accounting itself and its performativity in its reformulation, ANT's ontology that any actor itself is a constellation and Hopwood's notion of fluidity and specificity will all be restored.

The void identified so far in ANT inspired accounting research that shows how accounting construction itself has been overlooked, has directed the research interest in this thesis, thus, turning it to the fabrication of accounting to see how accounting's ontology is fabricated by *others*. Suddenly, closing matters of concern on studying accounting in IORs into a specific research question was translated into the new matter of concern on exploring the fabrication of accounting; despite the fact that this section has predominantly been discussing accounting in IORs. This, however, is not a detour. It shows that the network of entities generating a research interest in inter-organisational accounting is fragile and subject to challenges by extant ANT inspired accounting research. The new matters of concern do not put the motivation of studying accounting in IORs aside. Instead, to close them into a specific research question premised on accounting fabrication starts a new series of problems. If we follow accounting through its fabrication, we will better understand the trajectory of its transformation, its being; but

it has to be connected to the empirical domain that allows for the exploration of such fabrication. The case company, SWEDTECH, decided to implement a managerial technology, an S&OP process, to foster integration in the demand chain management; the obligatory passage point (OPP) of which is the calculation of a sales forecast to anticipate future market demand. This matches the research interest in fabricating accounting because calculating a sales forecast in an S&OP setting attracts the many *others* that participate in fabricating this calculation. These *others* include sales, manufacturing, product line management, financial forecasts, business cycle forecasts and so on. Matters of concern on theorising accounting fabrication[7] are now closed into a research interest in following the fabrication of a sales forecast in the S&OP process, but this closure in turn opens a space where new matters of concern on demand chain management (DCM) emerge. This thesis also aims to explore how an S&OP process is fabricated since the S&OP sales forecast and the whole S&OP process mutually condition each other. To close these matters of concern into another research question, in the context of DCM surprisingly brings my interest back to IORs. The research question is, thus: *How are an S&OP sales forecast and an S&OP process fabricated?*

To conclude, this literature review on the use of accounting in IORs has on one hand justified ANT inspired accounting research on IORs in order to embed accounting into an organisational setting; but on the other hand it has pointed out the void in this stream of accounting, that the fabrication of accounting has not been explored fully enough to allow complexity, fluidity and multiplicity to unfold. The interest in IORs shifted from the centre to the periphery of the research agenda; which was completely unexpected. However, the empirical context opens a space to follow the fabrication of a sales forecast in a managerial technology which is intended to foster DCM. This moves the interest in IORs back to the centre by focusing on demand chain management. This drift shows, in concert with ANT, that in the network of theorisation, the literature review is a mediator which may sometimes unexpectedly translate the initial research agenda.

[7] Here it means theorisation of accounting fabrication as matters of concern.

Answering the research question about the fabrication of an S&OP sales forecast and an S&OP process, however, not only contributes to extant ANT inspired accounting research, but also aims to solve some interesting puzzles in extant DCM literature. The next section will discuss how a study on fabricating the S&OP process contributes to the DCM literature.

Translation of uncertainty in future customer demand and in pursuing integration, multiple voices for customers and intra- and inter-organisational time and space

This section will start with distinguishing demand chain management (DCM) and supply chain management (SCM), and then discuss how research on DCM can benefit from ANT inspired accounting research which studies fabrications.

From supply chain to demand chain management

SCM focuses on the integration of material flow from raw material supplier to finished product delivery (Christopher, 1992), thus, aiming to optimise the material flow through successive steps of inbound logistics, operations and outbound logistics across the supply chain's comprising business partners (Van Landeghem and Vanmaele, 2002; Heikkila, 2002). Research has shown that consolidating customer and supplier bases, removing wasteful steps that add no value , accelerating information and material flow and establishing and maintaining long-term relationships with major suppliers and customers leads to better supply chain performance (Heikkila, 2002). As supply chains, originally dominated by original equipment manufacturers (OEMs), are gradually being replaced by new inter-organisational structures through the proliferation of electronic commerce and, in general, advanced information technologies (Williams et al., 2002), the last two decades have seen considerable outsourcing of their non-core intra-organisational operations to subcontractors of these OEMs. In the aerospace industry for instance, in order for system integration to achieve high-level deliverables and to develop production risk-sharing cooperation with a leaner supply base (SBAC, 2000), there has had to be an emergence of further sub-system integration and risk management. These SCM initiatives serve only one purpose, to promote higher customer satisfaction through information

technology; especially electronic commerce that enhances the physical flow and information transfer across the supply chain (Williams et al., 2002).

The discourse of increasing customer satisfaction has, in recent years, reminded scholars of the importance of emphasising the market needs (Vollmann et al., 1995; 1997; 2000; Vollmann and Cordon, 1998). Thus, customer needs are departures for supply/demand management instead of suppliers/manufacturers management (*Ibid*), which leads to the emergence of the term demand chain management (DCM). DCM focuses on the marketing, sales and service part of the value proposition, and starts with the obtaining of detailed information about prospective customers (Landeghem and Vanmaele, 2002). The integration of SCM and DCM is seen as a critical movement for the supply chain in order to deliver the right goods and services to customers (Lee, 2001).

In the DCM literature, DCM has been conceptualised heterogeneously. Vollmann et al. (2000) defines DCM as "extending the view of operations from a single business unit or a company to the whole chain". Whilst this definition does not differ from the concept of SCM, they go on and state that "DCM is a set of practices aimed at managing and coordinating the whole demand chain, starting from the end customer and working backward to raw material supplies. There are two fundamental objectives: (1) to develop synergy along the whole demand chain, and (2) to start with specific customer segments and meet their requirements rather than focus on internal optimisation" (*Ibid*). Although the first objective also applies to SCM, it is the latter that differentiates a *pull* from a *push* oriented management. The second objective is customer-centric, as Brace (1989) earlier defined the demand chain as "…the whole manufacturing and distribution process may be seen as a sequence of events with but one end in view: it exists to serve the ultimate customer". Williams et al. (2002) sees DCM as the management of supply and demand systems with the purpose of increasing customer satisfaction through electronic commerce that facilitates material and information flows between suppliers, manufacturers and customers. Fisher (1997), however, challenges the view that increased information flow in the supply chain will improve balancing demand and supply, and conjectures that when uncertainty in demand exists, there are two strategies available to

the SCM. A given supply chain has to emphasise either an efficient physical supply of goods or market mediation. Whilst the former refers to the conventional SCM that involves a series of *push* processes, but risks production of goods that do not meet customer demand; the latter means devoting a series of *pull* processes that adjust production to match actual demand, but lowers production efficiency. Fisher (1997) proposes that the choice of the two strategies depends upon the nature of the demand for the products. Products having functional demand featured by stable growth and low-margins should match supply chains that focus on efficient physical supply. Products having innovative demand characterised by volatile growth and high margins are suggested to select supply chains that call for market mediation. The purpose of physical supply is to convert raw materials into parts, components and finished goods, and to transport them from upstream to downstream of the supply chain; whereas the aim of market mediation is to ensure that the products that reach the market end match what the customer wants. S. de Treville et al. (2004) combine Fisher's division of supply chain choices with Vollmann et al.'s (2000) notion of transiting from SCM to DCM by defining that "a demand chain is a supply chain that emphasises on market mediation to a greater degree than its role of ensuring efficient physical supply of the product" (p. 617). Naylor et al. (1999) argue that it is possible to decouple a given supply chain into an upstream chain dealing with supply integration, aiming at efficient physical supply and a downstream chain engaging with demand integration, aiming at market mediation. It is the downstream chain that is described as a demand chain.

This subsection has discussed how DCM literature has conceptualised the term demand chain in opposition to a supply chain. In this thesis, demand chain is defined as a part of a supply chain that focuses on the transfer of demand information backward to the production and suppliers. Thus, the case company that transfers forecasting information backward to the manufacturing and the suppliers is considered to be engaging with DCM. The next subsection will continue discussing the link between accounting and DCM literature and formulate research questions based on the translations of uncertainty in future customer demand and integration, and settling multiple voices for customers in DCM.

Translations of uncertainty in future customer demand, integration and competing voices for customers

The role of supply chain planning (SCP) has largely been emphasising the control of the material flows. Such discourse of controlling material flows have been operationalised via a variety of popular instruments ranging from MRP, JIT, TOC, lean production and so on (Vollman and Whybark, 1988). The ultimate market demand, however, was seen at most as an exogenous variable (Lee, 2001). This means that market information was not taken in a structured manner in SCP methods. JIT focuses on the pull of products from upstream operations in response to demand from downstream operations, instead of focusing on the real market. In addition, products in a JIT system are replenished, assuming that demand is more or less stable (S. de Treville et al., 2004). Demand chain planning (DCP) is, thus, prescribed to integrate information that deals with the uncertainty of demand into planning techniques (Van Landeghem and Vanmaele, 2002). This is consistent with the situation of the case company that decided to use S&OP as an instrument to integrate market information on business volume into their planning techniques because key actors mentioned that there had been no structured process of incorporating such market information into their DCP.

Customer demand has, thus, been regarded as a central variable in DCM literature. In dealing with uncertainty in customer demand, DCM contributors have either proposed conceptual frameworks or investigated empirical associations related to such demand uncertainty. S. de Treville et al. (2004), in their attempts to engage with demand variability, propose a generic typology of demand chains. In response to Fisher (1997), they position the suitability of undertaking marketing mediation based on the degree of demand information transfer and relative lead time. Their framework proposes that not all supply chains facing demand variability are warranted investment in market mediation. For those chains that have warranted such an investment, the appropriate level of demand information transfer depends on the relative supply lead time (RSLT) of the manufacturer. Manufactures with sufficiently short lead times can afford to pursue market mediation via transferring demand information as soon as it becomes available. On the contrary, those with long lead times should devote their efforts to reducing lead times, as it is less costly

than transferring demand information. The framework, however, deals with demand uncertainty at a generic level; hence it gives little information about how to engage with such uncertainty via quantifying it in practice.

As demand unpredictability has been seen as a major contributor to overall uncertainty in DCM (Chen et al., 2000), Germain et al. (2008) use it as a moderating variable. They find that when demand is (un)predictable, supply chain process variability completely (partially) mediates the relationship between formal control and performance, and that organisational structure provides mechanisms to mitigate the detrimental impact of demand unpredictability on financial performance.

In relation to demand unpredictability, the most disturbing characteristic of demand uncertainty has been recognised as the bullwhip effect, the term that describes demand amplification which arises as disturbances in customer demand increase along the supply chain (Metters 1997; Chen et al., 1998). Chen et al. (1998) attribute the root cause of the bullwhip effect to the use of inadequate forecasting methods that do not accurately quantify the degree of uncertainty in the market demand. Sales & operations planning (S&OP), according to the American Production and Inventory Control Society (APICS), balances supply and demand for aggregated product families over a medium term horizon (Landeghem and Vanmaele, 2002). Van Landeghem and Vanmaele (2002) also claim that most companies use a planning instrument, namely distribution requirements planning (DRP), in their S&OP process trying to construct as accurate as possible a future demand forecast over the planning time horizon. Logistic managers are able to achieve significant inventory reduction and better financial results with advanced planning and scheduling (APS) systems. Van Landeghem and Vanmaele (2002) conjecture that these managerial technologies are purely deterministic, and the uncertainty in market demand is "either avoided by requiring the user to specify a target level for each stock point or it is handled by scheduling myopically each and every customer order in great detail" (p. 772). Whenever market conditions deviate from conditions designed in the supply chain, long lead time will occur. To directly embrace such uncertainty in market demand, they incorporate variability of outcomes and

expected value in their proposed *robust planning* approach, deploying the Monte Carlo Simulation as a risk assessment instrument. It is shown that the *robust planning* reduces the number of re-planning cycles at the tactical planning level. It also enables decision making in order to determine target stock levels and their location in such a way so that unforeseen conditions are less likely to invalidate the base plan (*Ibid*).

Stalk (1988) mentions that demand uncertainty is caused by long lead time when he illustrates the importance of time-based management. Long lead time, on one hand, requires sales forecast as guidance for planning, but on the other, reduces forecasting accuracy. Forecasting errors increase the level of inventories and safety stock, which leads to more unscheduled jobs interrupting the production flow, and an increase in delays and costs (*Ibid*).

S&OP is proposed to foster better planning on these aforementioned issues by calculating a sales forecast that represents pure market demand, this forecast is then to be carried forward to supplier capacity planning (SCP) (Grimson and Pyke, 2007). Whilst Shapiro, (1998) in his hierarchical levels in SCP, positions S&OP at the tactical planning level, the case company in this thesis engages with S&OP across operational, tactical and strategic planning horizons. More interestingly, as tensions unfold, the implementation of the S&OP process turns out to ally diverse interests, but only over the operational time horizon. This means that time is an effect of the relations between heterogeneous actors across sales, product line management and production (space). The journey of this thesis is to follow the S&OP sales forecast, which both theorists and practitioners of the S&OP pinpoint as the central element in the process for estimating future market demand, and to embrace the uncertainty in future customer volume. This is in concert with Van Landeghem and Vanmaele's (2002) engagement with market uncertainty, rather than taking a detour to avoid it. It, however, takes a different ontological view on forecasts, the calculations themselves in the S&OP process and the process itself.

The majority of DCM contributors studying demand uncertainty have pointed to the importance of forecasting and the urge to generate better forecasting tools. Calculations

of forecasts in DCM literature are predominantly equipped with a technical nature. Primarily based on modelling and simulation methods, DCM contributors have reported positive associations between forecasting accuracy and performance dimensions on inventory levels, replenishment and service levels (Gardner, 1990; Chen et al., 2000), logistics decisions and logistics performance (Smith and Mentzer, 2010; Van Landeghem and Vanmaele, 2002). In the composition of the sales forecast, DCM literature has a number of empirical findings. A computerised forecasting system, backed by statistical techniques, when combined with other mathematical forecasts, can increase forecasting accuracy (Clemen, 1989; Sanders and Ritzman, 1990). However, the judgmental forecasts, based on managers or analysts' knowhow on the behaviour of market demand, cannot be overlooked (Sanders and Ritzman, 1990). Edmundson et al. (1988) showed that judgmental forecasts improved forecast accuracy. Later empirical studies (Bunn and Wright, 1991; Collopy and Armstrong, 1992; Lawrence et al., 1986) confirmed the superiority of using a combination of computerised and judgmental forecasts. On a more contingent level, Sanders and Ritzman (1995) found that planting more contextual knowledge, referring to the information gained through experience on the job, into judgmental forecasts brought more value to the combined forecast than technical knowledge; referring to information gained through education on formal forecasting models. These structural models based on positivist epistemology attempt to mitigate the impact of uncertainty on demand, in terms of the likelihood and magnitude of deviation between actual sales and sales forecasts.

Forecasting is also considered to be a key process in S&OP to integrate lateral functions comprising of sales, marketing, product development and finance to deal with demand uncertainty (Oliva and Watson, 2009; Griffin and Hauser, 1992; 1996; Lapide, 2005). The S&OP process is conceptualised as a cross-functional coordination process among these functional groups (Bower, 2005; Lapide, 2005). Tohamy (2008) and Atkinson (2009) describe it as a formalised approach to internally integrate functions in an organisation with the ability to balance demand and supply by aligning these functions. Research on S&OP, however, is limited and mostly conceptual (Rexhausen et al., 2012). Grimson and Pyke (2007) developed a conceptual framework of S&OP in five

dimensions: meetings and collaboration, organisation, measurement, information technology and plan integration; with sales forecast being the key calculation.

This thesis, however, attempts to start with the demand uncertainty, but go a step further by problematising the taken-for-granted ontology of forecasts and integration under the context of an S&OP implementation. S&OP is a process linking strategic plans to daily operational plans and enabling organisations to balance supply with demand for their products and services (Gregory, 1999; Dwyer, 2000; Wight, 1999). In principle, there are five steps in the whole process (IOMA, 2004; Lapide, 2005; Mark, 2004; Gregory, 1999). First, sales meet either formally or informally to create a baseline unconstrained forecast that captures the whole market demand, which is subject to adjustments due to, for example, promotions, advertisement and trade shows. Forecast horizons range from 6 months to 3 years depending on contingent factors such as a product's life cycle and the type of industry. Second, operational functions collect information on inventory strategies, and factory/warehouse suppliers use this generated consensus demand forecast as the first step in creating an initial capacity to meet the forecast. Third, the cross-functional S&OP team formally meets to develop a final plan for the forecast horizon. The meeting frequency varies, with some meeting monthly and some being more driven by events. Fourth, the final operational plan is distributed and implemented. Fifth, the effectiveness of the S&OP process needs to be evaluated. These measurements can include inventory levels, stock outs, quality, and capacity utilisation for operational functions, sales growth, market share, and forecast accuracy for sales and financial accounting based indicators for the finance personnel.

Cross-functional integration across the demand chain is, thus, conceptualised as a taken-for-granted characteristic of the S&OP process; but this thesis argues that because of the sheer number of actors including different functional groups and calculations that participate in the S&OP process, that cross-functional integration becomes more of a problem than a solution for DCM. From an ANT perspective, the relations between those actors in the demand chain and how different interests of different groups are allied may create different properties of integration. From a conventional and functional perspective,

misaligned incentives of different parties obstruct the integration, thus, making the implementation of the S&OP process difficult (Rexhausen et al., 2012). Moreover, since the S&OP literature indicates that implementing the S&OP process implies a change of culture, mindset and organisational architecture of companies (Grimson and Pyke, 2007); a sharp jump from having a cross-functional team to achieving integration obstructs a comprehensive exploration of the implementation of the S&OP process. Therefore, although the S&OP process aims to domesticate uncertainty in future customer demand, implementing it may create uncertainty in pursing integration across functions on the demand chain because interests of diverse actors differ (*Ibid.*). It is likely that when S&OP participants are recommended to use the sales forecast in production line planning and capacity planning, they tend to debate on whether the forecast offers a reasonable representation for future customer demands since their interests vary. Therefore, uncertainty in future customer demand may be translated into uncertainty in moving towards integration. If the S&OP sales forecast are a set of matters of concern instead of a matter of fact, then the S&OP process and its target of integration will be as well. Studying how an S&OP sales forecast and an S&OP process are fabricated in this setting offers insights into how uncertainty of future customer demand is internalised and translated into uncertainty in pursing integration across the demand chain; in particular, how integration is problemastised and mobilised when actors debate problems on the sales forecast and the S&OP process.

The S&OP literature mentioned above also indicates that sales will produce a forecast that is to be discussed across functions to become a consensus demand forecast, but the extant DCM literature has been silent on how a consensus demand forecast is generated. This thesis aims to contribute to finding out how this consensus forecast is constructed across entities on the demand chain, and how such a construction impacts upon the S&OP process. This also highlights the importance of studying the fabrication of an S&OP sales forecast. A consensus means disagreements have been sorted out. If there are disagreements on the sales forecast, it means that different entities have different perceptions on future market demand. If these entities have different inscriptions when speaking for customers, then the internal integration process that is mentioned in the

S&OP conceptual framework will have to involve a process to reach a consensus in order to settle these multiple voices for customers. In this setting, demand uncertainty is no longer an exogenous variable that is independent of an organisational process of integration, but a construction of the latter. This means that uncertainty in future market demand cannot be studied separately from these multiple voices that compete for speaking for customers. How these voices compete largely shapes the boundary of integration, which has been taken-for-granted in the S&OP process. In the case company, it turned out that there were competing forecasts that all claimed to speak for customers. Thus, exploring the fabrication of the S&OP process also offers insights on how competing voices for customers are translated into a consensus S&OP sales forecast, and how this translation shapes the boundary of integration.

Although the S&OP process offers a generic roadmap of how to integrate DCP i.e. the five steps stated above, it is the absence of practicing them that attracts new relationships between demand chain actors. The performativity of a working time/space (Quattrone, 2009) of the S&OP will be discussed in the next chapter, but it is such a working time/space, a gap between abstract ideals of the S&OP process and its users, that makes integration a problem instead of a solution to DCM. Companies may propose to use the S&OP process to domesticate uncertainty in future customer demand and to foster integration across functions on the demand chain, but engaging with the S&OP process may create unexpected tensions that are not incorporated in the abstract ideals of the technology itself. For instance, competing calculations that all claim to speak for customers may displace integration in separate time and space, for each tension may have to be dealt with in a different time and space. These calculations may also construct new types of integration, for each of them claims to speak for customers and, thus, strives to be the calculation to translate integration in its own way. The focus of this thesis is, thus, on the working time/space in order to explore the inter-relations between the translations of uncertainty in future demand, the translations of uncertainty in the integration of DCM and the competing calculations speaking for the customers.

In short, how to reach a consensus for the demand forecast in order to domesticate future customer demands can be put into a theoretical question of how translations of uncertainty in future demands and uncertainty in integration are mutually conditioning each other because of the multiple voices of customers. Settling different voices for customers may involve a series of processes that will dissolve the tensions created by those competing voices. In this vein, to study the relationship between these entities will contribute to the DCM literature by showing how uncertainty in an inter-organisational space with customers is translated into uncertainty in an intra-organisational space, where integration is problematised due to tensions derived from competing voices for customers. Extant DCM literature tends to avoid dealing with uncertainty in demand, and this study wants to show that studying how an S&OP process is fabricated may offer new insights on how such uncertainty multiplies through networking in other entities in DCM. It also contributes to theorising the S&OP process by adding insights into the S&OP conceptual framework that tends to overlook how cross functional integration is made possible. This may explain why implementing an S&OP process is difficult. Existing findings and arguments on problems in the implementation of S&OP are discussed below.

Empirical studies do not indicate a high degree of implementation of the S&OP (IOMA, 2004; Kruse, 2004). One explanation is that S&OP requires not only a change of the business process, but also the corporate culture; for instance, managers with different responsibilities and incentives now need to pursue a common goal, followed by a fundamental change to performance evaluation (Slone, 2004; Smith, 2004). To enable S&OP integration, business processes including meetings, organisations, and measurements need to be installed. Sophisticated IT software is not significantly related to lower stages of S&OP maturity (Grimson and Pyke, 2007).

Although the conceptual framework by Grimson and Pyke (2007) presumes S&OP to be important in linking customer facing activities with internal activities of production planning and inventory management, Rexhausen et al. (2012) only find a weak relationship between S&OP implementation and demand management performance. Only a few companies (13%) in their study indicated that they implemented an S&OP, and

even fewer (7%) strongly agreed to rigorously following the S&OP process. Some interviewees say that until today they had not seen the full benefits of using it. It is argued in their study (*Ibid*) that in most cases production plans were not referring to the demand forecast and that production maintained a dominant role in the supply chain. This imposes concerns regarding the high level of complexity in cross-functional coordination when companies are implementing S&OP. Normative implementation principles have been challenged by local practices of production planning. Production still in most cases claims that they speak for customers. To study how this proposed cross-functional coordination struggles in implementing the S&OP will contribute to research on the S&OP by showing how different voices for customers between sales and production bring about tensions, which are largely scant in the extant DCM literature. Only by illuminating the nature of these tensions can we provide more suggestions on how S&OP will produce a consensus demand forecast. This study, therefore, attempts to set the theoretical path to investigate the working time/space where normative principles of the S&OP process are engaged by practitioners. Such a working time/space unfolds a series of tensions that translate uncertainty of future customer demand into uncertainty in integrating the DCM. This also contributes to the S&OP literature on how integration is constructed, in addition to studying how integration fosters the S&OP process. Integration is theorised as a problem instead of a solution.

To study tensions arising from competing voices for customers, it will also be beneficial to investigate the visibility and knowledge that calculations underneath those voices produce, thus, making these different voices convincing. This is the point that I think the accounting literature will help the DCM literature to theorise, the relationships between uncertainty in customer demand, uncertainty in integration, multiple voices for customers and organisational tensions on the demand chain. Mouritsen (1999) shows how competing accounting inscriptions that speak for competing management agenda re-shape inter-organisational strategies. In the context of S&OP, if production dominates sales, then a production plan may dominate a sales forecast. How these calculations are constructed and compete against each other will have significant implications on whether cross-functional planning activities are integrated, and how they are integrated. As

calculations become the objects that speak for customers, their ontologies can no longer be taken for granted. Their fabrications through relationships between artifacts and humans are not independent of how uncertainty in customer demand is translated. ANT inspired accounting research is of particularly great help here because it can show how the process of fabricating a calculation, which in this case is a forecast, and its related S&OP process translates the uncertainty in future customer demand; because calculations not only represent, but also create a space where entities are made amenable to intervention (Miller and Rose, 1990). In this setting, all intervening management agenda in the S&OP comes from the space constructed by competing calculations between sales and manufacturing. How these calculations are constructed largely determines whether cross-functional coordination is likely. In competing for speaking for customers, the calculation which is more convincing depends upon those many *others* who fabricate it. This implies that although the research question aims to explore how an S&OP sales forecast and an S&OP process are fabricated, their fabrications may unfold new insights into how competing voices of customers translate uncertainty in market demand, and on how integration is constructed in DCM.

ANT is considered just as relevant here because it is a method theory to study how science and technologies are fabricated by the many *others.* In their discussion on translation in ANT, Mouritsen et al. (2001) draw on three aspects of the theory: relationality, performativity and heterogeneity. Relationality means that entities do not have any essences unless they are positioned in a set of relationships with *others*. To study sales forecast, attention needs be placed upon *others* that engage with fabricating the forecast. Relationships between actors are unique, local and specific, thus, they cannot be generalised across contexts. Performativity suggests that phenomena exist because actors perform and it is this performativity that transforms other actors, thus, continuously enacting new relations. When *others* are transformed, actors also become something/someone else. Actors are always in the process of becoming. Heterogeneity implies that an actor-network comprises of heterogeneous entities, the boundary of which cannot be defined ex ante. We cannot define from the outset, that an actor is technical or

social, macro or micro, external or internal, and so on and so forth. These dichotomies are misleading.

This thesis aims to show the relationality, performativity and heterogeneity of calculations and how the network of an S&OP reassembles time (how future is domesticated in current humans and technologies that have their roots in the past) and space (how power relations shift across the demand chain where there are competing voices for customers and the loci of integration). It will utilise the vocabulary in ANT to show that a single sales forecast is actually a vast network, and that its trajectory in DCM drifts away from functionalist propositions and theories that have been proliferating in the literature of DCM. This is not to say that the vast literature of DCM is misleading, but that the use of mundane managerial technologies always turns existing theories into new and often surprising territories; thus, constructing new theories and practices. Forecasting in DCM is, thus, a situated practice, for every actor-network is unique. This thesis does so by problematising the space of DCM from the perspective of another discipline, accounting, because forecasting is an accounting practice; not to mention the variety of forecasting techniques that are written about in a variety of management accounting textbooks. Using ANT, this accounting research does not challenge the mainstream DCM literature, but attempts to assist the theorisation of an S&OP process in a humble way that shows the performativity of sales forecasts and its implication on demand chain management (DCM). What are the *others* that cannot be treated as blind spots, but contributing to constructing the sales forecast and its competing counterparty? Sales forecasts are technical, how can they engage with a series of social tensions brought by other forecasts that all claim to speak for customers? How is uncertainty in future customer demand translated into uncertainty in integration in DCM because of those tensions derived from multiple and competing voices of customers? Bearing these questions in mind reminds me that a research question on fabricating the S&OP process may help explore translations of uncertainty in DCM as well as multiple voices competing for speaking for customers.

The relationality and performativity of accounting research and research on DCM implies that when one offers a little bit of assistance to the other, it also receives help from the other. Whilst this thesis wants to offer some humble help to the literature of DCM, theories in DCM stimulate accounting research; especially studies in inter-organisational relationships (IORs), which theorise the role of accounting in DCM. Much has been done to trace accounting along the supply chain in subcontracting dyads or networks (Mouritsen, 1999; Mouritsen et al., 2001; 2009; Mouritsen and Thrane, 2006; Chua and Mahama, 2007; Dekker, 2003; 2004; Anderson et al., 2000; Wouters et al., 2005; Carr and Ng, 1995; Cooper and Slagmulder, 2004; Kajuter and Kulmala, 2005; Seal et al., 1999; 2004; Baimen and Rajan, 2002; Thrane and Hald, 2006; Coad and Cullen, 2006). It is therefore, interesting to take a *pull* approach on how accounting quantifies customer demands and how such a representation of the future market performs backward to production and suppliers on the demand chain. Whilst the *push* oriented SCM addresses process improvements (Dekker, 2003; Wouters et al., 2005; Carr and Ng, 1995; Cooper and Slagmulder, 2004; Kajuter and Kulmala, 2005; Seal et al., 1999), division of profits (Dekker, 2003; Carr and Ng, 1995; Cooper and Slagmulder, 2004; Kajuter and Kulmala, 2005; Seal et al., 1999), trusts and cooperation (Ittner et al., 1999; Baimen and Rajan, 2002; Dekker, 2003; Cooper and Slagmulder, 2004; Kajuter and Kulmala, 2005; Seal et al., 1999), innovation management (Mouritsen et al., 2009), dis-embedding/re-embedding of transactions (Seal et al., 2004), inscriptions and representations (Mouritsen, 1999), re-presentation of organisational identities (Mouritsen et al., 2001) and performance measures (Chua and Mahama, 2007); the *pull* based DCM may encourage the exploration of new territories of relationships between accounting and DCM. Although DCM implies that information flows between customers and the focal organisation which leads to better SCM through the proliferation and advancement of information technology (Treville et al., 2002), quantifying customer demands in the form of forecasts is sometimes undertaken in the absence of customers; as per the case company. In this setting, who speaks for the customer? How do multiple voices of customers compete against each other? This thesis attempts to engage with these questions and offer a narrative of how accounting travels backward from the customers in their absence, to the organisation that implements the S&OP when there are competing voices claiming to speak for customers.

Although accounting research in IORs barely touches upon downstream relationships, managing customers is not absent in accounting literature which turns its attention to individual organisations trying to embrace customers. In the name of the customers, strategies and internal processes have been re-shaped (Whiteley, 1991). Customers play a critical role in "the new economic citizenship" (Miller and O'Leary, 1994), and accordingly, customers are incorporated to tightly couple the enterprise (Miller and O'Leary, 1987; 1993). Within the domain of accounting technologies, the discourse of the customers has enacted innovation in management accounting techniques such as the Balanced Scorecard (Kaplan and Norton, 1992; 1996). The Balanced Scorecard was proposed as a strategic performance measurement system that was inevitably constructed as a space for discussing strategies. Hansen and Mouritsen (2005) place Kaplan and Norton's principles of BSC in the theoretical domain of strategy and claim that the BSC fosters strategy formulation and implementation as an outside-in process. The BSC matches firms' internal processes (internal business process perspective) and intangible investments (learning and growth perspective) to their value propositions which enables organisations to position themselves to the right customers (customer perspective). These value propositions include being either a differentiator or a low cost producer (Porter, 1980). Under the contingency based theory, a customisation strategy is best when it is tightly coupled to a timely and integrated management control system (MCS). Firms pursing a cost leadership strategy should build a MCS that emphasises rigid budget controls; and those trying to be differentiators should use a MCS that incorporates a broader scope of information (Chenhall, 2003).

A number of customer accounting (CA) practices have been introduced by practitioners. They are, however, mostly normative and there has been limited empirical literature on the implementation of these practices (Guilding and McManus, 2002). These CA practices include: customer profitability analysis (CPA) (Cooper and Kaplan, 1991) that calculates profits from a specific customer, customer segment profitability analysis (Ward, 1992) that undertakes a CPA on a market segment or customer group basis, life time CPA (Foster and Gupta, 1994) that extends the time horizon for CPA and valuation

of customers or customer groups as assets (Foster et al., 1996). Guilding and McManus (2002) survey the top 300 Australian listed companies on their use of CA and find that there is a positive relationship between market orientation and CA, as well as a weak positive relationship between competition intensity and CA. The CA elements are argued to be embedded in some recently promoted management technologies such as the BSC, mentioned above, and the total quality management (TQM) that highlights the importance of managing quality through customer complaints and product quality (Zink, 1995).

Accounting research's contribution to studies on CA has, thus, endeavoured to transform the discourse of customers into a calculable space so that programs, customers and organisational managers and employees are amenable to management intervention (Miller and Rose, 1990; Ezzamel, 1994). Calculative practices in this setting have been discussed closely alongside modernisation (Giddens, 1990) because they provide standardised information so that "practices are constantly re-examined and reformed in the light of incoming information about those very practices, thus constitutively altering their character" (p. 38); as well as the three divergent themes of "managerialism, centralism and localism" (Brooks, 2000) being integrated. Calculations bring together elements that are actually absent in the centre of calculation (Latour, 1987), but act upon those elements because facts are now created, constructed and accepted so that interventions can be made (Llewellyn and Northcott, 2005). Therefore, calculative practices can be viewed as a working time/space where seemingly homogeneous technologies are made heterogeneous when they are engaged with; because centres of calculation simultaneously create centres of discretion (Quattrone, 2009). For instance, although the BSC has a core that is constant, the content of the four perspectives and how they are linked to the strategy always differ across cases, "for they relate to the eventual enactment of this abstract method of performance measurement" (*Ibid,* p. 112).

Under the umbrella of CA, accounting instruments, thus, enact calculative practices that link customers to organisational actions (Mouritsen, 1994). Such an enactment, however, often raises resistance because the intricate power relations will be shifted (Ezzamel,

1994). In the *push* oriented supply chains and subcontracting relationships, accounting is found to shift power from hardware to software engineers, as well as restore power to the product department that has lost its voice when its development function is outsourced (Mouritsen et al., 2001), and to label an identity of "exploitative" to its suppliers (Chua and Mahama, 2007). The accounting literature, however, whilst focusing on CA and calculative practices, has been rather silent on the impacts of CA that quantifiy customers on the DCM. As the DCM aims to find a balance between customer satisfaction and supply chain efficiency (Heikkila, 2002), demand integration refers to the integration that supports the transferring of demand information to facilitate better responsiveness to changing customer needs; and supply integration refers to the integration that supports efficient manufacturing and delivery of products (Frohlich and Westbrook, 2002) between companies' abilities to understand customer demand and their capabilities within the supply chain (Lambert and Cooper, 2000). This thesis attempts to explore how the calculation of a sales forecast that domesticates uncertainty in future customer demand affects supply chain decisions on inventories, that is to say, how it impacts a *pull* based demand chain. In this milieu, the following questions are worth exploring. In the *pull* demand chain, who quantifies the uncertain market demand? If this information is expected to flow back to production and suppliers, will it flow smoothly or encounter resistance because of other quantifications, that is to say, other voices for customers? If resistance occurs, who becomes the spokesperson for customers then? These are not research questions in this thesis, but exploring the research question about fabricating the S&OP sales forecast and the S&OP process, as well as the effects that this fabrication will have on translating uncertainty in future customer demand and integration in DCM, and competing voices speaking for customers, will shed new light on these aforementioned questions. Studies on calculative practices mentioned above have shown how accounting inscriptions are enacted through specific orthopraxis and are made multiple, accordingly (Quattrone, 2009). This study wants to add a nuance to a specific orthopraxis in the S&OP process, in particular, how actors are enacted upon in the working time/space between the abstract ideals of the S&OP process and its users, making the S&OP process heterogeneous. Such heterogeneity lies on the shifting ontology of the S&OP process, emergent relationships between competing calculations

and fluid impacts on integration. This thesis aims to show that accounting and the discourse of customers are not tightly coupled, but are loosely coupled in a network that handles conflicting interests across the demand chain; especially between sales and manufacturing. This study argues that when DCM literature attempts to engage with uncertainty in customer demand directly, rather than avoiding it, it tends to avoid discussing the tensions, conflicts and resistance brought about by the multiple attempts to quantify customers. In addition, it tends to overlook the inter-relations between calculations, integration and uncertainty in customer demand. In response, this accounting research engages with the uncertainties in customer demand and integration across the demand chain, in order to provide a more comprehensive process and view on multiple endeavours in quantifying customer demand.

Tensions, conflicts and resistance aroused from multiple attempts to quantify customers are narrated in detail in Vaivio (1999), who traces a tension between knowledge constructed by the commercial staff in the discourse of the Customer and the rival; knowledge created by the sales in the discourse of the Sales Customers in a UK subsidiary of Unilever. It is claimed in his narrative that an accounting attempt to create orders via diagnosis to avoid "ad hocracy" is dominated by a marketing attempt to restore real problems via professional guts to promote "ad hocracy". Urgent real problems dominate distant and aggregate accounting representations. The attempt to control them at a distance fails. The locals are not willing to be dominated by a centre of calculation. This is a case where guts and intuition defeat accounting calculations. This is an interesting case because a calculative practice of quantifying customers does not produce power-knowledge that makes the commercial group's attempt to speak for customers convincing. Instead, it externalises the tacit power-knowledge of sales. In this sense, a calculation in one group makes a competing voice of customers stronger. This thesis attempts to explore the tensions derived from competing calculations that all claim to speak for customers by linking attempts to calculate future customer demand to internal integration on inventory management. It aims at offering a different vista from Vaivio's (1999) on how multiple calculations can be fabricated to provide knowledge that all attempts to speak for customers. It also adds to the extant accounting literature on

calculative practices by providing new insights on governing via multiple calculations in the working time/space just discussed; because extant literature studying calculative practices in governing economic life (Miller and Rose, 1990) tent to overlook how competing calculations create expertise that helps to govern economic life.

Other studies in public sectors also analyse tensions and conflicts between accountants and other specialists when accountants try to replace discourses of accounting with existing organisational discourses, even when they are not customer oriented. In the case of an organisational change in a British railway company, a business culture of seeking profit was gradually replaced by an engineering culture of public service (Dent, 1991). Accounting in this sense symbolises efficiency and calculative rationality. Business managers dominated railway engineers because they made themselves actors in the context of changing their status and modifying the accounting systems. They became OPP (*Ibid*) in the organisational change. Another example of this is the benchmarking of hospital costs via the discourse of an average hospital in Britain, accountants successfully planted an awareness of costs into the minds of doctors and resolved the latters' resistance by means of allying other actors, such as nurses, and making doctors responsible for the veracity of the data on which average costs were calculated (Llewellyn and Northcott, 2005).

As the S&OP process, in principle, encourages discussions on the sales forecasts between diverse functional groups, in order to structurally domesticate uncertainties in future customer demand, it draws attention to the uncertainties attributed to the tensions between diverse groups that participate in fabricating the sales forecasts. Investigating this will benefit the literature on both accounting and DCM by exploring how uncertainty in customer demand is translated into uncertainty in fabricating multiple calculations in a technology, which is intended to represent future customers, and in integrating the demand chain processes. Demand information may not flow backward from customers to organisations, but it translates and permeates into multiple times and spaces.

To conclude, inspired by the DCM literature that calls for research to directly engage with uncertainty in customer demand, this thesis takes a constructivist-oriented accounting perspective to engage with such uncertainty and to explore how it is translated into uncertainty in integrating demand chain processes, due to ongoing tensions across the demand chain when a firm undertakes an S&OP process to quantify customers; in particular how an S&OP forecast and an S&OP process are fabricated out of a series of competing calculations all claiming to speak for customers. This engagement focuses on the working time/space where the S&OP process is enacted by diverse actors. This contributes to DCM literature that has so far overlooked the tensions created by different groups claiming to speak for customers, and the uncertain nature of integration; especially the S&OP literature that has been silent on why the implementation of S&OP is so difficult. It also contributes to the accounting literature that has been scant on following how accounting creates a working time/space for DCM. The next subsection will continue the discussion on IORs, but turn focus towards the intricate relationship between fabricating the S&OP process and intra-/inter-organisational time and space.

Intra- and inter-organisational time and space

As is theorised in the last section, fabricating a demand chain process cannot be studied separately from the ongoing tensions it enables and the many *others* it attracts. This has significant implications on theorising intra- and inter-organisational relationships. Because of *relationality*, when tensions are emergent, ongoing and multiple, the ontology of accounting will be fluid, and so will intra- and inter-organisational time and space. It is, therefore, misleading to say from the outset whether accounting is intra- or inter-organisational.

Amongst studies on IORs, supply chain management (SCM) has attracted much attention in management accounting (MA) literature. Langfield-Smith and Smith (2005) provoked the research interests in performance measurement systems to stretch beyond legal organisational boundaries, explained the roles of performance measures in supply chain SCM and prescribed frameworks for the development of these performance measures. In the functionalist stream, empirical evidence indicates that the introduction of controlling mechanisms that enhance the level of information sharing mitigates the problem of

information asymmetry that leads to unequal bargaining power (Baiman and Rajan, 2002). Mahama (2006) documents positive relationships between performance measures and the four dimensions of cooperation in supply relationships, namely information-sharing, problem solving, adaptability to changes and restraint from the use of power; but he only found a positive relationship between socialisation practices and information-sharing. Frances and Garnsey (1996) in their study on UK supermarket chains find that IT enhanced-control mechanisms will tighten inter-organisational linkages, thus, enabling UK supermarkets to increase their influences on suppliers via informational feedbacks.

The constructivist approach, while having documented a number of studies on buyer-supplier dyads and subcontracting relationships, has not traced the interactions between accounting and the many other entities on the *supply/demand chain*. One possible reason is that by following accounting as an actor, inter-organisational controls may easily be traced to subcontractors (Mouritsen et al., 2001; 2009; Mouritsen and Thrane, 2006), but tracing them to other entities along the entire supply/demand chain could be challenging if contributors strictly follow the ANT slogan, "travel slowly". The potential void that originally motivated this thesis is whether and how accounting can travel along the demand chain.

The above mentioned increasingly popular DCM literature, in addition, points to the second void which lies in the accounting literature in IORs. Literature on DCP, especially studies on forecasting, may inspire ANT inspired accounting literature on IORs to travel even more slowly. Before moving to the demand chain relations, intra-organisational cross-functional coordination may have to be problematised. In the S&OP literature, its cross-functional identity has been assumed from the inception. Cross-functional support may be a normative proposition, but to make this proposition perform in organisational practices, tensions between different functions must be settled. This void points to a sharp jump between intra- and inter-organisational relationships presumed in extant MA literature in IORs, which presumes accounting as an inter-organisational technology. This presumption runs the risk of ignoring intra-organisational tensions that are relational to the construction of inter-organisational relationships. To date, there have been a few

exceptional articles paying attention to the interactions between intra- and inter-organisational spaces. Mouritsen et al. (2001) follow two inter-organisational control mechanisms – target costing and open book accounting – to trace its transformational effects on intra-organisational phenomena such as strategies, structures, core competencies and technologies. Thrane and Hald (2006) use a holistic approach to problematise the interface between intra- and inter-organisational relationships to see accounting as both an integration and a fragmentation device on this interface. Cuganesan and Lee (2006) claim that the use of IT, in a buyer-supplier relationship via a dialectic accounting control, stimulates suppliers to create unintended effects of its use in order to stabilise the procurement relationship. Both Mouritsen et al. (2001) and Cuganesan and Lee (2006) provide narratives on how inter-organisational controls have gained unintended feedback on intra-organisational space; whilst Thrane and Hald (2006) problematise and visualise the struggling space for the intra- and inter-organisational dichotomy. For Mouritsen et al. (2001) and Cuganesan and Lee (2006), the dichotomy between intra- and inter-organisational space is taken for granted, though the feedback is created by inter-organisational accounting controls. Accounting is in accordance with an inter-organisational identity from the outset, albeit, its performativity has implications in diverse time and space and intra- and inter-organisationally. The arrow is problematized, but the starting box – accounting – is black boxed. For Thrane and Hald (2006), the interface between the intra- and inter-organisational spaces is problematized, but accounting is struggling with an attempt to construct a final closure of this problematisation. They take the shortcut to accord accounting with either an integrated or a fragmented role.

Other exceptions include Hakansson and Lind (2004) and Seal et al. (2004). Hakansson and Lind (2004) trace accounting in its competition of serving intra- and inter-organisational buyers and suppliers. They open up a gate for exploring the interface between intra- and inter-organisations by showing that enormous controversies may exist before reaching a concluding dichotomy between the two. Seal et al. (2004), using the theory of structuration (Giddens, 1984; 1991a; 1991b), argue that accounting in supply chains may be understood as a wider manifestation of modernity. In their analysis of the

three phases of modalities of accounting practices, they (Seal et al., 2004) see accounting as a dis-embedding technology in existing institutions of internal production and business relations, because it transforms the identities of the buyers in the eyes of the suppliers. Different cost systems belonging to buyers and suppliers generate misunderstanding, thus, threatening institutionalised collaborative relations. Later, accounting will also re-embed business relations through open book negotiations, but this can be hampered by cost control of procurement (Seal et al., 1999). These studies illustrate the problematic treatment of accounting as a technology that encompasses either intra- or inter-organisational relationships. This space odyssey consists of multiple translations which may construct emerging space boundaries. Seal et al. (2004) provoke studying the relationship between accounting and institution production that is independent of the physical dichotomy between intra- and inter-organisational spaces. This means that studies on the relationship between accounting and intra- / inter-organisational space may gain new insights after disregarding the physical IORs. This thesis shares this view and attempts to see whether there is fragmentation within the legal boundary of an organisation and integration across legal boundaries across organisations (Thrane and Hald, 2006). In addition, this study aims to explore the complexity, fluidity and multiplicity of intra-/inter-organisational relationships. In the context of S&OP, intra- and inter-organisational spaces may be re-shaped when emerging, ongoing and multiple tensions transform the ontology of a sales forecast. We cannot state from the outset that a sales forecast in S&OP manages inter-organisational relationships, because uncertainty in customer demand may easily be translated into uncertainties in integration and in constructing the calculation in an intra-organisational space. Moreover, as tensions may be multiple, accounting will be multiple and, thus, boundaries of intra- and inter-organisational spaces depend upon those translations that accounting enables.

This monograph argues that by following the fabrication of an S&OP process may reveal new insights in relation to this interesting space of intra- and inter-organisational relationships. Hopwood's (1996) call was aimed at provoking accounting research to break its fixation on vertical organisational processes. Research on lateral processes in IORs was then motivated to study accounting in larger relations, but extant literature has

shown that it does not mean we should jump sharply from intra- to inter-organisational spaces. The lateral process in the internal supply chain of organisations which encompasses sales, factories, and product line planning management is worth exploring, before we conclude how accounting re-shapes inter-organisational relationships. There may be an interesting space odyssey in those lateral processes, due to those tensions between diverse entities. Since integration is a problem for DCM in translating future customer demand, the loci of integration may multiply and be dispersed into different spaces, because different tensions bring about different actors. How integration is delegated into separate spaces will have an impact on IORs because the distinction between inter-organisational integration and intra-organisational movements toward integration is blurred if they are inter-related. Figure 1 below shows a very interesting space for ANT inspired accounting scholars. It should be noted that this thesis does not assume from the outset that the internal supply chain is the space where more interesting theorisation will unfold. Instead, this study sees it as the starting point of a long journey that follows lay actors to narrate how they shape and re-shape the associations of these legal entities.

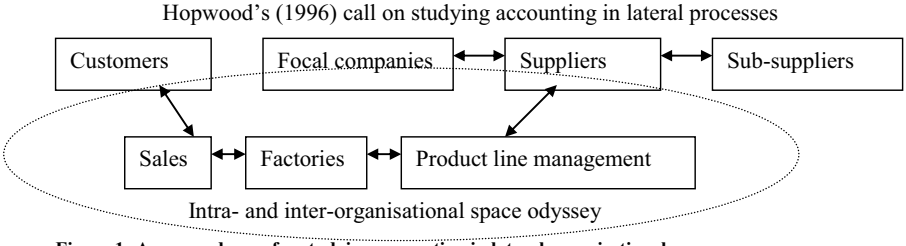


Figure 1: A space odyssey for studying accounting in lateral organisational processes

In addition, imposing a research question on how uncertainty in *future* customer demands is translated into a series of *current* calculations that compete in speaking for customers, constructs another research interest. Extant accounting research on IORs tends to focus on inter-organisational *spaces* in IORs. This thesis proposes that inter-organisational *time* may also be shaped and re-shaped by those emerging, ongoing and multiple tensions derived from the competing voices of customers. When fabricating these competing calculations that attempt to speak for customers, humans, artefacts, technologies and strategies residing in the *past* and *present,* may be brought to a *current* space of

calculative practice, which may in turn affect how *future* uncertainties are translated. This intra- and inter-organisational timing process may also be fluid when relationships between calculations and *others* change, and the loci of integration are shifted. Therefore, in addition to focusing on intra- and inter-organisational spacing in the context of an S&OP, intra- and inter-organisational timing is put on the research agenda in this thesis. I call such processes of timing and spacing a series of time and space odysseys in this thesis.

Based on the above reasoning, this thesis argues that answering the research question on fabricating an S&OP sales forecast and an S&OP process offers new insights into how fabrications of an S&OP sales forecast and an S&OP process re-shape the intra- and inter-organisational time and space.

Under the umbrella of fabricating an S&OP sales forecast and an S&OP process, this sub-section reviews DCM and MA literature on IORs. This literature claims that following the fabrication of an S&OP sales forecast and an S&OP process will contribute to the DCM literature by providing new insights on theorising time and space odysseys in intra- and inter-organisational relationships under DCM. Hopwood's (1996) call on studying accounting in lateral processes was provocative, but ought to be followed in a more rigid manner. Jumping directly from intra- to inter-organisational spaces runs the risk of missing emerging, ongoing and multiple tensions on the demand chain . Jumping is an alien to ANT. In the functionalist approach, the IORs are assumed as a black box, and the only theoretical assignment is to establish associations between variables in the IORs that can be generalised across contexts. Processes in creating and maintaining IORs are marginalised. The constructivist approach, though contesting this ontological presumption claiming that IORs are networks constructed by interactions between actors including competing accounting inscriptions, implicitly admits that accounting is brought to the front stage to shape and re-shape IORs due to intra-organisational concerns; for instance, innovation (Mouritsen et al., 2009). The transition from the intra- to inter-organisational space in accounting research has been treated as a jump. Although Mouritsen et al. (2001; 2009) trace the spill over and feedback effects of accounting on

intra- and inter-organisational relationships, the detailed processes of generating the accounting calculations inside legal boundaries of organisations were overlooked. It may start with an inter-organisational identity, for instance, target costing in Mouritsen et al. (2001); but throughout the long translation process, when competing interests of diverging parties are allied, it may also be transformed anew. As a result, a more localised view of the interface between intra- and inter-organisations may have to be accounted for. In addition, this thesis also attempts to explore how intra- and inter-organisational time is shaped and re-shaped because actors from past and present are participating in the fabrication of current competing calculations that claim to speak for future customers. Finally, blurring the distinction between inter-organisational integration and intra-organisational movements towards integration helps explore the inter-relations between timing and spacing integration, and realise the generic purpose of integration in DCM.

Conclusion

Using ANT to study the fabrication of the S&OP process contributes to both ANT inspired accounting and DCM literature. Studying fabrications of an S&OP sales forecast and an S&OP process contribute to the ANT inspired accounting literature by shedding light onto how accounting itself is fabricated; and to DCM literature by offering new insights on translating uncertainties in future customer demand and integration, calculative practices, competing calculations that all claim to speak for customers and on time and space odysseys of integrating DCM. More specifically, this thesis is interested in studying how accounting is fabricated because extant ANT inspired accounting research has either taken the ontology of accounting for granted or followed how diverse interests are allied to make accounting convincing in a one-off rather than a continuous manner. This thesis attempts to illustrate the complexity, fluidity and multiplicity of accounting in action by following a series of continuous attempts to close emergent, ongoing and multiple matters of concern on accounting. Under the umbrella of fabricating accounting and its related processes, this study is also interested in studying how uncertainty in customer demand is translated into uncertainty in integration in DCM, where there are multiple voices competing for the speaking for customers, because extant DCM literature tends to overlook the uncertainty in creating a forecast and the tensions

attributed from competing voices for customers. This also helps accounting literature in theorising accounting, especially calculative practices in DCM because extant accounting research has been silent in this area. Finally, by focusing on how uncertainty in customer demand is translated into separate time and space on the demand chain, this thesis contributes to accounting research in IORs by exploring how intra- and inter-organisational time and space are more fluid than has been theorised in extant literature. This also adds value to the literature on DCM by generating narratives on the inter-relation between the spacing and timing of integration and achieving the generic ideals of integration.

The resulting research questions, however, generate another matter of concern on methodology. ANT will be deployed to address these concerns, but ANT is itself evolving, and there can be many types of ANT studies. These concerns on ANT will be translated into the choice of *circulating references* and *matters of concern* analysing lenses that will be discussed in the next chapter.

CHAPTER 3

Literature Review: Method Theory

Inscriptions and centres of calculation were illustrated in Science in Action (Latour, 1987) to highlight the performativity of non-human actors. Circulating references were enlightened in Pandora's Hope (Latour, 1999) to visualise translations. Matters of concern were raised in Reassembling the Social (Latour, 2005a) to render cold objects disputable. How can you reassemble them to construct a collective?

ANT itself is evolving. These are the three networks constructed across the last two decades. This monograph wants to associate them in a mega-network of ANT to address the closure of matters of concern into research questions in Chapter 2.

Introduction

Inscriptions and *centres of calculation* were illustrated in Science in Action (Latour, 1987) to highlight the performativity of non-human actors. *Circulating references* were enlightened in Pandora's Hope (Latour, 1999) to visualise translations. *Matters of concern* were raised in Reassembling the Social (Latour, 2005a) to render cold objects disputable. This thesis will use actor-network theory (ANT) as a method theory (Lukka and Vinnari, 2011), and this chapter will attempt to reassemble them to construct a collective.

As is cogently pointed out by Justesen and Mouritsen (2011), most Actor-network Theory (ANT) inspired accounting research has so far utilised repertoires of Latour's (1987), such as *inscriptions* and *centres of calculation,* in order to follow the process of inscription building and its performativity (Robson, 1992; Preston et al., 1992; Chua, 1995; Mouritsen, 1999; Mouritsen et al., 2001; Briers and Chua, 2001; Mouritsen and Thrane, 2006; Chua and Mahama, 2007; Mouritsen et al., 2009). Only one paper explores inscription building from the lens of *circulating references,* but finds that the circulation is broken in their empirical setting (Dambrin and Robson, 2011). Only a few touch upon technologies as *matters of concern,* but they described the fabrication of an IT system (Quattrone and Hopper, 2005; 2006) which accounting is only part of instead of how accounting is constructed.

In my field study at the case company, where diverse actors contributed to fabricating an S&OP process, every attempt to close the technology into a matter of fact made it a set of matters of concern. Closing these emergent matters of concern on the technology into inscriptions attracted new matters of concern[8], even though old matters of concerns were closed. Some matters of concern even allied opposing networks, rendering the circulation of S&OP process at risk, thus, possibly blocking the fabrication; but this means they *de*-fine the S&OP and make it multiple by attracting new entities (Quattrone and Hopper, 2006). This monograph will construct narratives that focus not only on accounting

[8] That means it creates the technologies will not be closed to a matter of fact when certain disputes are closed as actors may raise new disputes around technologies.

inscriptions, uncertainties in customer demand and integration, multiple and competing voices for customers and intra- and inter-organisational relationships, but also on *inscription building*, *circulating references* and *matters of concern* as a collective whole. Domain and method theories are relational and cannot be separated from empirical analysis. Theorisation and methods become a collective whole, each of which conditions each other. According to Lukka and Vinnari (2011), method theories are theories borrowed from other disciplines to assist building domain theories. In this thesis, ANT is borrowed from the discipline of science and technology studies (STS) to build domain theories in accounting and demand chain management (DCM); these have been discussed in Chapter 2. Moreover, binding domain with method theories has implications on research methods. Theories are out-there, but as effects of their associations with methods and empirical data (Law, 2004; Lukka and Vinnari, 2011). Domain theories, methods theories and methods are all mediators in the production of theories of the thesis. This reflection upon research methods will be discussed in Chapter 5. It should be noted, that because ANT is used as a method theory, this thesis does not attempt to contribute to ANT as a methodology; but in short suggests that there are properties in ANT that have the potential to be used in ANT inspired accounting research to build domain theories in accounting.

This chapter will first go back to one of the earliest entities in ANT repertoire, namely *translations*. It will then turn to the enrolment of *circulating references* (Latour, 1999a), followed by an ally of a recent entity; namely *matters of concern* (Latour, 2005a). This chapter will end with a review of the ANT inspired accounting literature in fabricating accounting technologies.

Prelude

The past two decades have seen an increasingly proliferating use of ANT in accounting research (Justesen and Mouritsen, 2011), partly in response to Hopwood (1976; 1987) and Hopwood and Miller (1994) who call for critical and socio-historical analyses of accounting; though at that point in time, ANT inspired accounting research was still in its infant phase.

The purpose of the ANT inspired accounting research is and has always been to embed accounting into a social space, where "social" refers to the associations between intertwining human and non-human actors (Latour, 2005a). Research has shown that accounting can construct temporarily stable networks (for instance, Miller and Rose, 1990, though not an ANT study in its entirety), and displace organisations into diverse times and spaces (for instance, Mourtisen, 1999; Mouritsen et al., 2009). The critique is that accounting cannot be separated from its context and vice versa. This statement leads to a number of debates which challenge the conventional view on the ontology of accounting. A black box already closed, a tool to fulfill rational needs as is stated in economic based theories such as the contingency theory, transaction cost economics and institutional theory; but the modernist dichotomy of micro and macro, actors and structure, natural and social, humans and non-humans and alike has been criticised as obscuring the creation of scientific facts (Latour, 2005a). In accounting research specifically, ANT inspired accounting research points to the irrelevance of the separation of designing and implementing an accounting system and of the view that accounting changes are linear transformations from one time-space to the other (Quattrone and Hopper, 2001; 2005; 2006; Chua 1995; Briers and Chua, 2001; Ahrens and Chapman, 2007; Mouritsen et al., 2009; Preston et al., 1986; Robson; 1992; Dambrin and Robson, 2011; Qu and Cooper, 2011).

In order to equip accounting with a *disputable* social role, in addition to its *cold* natural role, ANT has largely been deployed as a method theory to discover the new properties pertaining to accounting. With the equal treatment of humans and non-humans (Latour, 1999a; 2005a), ANT brings back accounting calculations from the marginalised back stage, where they had long been appendices to the contingent forces of sensemaking and interpretation, institutions, agency relationships and structural rules, to the centre of the front stage (Justesen and Mouritsen, 2011); where the "social" links them to the macro-context, and the personal interpretation is flattened. Social are theorised associations (Latour, 2005a). From a paradigmatic perspective, accounting phenomena has also been studied as passive tools or mechanisms to be "adopted" to serve functions i.e the functionalist paradigm; Capitalism i.e. Marxist radical structuralist paradigm; and

personal sensemaking i.e the interpretive paradigm, according to Burrell and Morgan's (1979) two-by-two division of sociological knowledge (Justesen and Mouritsen, 2011, p. 163). Such reductionist divisions, albeit admitting multiple technicalities pertaining to accounting calculation, hinder the potential of exploring multiple interesting, emergent and ongoing and properties that organisations have been equipped with for accounting calculations; thus, distorting the reality by simplifying and generalising (Latour, 2005a). Accounting is to be brought to the front stage.

The dichotomy between the "macro" context and the "micro" actions is in sharp contrast with ANT where the social space has to be kept flat in order for a "real" explanation to be made (Latour, 2005a). Positioning accounting calculations underneath these "macro" umbrellas, as is in mainstream accounting research, will in most cases reach propositions generalised across situations, especially studies on accounting changes following the rationalist approach separating design and implementation of management control systems (MCSs). As Mouritsen et al. (2010) cogently remark, generalisation, however, is a procedure of drawing upon associations by means of highlighting elements having similar properties across cases. By omitting elements possessing dissimilar elements from an explanation, the explanation becomes less real and less interesting. They continue by arguing that generalisation, therefore, is a process of reduction and simplification, for generalisation to be interesting, it has to be assigned particular interests imposed by some actors; explicitly or implicitly (p. 311). In other words, to make an explanation real, it has to offer surprising accounts for actors and their interactions, and for it to be surprising, the procedure has to enrol dissimilar elements to make a detailed description; and to do so, the invisible string tying the "macro" and the "micro" must be made visible so that they are on the same horizon, that is, the social space becomes flat (Latour, 2005a).

In linking micro actions and macro contexts, and flattening the social space, the often invisible "social" is made visible through associations between actors. Generalisation does not construct this "social" because it ignores the loci of local movements. Mouritsen et al. (2001) point out, that relations between actors are unique and cannot be generalised across contexts. Chua (2007) and Ahrens and Chapman (2007) state that strategising and

accounting are situated practices whose ontologies shift as their associations with *others* change. This thesis uses ANT to follow associations between diverse actors that partake in fabricating a sales forecast and the transformations of these associations. I argue that by doing so, contexts such as intra-/inter-organisational relationships and demand chain management will be localised. Only then is the accounting entity, "surprisingly", not shaped by environment uncertainty, technology, strategy, organisational structure and the contingency factors alike. Only then are the accounting objects, "surprisingly", not driven by forces for homogenisation. Only then is the variability inherent among accounting entities, "surprisingly", not appreciated by the principle/agent relationship. Only then are accounting systems, "surprisingly", not bound by structural rules. Interestingly, there are episodes where accounting calculations can be mobilised to extend strategy (a contingent factor), in addition to implementing it (Mouritsen et al., 2009) and developing its context (Mouritsen, 1999). ANT, instead of provoking accounting researchers to place their positions within the boundary of one of the four cells in Burrell and Morgan (1979), uses an approach that localises researchers into interactions between lay actors; it follows their movements and enables them to write a constructive account. Limiting ourselves them by presumptions in the aforementioned paradigms is alien to ANT. But debunking is not the intention of ANT, ANT aims to re-discover the lost landscapes that have long been overlooked by studies more or less equipped with identities labelled with one of the Burrell and Morgan's (1979) paradigmatic brands. You will find these lost lands re-emerging later in this thesis. Finally, although it is naïve to regard the interpretive approach as a reductionist one, ANT tries to convince the community that conditions may be brought by cognitions, but cognitions themselves are coloured by a network as a resource provider. Attachments come first, actors second (Latour, 2005a).

The premise of ANT, as an anti-essentialism approach, in that although accounting calculations have no essence unless they are related to *other* actors, these *other* actors are not those sitting at the macro level overlooking the micro entities, instead accounting and these actors are mutually conditioning each other. It is through certain translations[9] that accounting calculations assign these actors' properties so that their interests are

[9] The concept of translation will be discussed in detail later in this paper.

reconfigured. Translations refer to the processes through which actors are transformed and new links are created. It is through the constellation of actors that accounting calculations gain new properties and become more powerful. In short, accounting calculations are actors. An actor in ANT is the entity "that does things" (Latour, 1992a, p. 241) and the one who "bends the space around itself, makes other elements dependent upon itself and translates their will into a language of its own" (Callon and Latour, 1981, p.286). In Miller (1990; 1991), Robson (1991), Miller and O'Leary (1994), Miller and O'Leary (1997), Kurunmaki and Miller (2006), Miller et al. (2008), Miller and O'Leary (2007), and Kurunmaki and Miller (2011), mediating instruments, including accounting inscriptions, serve as the technological part of governing economic life; thereby, making either political or organisational discourse operable. In Miller and Rose (1990), and Rose and Miller (2010), accounting calculations such as discounted cash flows (DCF) and standard costs, "construct, maintain and legitimise the status of expertise" (Justesen and Mouritsen, 2011, p. 172).

Accounting is an actor not because it *represents,* but because its representation creates a space where objects/subjects are made amenable to intervention. Accounting *inscriptions* such as NPV calculations, budget reports and the Balanced Scorecard not only represent realities, but represent them in a way that *action at a distance* renders the controlled calculable, and makes them amenable to management (Miller and Rose, 1990). As a result, objects/subjects under this control are translated into numbers. For instance, in Chua (1995) patients are translated into costs, in Llewellyn and Northcott (2005) hospitals are translated into average costs and in Vaivio (1999) customers are translated into performance indicators that encompass dimensions comprising of product quality, delivery, engineering service and so on. These are translations because properties of actors are transformed and *inscriptions* "construct a commensurability that did not exist before their calibration" (Latour, 1993, p. 113), that is to say, they create new links that did not exist before. Although numbers erase differences, commensurability brings together "elements that are widely differentiated in space and time" (Llewellyn and Northcott, 2005, p. 562), thus, making these elements amenable to comparison and evaluation. This constructs new knowledge, for instance, hospital A is more cost efficient

than hospital B. Chua (1995) refers to such knowledge as an object creating a hyper-reality, as this HOSPITAL is different from the hospital in the physical world. Accounting inscriptions on one hand represent, but on the other hand create new knowledge that constructs new realities, as is indicated by the following quote:

> *"And by responding to that picture of reality, they make it so: it becomes 'real in this consequences'. And what is more, when people respond to that picture, and the consequences occur, they see it as proof of our having correctly conveyed reality. Clever, isn't it? That is how society works." (Hines, 1988, p. 257)*

The above quotation is mesmerisingly in concert with Latour's (1987; 1999) view on inscriptions, translations and representations. No inscriptions can represent the "real", but they extend the real since knowledge attracts new intervention and new interactions will be induced i.e. new links are created and hence, more translations unfold. Is it not real? Accounting inscriptions, as actors, partly construct emerging realities. More specifically, Miller (1990) wrote, *"As technologies they do not have a neutral function of recording the real, but literally represent in such a way as to make it susceptible to evaluation, calculation and intervention" (p.318).* As was mentioned before, it is the evaluation, calculation and intervention of these technologies, including accounting inscriptions, that translate the programmatic discourses of government and allow *action at a distance* that features the modern state. Is it not real? Obviously this "real" is more interesting. The next section will, thus, present the term *translation*; a typical ANT concept proliferating in ANT inspired accounting studies.

Translations

To erase the division between macro and micro and to discover more scientifically the surprising accounts for accounting, and to see the social as associations between actors, ANT inspired researchers have been utilising a few advices in the tool box offered predominantly by Latour (1987; 1999a; 2005a); amongst which is the term, *translation*.

The notion of *translation* is rendered crucial in, from an ANT point of view, *transforming* science studies into real, interesting and strong narratives. To understand what a

translation is, *mediators* have to be distinguished from *intermediaries*. *Mediators,* contrasting *intermediaries*, make a good ANT study as they *translate* rather than *transport* a cause (Latour, 2005a). Mediators by definition make others do unexpected things, just like the life habits of scallops (Callon, 1986). According to Latour (2005a),

> *"We don't know yet how all those actors are connected, but we can state as the new default position before the study starts that all the actors we are going to deploy might be associated in such a way that they make others do things. This is done not by transporting a force that would remain the same throughout as some sort of intermediary, but by generating transformations manifested by many unexpected events triggered in the other mediators that follow them along the line...such is the philosophical meaning of ANT: a concatenation of mediators does not trace the same connections and does not require the same type of explanations as a retinue of intermediaries transporting a cause." (p. 107)*

Before moving on to illustrate the differences made by mediators, I find the above quote three-fold in relation to my aforementioned arguments. First, generalisation, by unveiling associations between elements with similar properties, according to an ANT, is never a good explanation because it simply transports a cause across settings and traces similar connections. Second, by transforming, mediators generate surprises because they always make others do unexpected things. Third, mediators, by making the social be explained instead of providing the explanation, the social is back as movements and associations, making ANT inspired researchers *constructivist* is in sharp contrast to *social constructivist;* as the latter tends to reduce controversies to some social explanations *"as a retinue of intermediaries transporting a cause",* whilst the former keeps controversies alive, hence, making the science studies "real".

It is the mediator that gives rise to the notion of translation, *"a relation that does not transport causality, but induces two mediators into coexisting* (Latour, 2005a, p. 108). Therefore, *"...[translation] mean[s] displacement, drift, invention, mediation, the creation of a link that does not exist before" (Latour, 1999a, p. 179)*. Callon (1999) provides a similar description:

> *"B can only see utility in the knowledge produced by A if A launches into the task of giving B an incentive. A translates B: he sets out to convince him...that it is in his interest to go through the competencies produced by A." (Callon, 1999, p. 41)*

If we combine how Latour (1999a) and Callon (1999) define what a translation is, we can see that for A and B to co-exist, there has to be a relation between the two. To create a link, a third entity, C, is needed as a mediator. A and B, in this sense, are relational and they have no essences without the enrolment of C. Similarly, Mouritsen et al. (2001) and Mouritsen and Thrane (2006) advocated that to understand the relationship between two entities, for instance, the company and its subcontractor, there needs to be a third actor, for instance, target costing (Mouritsen et al., 2001). In their episode, target costing delegates innovation tasks to the suppliers, but the network is fluid in the sense that the performativity of target costing flows back, requiring the focal firm itself to change its competencies, technologies, strategies and so forth. When translation occurs, in other words, a link is added, more controversies unfold and more surprising accounts will be drawn, which construct realities will later sit out-there. Accounting enables translations if it is deployed as a mediator.

Second, the narratives describing mere transportations are less convincing. Let us illustrate a generalisation that provides explanations, *"as a retinue of intermediaries transporting a cause"*. When proposing the Balanced Scorecard (BSC), Kaplan and Norton (1996a; 1996b; 2000) encourage building a set of causal links across four perspectives so that an enhancement in customer satisfaction will increase profitability. If we enrolled a new entity, namely loyal customers, it would not be hard to imagine that loyal customers are more expensive to serve, thus, higher customer satisfaction in this setting will reduce financial numbers (Norreklit, 2000). Indeed, Murthy and Mouritsen (2011) contest the taken-for-granted causal relationship between intellectual capital and financial capital assumed in the BSC and claim that a firm's budgeting process can mediate such a relationship. These episodes reveal how vulnerable an explanation can be when no accounts for translations are offered. If we, however, construct the "reality" by using a translation, i.e. adding a link, suddenly, the explanation will describe surprising

accounts for the "social". Deploying a new mediator and customer profitability analysis, which in some way points out the means to enhance loyal customers' satisfaction; but at the same time improves profitability, which will doubtlessly render the network sufficiently stronger to argue against objections, which in a Latourian (2005a) sense, makes the explanation more objective. Demonstrating how customer profitability analysis translates entities in the BSC requires us to move even more slowly, because every movement leaves a trace for researchers to follow (Latour, 2005a). Indeed, Ittner et al. (2003) claimed that 76.9% of the BSC adopters placed little or even no reliance on the causal business model. So instead of concluding that these firms were not fully adopting the BSC and attributing such "failures" into problems in implementation, it will be more interesting to follow the performance measures tracing their translations in their local settings that enable managerial interventions. Mouritsen et al. (2001) is no doubt one of such endeavourers that engage in deploying "full-blown mediators" with the central role assigned to open book accounting (OBA). OBA alerts managers that customised products will pull the financial numbers downwards, which puts customer orientation strategy at stake. Such a translation, however, induces surprising effects by enabling unexpected interventions. Rather than pursuing the strategy of hardware differentiation, software could be a source of differentiation. This means OBA helped the company to follow customer-orientation strategy, but with improved profitability and a strategy of standardisation inside it (Mouritsen et al., 2001). OBA induces *"two mediators* (i.e. customer satisfaction and profitability) *into coexisting"* and transforms organisational strategy. OBA, as a mediator, introduces a translation that not only explains the "social", but also simultaneously makes the causal argument inherent in the BSC literature stronger. Such an explanation in this setting is also an actor, as it makes an existing vulnerable proposition a convincing one.

Another example of translation can be clearly illustrated in Czarniawska and Mouritsen's (2009) deliberation on human resource management, where the use of intellectual capital statements translates the complex collectives of people into manageable capital. Such a translation pushes individual characteristics of the employees off centre, but transforms customers, operational processes and projects into objects of management.

Although there is no unified definition on what a *translation* is, this thesis is inspired by Latour (1999a) who regards a translation as a *"displacement, drift, invention, mediation, the creation of a link that does not exist before" (Latour, 1999a, p. 179)*. In this setting, *a translation* in this thesis refers to a movement that makes a difference, transforms actors anew, and creates a link that has not before existed. This requires following actors including accounting, and treating them as mediators. Furthermore, although *circulating references* and *matters of concern* will be discussed shortly, translation cannot be separated from them. Every attempt to close an object as a set of matters of concern into a form, i.e. circulating references, is a translation because when a form is created through networking new entities, the object is transformed into something else. Patients and hospitals are translated into costs, for instance. Such a movement does not end the circulation, however, because the resulting form creates new knowledge about reality. Management intervention is made possible by closing matters into forms, but intervention enacts more interactions and generates more matters of concern to be closed. Therefore, translations are emergent, ongoing and multiple in this thesis.

In conclusion, translations of organisational phenomena into accounting inscriptions have contributed to flattering the social space, hence, accounting has been attached to social and organisational practices. But is this the end of the journey, the end of the contributions that ANT inspired accounting researchers can offer to the accounting academy and profession? Extant ANT inspired accounting research has explored the performativity of accounting and a few studies have also followed the fabrication of accounting (Preston et al., 1992; Chua, 1995; Qu and Cooper (2011), but this monograph also seeks to contribute to the literature by narrating the gathering and fabrication of an accounting calculation in a space of demand chain management in a more slow and detailed manner by adhering to two of the key introductory notes of ANT by Latour, *circulating references* in *Pandora's Hope* (Latour, 1999a) and *matters of concern* in *Reassembling the Social* (Latour, 2005a). In their review of existing ANT inspired accounting research thus far, Justesen and Mouritsen (2011) conclude that notions such as *inscriptions* and *action at distance* in *Science in Action* (Latour, 1987) have been

deployed to unfold dynamic organisational and sociological identities that are accorded to accounting; but the field needs to develop itself along with Latour and follow his recent movements in ANT. The following two sections will discuss *circulating references* and *matters of concern*, two of which constitute the methodological guidance of this thesis.

Circulating references

The notion of *circulating references* was specifically raised in Latour's *Pandora's Hope,* where the scientific inquiry was to clarify whether the rainforest in the Amazon is retreating or intruding upon the savannah is made clear by a chain of transformations from local rainforest to a set of inscriptions building processes, "from mapping, tagging and sectioning of an area of rainforest and savannah to the many holes dug in the ground and to the transfer of soil samples to a gridded, wooden box, each coded by colour, type, depth and location" (Dambrin and Robson, 2011, p. 5). The building of a scientific fact must encompass a series of inscriptions that are transported from the locations to the laboratories (Latour, 1999a). References circulate from matters to forms with the "end" product being a scientific article published by a scientific journal (*Ibid)*. This also applies to organisational studies where local actions can be transcribed into a set of inscriptions comprising performance measures so that management can realise *action at a distance*.

Inscriptions play a vital role in building a scientific fact, as they are built as "forms" that represent "matters" (*Ibid);* but they can travel without distortion, which is why they are equipped with another name, *immutable mobile* (Latour, 2005a, p. 223). According to Latour and Woolgar (1986), an inscription can be any item of any configuration transforming a material substance into a figure, and this figure can be a written text, a table, a chart, a number or anything that can be acted upon (Latour, 1987). Inscription building is critical for developing power-knowledge for "writing, recording, drawing and tabulating" which are practical technologies for inscribing the world (Robson, 1992; p. 689). *Translations* make sure that the world comes to centres of calculation and the office workers can go to a location for further analysis and bring new inscriptions (Latour, 1989; 1999a). The process of translating matters into forms via circulating references is, thus, a process of *inscription building*. The world is in continuous flux (Law, 2004), thus, it is quite challenging and often impossible (Latour, 2005a) to close the technology as

massive *matters of concern* into *matters of fact.* Inscription building contributes to this process of closure. It does not necessarily close *matters of concern,* but every movement of translating matters into forms attracts new entities who bring about new *matters of concern*. In short, *inscription building* is a manifestation of *circulation references,* but it extends the latter rather than necessarily ending it.

Latour (1987; 1999a) illustrates a number of qualities of these inscriptions necessary for fabricating a fact. They are further developed by a number of accounting researchers in highlighting the performativity of accounting inscriptions. A thorough summary of these qualities is listed in Qu and Cooper (2011). For instance, *stability* refers to the capability of inscriptions to keep the traces of the locals and to be recognisable to actors partaking in the network (Robson, 1982). *Mobility* refers to the transportability of inscriptions that enables them to be carried across contexts (Latour, 1999a). *Combinability* means that inscriptions can be combined with each other to create new realities (Latour, 1999a). For instance, accumulation of two consecutive years' financial reports yields a graph that represents the differences and trends of various financial ratios.

It is these qualities of inscriptions that constitute a chain of circulating references that raise the parallel event of what Latour (1999a) calls a reduction and amplification.

> *"Stage by stage we lost locality, particularity, materiality, multiplicity, and continuity, such that, in the end, there was scarcely anything left but a few leaves of paper. Let us give the name* reduction *to the first triangle, whose tip is all that finally counts. But at each stage we have not only reduced, we have also gained or regained, since, with the same work of representation, we have been able to obtain much greater compatibility, standardization, text, calculation, circulation, and relative universality, such that by the end, inside the field report, we hold not only all of Boa Vista (to which we can return), but also the explanation of its dynamic...Let us call this second triangle, by which the tiny transect of Boa Vista has been endowed with a vast and powerful basis,* amplification*." (Latour, 1999a, p. 70 -71)*

This quote means that the amplification lies in the mobility, combinability, and relative universalisation (stability) that translates a three-dimensional far away material substance (the locals) into a two-dimensional inscription displaying information rendering the

manageable and transportable uncertainty to a different time and space. On the other hand, there is a reduction since *locality; particularity, materiality, multiplicity, and continuity* are lost. What are left on the inscriptions are the representations of material substances instead of the substances themselves. It is not the forecast that is brought to the laboratory. It is not the concrete actions of the workers that are brought to the manager's office. It is not the apples that are brought to the inventory account on the balance sheet of a supermarket. As a result, this movement is a translation because the substances are transformed into representations that claim to mirror them. Thus, there is always a gap between the matter and the form. Such a parallel of reduction and amplification facilitates accounting constructivists in claiming that accounting inscriptions represent a particular reality; but there can be a number of representations because the amplification may yield context-specific interventions.

Constructing a scientific fact, however, is not easy, for another property must be added to ensure the construction, this property is *reversibility*.

> *"An essential property of this chain is that it must remain reversible. The succession of stages must be traceable, allowing for travel in both directions. If the chain is interrupted at any point, it ceases to transport truth – ceases, that is, to produce, to construct, to trace, and to conduct it." (Latour, 1999a, p. 69)*

This implies that for the "fact" to be constructed, interruption and corruption must be avoided to allow *stability* which can only be realised by traceability in both directions along the chain. A *matter* is represented by a *form*, and a *form* must leave a trace of its referred *matter.* References cease to construct if they do not circulate *(Ibid,* p. 70).

Reversibility was a problem in Dambrin and Robson (2011) when tracing the performance of drug representatives to their performance in the French pharmaceutical industry, for according to regulation information, doctors' prescriptions gave rise to sales revenue, but yet this information is hidden from pharmaceutical companies. Therefore, the chain of circulating references is interrupted, corrupted and distorted (*Ibid)*. In

particular, how forms and matters are translated in a way that the reversibility from sales revenue can be traced to patients who buy drugs at the pharmacy, doctors who prescribe drugs to patients and to drug representatives' activities in informing doctors about the drugs all becomes difficult to trace. Flawed inscriptions comprise of a self-reporting management system, a database of the aggregated sales of wholesalers and direct sales of pharmaceutical companies to pharmacies and hospitals and a statistical panel analysis were all developed to repair the broken chain. They claim that in this specific pharmaceutical setting, weak references can still circulate without perfect reversibility in the chains of transformation between matters and forms (*Ibid,* p. 19). Ambivalent professional identity pertains to those drug representatives that are problematised between front-stage medical professionals as informants, and back-stage acceptance of sales targets that are shaped by the reward systems. The methodological opacity of performance evaluations that is surprisingly translated into a trust, and the bricolage of partial inscriptions that actually assembles new uses together, assembles the network of performance evaluation. They add to Latour (1999a) in the sense that circulating reference is "a fiction whose apparent travel depends upon" the aforementioned three context-specific qualities (Dambrin and Robson, 2011, p. 19).

In the context of an S&OP process in demand chain management (DCM), the long translation between the unknown market demand and factory and supplier actions on inventory planning may offer a narrative that describes circulating references for transformations between matters such as sales, forecasting fluctuations, market specificity and connections with financial plans, and forms such as sales histories, system forecasts and salespersons' intelligence. These matters continuously problematise the S&OP sales forecast and the S&OP process preventing them from becoming matters of fact, that is to say, making them matters of concern. A slow and local travel with circulating references helps explore how accounting is fabricated when the accounting calculation is expected to reach factories and suppliers, that is, along the internal supply chain.

Furthermore, the case company was using multiple forecasts and a discursive set of other technologies such as 6 Sigma and the Balanced Scorecard (BSC). Following the circulating references in fabricating an S&OP process, this thesis wants to find out how networking of different inscriptions affects the translation of uncertainty in customer demand and translation.

Non-human actors such as inscription devices have been emphasised in extant ANT inspired accounting research; but the *associations*, which Latour (2005a) refers to as what the society is made up of, between these non-human actors are worth following through observation of their movements on circulating references. However, when ANT scholars associate those inscriptions in the chain of circulating references, human actors cannot be downplayed because they also participate in closing *matters of concern* surrounding a technology into a matter of fact. This has indeed been criticised by advocates of practice theories for ANT's ignorance of managers' intentions (Ahrens and Chapman, 2007). Latour (2005a) responds to similar criticism on ignorance of humans in *Reassembling the Social* with a notion of *matters of concern.* This is to be discussed in the next section.

To conclude, *circulating references* is a process of *inscription building* that attempts to *translate* ongoing matters into ongoing forms and eventually to construct a fact. In addition, this thesis uses *circulating references* to describe the process of *inscription building* that attempts to close *emergent, ongoing and multiple matters of concern* surrounding a DCM technology into corresponding inscriptions and eventually to construct an S&OP process. This will show how a series of management problems are closed in order to fabricate a management technology. The purpose of this is to illustrate a reversible chain of circulating references to help ANT inspired accounting scholars explore how accounting tries to become a matter of fact. The next section will discuss the terms *matters of concern* and *fabrication.*

Matters of concern

Mindful of the performativity of accounting calculations in his stream of "governmentality" approach, Miller contextualises the local by seeking to "delineate the

conditions under which accounting became institutionalised in ways that produced specific systematic effects on the constitution and functioning of organisations and states, and what might historically qualify as accounting practices" (Ahrens and Chapman, 2007, p. 4). In this sense, inscriptions, as technologies of power (Miller, 2001), structure the practices of social groups (Ahrens and Chapman, 2007). The agent being acted upon by those managerial technologies, thus, is faced with a number of possible responses and reactions (Miller, 2001). Ahrens and Chapman (2007) draw upon the concept of structure of intentionality to analyse accounting's performativity on the construction of organisations and institutions through its programmatic ambition in governmentality, and remark that accounting can be simultaneously political, commercial and technical. Whist stating that the governmentality approach localises the macro structure, Ahrens and Chapman (2007), however, question its capacity in tracing the actions in the fabrication of organisations and institutions.

> *"The practice notion if governmentality has primarily been concerned with the putative origins of action, that is, its generic 'strategic or programmatic ambition' (Miller, 2001, p. 394), and not action itself". (Ahrens and Chapman, 2007, p. 5)*

So, "accounting remained a potential" (*Ibid.*). There is still a vast distance between accounting as a technology of power and its potential that constructs relevant actor-networks. The governmentality approach, albeit historical, is not local enough to trace how accounting is mobilised and fabricated, and mobilises and fabricates organisational activities. Turning to their reflection upon ANT, Ahrens and Chapman (2007) admit that the programmatic ambitions of accounting and freedom of human actors in this structure of intentionality can be traced to the gathering of accounting into an actant that comprises humans and non-humans. On the other hand, they criticise that ANT focuses on the generative paths of networks whilst actions are marginalised as secondary. Moreover, as *a priori,* privilege is presumed in any network location, organisational objectives are only network effects decided by *others*. Such fear of hero sociology is then debunked by Ahrens and Chapman (2007) who question the symmetry of humans and non-humans and argue that humans, such as managers and accounting system designers are indeed

powerful in setting objectives and, hence, need privilege. Their (Ahrens and Chapman, 2007) study in a UK restaurant chain assumes that "actions" are organised around practical understandings, rules, and engagements that define and connect agents *qua* practitioners" (Ahrens and Chapman, 2007, p. 10). This monograph argues that the inclusion of *matters of concern* (Latour, 2005a) in the construction of an actant restores the symmetry between humans and non-humans. ANT does not take a detour by avoiding talking about managers, but embraces them as actors, together with non-human actors, because the intricate relations between them create emergent *matters of concern* around technologies and attempts to close them also attract new entities; thus, creating new relations, which in turn create new matters of concern. Technologies and artefacts bring about management intervention which constructs new struggles that force management to close the very *matters of concern* on technologies that these struggles attract. Managers talk about struggles, problems, strategies and other organisational phenomena in their absences because they can only be concretised through actions. Drawing attention to how *matters of concern* are closed brings management back to the assemblage of actions with non-humans. It, however, does not advocate an approach of hero sociology, because humans and non-humans are in symmetry. Seeing objects as matters of concern, instead of matters of fact allows researchers to explore how fluidity and multiplicity of objects unfold as a result of intricate relations between humans and non-humans. Technologies are no longer cold objects. Instead, they are now disputable when humans and non-humans form a collective trying to close them as matters of fact. When technologies create a space, a working time/space to enact practices (Quattrone, 2009), humans and non-humans engage in heterogeneous relationships that turn technologies into emergent, ongoing and multiple matters of concern. Paradoxically it is the attempts to close these matters of concern that make the technologies more heterogeneous (Quattrone and Hopper, 2006).

In his evolving introductory notes in *Reassembling the Social,* Latour (2005a) illustrates the notion of *matters of concern*. The notion was explicitly remarked in contrast with *matters of fact*. He has been criticising *"Social Constructivism"* that attempts to give "social explanations" to science studies. As was discussed earlier, Latour's consideration

on *"society"* is to differentiate the associations between multiple entities of multiple identities from *"a substance made of social stuff"* (Latour 2005a, p. 115). "Society's" symmetric twin, "Nature", from an ANT lens, should also be analysed to *"keep the deployment of reality and reject its premature unification into matters of fact"* (*Ibid*).

> *"If it was a mistake to jump from the idea of association to the conclusion that they are phenomena made of social stuff, it's a symmetric error to conclude from an interest in non-humans that they will look like matters of facts – which are nothing more than a dumbed-down version of matters of concern as any reading in science studies will show." (Ibid)*

This means that just as much as opposing the reductionism that reduces objects and things into some "social stuff", *matters of concern* "*free matters of fact from their reduction by 'Nature'"* (*Ibid,* p. 109). Before objects are closed as such, attempts to close *matters of concern* must be followed. Objects are, thus, not cold and natural, but disputable. Latour (1991) describes these objects that are not fully black boxed as *quasi*-objects. This prefix means how an object is closed or defined is not independent of its network of relations, and it requires *others* in the network to be defined (Quattrone and Hopper, 2006). To make this closure possible, ANT scholars have to show the gatherings of all matters of fact pertaining to the so called "Nature". Such gathering, according to Latour (2004b, p. 246), is *"a thing, an issue, inside a Thing, an arena, can be very sturdy, too, on the condition that the number of its participants, its ingredients, nonhumans as well as humans, not be limited in advance".* The divisional belt between the "society" and the "nature" should be erased and only then will *"non-human entities be able to appear under an unexpected guise"* (*Ibid*, p. 111), a real guise, in ANT language. This means a journey to follow how *matters of concern* are translated via symmetry of humans and non-humans because in order to define a *quasi-object* as an object is inevitable. The following paragraph shows a few examples of why accounting cannot be closed into a cold object pre-maturely.

Accounting technologies are, thus, not just mere technical matters of fact serving functional needs. The price of greenhouse gas emissions may be just a price to be bought

and sold, but the framing of economic calculations makes it become an object that requires vast institutions in which scientists and accountants partake in order to respectively calculate the "exchange rates" rendering the various sorts of greenhouse gases commensurable, and make these new economic entitles visible. This facilitates decisions – not merely political decisions – to create an emerging market (MacKenzie, 2009). Self-regulating and orchestrating mechanisms may be just mechanisms in bringing focal firms and subcontractors together, but both technologies require considerable actions and interactions between partners so that the debate on the distribution of proceeds becomes an insignificant one and creates a network enterprise, respectively (Mouritsen and Thrane, 2006). The roadmap may be just a representation for the future trend of faster chip technologies, but it requires cost engineers and technological experts, which in this case would include Gordon E. Moore[10], extreme-ultraviolet lithographic tool suppliers, accountants and investors, to go through a series of translations, to make the progression of the power of the technology possible; this would make the future stable, for the future markets of microprocessors (Miller and O'Leary, 2007). Contribution accounting systems (CAS) and Activity Based Costing (ABC) may be "neutral" technologies representing profitability and costing of status of companies, but CAS transformed the worrying fixed costs into variable ones by proposing to reduce the factory capacity via outsourcing. This proposal, however, was challenged by the factory manager with ABC backing him, rendering that fixed overhead costs were visible; therefore, it was proposed to make the factory larger and put production in house. Accounting calculations not only determine organisational boundaries, but also support the competing interests of different participants (Mouritsen, 1999).

Matters of fact are cold and indisputable, but *matters of concern* are multiple and controversial because, *"everywhere, the empirical multiplicity of former 'natural' agencies overflows the narrow boundary of matters of fact. There exist no direct relation between being real and being indisputable* (Latour, 2005a, p. 111). *Matters of concern* do not move away from facts, but get closer to them *"render(ing) justice to objective facts"*

[10] In the 35th anniversary issue of *Electronics* magazine, published on the 19th of April, 1965, Moore published an article titled "Cramming more components onto integrated circuits", which later became the Moore's Law in the semi-conductor industry. For a detailed description, see Miller and O'Leary (2007).

(*Ibid*, p. 112). ANT, being constructivism and anti-essentialism, advocates the view that facts are fabricated. Writing an account of *matters of concern* problematises the singular, cold and routine matters of fact, and suddenly, objects become disputed, but real and objective. In other words, *matters of concern* draw attention to controversies unveiled by multiple agencies coloured by the "social", but as associations that all fabricate an object. Because the twins, "Society" and "Nature", "subjects" and "objects", are treated as collectives, *matters of concern* allow the network to ally a vast number of linked entities, making the network difficult to be objected, thus, more objective. "*There is no direct relation between being real and being indisputable* (*Ibid*, p. 112), but there are some relations between being real and being disputable.

Now, in response to Ahrens and Chapman (2007), it is correct that *matters of concern* do not assign privilege to humans' cognitions and intentions that contribute to the construction of organisational objectives as per the concept of structure of intentionality, but they highlight the importance of humans and wake them up in order to make the cold matters of fact disputable. To close an object into a matter of fact, humans and non-humans form new relations that create new matters of concern on the object. *Matters of concern* not only agree with Ahrens and Chapman (2007) that the power of managers cannot be downplayed in the network, but also raise the point that such power-knowledge is also constructed by its relation with other humans and non-humans. For a manager to be powerful, she has to close certain *matters of* concern around the object that the network considers as crucial into inscriptions, which in turn produces knowledge to make her a spokesperson. In concert with Ahrens and Chapman (2007), who conclude that management control systems are structures of intentionality both shaping and being shaped by shared norms and understandings, Mouritsen (1999) shows that such shared norms and understandings are the effects of networks, whereby inscriptions such as contribution margins and activity-based costs accord powerful managers with power/knowledge. Accounting is fabricated, but through its production, accounting also generates power/knowledge which shapes the structure of intentionality through the "consumption" of accounting. There can be no dichotomy between design and implementation of accounting, and there can also be no division between production and

consumption of accounting. *Matters of concern* not only care about the "being" of accounting and its constellation, but also the "doing". By taking into consideration *matters of concern* that network's participants attempt to close, accounting technologies can be traced as symmetry between materials and semiotics, and humans and non-humans.

In this thesis, *matters of concern* are entities surrounding a quasi-object that humans and non-humans attempt to close in order to use it as a matter of fact; an object, which in this case is an S&OP process. Some *matters of concern* are initiated by past problems, whilst others are derived from emerging tensions in the process of fabricating the technology. This is in concert with Latour's (2005a) inspiration on following matters of concern in order to make an object disputable and to move closer to it.

Studies illustrated up until now have demonstrated how a particular *matter of fact* is constructed – opening the black boxes – to show the *gathering of facts*. Such a critical endeavour, if not properly guided, is never an easy task (Latour, 2005b), and can easily fall into the field of poststructuralists; whose favour lies in deconstruction. Latour, however, never thinks of himself as a poststructuralist, so the logic implies that the process of deconstruction should not be the direction, and closing the accounts too quickly should not be the terminal of ANT inspired accounting research. This is then illustrated by the following remark.

> *"Can we devise another powerful descriptive tool that deals with this time with matters on concern and whose import then will no longer be to debunk but to protect and to care..." (Latour, 2004b, p. 232).*
>
> *"The critic is not the one who debunks, but the one who assembles" (Ibid, p. 246).*

As Justesen and Mouritsen (2011) indicate, Latour's (2004b) intention is to regress and get closer to the "facts" instead of getting away from them, which implies that the research strategy should pay attention to the complex "being" of things, or "*thinging of things"* (Latour, 2004b). A *matter of concern*, instead, keeps controversies alive (Latour,

2004a), thus, any actor-network is fragile. Deconstruction may concern how matter of facts are attacked, criticised, exposed and historicised, in order to show that *"they are made up, interpreted, flexible"* (Latour, 2004b, 245); but *matters of concern* care for the multiple beings of the facilitated "fact" because if an actor-network is fragile, it is in urgent need to be cared for (Justesen and Mouritsen, 2011). Such care and caution on the process of being points to the multiplicity of actors, which in our context would be accounting calculations. Justesen and Mouritsen (2011), hence, summarised, *"this account brings focus to the continued presence of multiplicity, fluidity and heterogeneity"* (p. 183); which confirms Latour's (2005a) implication that *"it is the thing itself that has been allowed to be deployed as multiples"* (p. 116).

Latour (1999a) would say that no representations would mirror the whole world, but for an explanation to be interesting, it has to include *"a string of actions where each participant is treated as a full-blown mediator"* (Latour, 2005a, p. 128), so that each mediator adds new properties to other actors and by doing so, it itself gains new properties. In short, a good explanation lets multiplicities unfold.

> *"...They call them 'functionally fixated'. Imagine, 'functionally fixated'! Other methods, they say, are 'substantive': these methods carry additional information content about reality, and so people react to them." (p. 256)*

It illustrates the importance of the multiplicity of being. Describing a fruitful narrative on how an actor-network is constructed and fabricated is convincing, but not sufficiently controversial. As disputes and controversies are properties which offer a surprising, hence, real account, *matters of concern* go one step further in making controversies live, fluid and ongoing. Therefore, this study will use *matters of concern* to move closer to accounting technologies, to focus on their inner gatherings, and to illustrate their complexity, fluidity and multiplicity.

Latour (2005a) discusses the danger in moving from metaphysics – the multiplicity of reality – to ontology – the progressive unification of reality. Deconstruction may fall into

the trap where deploying actor's worlds will be too easy, producing too many representations of the world, in the singular (p. 117). The consequence is that *multiplicity* holds its position within the domain of social sciences, and *unity* remains indisputable within the public of natural science; not to mention the danger of *"interpretive flexibility,"* which allows multiple *"symbolic"* representations of the *"same"* thing in the interpretative paradigm (*Ibid*, p. 116). *Matters of concern* illuminate that *"there is no rear-world behind to be used as a judge of this one, but in this lowly world there lie in wait many more worlds that may aspire to become one – or not, depending on the assembly work we will be able to achieve"* (*Ibid*, p. 118). This indicates that *matters of concern* pinpoint the many multiple worlds that are waiting to be assembled as a collective, an object. *Matters of concern,* thus, not only unhide the multiplicity of agencies intertwined between humans and non-humans, by keeping controversies alive, the beings of ontologies also become controversial, which is what Latour (2005a) described as "shifting ontologies". Quattrone and Hopper (2006) later refer to such ontologies as things that are already many things, because a movement to de-*fine* leads to *de*-finition. In this setting, an attempt to close matters of concern on the quasi-object makes the object multiple. Then science studies no longer need to struggle between reality and fiction, instead it is possible to *"distinguish the procedures allowing for realities – now in the plural – and those leading to stability and unity"* (*Ibid*, p. 119). Unification is the procedure of how multiple worlds become one, but even the unified one continues as a multiple because as long as we deploy entities on the repertoire of *matters on concern*, controversies never sleep, mediators never rest, translations never cease. Although, exploring the performativity of accounting and its resulting actor-networks, most ANT inspired accounting research still seems to run the risk of reaching the closure of objects as matters of concern into a matter of fact too quickly, notwithstanding that current controversies have been settled. For instance, the mediating instruments operationalising political discourse and constructing expertise (Miller and Rose, 1990), makes future markets (Miller and O'Leary, 2007) with a variety of superimpositions of inscriptions, generate accounting information systems as knowledge-objects (Lowe, 2001), with self-regulating and orchestration mechanisms that assure interactions between partners for creating a network centre in the inter-organisational

space (Mouritsen and Thrane, 2006); with target costing (translated to functional analysis) and open book accounting mobilising both inter- and intra-organisational phenomena (Mouritsen et al., 2001). While offering a critical stance by illustrating how to make a *thing* exist, they seem to have overlooked the movements of how to make a *thing* maintain its existence in the gathering of multiple participants (Latour, 2004b, p. 246). In this milieu, reducing the associations between heterogeneous actors into a set of performative inscriptions closes disputes pre-maturely. Humans' voices should also be brought up to the same level of those inscriptions, for their associations unfold more controversies (Latour, 2005a). As Latour (1999a) illustrates, constructing a scientific fact involves not merely inscriptions, but the process of *inscription building. Inscription building* is not a natural process because it creates a space for human intervention. In ANT inspired accounting research so far, however, there have been a few exceptions that address *matters of concern* implicitly.

In Czarniawska and Mouritsen (2009), *matters of concern* are illustrated through the long sequence of translations, which Latour (1999a) described as *circulating reference*, whereby the *"technology-as-thing" – a "technology to be adopted"* - was translated into an object of investment, permitting the development of a company – *a "technology to be adapted"*. These translations did not contemplate the power of the technology itself, but gauged the power of its context; hence, creating conditions to make it marketable, affordable and manufacturable. These did not happen without the addition of management technologies such as strategies, accounting systems and operations principles, so that the greatness of the technology did not reside on its technical terms, but in terms of marketability and growth (p. 163). As a result, *"the adequate technology wins over a wonderful one"* (*Ibid*). These translations also transformed the project-maker into a business manager who was able to understand the language in managerial technologies. It is through *matters of concern* that the material technology itself was marginalised and a-centred ,and constructed as something else; a company. Controversies, however, continued because translations created amplification on one side, and reduction, even distortion, on the other (Latour, 1999a). In the resulting company, technology was gauged separately as *"entrepreneurs' ambitions, a stream of cash flows, a possible*

market, and a manufacturable project" (*Ibid,* p. 172). The multiplicity will keep its fluidity once suppliers and other new controversies emerge. Mediators, or mediating instruments, *"not only help, but also lure and betray"* (*Ibid,* p. 173) when complexities absent in inscriptions return. In short, Czarniawska and Mouritsen (2009) account for the closure of a technology as *matters of concern*. *Matters of concern*, however, makes the technology bigger as it eventually includes *others,* such as a company.

In Mouritsen et al. (2009), accounting calculations rarely offer knowledge about the intricacies of innovation, and do not calculate innovative activities and make them transparent. This affirms the non-existence of correspondence between representations and reality (Macintosh, 2000; 2009). It is, however, precisely because calculations are incomplete that they need allies and produce power and the ability to intervene (Mouritsen 2011). This cannot happen if we view accounting calculations as closed *matters of fact. Matters of concern* render it possible by showing how fragile entities are and how multiple translations have made them so (Mouritsen, 2011).

Long translations, whereby multiple calculations are taken into consideration, create tension about innovation. In this setting, competing calculations challenge each other and development controversies beyond innovation activities themselves.

> *"Long translations develop new possible versions not only of preferred type of innovation activities, but also about their location in time and space. They develop competing propositions about the relevance of technical artefacts and link them to innovation strategy and sourcing strategy in the firm's inter-organisational relations. The tensions within long translations mobilise technological, organisational and environmental entities by framing considerations about the value of innovation to the firm strategically differently". (Mouritsen et al., 2009, p. 739)*

More specifically, in SuitTech, *sales performance* encourages engineers to value customisation of products via a combination of components; and the corresponding inter-organisational relation involves a broad range of suppliers. These associations are challenged by *the direct cost* which points out that using a combination of special

components is costly; thus, creating a context which economises innovation by focusing on programmable standardised components whose variability can be guaranteed by software programming. Suddenly, the inter-organisational relation has an inventory of a limited range of standard components (Mouritsen et al., 2009). In HighTech, *the contribution margin*, which treats the costs of the R&D department as period costs, proposes in-house experimentation, protects in-house capacities in relation to electronics and outsources manufacturing functions to suppliers. The efficiency of the R&D investments is challenged by *indirect costs*, which converts the period costs of R&D into product costs and proposes external technological development of chemical fluids, thus, making suppliers accountable for technology development (*Ibid)*. In LeanTech, *ABC margin* motivates exotic components which requires intensive interactions with suppliers with regard to components' performance, whilst *costs of capital*, aiming at reducing the complexity of components because of their high inventory costs and long delivery time, draws attention to standard software packages, which requires interaction with large suppliers who can define the industry standard (*Ibid)*. However, although humans are enrolled in the network, they are largely treated as the effects of the performative accounting. Intricate associations between their intentions and inscriptions are overlooked.

The episodes mentioned above precisely describe how surprising associations will unfold if the narratives are written in the optic of *matters of concern*. First, accounting calculations are equipped with powers through their interactions with the development of the entities they engage. Indirect costs can create value (HighTech), but can also destroy value (LeanTech) (*Ibid).* Second, the actor-network is fragile because even if a calculation is strong in one setting, new controversies will emerge. Although, ABC margin reduces cost of production to some extent, it opens up a new space for capital costs to reduce inventory costs. Therefore, accounting calculations are strong, but not because of their correspondence to reality and their inherent characteristics, but because of their influences over other entities; which in this case are innovation strategies and inter-organisational relations (*Ibid)*. Third, *matters of concern* show that the important thing in innovation management is to move innovation away from itself and its diverging concerns about the technological artefacts, innovation strategies and inter-organisation

relations; rather than to assist managers in knowing about the details of innovation, thereby, developing a homogenous interpretation (*Ibid)*. Innovation, thus, cannot be closed to a matter of fact before the diverse *matters of concern* around it are translated. Multiplicity prevails over the unification of realities.

In short, Mouritsen et al. (2009) account for the closure of vast *matters of concern* on innovation[11]. *Matters of concern,* however, translate innovation into inter-organisational strategies. *Matters of concern* focus on the entities in the making and keep controversies alive, rather than attempting to close controversies in order to reach a stable ending. Mouritsen et al. (2009), however, do not pay attention to the *matters of concern* on accounting calculations or the role of the associations between humans and inscriptions in the fabrication of accounting.

Quattrone and Hopper (2006) remain as an exception where controversies are kept alive all the time. Quattrone and Hopper (2001) describe the making of an object as a "drift", for "objects may be understood as a set of relations that gradually shift and adapt themselves rather than one that holds itself rigid" (Law and Singleton, 2005, p. 339). Callon and Latour (1981) also warn of the danger of closing black boxes too early, for they leak. Existing actors may exit and new actors may enter the network. As a result, relations between actors in the network change continuously. According to *relationality*, the ontology of objects is transformed anew if their relations with other actors change. In this milieu, Quattrone and Hopper (2006) criticise most IT studies for taking their ontology for granted, i.e. as a black box, as a matter of fact (Latour, 2004b; 2005a) and "immutable mobile" (Latour, 1997). They show how IT evolves over time and is equipped with different properties, thus, becoming a "boundary object" (Star and Griesemer, 1989; Briers and Chua, 2001), not only attributed to interpretive flexibility, "but also to its ontology, as IT is already many things" (Quattrone and Hopper, 2006, p. 220). The ideal of SAP, being "(global) integration", "common", "simple" and "real time control" induces presences, for they are discussed in their absences (Quattrone, 2006). In their study, from the outset participants refer to SAP, but only as an abstract technology

[11] That means to see innovation as matters of concern.

because it lacks functionality; but it is exactly this absence that establishes its presence for users that wish to establish its presence "by precipitating enactment of a simple three letter acronym – common, global, [and] simple" (Woolgar, 1981). These three words then becomes the minimal configuration of the SAP which actors are often referring to. However, to operationalise these abstract ideals, accounting must be attracted and enacted to qualify SAP as an operative IT system giving visibility to *other* things (Quattrone and Hopper, 2006; p. 228). But, accounting inscriptions being references for the SAP to become operative (Latour, 1999a), are partial representations because they are incomplete, thus, distorting. As is alleged by Quattrone and Hopper (2005), "making items visible also involves absences, for one way of seeing precludes seeing something else" (p. 229). As a result, while they are enacted with an aim to introduce order into certain dimensions of organisational practice, they simultaneously produce disorder somewhere else. This is consistent with Quattrone (2009) who states that, for the managerial technology to be used, it needs a minimal configuration which offers a working time and space so that actors can engage with the technology differently. This thesis will also use the notion of the minimal configuration of a technology, which is the object that actors frequently refer to and that create a working time/space where actors can engage with it heterogeneously. For instance, the minimal configuration of the S&OP process is that the S&OP process starts with an unconstrained sales forecast to guide product line planning and supplier capacity planning in order to foster integration on demand chains.

Continuing with Quattrone and Hopper (2006), it is found that, initially SAP, in its minimal presence of an absent IT system, becomes an attractor of accounting to make itself operative. However, when accounting is allied, in addition to its partial representation which projects order somewhere, disorder is introduced elsewhere, thus, causing organisational tension to emerge. The ideal of a "common, global and simple" system through the multinational organisation is perceived as unable to solve the information needs of business actors. Merely adopting the standard SAP fails to reconcile emerging local needs. For instance, the standardised version of SAP is incompatible with Excel, which cost and profitability analysis and activity based costing are run on. This

technical insufficiency is then mediated through customisations like "bolt-ons" made to the standard SAP package, which then makes SAP upgrades economically infeasible. Quattrone and Hopper (2006) finally summarise IT as a "heteromogeneous object" to describe the symmetry between homogeneity and heterogeneity. Homogeneity refers to the abstract terms and minimal configurations of an object that people refer to. It enables the object to be an attractor of new entities which makes it different from what it is because abstract terms and minimal configurations invite new entities to make abstract terms concrete and develop configurations of the object. When new entities are enrolled, relations between existing actors change and the object becomes heterogeneous. The symmetry of homogeneity and heterogeneity can also be used to theorise the ontology of S&OP. Later analysis will show that the S&OP is homogenous, as it represents abstract and common terms of integration. This entices multiplicity because bringing these absent terms to the present attracts more entities that have been mentioned from the first to the fifteenth episode, where a series of attempts to close emergent, ongoing and multiple matters of concern take place. People also refer to the S&OP in this minimal configuration as a technology that attempts to increase availability in the long-term. The construction of the agenda of the S&OP sales forecast enhanced such homogeneity that people referred to it as an unconstrained sales forecast that covered the next 36 months. As a series of attempts to close emergent, ongoing and multiple matters of concern took place, the S&OP became heterogeneous, but people still referred to it in its homogeneous form. Heterogeneity, simultaneously, is emancipated through a continuous series of translations of "'*de*-fining' information needs of the humans to mobilise and engage diversity through accounting and visibility (*Ibid,* p. 242); that is to say, a series of translations attempting to close the S&OP process as matters of concern.

Matters of concern are ubiquitous in Quattrone and Hopper (2006) because first, the gathering and fluidity of the ontolog(ies), in this case IT(s), are continuously traced, thus, Latour's (2005a) recommendation to respect shifting ontologies is firmly taken; second, in addition to the multiplicity of the attractor, the multiplicities of "the attracted", in this case, accounting inscriptions, accountants, plant analysts, subsidiary financial controllers and etc., whose agencies are treated equally, are added to the descriptions; third,

controversies are kept openly, as illustrated by the concept of "drift"; and fourth, constructivism, which is the paradigmatic foundation of ANT, is followed. Unlike most ANT inspired research that focuses on merely tracing the gathering elements of an object, implicitly leaving an illusion that ANT is de-constructivist, this study offers a vivid account of how an object, IT, is constructed, albeit it is subject to ongoing forces that makes its ontology shift all the time. This thesis will also take this engagement with multiplicity in the sense that every attempt to close *matters of concern* makes the object multiply.

Because the research questions developed from the domain literature (Chapter 2) concern the fabrications of an S&OP process and integration, the S&OP process and integration will be theorised by sets of matters of concern instead of matters of fact. This will allow for the exploration of how heterogeneous actors create disputes around a technology (the S&OP process) and its target (integration), thus, making them matters of concern. Interestingly, this happens when actors are trying to close them into matters of fact. Therefore, studying a technology and its targets, as matters of concern, actually brings focus to their inner gatherings, thus, moving closer to them.

To conclude, this section has illustrated some examples of how following *matters of concern* can explore the fluidity, complexity and multiplicity of technologies. Indeed, *matters of concern* allow humans to play as equal a part as the non-humans, thus, having the potential to unfold more controversies and surprises. It has also alerted that an ANT study following *matters of concern* in the fabrication of a technology, should end up with a narrative that constructs instead of merely debunking an actor-network; though this may cost the researcher a long journey that sometimes does not ensure success (Latour, 2005a). This thesis attempts to embrace the *matters of concern* surrounding an S&OP process and its target, integration, in order to show how attempts to close them attracts new entities, thus, making the technology complex, fluid and multiple.

Fabrications of Accounting

Having enrolled matters of concern in the network of theorising, I now turn to discuss the use of the ANT entity to fabricate accounting images, inscriptions and calculations. In

provoking the use of *matters of concern,* Latour (2005a) mentions that they turn to the *gathering* and *fabrication* of a thing. This thesis is titled fabricating an S&OP process. Let me now discuss what the term *fabrication* means and how it will be used in this thesis.

Fabrication

The term *fabricating* in the title of this thesis, is inspired by Latour (2005a), and borrowed from Preston et al. (1992) whose thesis was tilted "Fabricating Budgets …". In Preston et al. (1992), fabrication is "an attempt to examine the chains of reasoning and mechanisms of influence between structured forces in the determination of the direction of change and human agency in the determination of the pace of that change" (p. 565). They further elaborate that *fabrication* conveys three dimensions: the first concerns the construction of the technology; the second points to the fragility of the technology; and the third refers to the selling of the technology, that is to say, the attempt to close the technology into a matter of fact. This indicates that although *matters of concern* were introduced (perhaps highlighted) in Latour (2004) and Latour (2005a) to criticise that social science tends to close disputable matters into cold objects, i.e. matters of fact prematurely, ANT inspired accounting research seems to have embraced this ontological premise on objects in the early 1990s. Preston et al.'s (1992) *fabrication,* thus, motivates this thesis to follow the construction of a managerial technology, namely, the S&OP process; this shows how an attempt to close the S&OP sales forecast into a black box brings about fragility and multiplicity to the technology.

Quattrone and Hopper (2006) in their study of the construction of IT also criticise the closure of IT into a 'fact'. However, rather than going into a debate about epistemology, they trace a 'fact' to its Latin etymology. One source of the word 'fact' in Latin is the verb *facere*, which means 'to make' (*Ibid,* p. 241). "The word 'fact' also, interestingly, shares the etymology of the word 'effect (from *ex facere*) and highlights the power of fact in affecting and influencing (from *ad facere*) the Other…" (*Ibid*). The Latin etymology of the word 'fact' interestingly coincides with the ontology premise of ANT, which Mouritsen et al. (2001) label as *relationality* and *performativity*.

Relationality means entities do not possess any inherent characteristics until they reside in a set of relations with *others*. Thus, it is the networking with *others* that defines what an entity is. An entity in this sense is also fragile and fluid, for movements in the network transform its essence.

Performativity means entities gain their properties via performing upon *others*. Accounting, for instance, is not only a passive technical tool, but also frames *other* entities such as SAP implementation (Quattrone and Hopper, 2006), strategies (Mouritsen et al., 2001) and supply relationships (Chua and Mahama, 2007).

In concert with the Latin etymology of the word "fact", ANT, thus, sees any entity as an effect of a fabrication process, for to become a fact means to enact, to engage with, and to affect *others*. By doing so, the entity also becomes something/someone else. If we follow ontologies from a gaze of fabrication, a *"fact"* is an *attractor,* because to become a seemingly unified "fact", an entity must attract *others* to accord herself with the properties. But, to attract *others* also means to attract difference and diversity which in turn transforms the entity. Such binding of *homogeneity* and *heterogeneity* leads to what Quattrone and Hopper (2006) term *heteromogeneity*. Stability means changes. An *object* means it is already many things (*Ibid*).

Heteromogeneity arises from the Latin etymology of definition. "Every de-*finition* (a closure) is also a *de*-finition (an incomplete order)" (Quattrone and Hopper, 2006p. 234). Thus, every attempt to close a quasi-object into an object, i.e. to de-*fine*, is to attract diversity that is different from itself, i.e. to *de*-fine. "…incompleteness and its constitution enabled to engage different constituencies simultaneously" (Ibid, p. 236). This is consistent with the Latin etymology of the word "fact" mentioned above. To become a "fact", a quasi-object is also an attractor. Although actors often times refer to an object in its minimal configuration, its homogeneous form, for instance the BSC, is referred to as a multidimensional performance measurement system with four perspectives. Fabrication of an object enacts diverse new actors that, while attempting to

close the object into a matter of fact (to de-*fine*), create new matters of concern that in turn attract new entities (to *de*-fine). This makes the object more heterogeneous.

Quattrone (2009) offers a historical analysis on how accounting is diffused successfully across economies and societies. In order for accounting to succeed, i.e. to happen[12], it needs a "good method" that is capable of "coping with and handling a theoretically infinite number of situations" (*Ibid,* p. 95). A good accounting method is one that provides practitioner accountants with a manner in order to invent new accounts and relationships between them (*Ibid,* p. 96). This is consistent with earlier theorisation in this chapter that argues that accounting does not represent truth, but makes use of a specific set of practices, for accounting provides "a method which could be flexible enough to be adapted to all types of circumstances, thanks to the infinite combinatory possibilities given by the segmentation and re-composition of accounts" (*Ibid*). These methods of segmentation and classification help accounting practices succeed (happen) because they see things better. The Latin etymology of the word "division" suggests that in order to see things better, one needs to break them down. This is also in concert with seeing objects as matters of concern, as opposed to matters of fact, because matters of concern move closer to objects, whilst matters of fact move away from them. This thesis, thus, recognises the link between homogeneity/heterogeneity, de-*finition*/*de*-finition and *matters of concern/matters of fact* in studying the fabrication of accounting. In order for the S&OP process to succeed i.e. to happen, the minimal configuration of the technology i.e. the homogeneity, forms a method that helps actors to see the technology better, but engaging with such homogeneity allows actors to create matters of concern around the technology in order to allow it to be used as a matter of fact. Paradoxically, attempts to close these matters of concern i.e. to de-*fine,* attracts new entities i.e. to *de*-fine and create new matters of concern around the technology. This increases the heterogeneity of the technology. There is, thus, a gap between the minimal configuration, the homogeneous part, of a technology and its heterogeneity when diverse actors are enacted. This gap is what Quattrone (2009) calls a working time/space, a time/space which can be performed

[12] In Italian, to happen is *'succedere'*, from the Latin *'succedo'*. This is the origin of the word *'success'* in English. To happen is, thus, to succeed (Quattrone, 2009, p. 90).

and practiced. In this working time/space, the minimal configuration makes a technology appear homogeneous so that it becomes an object that people can easily refer to (p.112). While the form appears clear, the content is evanescent. Quattrone (2009) uses the BSC as an example to show that although the core of the BSC is constant, users are free to enact that working time/space is "provided by the typology of the ordered method" (p. 112). The S&OP process is of no difference. As will be shown in Chapters 6, 7 and 8, the S&OP process has an ordered method – a cross functional process that uses an unconstrained demand forecast to integrate product line planning and supplier capacity planning on the demand chain – that actors refer to it as a technology to foster integration in DCM. But users do not engage with the technology in a homogeneous manner because different actors have different interests in the proposed technology, therefore creating matters of concern around the S&OP process. Attempts to close these matters of concern generate new matters of concern when new entities are attracted. Accounting technologies have homogeneous prescriptions, but this homogeneity is empty, and thus, offers a working time/space to attract a process of filling this emptiness (*Ibid,* p. 113). This is in concert with the reduction and amplification dynamics of circulating references discussed in prior sections of this chapter.

The focus of this thesis is on this working time/space, where the minimal configuration of the S&OP process enacts diverse actors creating emergent, ongoing and multiple matters of concern around the technology.

Ontologically, *heteromogeneiy* is different from an epistemological strategy using *boundary objects* (Star and Griesemer, 1989). A boundary object is an object that is plastic enough to adapt to local needs because they have different meanings in different social contexts, albeit its structure is common enough to be recognised. Accounting practices such as activity-based costing (ABC) and the Balance Scorecard (BSC), have been claimed as such objects by Briers and Chua (2001) and Hansen and Mouritsen (2005), respectively. Such acceptance of multiple interpretations accorded to an entity by humans, however, cannot be confused with the ontological take from an ANT point of view. This is an ontological departure rather than an epistemological one. An entity is

already many things, not because humans interpret it differently, but due to translations and mediations that connect it to *others* in different times and spaces. Taking a critical view on Hansen and Mouritsen (2005), for instance, a BSC is already many things, but not because people use it to interpret organisational problems differently, but due to those translations that connect past organisational problems with accounting. BSC now offers visualisation of those problems that have not been resolved in the past, but can be solved in the future because a BSC makes them calculable; thus, manageable. For a BSC to become a "fact", it has to attract past, it has to attract organisational problems, it has to attract managers, it has to attract future, and thus, it attracts what is different from it. It is already many things.

This thesis largely follows Preston et al. (1992) and Quattrone and Hopper (2006), and defines fabrication as a process of constructing a "fact", and also according to the theorisation mentioned above, a process of attracting, enacting, engaging with and affecting *others* in order to make itself more convincing. Fabrication is not only about constructing a "fact", which in my case is accounting, but also about *networking others* to make it acceptable to debunkers.

The three studies mentioned in the previous section illustrate how *matters of concern* unfold surprising transformations of technologies, innovation and IT. Accounting has been traced as both an actor embedded in larger networks, and a force mediating these works, but the fabrication of accounting is not the main focus. Indeed, early ANT inspired accounting research, illustrated non-humans in their constructive endeavour, unwittingly downplaying humans in the fabrication of accounting. There are, however, a few studies following *matters of concern* that gather specific accounting images, and therefore, a close discussion with these studies helps formulate the research agenda of this paper.

Chua (1995) documents the fabrication process of a DCG (diagnosis-related group) – based accounting information systems in Australian hospitals and shows the long translation process of how a wide range of participants are converted into an obligatory

passage point – the University Project Team – and how the accounting system is constructed through devices such as the generation of product cost information and the YCM (the Yale Cost Model). She followed accounting in the making by tracing it to its birth. The birth of an accounting system is not brought about by a pre-existing reality where accounting serves as an economic fact. The accounting representation, in addition to ally interests of the University Project Team of R&D, ties together the concern brought about by a great number of *others* that contributed to the construction of the accounting information. For instance, a managerialist Commonwealth needs a "rational" and "scientific" system to foster resource allocation, efficient rewards, waste elimination and budget deficit management. CEOs in Australian hospitals are keen to resolve the pressure of facing tighter state budgetary constraints, sharper decreases in spending and more intensive inter-hospital competition. The reality of an inadequate DRG-based accounting information system is not just sitting there waiting to be found. They are constructed and emerge later as a result of a network involving participants in financing and administrating health care, findings of deteriorating macro-economic conditions attributed from population growth, an increasingly managerialist bureaucracy at both the state and Commonwealth levels, competition between administrators and clinicians to extend their professional accountabilities and last, but not least, the interests of academic experts (Chua, 1995, p. 126). This, however, does not lead to the enrolment of entities into the network. The YCM is then called upon in order to answer the questions such as whether the information is reliable and can be used by hospitals, the state and the Commonwealth bureaucrats, and whether it will be sufficiently strong to stand against the scrutiny of debunkers in order to bring about certain statements. The YCM in turn calls for isomorphism in standardised cost centre definitions, common formulae for calculating in-patient fractions and Australian cost weights and so on. In the end, the accounting system generates another reality, namely the HOSPITAL, distinct from the reality of Australian hospitals.

Chua (1995) claims that accounting images create what Baudrillard, (1984) calls a semiotic hyperreality in the sense that accounting constructs simultaneously a representation and a reality. In concert with Mouritsen (2011), instead of allying

Macintosh (2009), who debunks that such hyper reality be avoided and that accounting be stripped from producing such hyperreality with "a true and fair view"; Chua (1995) states that the gap between the invisible reality and the visualised hyperreality fosters organisational intervention. It is this gap that a situated practice of fabricating an accounting information system takes place. She interprets the perceptions of the actors on the calculated DRG cost as information that contains error, but brings consistency and certainty for the true DRG cost is a "myth". Hence, the simulated reality, albeit being an approximation, promises "interventionist action from a distance" (p. 136). Time and space can be compressed to allow comparability so that new knowledge, that has never been generated before, such as hospital A is more cost efficient than hospital B, can be formulated as a new reality. In the hyperreality of the HOSPITAL, patients are transformed from customers to products that have costs, but the good thing about simulacrum is that its simulation of patients and hospitals can be reproduced so that disputes raised by researchers, hospital administrators, clinicians, the states, and the Commonwealth government on the accounting system get closed into a collective whole; namely a DRG-based accounting system.

Similarly, Chua and Mahama (2007) provide a narrative of the "being" trajectory of the performance measures of how a large Australian telecommunication company manages its suppliers. OzCom introduced the business performance indices (BPI) to facilitate vendor comparisons because of its concern about costs once the time pressure of being granted the license was managed. The BPIs were created on the premise of "value generating". Controversies emerged as the comparative index failed to enrol the financial concerns of OzCom, and "value generating" being interpreted differently between suppliers and OzCom; with the former allying with quality and functionality and the latter wanting to attract cost savings. Consequently, the suppliers were constructed with an identity of an exploitative nature. Subsequent financial based measures also failed due to the ongoing controversies they created. The cost-per-subscriber measure revealed the inadequacy of its forecasting system, the operation breaker-even number indicated the suppliers' unwillingness to cooperate, and the incentive scheme and budget constraints enhanced QzCom's perception on the suppliers as exploitative, showing their use of

expensive labour. None of these measures reduced the costs, but they generated a perception that now performance needs to be interpreted in financial terms, which is why the search for a workable performance measure continues despite its history of failure.

Chua and Mahama (2007) claim that accounting controls are tied to a variety of "other worlds" (p. 80), indicating that accounting is already many things (Quattrone and Hopper, 2006) because it is the effects of lay actors' interpretations and norms. In OzCom, had the cost-based numbers improved, an "exploitative" supplier would suddenly have been accorded an identity of "well-behaved" (p. 78). This is also consistent with Chua's (1995) discussion on the hyperreality. Had the suppliers provided their reality of "value generating" by quantifying quality and functionality, had OzCom reserved a forecasting system that quantifies future markets, the reality offered by cost accounting would have been re-constructed. Therefore, accounting is both a technique artefact and a social effect; which again renders the dichotomy between design and implementation of an accounting system, for misleading accounting always brings controversies that attract unexpected concerns.

Briers and Chua (2001) account for a panorama of the fabrication of an ABC system in an Australian aluminum manufacturing organisation. First, on the subject of heterogeneous networks of actors and actants, Briers and Chua (2001) claim that accounting changes are the outcome of fluid interconnections between local and cosmopolitan actors. Local actors may become cosmopolitans and vice versa. Second, on holding actor-networks together, Briers and Chua (2001) illustrated the prominence of visionary boundary objects that have the capacity to hold diverse parties together, but are plastic enough to adapt to local circumstances and shape boundaries of actor-networks. Third and fourth, on success and failure, and on soft and hard numbers, Briers and Chua (2001) claim that whether an accounting system has a good strategic fit or not, is not an explanation for its success or failure. An ABC system temporally attracted universal consensus, but not because of its rationalised strategic fit. On the contrary, it was the ally of diverse interests throughout the ABC system, for instance, consultants who were keen to sell the idea of "value adding"; an accounting general manager who sought legitimacy

for his group; a new business analyst who had faith in ABC, not because he understood it well but, because ABC confirmed his gut feeling that a product was unprofitable; and the MD who had faith in ABC because he believed the system would help him with his "product rationalisation" problem. This system succeeded not because of hard data, but soft data because the ABC itself had a lot of technical insufficiencies. A system succeeded not because it had an objective strategic fit, but because of its allies enormous subjective interests. In ANT language, a system, thus, stays objective because of its subjectivity.

Chua (1995), Chua and Mahama (2007) and Briers and Chua (2001) show that networks are not only the effects of accounting images, but also contributors to the fabrications of accounting. Attending the scene of fabrications of accounting will allow more controversies to unfold, for accounting inscriptions will bring order somewhere and disorder somewhere else. A variety of hyperrealities can be delineated by accounting, thus, fostering diverging managerial interventions. The above four papers allege that accounting creates meanings and institutions, and shows that diverging efforts of converging meanings and institutions have to be allied in order to make an accounting technology convincing. They show that an accounting technology is a vast network where interests of diverse actors are to be allied, but they tend to overlook the importance of inscriptions in translating these interests. Therefore, this thesis attempts to follow how diverse interests are allied in the network of an accounting technology through a set of inscriptions; as Mouritsen (1999) argues, for a manager to speak loudly, she needs her inscriptions. In OzCom, suppliers A and B have not supplied inscriptions of quality because of their asymmetric bargaining power and asset specificity in the alliance. Focus should also be placed on how competing accounting inscriptions contribute to constructing meanings and institutions. Competition makes a calculation stronger, for the champion of the battle has defeated another series of opponents whose interests are summarised in accounting images; as Latour (1987) comments, interests do not count, interest-accounts do.

More importantly, fabricating an accounting technology does not stop after different interests are allied. Relations between actors are not fixed and when they change, actors and their interests are also transformed anew. This means that new efforts need to be put in place to ally these new interests to make the technology work, because any network is fragile and leaks (Latour, 2005a). Therefore, it is misleading to theorise an accounting technology in terms of success or failure. A technology is debunked not because it is insufficient, but because new relations between actors create new tensions, which require the technology to be transformed again. Existing ANT inspired accounting on fabricating accounting technologies, tends to emphasise how a technology allies diverse interests of actors, but tends to overlook the fluidity of relations between actors and their interests. This thesis follows the emergent, ongoing and multiple matters of concern on the accounting technology and the actors' continuous attempts to close them, in order to make the technology a matter of fact. This helps theorise the complexity, fluidity and multiplicity of accounting in action. When relations between actors change, their interests will change accordingly. This may create new matters of concern on the technology. To close these matters of concern is to attract more entities into the network. Following these continuous attempts to close emergent, ongoing and multiple matters of concern, and exploring how these closures affect the process of *inscription building – circulating references* – will shed new light on how an accounting technology is made convincing.

This section has discussed the development of ANT inspired accounting research in its endeavour to study fabrications of accounting. The aforementioned studies have highlighted the importance of *matters of concern* in unfolding the multiplicities of accounting. These studies have, thus, moved closer to accounting, rather than turning away from it. The next question is how to account for the vast array of *matters of concern* around accounting. My claim after discussing the method theory in this thesis is that, by following a series of continuous translations of *matters of concern* in the working time/space provided by the homogenous prescriptions through the optic of *circulating references*, we can better theorise the complexity, fluidity and multiplicity of accounting in action.

The construction

So far, I have discussed the importance of following *circulating references* (Latour, 1999a) and *matters of concern* (Latour, 2005a) in studying fabrications of accounting. *Inscriptions* and *centres of calculation* (Latour, 1987) are not discussed in detail in this thesis because they have been treated as matters of fact in ANT inspired accounting research (Justesen and Mouritsen, 2011) and will be treated as such in this thesis. A number of studies follow the translational process of accounting inscriptions and their performativity, but Ahrens and Chapman's (2007) critique on ANT inspired accounting research is firmly in concert with Latour's (2005a) recent development in ANT in relation to *matters of concern*.

This monograph wants to follow matters of concern around the S&OP process and the translations of uncertainties in customer demand and integration, and their impacts on intra- and inter-organisational time and space in a more detailed manner. The approach to answer the research question on fabrication formed in the last chapter is to focus on the working time/space provided by the homogenous prescriptions of the S&OP; where diverse actors, when attempting to close matters of concern around the technology, create emergent ongoing and multiple matters of concern. The process of circulating references is also followed to explore the construction of competing calculations relevant to the S&OP process, as well as the implications on their competition in the ontology of the technology. Thus, *circulating references, matter of concern, a working time/space* and *fabrication* (including de-*finition/de*-finition and homogeneity/heterogeneity) are all entities in the method theory of ANT deployed to build domain theories in this thesis.

To associate method theories with domain theories in the empirical context, exploring the fabrication of a sales forecast in an S&OP setting on the demand chain of an organisation through *circulating references* and *matters of concern* is motivated for the following two reasons. First, the long translations between the unknown customer demands, practices of forecasting and inventory management calls for a detailed narrative of *circulating references* to document the association between inscriptions, and attempts to close emerging *matters of concern*. Second, in the network of the S&OP, ongoing tensions

between the group demand chain, sales, factories, senior management and suppliers, each of which possess their own inscriptions, calls for even slower travel to observe how competing voices for customers are closed in a technology that aims to speak for customers.

It should be noted, that the term *visionary boundary object* will also be frequently used to describe entities that are demand driven, knowledge based, proactive, agile and flexible, and so on. These entities are oftentimes referred to in their absences in fabricating a managerial technology such as IT and S&OP (Quattrone and Hopper, 2006). They are therefore, actors in the process of such fabrications. Star and Griesemer (1989) define boundary objects as objects which are "plastic enough to adapt to local needs and constraints of the several parties employing them, yet robust enough to maintain a common identity across sites" (p. 393). An entity of being demand driven is a boundary object because it ties together actors with diverse interests because of its common identity, but is capable of being interpreted differently within each actor. Briers and Chua (2001) add a dimension of visionary to these boundary objects and define them as objects that "have highs level of legitimacy within a particular community…possessing a sacred quality that makes it difficult for a 'rational' person to be against them" (p. 242). A boundary object that is demand driven is also visionary because it has a high level of legitimacy in the case company, which makes it difficult to be argued against. A visionary boundary object in this thesis is defined as an object that has high levels of legitimacy within a particular community and is plastic enough to adapt to the local needs and constraints of the several parties employing it; yet robust enough to maintain a common identity across sites and difficult to be argued against.

Inscriptions, translations, circulating references, matters of concern, fabrications and visionary boundary objects are elements in the method theory that will be used in the case analysis in this thesis. Their "definitions" are listed in the following table.

Elements	"Definitions"
An inscription	Any item of any configurations transforming a material substance into a figure; and this figure can be a written text, a table, a chart, a number or anything that can be acted upon.

A translation	A movement that makes a difference, transforms actors anew, and creates a link that did not exist before.
Circulating references	A process of *inscription building* that attempts to *translate* ongoing matters into ongoing forms and eventually to construct a fact.
Matters of concern	An "objects" that humans and non-humans attempt to close in order to create a matter of fact. That means an object itself is gathering of *others* instead of a matter of fact.
A fabrication	A process that constructs a "fact" and attracts, enacts, engages with and affects *others* in order make such a fact
Homogeneity	An ontological part of an object which people refer to in abstract terms and in its minimal configuration.
Heterogeneity	An ontological part of an object which is constructed through a series, the series attempts to close emergent, ongoing and multiple matters of concern when new entities are attracted.
Minimal configuration of a technology	The object that actors frequently refer to and that create a working time/space where actors can engage with it heterogeneously
A working time time/space	A time/space that is created by the homogeneous prescriptions of a technology in order to enact diverse actors to engage with the technology.
De-*finition*	A movement that attempts to close a matter of concern around a technology.
De-finition	A movement that attracts new entities into the network.
A visionary boundary object	An object that has high levels of legitimacy within a particular community and is plastic enough to adapt to local needs and constraints of the several parties employing it; yet robust enough to maintain a common identity across sites and difficult to be objected.

Table 1: Elements in the method theory that are to be used in later case analysis

Lukka and Vinnari (2011) cogently point out that there should be an alignment between domain theories, method theories and methodologies. This study takes their advice, and thus, the purpose of this chapter is to illustrate the importance of the method theory in this monograph. In Chapter 2, I indicated that this study attempts to contribute to building domain theories in accounting and demand chain management (DCM), more specifically, in fabrication of accounting, translation of uncertainties in DCM and multiple voices for customers. Building these domain theories requires me to follow the translations between heterogeneous actors and organisational problems and tensions. ANT is deployed as a

method theory because it allows a detailed exploration on how relationships between actors change and the implication of such a change on accounting technologies themselves. In particular, I will use three major elements in ANT, namely *translations, circulating references and matters of concern,* to follow how attempts to close matters of concern create circulating references that make up a technology. Using these elements will also allow me to trace how uncertainties in future customer demand and integration are translated into a variety of objects and diverse times and spaces. Applying ANT as a method theory in this way has the potential to create a detailed narrative on how accounting is fabricated through circulating references and attempts to close multiple and continuous matters of concern, and how the time and space of DCM can be more complex, fluid and multiple compared to mainstream DCM literature.

Using the above mentioned elements in ANT also has implications on research methods, which will be discussed in Chapter 5. In short, empirical data is collected and will be analysed based on a series of continuous episodes on how a series of matters of concern around the S&OP process are closed to a series of references. In other words, each episode describes how a particular matter of concern in the accounting technology is closed.

The next chapter will provide a construction of the actor-network generated so far. Domain and method literature associated in an intricate manner now leads to the research questions of this thesis.

CHAPTER 4

Research Questions

I cannot recall from memory a thesis that has a separate chapter for research questions, so why do I have one? It is because of my observations over a vast number of conference and seminar presentations. So many times the presenters were asked to explain what their research questions were in the paper, and few of them addressed this well. The efforts to close matters of concern on theories so far are now translated into a form, a chapter that seriously presents the research questions in this thesis.

Source:http://ro.uwe.ac.uk/RenderPages/RenderLearningObject.aspx?Context=6&Area=1&Room=3&Constellation=54&LearningObject=296

A: So what are the research questions then?

B: OK, so let me be a bit more specific

The constructions

It can be argued that the above theorisation amounts only to debunking, so where is the construction? What are my research questions?

Accounting calculations have been viewed as inscriptions that translate organisational phenomena such as innovation, but it is the inner fabrications, gatherings, and beings of particular accounting calculations that have been overlooked; even in ANT inspired accounting research. Filling this void is beneficial to the accounting academy and profession, for it will address a lot more controversies in the intertwining process of design and implementation of an accounting system. ANT inspired accounting research has long followed the mediations of accounting calculations as inscriptions. It is time now to care about the "being" of a calculation, for instance, a sales forecast where other calculations, technologies and humans continuously create new matters of concern on the technology, albeit, trying to close them.

This monograph will follow the symmetry of human and non-human actors tracing both *circulating references* and attempts to close *matters of concern* around an S&OP process, where an accounting calculation and sales forecast play a vital role. Figure 2 shows the relationship between domain and method theories, relevant in this thesis.

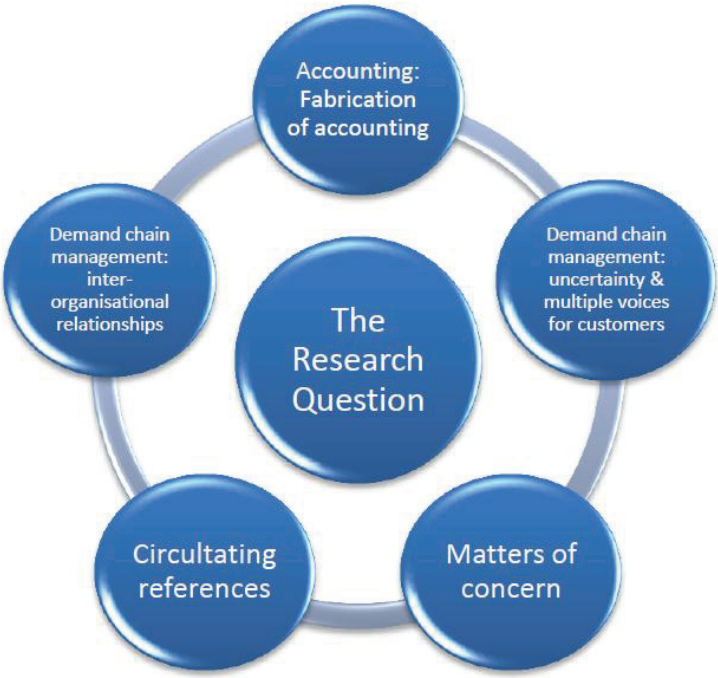


Figure 2: a fabrication of the research questions in this thesis

In the above figure, the central sphere puts the closure of matters of concern around theorisation of the thesis discussed so far into a research question on fabrication of accounting and its related processes; whilst the peripheral spheres show the binding of domain and method theories.

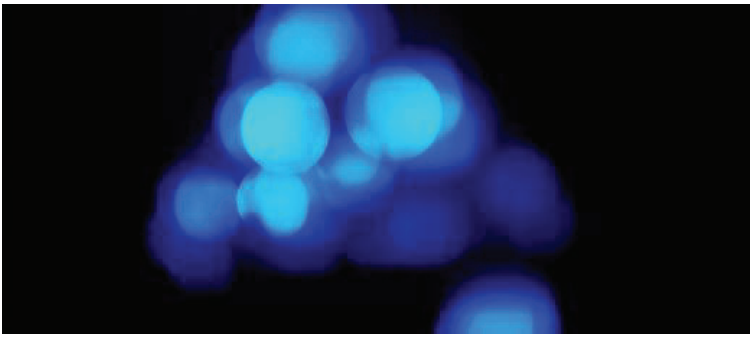
The research question is,
How are an S&OP sales forecast and an S&OP process fabricated?

It should be that, although the research question is formulated using ANT language, it also aims to solve the puzzles in extant DCM literature, namely uncertainties in future demand and integration, competing voices for customers and intra- and inter-organisational timing and spacing.

CHAPTER 5

Research Methods

> *"Methods are crucial for establishing a theory's scientific credentials, but they are not neutral (Latour, 1988): they are not the solution, but should be the object of study when researching how scientific knowledge is constructed (Woolgar, 1988). Methods and science are black boxes that require unpacking (Latour, 1987, 1999)." (Quattrone and Hopper, 2006, p. 221)*



Is there any method that can provide a true and fair representation of the reality in the picture? Methods are mediators not intermediaries.

Source of the picture (http://www.thescienceofdeduction.co.uk/)

Introduction

This thesis shares ideas with Latour (1987; 1988), Woolgar (1988) and Latour and Woolgar (1986), that methods are not neutral intermediaries used to discover the "real" reality that verifies researchers' propositions. Latour (2005a) cogently indicates that a good Actor-network Theory (ANT) study is one that treats as many entities as mediators, instead of intermediaries. Methods, thus, are not solutions, but actors that contribute to theorisation. Solutions can be detached from problematisation, but actors reside with *others* in the network. Just as it is problematic to see accounting as a neutral technique trying to provide a true and fair view on the financial position and performance of a company (Tinker, 1991); it will be equally "unfaithful" to consider methods in the same manner. The basic argument of this chapter is that methods, researchers, and lay actors reside in a flat space, equally contributing to the network of organisations and theorisation.

This chapter will first state the link between inscription building and realities, and its mediation on the use of methods in theorisation using Law (2004). I will then use this reflection on the case study methodology, followed by a discussion on corresponding research strategies.

Methods and theorisation: inscription building and realities

In concert with the advocacy of the heterogeneity of realities mentioned in the chapter of method theory, the metaphysics and ontologies this chapter ally, already in social science claims, are "variegated", and "even more so in their practices" (Law, 2004, p. 4). Therefore, the world is an "unformed, but generative flux and relations that work to produce particular realties" (*Ibid,* p. 7). Conventional research, or what Law (2004) calls as Euro-American, sees that reality is singular and can only be discovered through rigid methodological rules. Failure to follow these rules will produce substandard and distorted knowledge that does not faithfully *represent* what ought to be *represented.* This claim on methodological rules believes that the world, if studied properly using rigid rules, is *"a set of fairly, specific, determinate, and more or less identifiable processes"* (Law, 2004, p. 5). Therefore, the purpose of social science is to *discover* more or less *similar* and *definite* processes in reality that can be generalised. This thesis has shown, on the

contrary, via both domain and method theories, that there are multiple realities with heterogeneity and variation. The world is not merely technically complex *discovered* by following so called rigid methodological rules, but is inherently complex because realities "necessarily exceed our capacity to *know* them" (*Ibid,* p. 6). If realities are unknown, what does this mean to methods? How can research methods mediate such a shift in metaphysics that "escape the postulate of singularity, and respond creatively to a world that is taken to be composed of an excess of generative forces and relations" (*Ibid,* p. 9)? How can research methods mediate the metaphysics of the *social* that ANT sees as a flat space comprising of *associations* (Latour, 2005a)?

Law (2004) then enrols Latour and Woolgar (1986) to develop his reflection on the mediation of research methods on theorisation and knowledge of production. Law's (2004) reflection on knowledge production in social science starts with a discussion on *inscription building* in laboratories. According to Latour and Woolgar (1986), a laboratory is a system of material/text translation, where material resources are transformed into texts and that more or less stable similarities are transformed into *substances and facts*. Realities are, thus, *constructed* by inscription devices. Law (2004) then takes a journey around the metaphysics of realities as *out-therenesses,* and reflects upon how Latour and Woolgar (1986) problematise the *out-therenesses* of realities differently than Euro-Americans[13]. Properties discussed include *independence,* whether the external reality is independent of our actions and perceptions; *anteriority,* whether the external reality exists before us; *definiteness,* whether the external reality is composed of a set of definite relations; and *singularity,* whether the external reality is the same everywhere. Table 1 below shows these different epistemologies between Euro-Americans and Latour and Woolgar (1986) as generally, ANT, proposed by Law (2004).

[13] Law (2004) uses this term as an index for those "more or less hegemonic set of claims about method, notwithstanding the divergences in practices" (p. 165).

Out-thereness of the world	European-American	Latour and Woolgar (1986); ANT
Independence	Reality has properties independent of perceptions and practices of the scientific community.	Reality is not independent of the apparatuses of producing inscriptions of realties.
Anteriority	Reality pre-exists any attempts to know it.	Generally realities and texts are produced together in laboratory apparatuses of inscription, but over a long time horizon, a large hinterland of texts and realities that relate to the statements in question are already made.
Definiteness	Processes and elements in reality have clear, certain and definite attributes. Underdevelopment and distortion are failures to produce knowledge.	Yes – when texts fit and reinforce each other. No – when they do not. Indeed most of the time scientific inquiry deals with uncertain attributes of realties.
Singularity	Objects in reality are singular.	Yes, but only after controversies are resolved. Before this realties are multiple because they are effects of different sets of inscriptions devices and practices.

Table 2: Metaphysics on the out-thereness of reality by Euro-Americans and ANTs according to Law (2004).

Table 2 shows that on *independence* and *anteriority,* ANT sees that realities are associated with the apparatus of *inscription producing*. On *definiteness* and *singularity,* ANT also sees realties as effects of the apparatus of *inscription building*. Producing inscriptions, therefore, is vital in generating scientific power/knowledge, and thus, cannot be separated from the *out-there* realities. Law (2004) describes those inscriptions

produced yesterday as hinterland of today's statements and modalities. "It is not a matter of words representing things. Words and worlds go together"[14] (*Ibid,* p. 33).

If the hinterland of inscriptions is central in transforming modalities into unqualified statements about reality that have the potential of becoming routinised *facts*, the conventional take on research methods becomes an object subject to scrutiny.

> *"But this means that as the modalities disappear, so too do almost all of the processes in which statements and realities are produced. The largest part of the work that has gone into their production is deleted. In the end, the inscriptions devices themselves disappear, though those that are most novel are likely to retain a foothold in the 'method section' of scientific papers. But it is the 'subjective' and the 'personal' that disappears first. The traces and the statements in the laboratory are used 'in such a way that all the statements were seen to relate to something outside of, or beyond, the reader's or author's subjectivity' (Latour and Woolgar, 1986,* p. 84)*." (Law, 2004,* p. 36)

The abovementioned reflection on *inscription building* points to a fallacy of the conventional main stream Euro-Americans, to whom realities come first and inscriptions come later as representations of the former. But it is the other way round! It is "the processes of comparing, contrasting, and weighing up inscriptions that *produce* reality…It is arguments, debates, discussions or controversies that *produce* reality" (Law, 2004, p. 37). It is not reality that settles any disagreements via setting rigid methodological rules. Methods where *inscription building* plays a vital role *constructs* realities.

The construction of this section is that this thesis will not delete the "subjective" or "personal" processes of *inscription building* and write this chapter of research methods to raise those rigid methodological rules of case based field research to try to apply these rules to claim that the realties are objective and faithfully represented. Instead, I am now writing research methods, as a researcher, and lay actors are equal mediators producing

[14] This is also Latour's (1999a) argument for studying social science as circulating references.

scientific knowledge and realties. This reflection on Law (2004) and Latour and Woolgar (1986) will shape my research strategies that are to be discussed in the next section.

Case study methodology and its role in theorising

Logics of the case methodology and its role in theorising from this study are in concert with the above reasoning on methods; and Quattrone and Hopper (2005; 2006), who build upon Latour (1988), allege that scientific methods are bundled with theorising, but are not neutral representational tools. And Woolgar (1988), views scientific methods as mediating the connection between the object of study and its representations. Researchers need to reflect upon a concept as part of the object they wish to represent (Woolgar, 1988), and the perception of ontology shapes a particular epistemological underpinning, which in turn points to the character of the methods, hence, the nature of representation (Woolgar, 1988; Chua, 1986); "scientific methods become the problem rather than the means for investigation" (Quattrone and Hopper, 2005, p. 743).

ANT is well known for its methodological slogan, "follow the actors". Field based case study research is in principle coupled with research that deploys ANT as its method theory for its orientation towards the locals and particularity. Its theorisation, however, differs from conventional case based research that implies the modern separation of the researcher, and the researched objects that search for abstraction and generalisation.

This typical kind of case study research, thus, becomes both the means and the object of the investigation (Quattrone and Hopper, 2005). Some would argue that ANT's approach of looking at "things out there" and reporting back, and representing those same things "in here" enables *action at distance* (Latour, 1999a); which is replicated in other empirical studies. There is, however, a vast difference. ANT inspired case study research sees methods as an object instead of as a means of investigation (Calas and Smircich, 1999). The ideology is not to discover a theory that can be generalised, either statistically or analytically across settings, but to look for surprising explanations which challenge the taken-for-granted; as is mentioned in prior discussions. This conforms to Latour (2005a), that this peculiar type of case study research is positioned in a space looking for technologies as *matters of concern* in relation to taken-for-granted *matters of fact*.

Following Quattrone and Hopper (2005; 2006), a conventional chapter with sections separating data collection and data analysis is not written in later sections (for the observed and the observer are inseparable). Description and analysis will be merged, for a good description renders the explanations unnecessary (Latour, 2005a). Research methods, together with accounting reports, human participants and technologies, are also actors contributing to the theorisation of the observed. A way of seeing data is no longer an independent given priori, but acquires its meaning from the researchers and empirical subjects/objects. This ontological outlook from a constructivist's view differs from the empiricists and positivists who try to use case study research to discover theories which best represent the reality "out-there". Silverman (2001) says that "according to positivism, interview data gives us access to 'facts' about the world…according to constructivism, interviewers are always actively engaged in constructing meaning" (p. 86-87).

As ANT is a constructivist methodology, empirical data, does not just sit organisationally independent, waiting for the researchers to pick it up. Data emerges from a network of heterogeneous participants, including the researcher and the interviewees. Any research methods attempting to end up with a neutral representation of organisational realities is, in this milieu, unscientific. Methods comprise *inscription building* that is central to producing knowledge and realities (Law, 2004).

The abovementioned reasoning is also allied with the performative definition inherent in ANT; this asserts that no methods guarantee access to the world. Earlier in the thesis I quoted Mourtisen et al. (2010) in order to claim that the importance of the method lies in its power to persuade other actors, instead of its ability to offer a better representation of reality. This line of argument holds for all actors, including accounting inscriptions and methods. Method, thus, becomes a meta-mechanism through which the researchers and actors' interests inosculate (Mouritsen et al., 2010, p. 295). Such a symmetric treatment of the research methods and the objects of inquiry leads to vast implications on theorisation. This "flattened" space blurs the distinction between the method and the object investigated, implying that the dichotomy between descriptions and explanations,

i.e. the empirical and the theoretical, also disappears (Quattrone and Hopper, 2005; p. 744). What the lay actors explain becomes the researcher's description. What the researcher explains allies the lay actors' descriptions. Suddenly, each description becomes an explanation and vice versa for "observers cannot be detached from their observations" (*Ibid*). Thus, "[T]heory is a way of seeing what blinds us to other vistas" (Quattrone and Hopper, 2006, p. 221); and so is the case study research (Quattrone and Hopper, 2005; p. 744). In my case study research, the attempt is not to uncover and represent an absolute organisational reality with research methods being solutions to do so. Instead, the intention is to construct a narrative that embraces the research questions; where researcher's see and interpret, and lay actors' talks and acts ally. There is no fixed interview guide that is followed in order to discover a theory that is out there to represent reality. Method is a mediator, and I am a mediator. As *matters of concern* are key ontologies in this thesis, I need to follow them to trace their translations. Therefore, sometimes when new *matters of concern* around the technology emerged, I traced them to multiple time and space by asking questions repeatedly to diverging interviewees. For instance, I repeatedly asked the same interviewees why factory forecasts were higher than sales forecasts; but their contexts differed, which implied that the object was multiple (Quattrone and Hopper, 2006). This is consistent with Law (2004) and Latour and Woolgar (1986) who believe that multiplicity of realties is to be followed before singularity can be concluded. Then when translations occurred, I went on to focus on *circulating references*, and the processes continued. Methods become an actor in theorising instead of being an intermediary of representation.

This, however, does not mean that the process of *inscription building,* in terms of documenting empirical evidence is of less importance. On the contrary, documentation of empirical materials plays a vital role in constructing theories. In order to convince the readers about the findings of this thesis, this study documents empirical material in the same way as Latour (1999a). Empirical materials are organised based on a series of episodes. Each episode closes certain matters of concern around the technology into certain forms, and simultaneously this attempt to close matters of concern attracts new entities. Organising materials in this way generates a reversible chain of circulating

references, an audit trail that helps readers to trace the very interview quotes, documents and meeting observations that are grouped to describe an attempt to close certain matters of concern. For instance, if an episode describes an attempt to close a matter of concern on forecasting logics, readers will be able to link the findings to those particular empirical materials in relation to the episode.

To conclude, research methods in ANT language are no longer taken-for-granted matters of fact, for they are not solutions to an inquiry. They are themselves fabricated *matters of concern,* together with other actors that contribute to the construction of scientific knowledge (Woolgar, 1988; Latour, 1987; 1999a; 2005a). Realities are network effects of methods comprising of *inscription building,* rather than causes of selecting optimal methods (Law, 2004; Latour and Woolgar, 1986). The next section will follow this line of argument and discuss strategies of the field research.

Approach and Research Strategy

The above reasoning, however, does not mean that ANT inspired research should not follow guidance of research methods. On the contrary, there are principles that decide a good ANT study.

> *"I would define a good account as one that traces a network. I mean by this word a string of actions where each participant is treated as a full-blown mediator. To put it simply: A good ANT account is a narrative or a description or a proposition where all the actors do something and don't just sit there. Instead of simply transporting effects without transforming them, each of the points in the texts may become a bifurcation, an event, or the origin of a new. (Latour, 2005a, p. 128)"*

The above quote points to the importance of treating entities as mediators as well as following their translational amplifications; these have been discussed in prior sections of the method theory. In terms of research methods, a good ANT study would require interviews, observations of phenomena and inspection of documents to slowly trace the actors from their origin, to bifurcations and events that they both engage and generate. This shows emergent, ongoing and multiple *matters of concern* around the object under

investigation; thus, making it complex, fluid and multiple. This calls for semi-structured interviews that develop ongoing controversies. Researchers need to reflect upon interviewees' responses to identify follow up questions in order to trace the performativity of actors. This principle requires researchers to adaptively and reflexively develop emergent and ongoing interview questions both on site and shortly after the interview. Interviews need to be transcribed and coded immediately after because any delay may lose the trajectory of the movements of the actors which is continuously evolving. In this study, each interview was transcribed and coded either the same day or the day after the interview. Since closing matters of concern creates new relations between entities, follow up interviews were also booked and conducted as quickly as possible to follow those actors. Therefore, it was quite common to have interviewed the same interviewee(s) within a short period of time. Also, participants that were not in the planned interview lists were contacted and consequently interviewed, the outcome of which sometimes led to identifying other potential interviewees. For instance, an initial following of closing a matter of concern on the primary keys of the S&OP sales forecast discovered that customers' supply chain management was an actor. As a result, a business process analyst and a particular forecasting manager, who had intensive knowledge of customers' operations, were interviewed within only a few days.

Following Latour and Woolgar (1986), for a statement to be transformed from a mere modality into a fact, it needs to ally a hinterland of other statements. Therefore, this paper shares the principle of triangulation with conventional case study approaches, but the difference here is that in ANT studies, disagreements between participants and evidence are not intermediaries to test reliability of the data collected. Instead, they open a space for more controversies, allowing actors to show longer translations that construct a collective once the controversies are more or less closed. Triangulation tests reliability, but more importantly it allows more tensions to unfold. In this study, quotes are cross checked with multiple interviewees and meeting minutes and graphs are analysed accordingly. In most cases, when a disagreement is found, questions in the follow up interviews will be developed in a way that unfolds the debates. For instance, when the demand chain manager for the large bearings mentioned the importance of calculating

forecasts in the warehouses, which had been skipped in the current S&OP process; his argument was then brought to the manager of the S&OP, who in turn challenged this inclusion of forecasting in warehouses. The result of this disagreement did not point out any data as unreliable, but collectively both arguments were addressed in the end via the enrolment of another mediator; a translation of the sales forecasts into a shipment forecast.

As was mentioned earlier in this chapter, transcriptions of interviews, meeting observations and relevant documents were triangulated in a way that will help readers to trace what empirical materials were used to describe particular episodes' attempts to close particular matters of concern around the S&OP process. In this way, triangulation not only increases reliability of data and helps unfold controversies, but also contextualises data into local settings. This creates a reversible chain of circulating references, that later will construct new theories in this thesis. Latour (1999a) says to construct a fact, a reversible chain of circulating references must be provided to convince readers. This thesis, thus, applies triangulation in a way that helps to convince readers, by offering such a reversible chain.

Following ongoing controversies and triangulating empirical data in a way that traces the translational process and opens a space for debates is in concert with Mouritsen et al. (2010), who inspired by Latour (1987; 1999a; 2005a), listed four methodological attributes that differentiate ANT inspired research to advocate on performativity; as opposed to conventional research that illustrates ostensivity: *attributes of knowledge, attributes of actors, knowledge possessed by actors* and the *epistemological question regarding whether scientific methods guarantee access to the world.*

Attributes of knowledge of the world refer to the epistemological presumption concerning the extent to which researchers already know before the study (Mouritsen et al., 2010). To reserve a space for surprises, the performative view, which ANT allies, advocates that researchers must disregard any prior assumptions; which is the only way of understanding the world. The only way to discover and write a scientific account is to

trace the associations between entities participating in constructing the network (Latour, 2005a). The ostensive definition assumes many entities are already-made, thus, *matters of fact*. *Matters of concern* are not the problem. What is at stake is whether researchers can verify propositions with regard to associations between fragmented pieces across time and space, thus, generalising these propositions. As explained in previous sections, such generalisation is alien to ANT (Mouritsen et al., 2010). In terms of research methods, this attribute is manifested by a set of semi-structured interviews aforementioned that trace the associations between actors. Although this precludes researchers from having a set of detailed questions that pre-assign identities to actors, it puts enormous efforts in getting evidence that is deeply localised in the organisations. In this field research, locality is preserved for episodic data collected, for instance, an episode to close a matter of concern on primary keys of forecasting, an episode to close a matter of concern on forecasting logic and so on. Data of these episodes is organised in a sequential manner so that readers see a reversible chain of circulating references that help them to see what happens in those series of episodes.

Attributes of actors refers to the power of participatory actors in constructing the world. The performative approach states that all actors, humans and non-humans, including researchers, partake in translating and formulating the world, and hence, should be treated equally (Latour, 2005a). In contrast, the ostensive definition denies such symmetries believing that lay actors are merely the effects of "culture, capitalism, contingency, or discourse, and therefore, they act on the commands of others" (Mouritsen et al., 2010, p. 294). This attribute is reflected in this study in the symmetric treatment of human and non-human lay actors and researchers. A large degree of liberty was given to lay actors to allow them to travel and construct their arguments. Instead of categorising lay actors into certain theoretical presumptions, inscriptions were traced from one to the other, to identify new translations and new actors; thus, erasing the separation between the observation and the observed (Quattrone and Hopper, 2005; 2006).

In terms of *knowledge possessed by the actors,* from the performative lens, actors' knowledge is crucial in organising the world. Their knowledge cannot be emptied out, for

philosophically if actors cannot act, why include them in the explanation? Therefore, actors are knowledgeable about their interactions with other actors. They, however, may not always be able to account for all effects generated in the network. As a result, "actors construct their world, but do not seal it" (*Ibid*, p. 295), for there are overflows from all networks, which lead to network fragility making stability a mere fantasy. Semi-structured interviews allow actors to use their knowledge to unfold interactions, whilst triangulation in an ANT sense, identifies the leakage of the network because disagreements between actors introduce new controversies to be resolved.

ANT, the performative definition cogently points out that there exists no method guaranteeing access to the isomorphic world. "Method is important, but not because it inherently produces a better description than the absence of the method; method may be an important device with which to persuade certain actors" (*Ibid*, p. 295). In this line of argument, the method itself is an actor, if the persuasion transforms actors. It should be noted that the method will by no means mirror a universal reality in singular. Rather, it is a meta-mechanism through which the researchers and actors' interests inosculate (*Ibid*, p. 295). This contrasts the ostensive approach, maintaining that there is independent truth separable from untruth. Scientific method is the media used to discover this truth by verifying hypotheses proposed, hence, generalising propositions (*Ibid*). This attribute confirms the prior discussion on the separation between methods and realities.

This research was based on a longitudinal case study in a large Swedish manufacturing organisation that was implementing a sales and operational planning (S&OP) process throughout their operations in response to poor availability problems. The choice of conducting a longitudinal case study complies with ANT's re-habitation of the detailed descriptions and actions at the empirical level (Justesen and Mouritsen, 2011); which is the approach that Latour (2005a) refers to as "slowciology" (p. 165). Conducting interviews, observing habitants' behaviour, participating in meetings and reading internal documents are common means to "go slow", "keep everything flat", and "don't jump"; which are typical slogans representing ANT's methodological advices (*Ibid,* p. 190). In the next section, I will briefly present the background information of the case company.

Background of the case company

The case study was conducted in a Swedish based large bearing producing company, called SWEDTECH (a pseudonym). Its product range comprises five platforms including bearings, seals, lubrication systems, mechatronics and services. Its customers encompass a wide range of industries including aerospace, agriculture, cars, compressors, construction, electric motors and generators, electric power tools, food and beverage, home appliance, oil and gas, industrial fans, pumps and transmission, racing, solar energy, and so on. The company's annual turnover amounted to 56, 227 SEKm, 61, 029 SEKm and 66, 216 SEKm in 2009, 2010 and 2011, respectively. Operating profit for the same periods were 3, 203SEKm, 8, 452 SEKm and 9, 612 SEKm.

In 2007, the group demand chain of SWEDTECH realised that, although the products the company was offering were cutting-edge, it had to decline a lot of customer orders because of capacity constraints. Significant revenue would have been generated had factories and suppliers had sufficient capacity. In order to balance demand and supply, the group demand chain decided to implement the Sales and Operations Planning (S&OP) process to drive the company demand. Also, during the same period, consultants deployed by the company indicated that the company did not have structured information processing and methodologies for using data. Disparate sub-organisations were using different information systems, producing different structures of data which made it impossible to integrate. The group demand chain also wanted the S&OP process to provide a space where these information and methodology problems could be solved. From 2009, the group demand chain started to delineate the S&OP agenda because the 2008 credit crunch drove the organisation's attention to other urgent problems. It was not until September 2010 that it started its first pilot S&OP product group planning (PGP) meeting. I entered the organisation in June 2010, when the group demand chain considered rolling out the pilot process in some of the product groups, for instance, SRB/CARB in the industrial division. When I completed the field research in September 2011, the pilot S&OP process was still in effect, due to the many controversies that are going to be discussed in the next two chapters. The S&OP sales forecasts were calculated by the sales organisation, and were then sent to factories and product line planning

management (PLP). In PGP meetings, discussions should be centred on how to make up the shortage of capacity identified. However, in those pilot PGP meetings, debates proliferated on the reasonableness of the sales forecasts because factories believed that the sales forecasts were of low quality. The majority of the efforts spent in the pilot S&OP process were, thus, focused on how to generate a reasonable sales forecast.

The company attracted my interest, but not merely because of its new S&OP process. Since it is the leading bearing producer in the world, it has implemented a number of managerial technologies ranging from S&OP, NSCD (New Supplier Delivery Concept), to Balanced Scorecards and 6 Sigma to facilitate a variety of discourses in order to be knowledge driven, to be demand driven and to have manufacturing excellence. Interestingly, all these artefacts are in some way connected to the S&OP process. This generates the potential for my research to reveal some insights into what a modern organisation is doing in order to close diverse *matters of concern* around a DCM technology. SWEDTECH was selected because of not only its implementation of the S&OP, but also its potential for creating multiple matters of concern around the S&OP that keep it from becoming a matter of fact, albeit, actors strive to close it to as a matter of fact.

I was present in the company interviewing and observing during the period from June 2010 to December 2010. Then I went to the company to do a number of follow up interviews when new concerns emerged. This discontinuous presence occurred throughout the Year 2011 up to October. The empirical domain mostly involves headquarters and the production channels located in the adjacent factories of the company. 41 semi-structured interviews (including 6 telephone interviews due to inability to conduct face to face interviews) with 16 managers across functional groups were conducted during the period from June to November 2010 and December 2011. Each interview lasted between 0.5 and 3 hours. I only interviewed these 16 actors because the S&OP process was still in its pilot phase and these 16 persons were key actors involved in the pilot process of implementation. Most of them were key participants in the group demand chain because the group demand chain was in charge of the pilot process, and the

S&OP process was intended to be fully rolled out to local functions later. Most of these persons were repeatedly interviewed in order to trace ongoing tensions. This allowed for in-depth analysis of ongoing attempts to close multiple *matters of concern* around the S&OP process. Some key players in the sales organisations, factories and product line planning management were also interviewed.

I explained to the managers that I was interested in their efforts to calculate, to control and to account for the impacts of using the S&OP. Semi-structured interviews were preferred because their reflexive (Alvesson, 2003) and analytical (Kreiner and Mouritsen, 2005) nature enables the researcher to follow the translations between accounting calculations, uncertainties in customer demand and integration in DCM, multiple voices for customers and intra- and inter-organisational relationships. This means a questionnaire was prepared, but the dialogue was quickly stimulated to develop its own momentum, for entities unfolded unexpectedly to compete for a voice. Reflexive and analytical semi-structured interviews also placed the researchers at the same level as the lay actors, so that lay actors' interests, actions and interactions could be followed to allow for surprises to unfold.

Two pilot S&OP meetings were attended (September 2010 and February 2011). Some important pilot S&OP PGP meetings in 2011 were not attended because I had teaching and studying responsibilities at the business school, but telephone interviews were conducted in order to trace those events as much as I could. Real time debates on the construction of the S&OP sales forecast, for instance, the disagreements on the sales forecast from the factories, were followed to trace the fabrication of a company wide sales forecast. These debates were then translated into different time and space where local actions were enabled.

A vast range of internal materials were studied including S&OP charters, 6 Sigma charters, business cycle forecasts (F18), financial forecasts, an S&OP instruction manual, data in the pipeline and Demand Solution, factory daily planning inscriptions, factory

stock levels, safety stock levels, shipment histories and meeting minutes. A summary of the interviews, meeting observations and documents inspected is provided in Table 3.

Interviews		
Postions	Face to face	Telephone
Sales manager of bearings and units	1	0
Demand chain manager for large bearings	5	2
ID manager on manufacturing & supply	5	1
S&OP manger	4	0
Business process analyst A	1	0
Business process analyst B	3	0
Business process analyst C	2	1
Regional sales director	1	0
Sales manager in SD	2	0
Product line manager for medium bearings	1	0
S&OP PLP manager	3	0
S&OP SCP manager	2	0
Sales manager in ID	1	0
Purchasing manager	1	0
Direct of demand chain - ID	1	0
Product line manager for group demand chain	2	2
Total	**35**	**6**
Meetings		Attendance
Pilot S&OP meeting Sept. 2010		1
Pilot S&OP meeting Feb. 2011		1
Total		**2**
Internal documents		
S&OP charter 6 Sigma charter Business cycle forecasts (F18) ABC analysis Financial forecasts S&OP instruction manual Pipeline Demand solution Factory daily plans Factory plan, stock levels & safety target levels Shipment histories Meeting minutes		

Table 3: A summary of interviews conducted, meetings attended and documents studied

As was remarked in the previous section, the coupling of research methods and objects of inquiry rendered the methods themselves as actors in the theorisation. This not only took

place when semi-structured interviews were undertaken, but also when I wold read internal documents comprising presentational slides of introducing S&OP, graphs displaying historical financial and non-financial patterns, scorecards, software instructions showing how to calculate the system forecasts, business plans and other calculations. These documents provoked follow up interviews where researchers and interviewees continued to reflect upon tensions that both considered worthwhile to further explore. Triangulations were used to detect and trace ongoing controversies in order to account for surprising narratives.

Interviews were transcribed at the earliest possible time. Qualitative data was coded in NVIVO by matters of concern around the S&OP process, forms, sales forecast, factory forecast, debate, uncertainty in customer demand and integration in DCM, multiple voices for customers and intra- and inter-organisational relationships; but not in a conventional manner. Data was organised by episodes, and in each episode an attempt to close a *matters of concern* on the technology is narrated. There were no categories assigned to data from the outset, because ANT looks at the processes rather than structures of empirical events. Episodes include, for instance, an episode of closing a matter of concern on primary keys and an episode of closing a matter of concern on forecasting accuracy. This was inspired by Latour's documentation means in *Pandora's Hope* of his scientific inquiry to clarify whether the Amazon is retreating or intruding upon the savannah. He documents his empirical material through a set of inscriptions building processes "from mapping, tagging and sectioning of an area of rainforest and savannah to the many holes dug in the ground and to the transfer of soil samples to a gridded, wooden box, each coded by colour, type, depth and location" (Dambrin and Robson, 2011, p. 5). His narrative is convincing because readers can go along the reversible chain of circulating references to see how an attempt to close a particular matter of concern around the S&OP process is translated into a particular inscription. Readers know which inscription refers to which matter of concern on the technology. This thesis documents empirical material similarly according to episodes, so that readers can also go along the reversible chain of circulating references to see how a particular attempt to close a matter of concern is translated into a particular inscription.

Within each episode, tensions and controversies pointed out by interviewees and indicated by documents were constructed in order to produce ongoing interview questions. Theoretical concepts are organised via episodes. This is considered as more appropriate to illustrate the fabrication process.

Conclusion

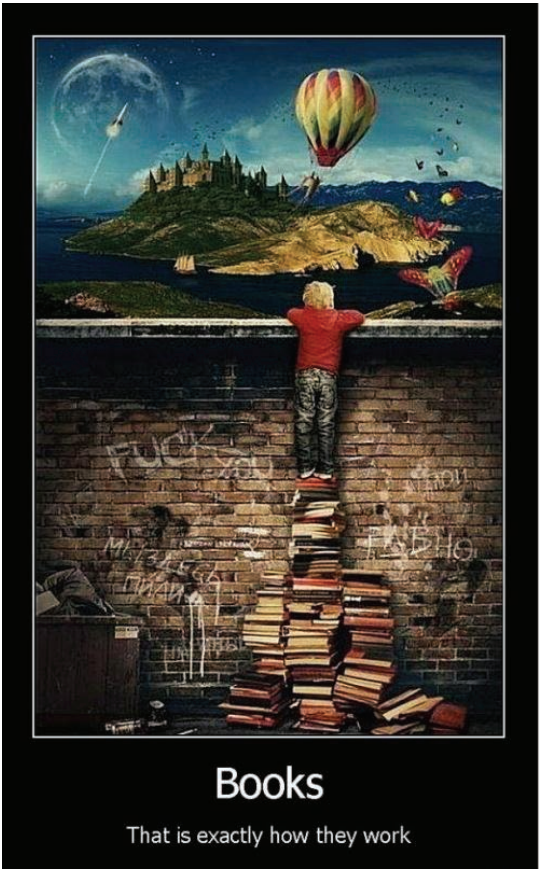
As research methods in this thesis were treated as mediators that reside at the same level as lay actors, research methods were not utilised to discover a proposed organisational reality. Rather, realties are effects of methods. Triangulations were not primarily used to check reliability, but to follow emergent *matters of concern* around the technology that could be traced and discussed in follow up interviews. Validity issues were sometimes identified during transcribing, so then the same questions were asked to particular interviewees again to gain some clarification. Reliability is enhanced by organising empirical data based on episodes, so that a reversible chain of circulating references is available to readers to trace what happens in local contexts.

So far, we have explored the associations between literature, theorisation and research methods, but there is yet to be a network until lay actors enter the front stage. This will be narrated in the next three chapters.

CHAPTER 6

Fabricating an S&OP forecast: circulating references and matters of concern – Part I: creating a sales and a factory forecast

An Illustration



This is a poster for sale at demotivation.us, originated by the Russian Artist, Anastasia Gorbunov for a competition to encourage literacy and for Russians to reading more. “Reading is not dangerous. No reading is.” There have been many reflections emancipated from this picture. Here is one of a few.

This is an amazing picture, and it really hits home for me. I too would like a copy of it to hang in my office. You see, when I was born, I really didn't have much going for me. Then, around grade 5, I got hooked on reading. I'm not well traveled, in fact, I've never flown out of my country due to money issues and putting myself through two degrees sans help from anyone. However, despite this, I have been to too many places to count in my mind's eye, and I've walked in the shoes of 10,000 men. I attribute my love of reading to overcoming the circumstances of my birth. Not only has it made me smarter, and - I think - more insightful, but it also gave me a means of escape. Hungry? Read. Can't make rent? Read. Broken heart? Read. Feeling like the world is caving in on me like an old mine shaft? Read. Books are my best friend, I just realized. - From a thread posted by thedevilyousay

Books are circulating references brought by authors who have travelled, approached and represented the locals in their absences. We readers start from, reflecting upon and citing these books as references, for our next step so that we learn from representations of the world and carry these two-dimensional

representations forward; for they are *mobile, stable and combinable (Robson, 1992)*. This illustration is indeed a circulating reference.

Introduction

This chapter will associate the delineated theorisation completed so far, with the residency of lay actors at the case company. This will be a long journey with *circulating references* translating a series of emerging matters of concern around the S&OP process, while attempting to close them into a series of forms that in turn produces intended and unintended effects. A long journey is indeed a challenge for me to narrate, because writing is also a "drift" (Quattrone and Hopper, 2001). You know where you are going, but you can never anticipate every emergent *matter of concern* on the S&OP process, that is, the technology as a set of matters of concern. Therefore, my attempts to close *matters of concern* in relation to the narrative of such a fabrication are translated into a series of constellation-shape figures that will be depicted throughout this chapter. I will call these figures resting spots for travelers.

The narrative will describe the circulations of sales and factory forecasts one by one, each of which comprises a series of episodes, followed by another series of episodes taking place in the space where there is competition between the two calculations. Competition between sales and factory forecasts will be narrated in the next chapter.

Delineating a sales forecast

This section provides a narrative of the context of delineating the agenda of an S&OP sales forecast before calculations take place.

Episode 1: Creating a companywide process

This episode describes a historical context of why the company needed a company-wide process, and how this matter of concern on the S&OP process was closed.

The initiation of the S&OP can be traced back to around 2007, when consultants of SWEDTECH generated a voice, as was commented by the manager of the S&OP.

> We had a consulting company looking at the demand chain processes, and they have found out is that we have no company-wide S&OP process. We had different solutions, pieces here, pieces there.

These different solutions located in diverse temporal and spatial areas refer to the inconsistency in information structure, software, processing and methodologies. They are effects of the organisational structure of the case company. In SWEDTECH, there are automotive (AD), industrial (ID) and service (SD) divisions, each of which has both a sales and a manufacturing organisation. The consultants found that sales and operational planning had been working "pretty well" when sales and manufacturing were in the hand of the same organisational unit, that is, the same division. However, problems occurred when sales and productions were cross-divisional, which formed the starting point for the S&OP process. The S&OP manager and one of the former process analysts of the group demand chain explained further the detailed story, respectively.

> If you have a product that is produced in a car and sell it to industrial division, that it's not that good communication flow. And this is the starting point of the S&OP project...because in SWEDTECH we produce, for example, a bearing which is mainly for car customers, but there is always a certain part which goes to either service division or industrial division, so it's very seldom that one product only goes to one segment. So factories produce for different customers, SWEDTECH customer segments. That's why it's so important to get the whole demand right for all our customers.

> And when it comes to sharing, the divisions are a little bit obstacle, you can say. If the factory and the sales belong to the same division, then it's generally working better. But for example, automotive division factory does not have good communication with ID (industrial division) sales. So between the divisions, there has been less good sharing on information. Now it will be across all divisions and across the whole supply chain.

The above quotes indicate that managers at SWEDTECH interpreted consultants' findings in terms of a matter of concern on the demand chain management, with regard to a lack of communication between divisions and departments. The ontology of the S&OP included a matter of concern on cross functional communication. Fabricating an S&OP process involves closing this matter of concern into a particular property of the sales forecast, which in this episode is a company-wide process.

Also, according to the manager of the supply capacity planning (SCP) of S&OP, when there are a huge volumes of products for certain car and truck manufacturing companies,

demand will be easy to predict and to follow up, for there is always communication between sales and manufacturing for these automotive products; but when it comes to a wide range of products for small industrial customers, after market, forecasting becomes a problem. This manager in SCP said,

> While there is a wide range of products for small industry customers, after market, there has never been a detailed forecasting…also after market, it is not easy to forecast, also in the S&OP it is not detailed in the final variant.

He mentioned the uncertainty in forecasting when a customer orders multiple products from SWEDTECH. This pointed to the product coverage that the SWEDTECH had been offering to its customers for decades. To translate the matter of concern of lacking cross functional communication, product groups played a role; which will be described later as the platform concept.

The aforementioned "different solutions, pieces here, pieces" by the S&OP manager was also reflected by the manager of SCP in terms of information structure and consistency.

> All this information has been flowing to the factories, but never in a unique organized structure. Factories are of course planning their production and capacity again with not the same methodology. And the supplier side, of course all factories are communicating their supplying needs, also there has never been a consolidation of these requirements, each factory has been going to the suppliers, our purchasing organisation didn't have a detailed organized updating of the information of the demand of different components, materials and so on. When they have a special question of the demand, they will ask the factories getting information, but there wasn't anything structured already in place.

This means, that disparate organisations had different information structures and different degrees of updates for their information. Information was also processed differently. All this made it difficult for management to consolidate. This constructed another matter of concern that is to be incorporated into the boundary of the S&OP process, namely a lack of structured and consistent methodology and information across the demand chain.

This revealed that delineating an agenda of an S&OP process unfolds two matters of concern around the S&OP; how to have better cross functional communication and more consistent information and methodology on the demand chain. The S&OP sales forecast, even before its calculation, was already many things (Quattrone an Hopper, 2006). Indeed, intra-organisational communication and coordination between divisions was considered an obligatory passage point to foster the company's strategy of being a knowledge-based organisation; with one of the initiatives to sell solutions, rather than products to customers. SWEDTECH operationalises solution selling through the platform concept, which was highlighted by the manager in charge of the product line planning stream of the S&OP.

> Platform concept… SWEDTECH's company vision is to equip the world with SWEDTECH knowledge, not to sell bearings. With SWEDTECH knowledge, that is the important message. There are five different platforms. We have the bearings units, which is the largest one. There are also seals, lubrication system, mechatronics and services…The main purpose is to combine as many of these platforms as possible. The more we can combine these solutions, or platforms, the better it is for us and for the customers; and it also gives more value to us and customers.

The above quotes raised indicated that the diversity in product offerings was in recent years translated into a platform concept, with a purpose to foster one of the company's visions, namely to be knowledge based. The platform concept was used to offer combined products as a package of solutions to customers. This would require cooperation, especially information integration between divisions. The platform concept was not intentionally developed to foster the closure of the aforementioned two matters of concern into an S&OP agenda. It existed before the S&OP, but made such closures more convincing. The platform concept was never connected to consultants and the S&OP network before. There interests were now allied. The manager of the S&OP also indicated:

> In SWEDTECH we produce, for example, a bearing which is mainly for car customers, but there is always a certain part which goes to either service division or industrial division, so it's very seldom that one product only goes to one segment. So factories produce for different customers,

SWEDTECH customer segments. That's why it's so important to get the whole demand right for all our customers.

This means that the company was short of a technology that was capable of domesticating uncertainty in future customer demands, attributed from a platform concept that combined multiple product groups. Cross divisional cooperation and consistent information and methodology were OPP to address this uncertainty. It is, therefore, under these relations between actors, a delineation of a "company-wide" process was constructed. It was a network effect that is shown in Figure 3 below.

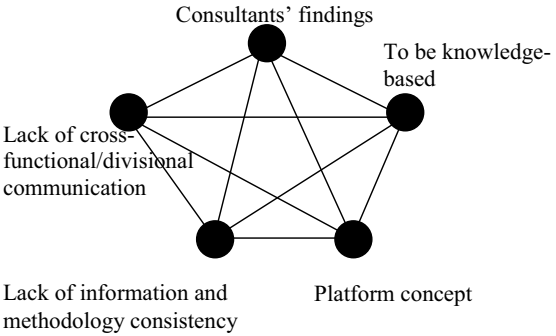


Figure 3: Delineation of a "company-wide" process

This figure indicates that consultants' findings constructed two problems that became part of the ontology of the S&OP process: a lack of cross functional and divisional cooperation and communication and a lack of information and methodology consistency. Addressing these problems was considered important to convince participants to accept the S&OP process, because they were connected to a visionary boundary object of being a knowledge based company resulting from the platform concept introduced years before the S&OP process. To be knowledge based is a visionary boundary object, because it has a common boundary that can be used differently in local contexts, and is difficult to be argued against.

In this episode, actors were problematising what the proposed technology in DCM would be. Actors participating in this episode were consultants, the group demand chain, the two matters of concern constructed, a visionary boundary object of being a knowledge-based

company and the platform concept. Although calculative practices did not commence, circulating references of fabricating the S&OP process had already started. The attempt to close a matter of concern on the S&OP process, the type of the proposed technology, created two organisational problems, namely cross divisional cooperation and information and methodology consistency were translated into a form of a "company-wide" managerial processes. The fabrication of the S&OP process in this episode ended up with a proposed technology that would integrate management processes across the demand chain, where communication and information processing were to be standardised (See Figure 4 below for the birth of the S&OP process). Figure 4 shows the outcome of the fabrication of an S&OP process in this episode. The proposed technology aimed at transforming existing management processes, where corridor thinking dominated, and each function had its own information system (IS) (see the left hand side of the figure); a new process where there would be cross functional communication and all the functions would use a standardised information system. This is the minimal configuration of the S&OP process.

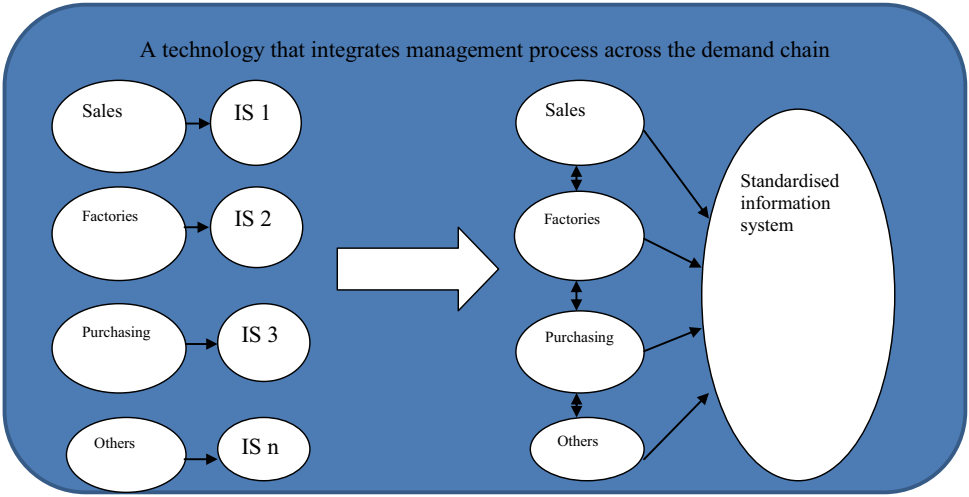


Figure 4: Outcome of the fabrication of the S&OP process in Episode 1

In terms of demand chain management (DCM), uncertainty in future customer demand was firstly translated into uncertainties in intra-organisational cooperation and information and methodology consistency. An inter-organisational problem was

translated into two intra-organisational problems. A managerial technology to domesticate future uncertainty in customer demand was connected to historical actors, such as a visionary boundary object and the platform concept. Intra-/inter-organisational time and space were, thus, re-shaped.

Uncertainty in future customer demand was also translated into a movement towards integration. Striving for integration on management processes was not the outcome of either external or internal forces, but networking that existed of organizational problems and visionary boundary objects.

To speak for customers, sales were not enrolled to delineate the S&OP agenda, although their forecasts were proposed to be the OPP in the process. The group demand chain was, thus, initially speaking for customers by calling upon existing organisational problems and visionary boundary objects. In DCM, voices for customers may not necessarily be those close to customers. Instead, their voices are capable of creating a space for customers if they ally attempts to solve existing problems and visionary boundary objects that are difficult to be argued against.

Episode 2: Creating a boundary for the S&OP sales forecast – a companywide "unconstrained sales forecast for the next 36 months"

This episode describes a historical context of how a boundary of *unconstrained sales forecasts* for the *next 36 months* is constructed for the S&OP process. The dilemma is to construct the calculation and time horizon in the S&OP process.

The consultants' findings in 2007 were put aside during the financial crisis, and it was not until late 2009 that the delineation of an S&OP forecast continued. As the story unfolded, it did not take long for the group demand chain to raise the agenda to install "a company-wide" process that may help facilitate better communication. But why a company-wide S&OP, in other words, why a company-wide "sales forecast"? The S&OP manager answered,

> We want to balance supply and demand, and we have seen that market demand is changing very fast, so we need to be very agile to follow this. We will not be able to shape the demand, so we need to make sure that we follow (demand) with our supply.

According to the S&OP manager, in later 2009, the implementation of a company-wide "sales forecast" was enacted because of a connection between an inability to follow the market demand, insufficient cross-divisional communication and disjointed information methodologies constructed in episode 1. In episode 1, uncertainty in future market demand was translated into intra-organisational problems of cross divisional cooperation and information, and methodology inconsistency. Now this uncertainty was translated into an inter-organisational problem of balancing demand and supply. However, the amplification effect of "a company wide sales forecast" to generate a consensus across all functions on the demand chain, was nothing more than a management ideal to be agile in following market demand; but it was the connection of such an ideal, a visionary boundary object, with consultants' findings and the platform concept that gives the S&OP a more convincing voice in the company. This matter was even concretised and visualised by the form of availability failure, which refers to the failure to acknowledge a customer order due to inventory shortage. The S&OP manager illustrated this by saying,

> Yes, so we believe we lost business through not being able to predict early enough on increasing demand…To be more flexible, I think this is the overall. To be successful, we need to increase our availability, availability in our terms, the possibility to acknowledge all our customer requests.

This means availability failure had caused the loss of some of the potential businesses to the company. The problem of availability had been attracting attention at SWEDTECH prior to the arrival of the consultants. It was centred on management agenda during the financial crisis because sales orders dropped dramatically, but when the crisis started to invade in 2010, it became centred again. S&OP stemmed from a need to balance demand and supply, which in turn was translated into a problem of availability. In fact, in SWEDTECH, availability was the most frequent word mentioned during the interviews by a number of interviewees, especially those from the factories and the purchasing department. These comments all pointed to serious availability problems.

> We have poor figures on more or less all channels…this is the actual situation when it comes to deliveries right now, so that is not good picture now…I just give you a hint on our availability. Here you see the H channels that we have, you see who is the planner, here we have the availability on the stock items, 81% for the H2, 9, 35, 51, 53 and so on.– by the purchasing manager of medium bearings.

An availability failure of 19% as indicated above was considered high at SWEDTECH, but some channels were even worse.

> In 2008 we had a delivery time of 2 years in Channel 77, and one year ago, we had a…one month, delivery time. The trend is that we are getting longer and longer delivery time. If you look at C2, availability 9%...we have a factory in India now which has availability failure of 50%, I mean it's just ridiculous, I mean it doesn't matter because the sales guy, they don't talk any more to customers…I mean you should have already taken the decisions to either build a new factory or get support production, or get rid of customers before. Now you are absolutely in crazy situation.– by the process analyst of the group demand chain

> We have different channels here for example 21,22, 23, 29, C3. If we look at 2008 in October, we had delivery times in months. If a customer places an order, then they will get in Channel 29 36 months late when they get the bearings, so it's three years. This was due to shortage. – by the manager of the demand chain for large bearings

These quotes indicated the performativity of accounting inscriptions that visualise availability failures and delivery time. The amplification of the form of availability lies in its enrolment of customers in the S&OP. Customers had to wait for longer delivery time due to capacity constraints of either factories or suppliers. When the economy was in its upturn in 2009, SWEDTECH failed to translate the upturning market business volume into increased returns because of the imbalance of demand and supply.

> It came from the last upturn. We had very big sales issues. We couldn't sell…because of constraints in our factory and suppliers as much as the customer wants to have…That is the main reason why they start this process to have enough or to get the right capacity to supply the market needs. It's also the opposite in the downturn…The main driver was that we to have the right capacity. It came from

> last upturn when they have what they called availability problems. – by the manager of the product line planning stream of S&OP

This quote indicated that the form the availability pointed to a matter that the company had lost some of their business volume because of capacity constraints. Re-capturing the lost market demand, in turn, generated a form of the S&OP agenda to create a company-wide "unconstrained" sales forecast. This form of the S&OP agenda was created in early 2010, but the group demand chain decided to implement the process later in the year. The amplifying aspect of this form lied in the displacement of time, so that the whole future market demand was calculated to identify any potential capacity shortages at the present. The uncertainty of an imbalance between demand and supply was translated into capacity management that would enact actions of making up for such shortages by, for example, increasing shifts, investments in machines and additions of factories.

> We want to compare our capacity to our sales forecast three years from now so that we can increase our capacity. – The manager of the product line planning for medium bearings.

This manager provided one example of the purpose of the sales forecast, to identify a gap between current capacity and future demand and to initiate actions accordingly. The content of the S&OP forecast, an "unconstrained" market forecast, was thus, proposed in order to recapture the lost business due to capacity shortage. The manager of the S&OP explained,

> What we want is the people making the forecast give the best picture of future demand. What are they really believing today and not what was in the last business plan and in the last financial forecast. I mean this is all gone. What we believe today what will happen tomorrow…Here we talk about a customer, he has a new order, very big, do we want to take that and what do we need to take that order. Do we need to invest in the channel, do we need to invest in the machine, do we need to build up a shift, those kind of discussions are what we have in S&OP…I think everything is driven by the forecast. This is totally demand drive. This is also we need to follow the market in the best possible way…the different demands we are having, to get the whole, the complete picture of, to make it much clearer that what are demands.

As is illustrated in the above quote, the manager of the S&OP highlighted the possibility of losing big customers because of constrained capacity, hence, the S&OP forecast needs to be able to predict the pure market demand so that capacity can be gradually developed to handle this calculated future market demand. The process analyst of the group demand chain added in an unfaltering tone,

> Yes, pure customer demand, because this...I mean…the purpose of this is that we should be prepared and able to make decisions and actions before everything is a big mess. We have, 50% availability failure, for example, because we are not able to increase the production according to the speed that the market wants.

This proposal was also confirmed by the manager of the product line planning stream of S&OP, albeit, their calculation needs the sales forecast as an input.

> We will look at full customer demand for as long as possible.

The amplification of such an unconstrained forecast lies in the creation of a space of scenario building so that the consequence of the deviation between the planned and the actual production volume can be visualised. The future becomes visible in the supply capacity planning calculation and its origination can be traced to an unconstrained company-wide sales forecast. Because consequences can be made present, actions can be proactively taken, according to the manager in charge of the SCP stream of the S&OP process,

> Forecast is of course prediction, but at least we know what the consequent is. Of course there will be deviations because we have built a scenario, on our sales, on our production, on our suppliers, they can be consistent based on the same assumption, then we can know the consequences of the deviations. If we say it will grow 5%, if instead it doesn't grow, or it goes down, it's OK, we have taken certain assumptions, we have foreseen certain procurement plans, that assumption is not valid, what is changing then, what is going to change. Our suppliers have to know there is a fall in 2011, OK, that's our best assumption today, in a few months time, it will be higher or lower, at least we can start with a discussion of a scenario on base of which decisions are to be made. 36 months were written in somewhere I entered this project, they have been visiting the suppliers and presenting the processes, OK, now we say one year.

The above quote indicated an interesting translation. The unconstrained forecast transforms the S&OP from a representational technology, which is a numerical outcome of estimating future demand, to an interventional one, which becomes a numerical antecedent to capacity management. This form, however, constructed another matter of concerns which were to be closed in the time frame of the forecast. Discussions focused on how many years the rolling forecast should cover.

> I think also it's good timing for SWEDTECH to do this now because we…it's only 2 or 3 years ago we had the worst and best upturn ever, I mean…when you wait for large size bearings for 1.5 years, you place your order today, you get it in 1.5 years, which is absolutely crazy. And I never experienced that before. And then I think S&OP will be of great help. – by the process analyst of the Group Demand Chain

> Because even it is decided today, or even we get a high volume order from a Chinese customer today, if Dalian will not be able to produce that due to technical reasons, it will take 1.5 years before they will have all the machines and so on. – by the manager of the demand chain for large bearings

Accounting inscriptions showed that the poor availability and long delivery time had proliferated throughout the whole demand chain. To avoid the problem of a 1.5-year-delivery time, there needs to be a satisfying level of finished stock, which in turn requires sufficient capacity of at least 1.5 years before customer orders come in. This delineated the original figuration of the S&OP, to have a company-wide sales forecast for the next 36 months in order to foster tactical and strategic time horizon capacity planning. The 36 months, however, was just an ad hoc decision. The intention was to cover both tactical and strategic horizons of capacity improvement.

> I think that must be the purpose, using it in a strategic way, and also put sources to where sources should be. So for this material family, SRB, we have production in China, Luten, USA, so it's also where are the needs. The strategy is to produce as close to the customer, so in the long term, to use this tool, it must be very good. – by the purchasing manager for medium bearings

The long term was defined as 36 months in the S&OP process. The amplification of this form of a strategic focused S&OP forecast lies in the mediation of forecasts on the operational processes. The plan, which follows the unconstrained company-wide sales

forecast, shapes the operational level activities and decision making, so that the company can become *proactive, agile and faster,* according to the S&OP manager.

> Obviously the better we do in S&OP, the less problem we should have in the operational time frame. If we could really say this is the volume we need to produce in 6 months, then manufacturing could obviously prepare exactly based on that plan, can make sure they have the material, so they shouldn't have a real disturbance at that point of time. So a good S&OP will improve operational time frame as well.

Actors in this episode problematised the boundary of the S&OP process i.e. what calculation of the time horizon was needed to be included in the S&OP process. Actors participating in this episode included the group demand chain and consultants who attempted to close matters of concern around the S&OP process in relation to cross divisional cooperation, as well as information and methodology consistency, the platform concept and a visionary boundary object of being a knowledge-based company. In an attempt to close a new matter of concern in relation to an imbalance between demand and supply, accounting inscriptions showed availability and delivery time, as well as a new visionary boundary object of being proactive and agile to demand. These actors are shown below in Figure 5.

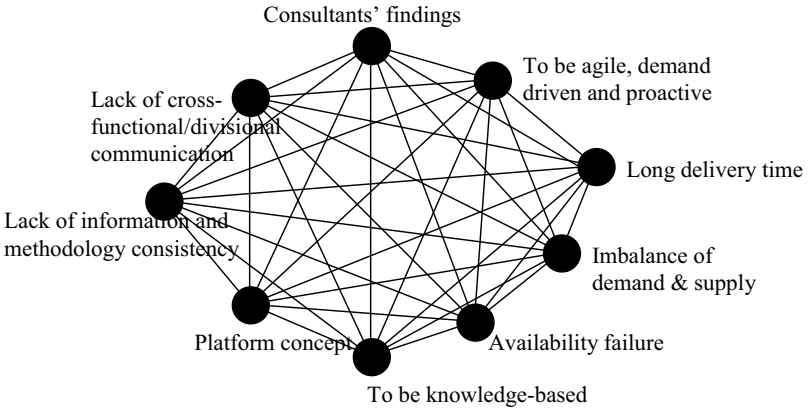


Figure 5: Delineation of a company-wide unconstrained S&OP forecast for the next 36 months

According to Figure 5, the S&OP is now even more things, because it incorporates a new matter of concern to the balance of demand and supply. This matter of concern was connected with existing actors in episode 1, because the group demand chain had to figure out how to have a company-wide managerial technology. Intra-organisational problems on communication and information processing had to be related to revenue generation. An imbalance between demand and supply was visualised by an inscription showing availability failure. This made the group demand chain realise that significant business volume was lost because of capacity shortage. To re-capture this lost business, "an unconstrained sales forecast" was to be calculated to translate future market demand into current production plans. Another inscription showing delivery time made up the final property in the S&OP agenda, a forecast to cover the next 36 months. Although the S&OP was intended to be a strategy oriented technology, it also had implications for operational activities. A gap between expected capacity and actual capacity would enact operational activities such as adding shifts and manpower and providing supports between factories, as well as strategic activities such as adding a new factory somewhere else in the world. This would in turn help the company to be agile, demand-driven and proactive, because current activities preceded future risks. A strategy was, thus, born in response to an organisational problem (Hansen and Mouritsen, 2005). Its performativity was not trivial, for it re-presented the strategy in the supply chain. A *push* strategy focusing on efficient flow of material (efficient physical supply of goods) would be transformed into a *pull* strategy adapting capacity to market demand (market mediation). The transformation was proposed when the S&OP forecast was still in its delineation phase. The proposed strategy and the proposed managerial technology were mutually constructing each other even in their physical absences. The episode concluded with a matter of fact, the S&OP forecast was proposed to be an unconstrained forecast covering the next 36 months, and the S&OP process was to be a companywide process. The S&OP process became a matter of fact, but only at the completion of its delineation phase. The process will be transformed into a set of new matters of concern when it is implemented. These will be introduced in later episodes. The outcome of the fabrication of the S&OP process so far – the minimal configuration - is displayed below in Figure 6, based on Figure 4 from the last episode. It shows that the S&OP process was proposed to foster

capacity planning to reduce the magnitude of availability. The process is to be guided by an S&OP sales forecast prepared by sales to estimate the pure market demand for the next 36 months. This forecast will then to be used in product line planning (PLP) and supplier capacity planning (SCP), to reflect a *pulling* process. The minimal configuration of the S&OP process has evolved.

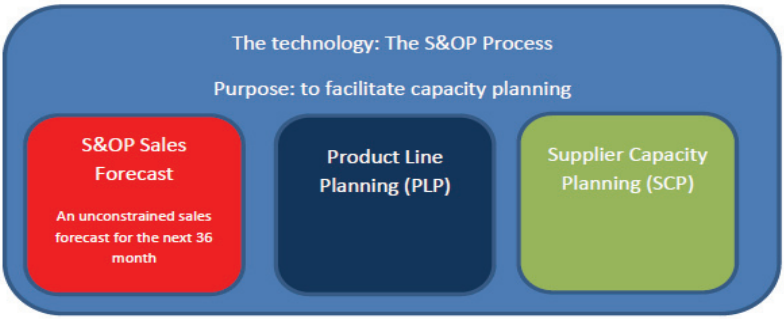


Figure 6: Outcome of the fabrication of the S&OP process in Episode 2

In terms of demand chain management, uncertainty in intra-organisational problems of cross divisional cooperation, information and methodology consistency was translated into uncertainty in inter-organisational problems of balancing demand with supply. When the S&OP sales forecast was calculated, it translated the possibility of losing some customer volume into a set of operational, tactical and strategic plans to increase capacity; meaning uncertainty for future customers would be translated into certainty in current productions. Time and space are, thus, shifting in a continuous flux.

Uncertainty in future customer demand was also translated into certainty in integration. This uncertainty was in the object integration, namely capacity planning.

The group demand chain was still the voice speaking for customers. This voice was made more convincing, even in the absence of customers, by sales; who deal directly with customers. This was made possible by calling upon not only attempts to solve existing organisational problems and visionary boundary objects that were difficult to be against, but also inscriptions representing these problems. Certain visionary boundary objects

such as being agile, proactive and flexible were also allied, even though they had been introduced in other times and spaces. They could easily be borrowed to speak for customers because they were difficult to be objected.

So far, the chain has been going continuously without any risk of being broken. The calculation, however, is yet to start. Circulating references of the S&OP process are still in the blueprint stage. The purpose is to translate the company-wide sales forecast to product line planning and supply capacity planning. Moreover, the S&OP is intended to transform the current spatial organisation of SWEDTECH, which was illustrated by the manager of the demand chain for large bearings:

> And the concept here is local demand, local supply. So if there is in the Asian region, a demand, and the volume is large enough, it should be produced here. If it's small volumes, it should be produced here. So we make all kinds of bearings, full assortment, and they make specific assortment. So there are some overlaps. But it's the local demand, local supply.

What this manager meant was that global plans for capacity for the whole organisation need to balance local demand and supply to reduce the delivery time. A company-wide sales forecast should in principle, smoothly handle the capacity management in local supply chains. The next subsection will illustrate the circulating references and matters of concern around *calculating* the sales forecast.

Calculating a sales forecast

This section will describe the process of circulating references once the calculative practices have started. The blueprint/delineation of the S&OP forecast has been constructed, but where does the calculation start? There are many matters of concern on the S&OP sales forecast to be closed in order to fabricate a consensus forecast. The approach I took was to take snapshots of these translations in the same way as Mouritsen et al. (2009); but unlike Mouritsen et al. (2009), the circulation of the S&OP forecast was so long that it became impossible to visualise the translations in a consistent way. In general, the visualisation is presented in the following manners.

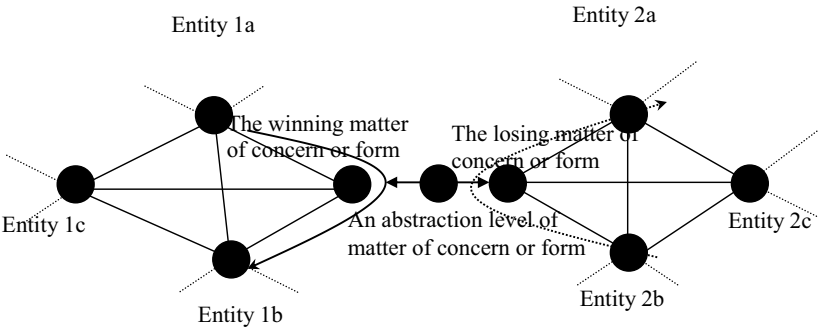


Figure 7: The template of translating competing matters of concern or forms in this thesis

Figure 7 shows a template that will be used throughout this thesis when there are competing matters of concerns around the S&OP process or forms. The central node refers to an abstraction of matter of concern around the technology or form (eg. a primary key, that is, the starting level of forecasting). This node, in most cases, is translated into competing residential matters or forms (eg. a primary key of customer items level and a primary key of product lines), each of which allies other entities, thus, generating different networks. There are in most cases four nodes in each network as is in this template, but sometimes there are only three nodes. The solid (dashed) curvy arrow points to the winning (losing) network, and thus, the corresponding node originated from the central node becomes the winning (losing) matter of concern or form. Sometimes when there is no competition, the central node will be translated into different time and space. In this case, both curvy arrows will be solid.

Figure 8 is a template that is to be used when there is no competition. The central node is translated into specific matters of concern around the S&OP process or forms that bring about separate time and space. Also, sometimes there will only be three nodes in each

network. In this case, both arrows will be solid because both networks exist, but in different time and space.

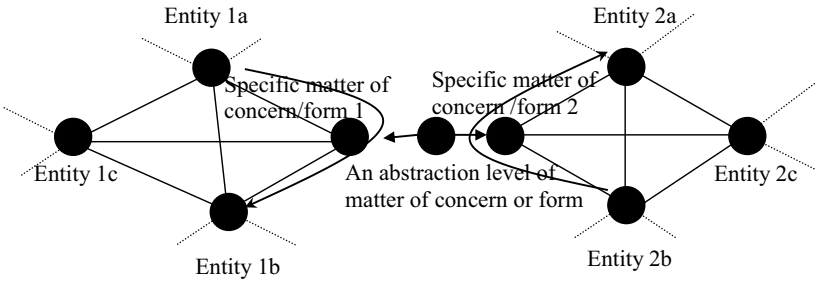


Figure 8: The template of translating matters of concern or forms into separate time and space in this thesis

Figure 9 is a template that will be used when there are no competing matters/forms and no multiple existing time and space, but when there is a construction of a network comprising associations between a number of entities. There may be four nodes representing four entities. There may also be five, six or even more entities. In Figure 9, there are 5 entities.

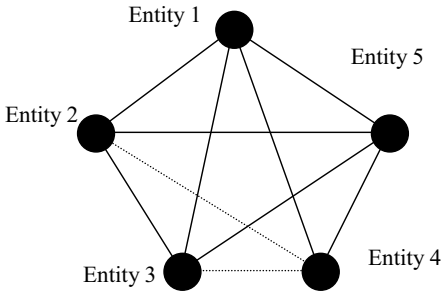


Figure 9: The template of constructing a network comprising five entities

It should be noted that there is no consistent structure regarding the position of the entities in Figures 7, 8 and 9. For instance, if the network is visualised in the form of Figure 7, it doesn't mean that entities drawn on the top (left, right or bottom) are of some similar properties. All entities are simply actors that construct the network, whether they are material or semiotic.

Episode 3A: Closing a matter of concern on the primary key of the forecast: a dilemma between forecasting accuracy and the possibility of management

When calculative practices started, the S&OP sales forecast was made even more multiple by emergent, ongoing and multiple matters of concern around itself. For the S&OP sales forecast to come to a matter of fact, attempts to close these matters of concern on it were to be followed. The calculative practices, however, did not provide a space where normative frameworks on DCM could be applied in a linear manner. The S&OP process could be described as a flux, that uncertainty often emerged to extend the chain of circulating references via enrolling new entities into the network; thus, creating a long translation (Mouritsen et al., 2009) because sometimes a matter of concern bifurcated into competing networks comprising of competing calculations and groups of actors. This episode describes a movement of closing a matter of concern on the primary key of calculating the forecast, and how this matter of concern became part of the ontology of the S&OP sales forecast. The dilemma that actors were facing in this episode was the choice between accuracy of forecasting and possibility of management.

The object on which the sales forecast is based forms the starting point of the calculation, for SWEDTECH produces a variety of end products to a wide range of customers. This is reflected in the division of the AD, ID and SD. The manager of the S&OP described the embedded nature of the sales forecast in a variety of business types.

> The sales forecast is depending on what business we are talking. We are following the sales organisation on the forecasting side…And this is the level we do the forecasting. And for each those units, we have defined what we call the primary key, so the level we are doing forecasting. In AD, we do it on the lowest possible level, which is item customer, whilst in ID and SD, we do it on

> product line. The lower you go in the primary key, the more details you can put in, but obviously the more records you get. Therefore it's very much depending on which business you are in. If you are on the typical automotive business, then you need to enter data on that low level because you talk about a limited number of links, item customer, but every individual link, you sell a lot of items, volume of each, record is very big. If you look at service division, business is completely opposite. We sell to one dealer a huge amount of records, and we sell to a huge amount of dealers, so if we look on a typical service division business, you will not be able to forecast on item customer level.

The above quote says that in an attempt to close a matter of concern, the detailed level that the forecast should start with is mediated by business characteristics that are shaped by the divisional structure of SWEDTECH. In AD, the S&OP forecast is done to the item/customer level or the final variant level; for instance, a certain type of bearing sold to Volkswagen (VW), for SWEDTECH normally sells a large volume of bearings to a limited number of customers in this division. The S&OP manager illustrated an example,

> The item, is sold from the factory 5551T to a customer with a customer number Brazil, 2110. Here this is the customer called Tintin Lapa (a pseudonym), it belongs to the customer group called Las Coco, so we have customer grouping.

The ID/SD, on the other hand, serves a huge number of customers each with a tiny proportion of the business volume. Therefore, the sales forecast is done on a higher aggregated product line level, for instance SRBs. Business volume consumed by the number of customers gives rise to a trade-off, as was mentioned by the same manager.

> Exactly, so due to the business we are in, we have different ways of forecasting. Regarding primary key, basically this defines the units of the record, it defines the detail of information you have. The problem is if you have a too detailed structure below, you have a huge number of records, which you cannot handle. If you are too high in your aggregation, then you lose details.

Despite the trade-off between forecasting details and practicality, as is mentioned in the quote abovementioned, one of the forecasting managers in SD, for instance, agreed with the form of the primary key for SD.

> We do forecasts at an aggregate level, not on final variant. Basically, the lowest level we do in the sales forecast on the pure front end is what we call product lines or a sub-group of product lines. A product line could be a TRB (tapered roller bearings), and a sub-group level could be medium size TRB.

For ID/SD, the primary key i.e. the detailed level of forecasting, however, constructed another matter of concern regarding forecasting accuracy, leading to the first time in the fabrication of an S&OP forecast when the chain of circulating references met the possibility of being broken. The primary key for the AD does not attract the matter of concern on forecasting accuracy, due to its association with its customers through the mediation of the order book. AD's primary key of reference for the forecasts is down to detailed customer items on final variant levels because they have a good quality order book. According to another process analyst in the group demand chain:

> For the automotive business, I guess they are really focusing on the order book. They have a good quality order book, reliable, and customers give SWEDTECH the forecast of 12 months in general, so for the automotive business, the order book is pretty much fixed for the 6 months, of course it's getting a little bit weak, but information is in that respect quite reliable.

The quality and length of the order book mediates the choice of the primary key. Also, the quality of the order book, according to the process analyst, is translated by the sound supply chain management of SWEDTECH's customers in AD.

> They are pretty much scheduled and they have very good supply chain management, in the AD, let's say all the OEM manufacturers like Audi and Volkswagen (VW), they are pretty sharp in JIT deliveries. They also negotiate very hard with suppliers and also with SWEDTECH, so I think SWEDTECH, they don't have a chance to change what the automotive end producers are dictating so to say.

The fabrication of the primary key in AD can be depicted in Figure 10 below.

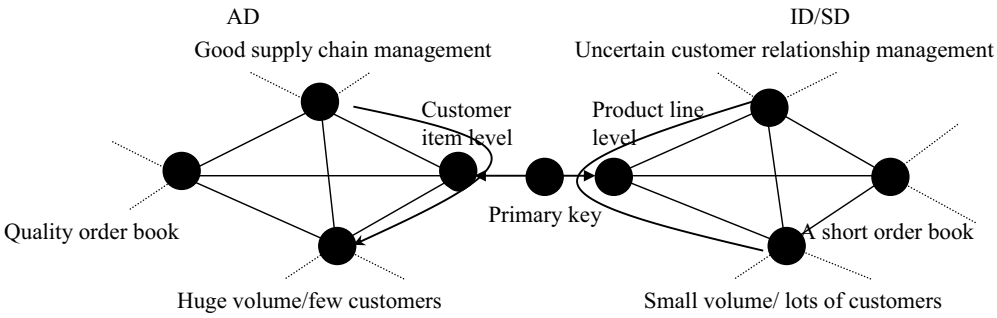


Figure 10: Translation into a primary key for AD and ID/SD

It shows that even a short translation that attempts to close a matter of concern on the primary keys of the S&OP sales bifurcates into two actor-networks. The association between AD's business characteristics and sound supply chain management of its customers constructs a good quality order book, which in turn constructs a very detailed level primary key on the customer item level. On the other hand, an attempt to close a matter of concern, with regard to the primary key of ID and SD generated a huge debate when the S&OP process was initiated in the summer of 2010. Even now, such an attempt to close this matter of concern still unfolds another uncertainty regarding the combination of inscriptions; when the sales forecast meets the factory counterpart, as is illustrated by one of the forecasting managers in the SD.

> For SRBs, we forecast…I ask this sales unit to forecast on the level of product lines, so that means they do not know which size of SRB, what kind of clearance, what kind of grease, what kind of seal etc. They just need to tell us what volume of SRB will be…and then actually as part of the sales forecast, we will translate that into an itemalised forecast, which is a purely technical exercise. So we aggregate system forecast on final variants, we generate the system forecast on the aggregate level, and then we prorate volume down to final variants.

According to him, any intelligence in relation to forecasting is placed on the product line level, but because the final figure of the S&OP forecast is the forecast for the final variant, translating from a product line number into a group of final variant numbers is a pure computerised process. When asked specifically why SD is doing forecasts on the product level, he agreed that this translation is not a compromise, but a necessity.

> This problem now is … in the unit which I was forecasting includes 33 sales units, we have roughly 30 product lines. The combination if you have all those together to follow up on detailed levels makes it mission impossible…So this is a product line, it's going to our bearing platform, it's for Turkey. Here you have a dimensions which is the same, but for a specific customer, it contains 500 to 700 records, that's the lowest level, to be accurate on that level is not easy. To take into account this after market business, we do not have a very long order book, so it's not like OEM business, we might have a schedule for the next 12 months, you have nothing, you might have an order book for the next 3 weeks.

A short order book in this setting was not sufficient to forecast on the final variant level for the medium- to long-term horizon. Also, in contrast with AD where its customers

have sound supply chain management, ID and SD customers were summarised in terms of long lead time and investment centres. According to one of the business process analysts of S&OP:

> In the ID, for example, lead time is much longer; we sometimes have 6 months lead time for a bearing. This is a problem. This ID is more of an investment centre, you know that the customer is ordering a machine, or a huge machine for the consumer industry, which is a pretty big and complex project for SWEDTECH. For a big business that is ordering 6 machines with several bearings, is much more like an investment in the machine. But compared to AD, it is little bit more like… for example, a newspaper press manufacturer is going to invest in the future, this is more like customer relationships SWEDTECH has with their customers. So it has much more soft effects, which are important, and also little bit more on the experiences of sales persons.

This means that future business volume for ID/SD, in this setting, is constructed by customer relationship management between SWEDTECH's sales people and customers, which is uncertain; so the association between the business characteristics in ID/SD, i.e. small business volumes sold to huge numbers of customers, and uncertain customer relationships, produce a short order book that cannot be relied upon for forecasting. This translates the primary key into one that refers to the higher product line level (see Figure 10 above).

In this episode, an attempt to close a matter of concern on the primary key of the sales forecast was successful in AD, and temporarily successful in ID and SD. An attempt to close a matter of concern on the primary key of the sales forecast was separated into two spaces namely AD and ID/SD. An S&OP sales forecast, thus, digested this matter of concern and closed the dilemma on the choice between forecasting accuracy and the possibility of management. Actors participating in this episode included the group demand chain, the order books, SWEDTECH's customer relationship management, customers' supply chain management, business volume of different divisions and the type of customer groups to which SWEDTECH's products were offered. Continuing with Figure 6, Figure 11 below shows the outcome of the fabrication of the S&OP process in this chapter. On the ontology of the S&OP sales forecast, the primary key for AD lies on

the customer-item level, whilst the primary key for ID/SD lies on the higher product line level.

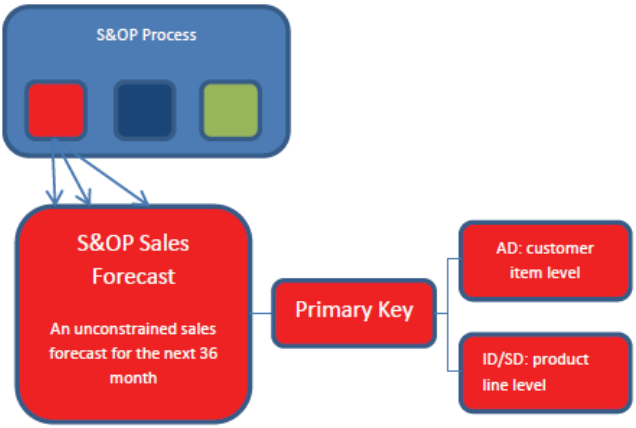


Figure 11: Outcome of the fabrication of the S&OP process in Episode 3A

In terms of DCM, uncertainty in future market demand was translated into certainty at the level of aggregation on which forecasting is calculated. An inter-organisational problem of projecting future market demand was translated into an intra-organisational problem of constructing a starting level of forecasts. The dichotomy between intra- and inter-organisational spaces was blurred because an internal decision on the primary key was relational to order books, customers and even customers' supply chain management. The translation of a matter of concern on primary keys for forecasting into a matter of fact was short, but this matter of concern in ID/SD later re-emerged when factories and sales were debating on the forecasting accuracy.

Uncertainty in future customer demand was also translated into uncertainty in integration. An attempt to integrate by setting primary keys for different divisions was delegated into separate spaces, which in this case were different divisions. Separation fostered integration.

Sales are the voices speaking for customers in this episode. However, their ability to speak for the customer depends upon the order books, customers' supply chain

management and customer segmentation. In this episode, to speak for customers is a matter of whether information on customers produces a primary key that can be used on a detailed level for forecasting, or a compromised higher aggregate level. Demand information decides whether sales' voice for customers is strong.

Episode 3B: Closing a matter of concern on the primary key of the forecast: a dilemma between an internal or an external calculation

In episode 3A, it was stated that a matter of concern for the primary key on forecasting in ID/SD, was only temporarily closed into a matter of fact. This matter of fact was re-opened in this episode when some of the human actors challenged the accuracy of the forecast for ID/SD that was derived from using the decided primary key. This in turn led to a re-opening of the matter of concern on the primary of the S&OP sales forecast that had been long settled in the last episode as a matter of fact. This time the dilemma was to choose between internal calculations within the S&OP team using the primary keys set in Episode 3A, or the external calculations of a central business unit outside the S&OP team using a macro-economic trend such as the primary key. This matter of concern on the primary key was referred to as the forecasting logic in this episode.

Primary keys for AD, ID and SD, though enabling the calculative practices of the S&OP forecast, enrolled a wider matter of concern in relation to a debate on forecasting logic, between a top down and a bottom up forecasting. The forecasts discussed so far in this section that referred to the primary keys of the three divisions, that is, either a detailed final variant level or an aggregated product line level, were considered to be bottom up forecasts since they started with more or less detailed levels of forecasts referring to customers, rather than centralised forecasts from the upper management. A business manager in the sales organisation in the bearing unit at ID, however, once expressed her concerns:

> The negative thing about detail bottom up forecast is of course that when you make a forecast, then...our strength in sales is that we can ask the customers about their plans, and we can get more details and more details, but of course each customer is a little bit inaccurate…They can only ask the customers saying what you think. And normally SWEDTECH has a better understanding of what trend and future will be than some of the customers that we asked, so what is needed is to apply a certain

> top-down logic to say, OK, where is the general trend, can we anticipate things because customers don't know yet. So it needs....you cannot only work one the detailed bottom up forecast because the truth is not there to be caught…

She added,

> Most of our customers even the really good ones are wrong when they give us numbers about the future. They may give us numbers about...they may be right about next week, and might be reasonably right about next month, but if you go beyond one month, the customers are completely unable to say us what exactly they need, even... so what you have to do is to decide where the market is going and the best tool we have there is the F18 curve (the business cycle forecast) because it gives you a chance to see if this is a logic continuation of the business cycle and the trend. When you have done that, you have an imagined number when you think it might be, and you look at the content and say this customer we have gained...it's a big customer, we gain market share, you add pieces of knowledge about the market that you have.

This indicated, that surprisingly this business manager advocated a top-down business cycle forecast (BCF/F18) that displays the general trend of the business; for she believed that SWEDTECH would have been able to forecast customer demand better than customers themselves. Because customers could not predict their future business volume, there would be no objective customer demand for SWEDTECH to capture in the first place. SWEDTECH needs to construct its own projection of customer demand according to its own predictions based on the general market trend. The F18 curve mentioned above is a BCF prepared quarterly by a central unit in Brussels in order to visualise the macro-economic trend. According to some managers, the bottom-up forecasts referring to the primary keys defined were not sufficiently accurate, for they would have no relevance unless they were guided by some top-down forecasts. The perception of whether an objective customer demand exists, constructed an attempt to close a matter of concern on forecasting logic, that is to say, whether the S&OP sales forecasts were to be top-down or bottom-up. The attempt to close this matter of concern also involved two networks, which are depicted in Figure 12 below.

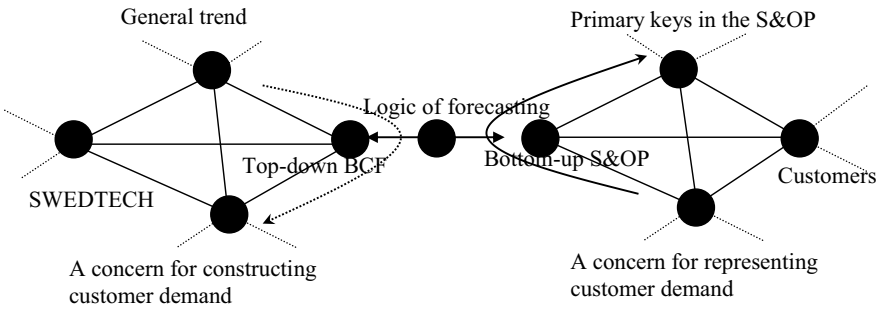


Figure 12: A matter of concern of the combination of a top-down and a bottom-up forecast

This figure shows that a top-down forecast, such as the F18 curve, is allied with a view that no reality of a customer demand exists, and the belief that SWEDTECH is more sophisticated in predicting the long-term business volume of their customers than the customers themselves. On the contrary, a bottom-up S&OP forecast is allied with a view that there exists an out-there external demand and the belief that the best forecasting level depends upon the business characteristics, supply chain management/customer relationship management, and the quality of the order books, as per Figure 10. In this case, customers are also part of the network and they are competing against SWEDTECH in forecasting, although physically absent. Figure 12 shows that an attempt to close the matter of concern on forecasting logic is an effect of networking a matter of constructing/representing future demands, primary keys of the forecast, general economic trends and inter-organisational boundaries. A matter of concern on forecasting logic was closed to having a bottom up S&OP forecast this time; not because a top down forecast was irrelevant, but because capacity management and availability were crucial problems during that period of time. I will later show that the top down BCF never rested, but challenged the S&OP process from time to time.

Moreover, there are other forecasts existing at SWEDTECH, for instance, a financial forecast prepared by each organisational unit including the sales organisation that is linked to the bonus system. For the first time along the chain of circulating references in

creating a sales forecast, the chain met a possibility of being broken i.e. if matters of concern on forecasting logic cannot be settled. Unlike Dambrin and Robson (2011) who claim that networking inscriptions can repair the chain, flawed references are still amplified, and this episode shows that such networking also contributes to creating a possibility of breaking the circulating references and the consequent fabrication of an S&OP forecast. The F18 curve that was intentionally prepared to capture the macro-economic trend, suddenly, became the opponent to the S&OP forecast. The financial forecast also created problems, for it offered an incentive for the sales people to under-forecast because bonuses would be given if they achieved their financial forecasts. A number of managers mentioned the "politics" of doing forecasts in this milieu. At this point, the S&OP forecast continues its journey by reverting to the amplification of the primary keys. What an S&OP forecast depends upon is the closure of this matter of concern, which is fluid depending on the contexts. In this episode, this matter of concern was temporarily closed, but tensions between these forecasts would emerge again later when the sales forecast met the factory forecast. At SWEDTECH, the use of these forecasts can be described as a "drift" (Quattrone and Hopper, 2011), where organisational members know the purposes of these calculations, but uncertainty still unfolds because of their combinations. Sometimes they are aligned with each other, whilst other times they compete against each other. A detailed narrative of how these forecasts ally with or compete against each other will be provided in later sections, when there were debates between sales and factory forecasts.

The dilemma actors faced in this episode was the choice between an internal forecast calculated by sales (within the S&OP team) using primary keys set in Episode 3A, and an external forecast from a central business unit in Brussels (outside the S&OP team) which used macro-economic trend as the primary key. Actors participating in this episode included the already set primary keys for the S&OP forecast, BCF, the central business unit in Brussels which speaks for SWEDTECH in determining the macro-economic trend, customers in their physical absences, the group demand chain and actors' perception on whether there is an out-there customer demand. The outcome of fabrication of the S&OP process is shown in Figure 13 below. The calculation finally chosen is the internal

forecast (S&OP sales forecast) by the S&OP team using the primary keys set in Episode 3A. The external BCF was disconnected to the S&OP process because the S&OP sales forecast allied an inscription showing availability failure.

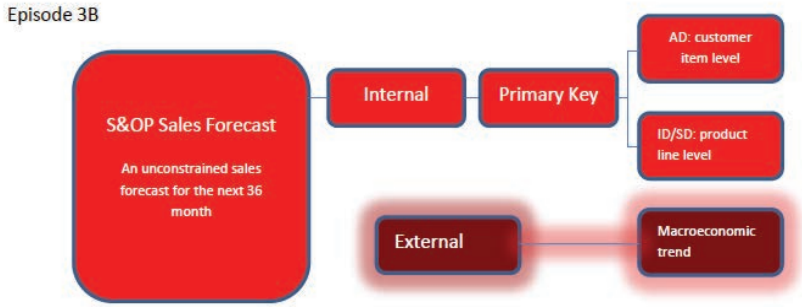


Figure 13: Outcome of the fabrication of the S&OP process in Episode 3B

In terms of DCM, uncertainty in future market demand was translated into uncertainty in forecasting logic. The customer was allied with the internal S&OP forecast, but SWEDTECH – represented by the central business unit in Brussels – became an alien to the S&OP forecast. The customer was sometimes considered unable to predict their own business volume, whilst SWEDTECH was perceived to be better than the customers in predicting what they wanted in the future. The BCF, however, was regarded as weaker than the S&OP forecast by the group demand chain, because it only predicts macro-economic trends and had nothing to with any specific customer groups. Capacity management had to be undertaken in relation to either particular customer groups in AD or product line groups in ID/SD. The internal forecast by the S&OP team triumphed this time because it allied customers and the urgent need to manage capacity.

Uncertainty in future customer demand was also translated into uncertainty in integration. The original idea of integration was supported by an internal S&OP sales forecast, whilst an external BCF supported another type of integration. Integration was translated into separation, but separation created competing types of integration.

In this episode, there are two competing voices for customers. The group demand chain wants the S&OP forecast to speak for customers, and therefore, it proposes that the primary key of the forecasts should more or less start with customers. Certain participants, however, prefer to have the central business unit in Brussels speak for customers. They believe that a BCF can better represent customer demand because an inscription showing the overall macroeconomic trend is more reliable. They think that customers cannot ascertain their future business plans, and therefore, when speaking for customers, a calculation should keep customers at bay. These participants advocate that a BCF should guide an S&OP forecast to speak for customers. The S&OP forecast, however, gets through this because it allies mundane problems and visionary boundary objects that are difficult to be argued against.

Episode 4: Closing a matter of concern on distributing workloads between the system and market intelligence

This episode describes the closure on a matter of concern of the workloads to be distributed between the computer and the sales peoples' intellectual efforts. The dilemma actors' face in this episode is the choice between computers and salespeople for calculating forecasts.

The trade-off between forecasting logic and forecasting accuracy described in episode 3B, has implications for the proportions of the workload to be distributed between the computer system and the market intelligence input by the sales people; the collaborators as is called in SWEDTECH. The initial agenda of the division was decided in early 2009, when the S&OP process was put into the agenda, but the translation of this division into the exact distribution of workloads between system and collaborators' inputs did not occur until the pilot S&OP process was enacted after the summer of 2010.

The system forecast is created by the forecast manager responsible for the primary key i.e., the units of record pertaining to the sales forecast, which is based on the history, historical sales forecasts and actual sales. The forecast manager, being close to the customers, can adjust and validate the system forecasts according to her specific knowhow before handing them over to the collaborators. Finally, the adjusted forecasts

are reviewed by the sales director for a specific sales region, who via communication with the forecast managers and the collaborators, constructs and is responsible for a concrete sales forecast number.

The first actor, who determined the workload of the computer system and the collaborators was a reference called the ABC analysis[15], although computerised, is explained in detail by the S&OP manager:

> This is the 100% of the business volume. Then we divide it in 30%, 30%, 20%, 15% and the last 5%, this is the agreement what we have taken. Try to work on the 80% of the volume which is normally maximum 3% of your lines and let the system do that part because even if you are wrong here, that's just 20%, doesn't care if you are correct here…[These 80%] are A, B and C items…this will be a typical account that you are responsible for the business for Puna, to take care of 30, 40, 60 records, just select them already according to priority, so you will open that one…So first rule, focus on this part of the business, which is the big volume, and let the systems take care of all the rest, 97% of the records.

The above S&OP manager indicated that the A, B, and C items, which represent a huge business volume of the company, are the focus for collaborators' manual inputs. The process analyst of the Group Demand Chain also illustrated the importance of the ABC analysis.

> What you see there is ABC on country customer group, customer product line…If we open the first one, for example, you can see we have text down that you can see, for example in this case, this is from Norway, they basically have one single item that is representing 30% of the sales, so it's very important that we have very good forecast for this one. If I open next one, so basically what the collaborators do, they right click on this button and they take a few selections of upper grid then they have the total business here in cost, then they work on each record on this part. So the process how we want them to work is to review all the A and B items every month.

She mentioned that the collaborators were to review A and B items because these items represented a significant proportion of the company's business volume, though actually the C items were also within the boundary of the collaborators' forecasting

[15] This is not the accounting based activity-based costing.

responsibilities. The cut-off point was 3% of the customer records representing 80% of the sales volume, according to the S&OP manager, meaning that the focus of the collaborators' input was decided by the senior management. This 80% of the total business volume is translated into A, B and C items representing business priorities. This translation has an amplification that is twofold. First, as the two managers indicated, collaborators have limited time, so let them spend that time on critical items. Second, collaborators' time is then more efficiently transformed for that 80% of business volume which possesses only 3% of the customer records. Collaborators do not need to worry about the remaining 97% of the records because they only amount to 20% of the total turnover and the work of forecasting them was left to the system.

> We have some of those tools developed to direct the people to the things that they should spend their time on. People don't have endless time, so we need to give them tools which put them in a position to review what is important. It's not the new item with 5 Euros but the new items with 500,000 Euros. This is the procedure of what people should spend their time on, exactly on the ABC items and exactly on the ones we filtered with high value. Then do we take the system as it is or de we make aggregated adjustments? You can say I take all my D E items, 5% of the volume but 95% of the records and I look on overall and we see overall I have -10%, I will say I will overall grow by 10%, so I just say, I change this to +10% and then all the records are automatically adjusted. Good or bad, individual items will be wrong, but this is not important. – by the manager of the S&OP

ABC analysis, whilst prioritising a small proportion of customers contributing to a large percentage of the business volume, this is only one of the references attempting to close the matter of concern on distributing forecasting workloads between computers and collaborators. As was described earlier, the divisional structure of SWEDTECH plays a part here. ABC analysis may work for AD, but for ID and SD, there must be other references capable of handling a large number of customers, each of which only has a fraction of the total volume.

> There is just one number for you to understand, if we take our total automotive business worldwide, we are talking about 5000 records in combination with final customers. We have 20 sales units in each car, so each unit has 250 of those records; thinking of this ABC analysis, there is a very limited number with which you can complete your forecast due to this kind of business. If we take the same

> key for the service division in Europe, we have 3 million of those records, items and final customers; who are in this case are dealers. So there is no way to make a forecast of 3 million records; first of all, we do not have the capacity; second, they do not have the IT; and what is even worse is the forecast itself will be very bad. The quality of the forecast is bad because…if this is the time, you have 36 months, on that line, you will have something like this, very erratic sales patterns, 5 pieces here, 20 pieces here, a lot of months, nothing, so what the system forecast creates will be very bad. That is why we go there, the much higher aggregations. We make a forecast on all paper roll bearings for certain customer groups, for all my distribution in Germany, obviously I lose some detained information, but I get a very stable good forecast for the volume of certain products.

This quote means that for the quality of the forecast to be improved in SD, its primary key must be set on a higher level, which is a reduction, for it erases volume fluctuation, but also amplification, for it creates stability which opens a space for long-term capacity management; but even forecasting on a higher level still looks for a decision to be made by going to the system forecast and going to the collaborators' market knowhow. This is solved by other inscriptions, as was introduced by the manager of the S&OP.

> The second rule is we give all those cases a certain tag, so for example, if we only have order book, but no history, which means this is a new item, we give a pre-warning, we never sold that item to any customers, for now we have the order book, so for sales man, it's good for them to get these pre-warnings. Or you have a strongly growing item, or your order book is much bigger than your forecast, those kinds of things you can fill out of your data, we say, look, these are certain events, you should be aware of it, you should make a reviewed forecast…If I have a sales, what was the average value of it? And combine that with those filtered events, then you have a very powerful tool. … here we have a tree which says in this case the sales per month is above certain amount of money, so it is an important item, and we filter out items that are strongly growing, of course it's question of how do you define a growing item. We have two definitions, one is year over year, so last 12 months should be 50% above the year before, and the last quarter needs to be 100% over the quarter the year before. Here is the situation we have last 12 months, before certain period of time, it was nothing, we have according to that definition a growing record.

This inscription highlights new, growing items and items with high sales values. The ABC analysis may not provide a complete picture of the business, for items in the D and E categories may have either a high value or a strong growth. The reference of ABC analysis amplifies, for it determines the kinds of businesses that enter the system or go to

the collaborators' manual analysis. The references of highlighting items with enormous value and strong growth are amplified, for it solves the complex puzzles of business volumes and customer segmentation represented in the divisional structure of the company, and makes the set of references more complete. There are 10 to 15 of these references, but all contribute to the transformation of time and space to be managed by the collaborators.

> This [ABC analysis] is the complete business. This [growing items] is also the complete business, only sorted in a different way. Here we have sorted it according to certain sales responsibilities, so this is now the salesman and he would have this customer in his portfolio, and inside his customer, he has only those three C items. No A no B items. This is his portfolio customers and this is his important records in that portfolio. We can have 10 to 15 ways of sorting the data. I think each collaborator should not have more than 52 records he needs to review. He needs to look at these specific cases filtered out and new records. – by the S&OP manager

This means that collaborators can choose the ABC representations which identify A, B and C items. They can also shift to other representations if they want to figure out new items, items with high sales values and high sales growth. When I later interviewed the forecasting manager in SD, he actually showed me the different trees that the collaborators can use to determine which records they should choose for inputting market intelligence.

> Have a look here at I711, in this case Turkey, we have the classical ABC, and they (the collaborators) can easily see what 30% of the volume is. We are also presenting average sales value and frequency. Here are my records with more than 1m SEK per product line for Turkey.

These trees (representations), are thus, not mutually exclusive, but complementary in aiding collaborators focus to items that are considered significant for inputting their market intelligence.

The dilemma actors' face in this episode is the choice between computers and salespeople for calculating forecasts. For an S&OP forecast to become a matter of fact, it had to close a matter of concern on the distribution of forecasting workloads between the computer system and collaborators' manual input. This was successfully closed with the

help of a set of inscriptions of ABC analysis and inscriptions pointing out new items and items with strong growth and high value. An attempt to close matter of concern on the data organisation was separated into computerised visualisations and collaborators' intelligence, Actors participating in this episode included business volumes sold to the very types of customer groups, Demand Solutions, collaborators, senior management, forecasting managers, sales directors and inscriptions just mentioned. The outcome of the fabrication of the S&OP is depicted below in Figure 14. It shows during calculations of the S&OP sales forecast, collaborators' manual forecasts dealing with A, B, C items, new items and items with strong growth and high value. Computer forecasts deal with the remaining items.

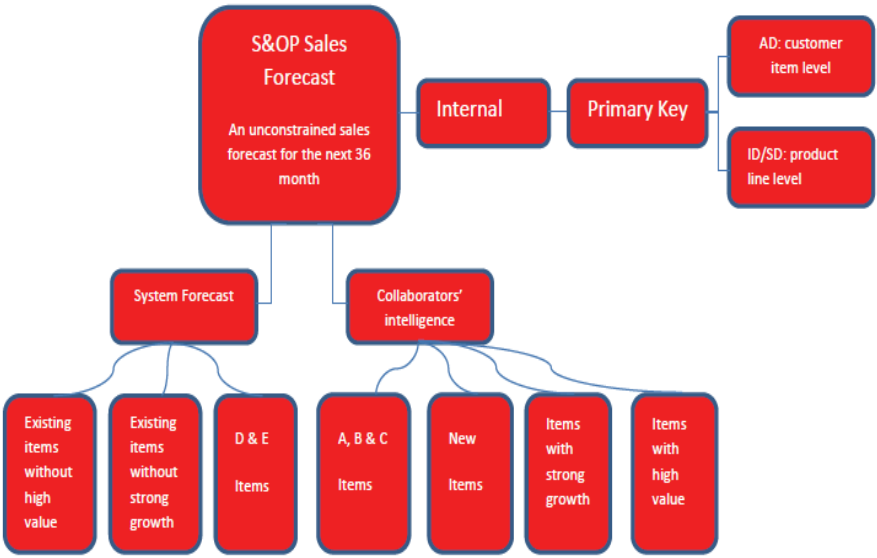


Figure 14: Outcome of the fabrication of the S&OP process in Episode 4

In terms of DCM, uncertainty in future market demand was translated into certainty of setting priorities on the records of forecasting. This certainty was also shaped by attempts at closing a matter of concern on primary keys in episode 3A.

Uncertainty in future customer demand was also translated into uncertainty in integration. The attempt to integrate the DCM process via an S&OP sales forecast was separated into difference spaces, where different visualising inscriptions constructed different data allocation between computers and collaborators.

To speak for customers does not mean every item is to be taken care of. Sales' voice for customers is centred on those few items that represent the 80% of the business volume of the company, items with high value and growth and new items. The computer speaks for the rest of the customers.

Episode 5: Forecasting accuracy

When the calculative practices started, it turned out that even the system forecast contained a set of matters of concern that prevented it from becoming a matter of fact. One of the most significant matters of concern in this setting was which measuring criterion was to be selected to evaluate forecasting accuracy, mean error or absolute (net) error. The dilemma that actors faced in this episode was the choice between compromising, due to the constraints of the software and adhering to the S&OP purpose. Forecasting accuracy, was thus, constructed, rather than being an out-there reality. This episode describes an attempt to close this matter of concern. At the end of this episode, the sales generated an S&OP sales forecast.

The system forecast calculateed a sales forecast via software, namely Demand Solutions. Every month, each forecasting manager activated Demand Solutions and loaded the system forecast. When the pilot S&OP was initiated in September 2010, every forecasting manager followed a checklist (see Appendix 1) that instructed them on all of the forecasting responsibilities that were to be fulfilled. There are 21 formulas available in the Demand Solutions, but there cannot be 21 forecasts; therefore, the next calculative practice decided which one of the 21 contenders finally became the spokesperson for the system forecast. This is explained by the S&OP manager:

> …you select all the formulas, normally what the system does is it is taking the last 12 months of actual sales, uses the forecast on the history, and calculates which formula gives the best forecasts,

> and then this formula will generate forecasts for the next 36 months and I can also say that I know in the actual business situation this formula is not good, so I can de-select it, I have certain options to do and certain factors to choose, there are certain parameters to choose for those formulas, and if I now forecast this record, now what you are seeing is the result of these 21 formulas, and it is then giving you the total forecast error in %, so the deviation on average is 34%.

Thus, every formula produces a system forecast and shows its deviation from the actual sales, which will be recorded in Demand Solutions. After showing me the forecasting errors for each formula, the S&OP manager then turned to the selection criteria of these formulas.

> This is the absolute error and this is the mean error. This is your forecast, if your forecast is always 100, your actual is one time here and one time here, if this is 150 and this is 50, and there you have the error of +50, and here you have -50, so if you make a mean error, the mean forecast error on those two would be 0. This is the [average] net error, so taking + and – away, it's -72% here. So this is 50, this is also 50, the average (net) error is 50%. So this is the difference between those two. And the system is taking the formula which has the lowest average (net) error here.

The average net error percentage, therefore, determines the formula that needs to be used for a particular system forecast. The forecasting manager, who is responsible for the system forecast, can de-select formulas that she perceives as not representing the true business reality. An example of this was later given by a process analyst of the S&OP when he showed me how the system generated its forecast.

> If the last three months show tremendous decreases, but we know that these decreases are just special situations, it was just an interim decrease, then the forecasting manager can let the system know that it should not reflect those three months completely in the next 36 months. Here, for example, you don't want the system to be that easy picking up the trends, so then you increase and smooth the actual, you forecast is not going up by 10% but only 5%, 2012, 2013. This can be adjusted by forecasting managers.

In this example, it is shown that a forecasting manager can override the system forecast and input a number that she perceives as a reasonable representation of future market demand. Normally, the winner of the formulas is the one with the lowest average net

error compared to the actual sales of the last 12 months. This, however, according to the manager of the S&OP, is not unproblematic.

> Within this case, it's also surprisingly the smallest [average] net error. But this is not necessarily the case, it could also be…if we take another example, another record and forecast it, here the system is choosing the formula which has 23.5% (net) error, 13.7% mean error, if we would choose that one [average net error], then you may forecast the (higher) level better, but the individual month has a higher fluctuation, so there could be one reason to say I will accept this system forecast instead of that one, but the system will automatically take that one.

It was revealed that the formula with the lowest average (net) error would result in higher fluctuations of sales forecasts across individual months, but this contradicted the purpose of smoothing out fluctuations across months, because the S&OP aims at fostering medium to long-term capacity management, as discussed earlier. The formula with the lowest average error is still selected as the forecasting formula for the next time. This rule cannot be changed because it is built into Demand Solutions. A form of the lowest average error amplifies in the sense that its stability ensures all system forecasts are generated referring to the same principle; but so is the form of mean error, and mean errors address the issues on monthly forecasting fluctuations. However, the fact that the system forecast is built in Demand Solutions disregarded any attempts to close this matter of concern in order for the calculative practices to continue. Circulating references were not broken here, but the form translated was weak, for it did not even attempt to close a matter of concern on the monthly fluctuation created by the use of average error as a criterion to measure forecasting accuracy.

> This is the standard from Demand Solution, you cannot change it. We ask them requesting them to give us the possibility to select according to that error or that error. Because I believe when we talk about understanding the correct level, this may be more important to have this formula and select it with the lowest mean error compared to do it having the lowest absolute error (average error)…If you looked at there, we only have a mean error of 3%, the absolutely error is 40%, it's quite bad. You can also see the difference, this formula will come up with 112, if you select this formula, it will be 160, so it (the difference) is quite significant. That one is a very stable formula not going too much into + and -, we have one 120 and one 180. So it's also a little but tough. It's a small decision criterion, which formula to select, but it can have huge impacts. – by the manager of the S&OP

This quote shows that using mean error will yield stable forecasts across months, and that different formulas will produce significantly different forecasts. Although, in later interviews this manager kept mentioning that the forecast managers should be given the option to select the decision criterion i.e. mean error % or average (net) error %, the system forecast today still start with the one with the lowest average error. Again, an attempt to close a matter of concern on forecasting criterion involves two networks, each comprising three entities that lead to different amplifications. This is shown in Figure 15 below.

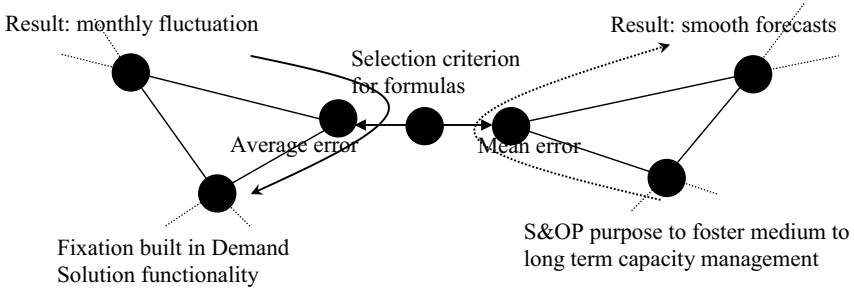


Figure 15: Matters of concern of measurement of forecasting accuracy between average error and mean error

Figure 15 shows that the form of average net error calculation is allied with Demand Solution's functionalities that transforms the market demand into a forecast that fluctuates significantly across months; whilst the form of mean error calculation is in line with S&OP's purpose to foster medium to long term capacity management. This association will translate future business volume into smooth forecasts across months.

The resulting network, however, was not stable when adjustments other than changing the selection criteria were available to forecasting managers. One of the process analysts of the group demand chain gave me the following example:

> Because where the history is bad, then of course the forecast will also be bad. There is something is the system which is called the adjusted history, what is adjusted history? That sounds cheating you know. But if you have a strange history, we have for example for large bearings, we had a situation a

> couple of years ago where you can wait for 1.5 years for your orders, that means you get no supply, no sales, no sales, no sales, then suddenly there is a production, and you produce all sales in one goal, 20 large bearings in July, then there is a long period of no sales, no sales. Then of course we use that input to plan the forecast. That is not really good. So in those kind of cases, it is very valuable to adjust the history to smooth it out what was the really one.

The example illustrated above refers to an adjustment used to smooth out erratic historical sales. It means that when the criterion of average error is selected to determine the forecasting formula, and this in most cases will lead to monthly fluctuation in forecasts that contradicts with S&OP's purpose to manage medium to long term capacity management, forecast smoothing is preferred. The key actor making this possible is the forecast manager who has the opportunity to override the computerised system forecast. She can also input other adjustments if she believes the system forecast is not reasonable, as was stated by the S&OP manager.

> So in the end, he's preparing the system forecast, and the system is stupid. It follows some mathematical rules, quite OK, but if he has another opinion…it's not enough, because he has the brain and he can always override what the system says.

Because other means such as de-select the formula and manual adjustments were enrolled in the network as an "interessement device" (Callon, 1986), the form of average net error becomes stronger in the network of generating a sales forecast. On the other hand, the form of mean error, though not amplified in creating a forecast for it has lost its mobility in Demand Solutions, may regain its mobility in evaluating forecasting accuracy for the sales organisation. This was proposed since the attempt to close a matter of concern on the competition between average error and mean error emerged, but had not been officially activated. When asked how the SD used mean error calculation to measure forecasting accuracy, one of the forecasting managers in this division answered:

> We export data out of the forecasting tool (Demand Solution), and we do it manually in excel sheets because the functionality is not really rich in Demand Solutions, so we store the forecast accuracy here.

Unofficial forecasting accuracy measurements were, hence, manually done outside the functionality of Demand Solutions. Even though this evaluation has never been made official throughout the S&OP process, the mobility of mean error was indeed transported into another time and space, where measuring forecasts were enacted. An absence in an official world triggered a presence of an unofficial world. One business process analyst conveyed to me his concern.

> We are already measuring accuracy, but the problem is that…we are measuring…for different measures, we have one month measuring, let's say what people say for August as a forecast, and what the August actuals are. So we only have one month. This is pretty short if you mach that we have a 36 months forecasting horizon. We have another one, which is three months in the past, and we have another one, which is nine months in the past. It's getting of course a little bit into the direction where S&OP forecast is taking place, not really in the operational term but in the strategic term, but 9 months from now, it's something that is changing. You have said 9 months ago that the business is going up and then we have a crisis, and then this person doesn't get a bonus because we have a financial crisis. This is not a really good idea to really connect to the 9 months forecast, but something like to have in between to have a reward concerning the quality of the forecast, it should be a good idea.

This indicated that, although a matter of concern on evaluating forecasting accuracy has not been closed, the mobility of mean error in this setting extends not only to a space of forecasting evaluation for the sales people, but also to a space that attempts to modify the reward system for the current compensation system which, at that time, is only concerned with achieving the financial forecasts. This attempt, however, still has not been closed to date. The enrolment of other adjustments in Demand Solutions, on one hand stabilises the form of average error in creating the system forecast in the S&OP by dissolving a problem of the fixation for the selection criteria of formulas in Demand Solutions; and on the other hand, translates another form, mean error, in bringing about spaces of forecasting evaluation and modifying compensation systems that were present in the unofficial world. This is illustrated in Figure 16 below.

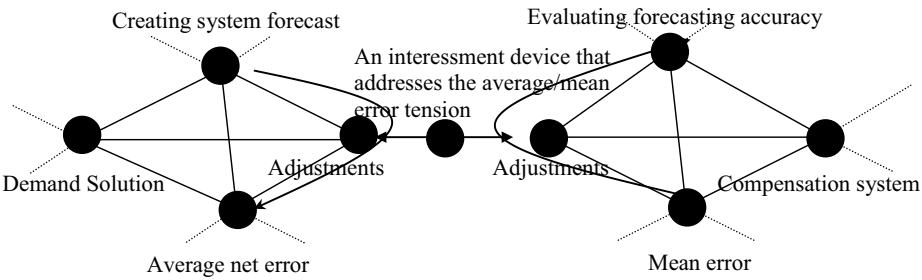


Figure 16: An enrolment of other adjustments in translating the matters of concern for the choice between average and mean errors

This figure indicates that average and mean errors are no longer in competition, for they are now settled in a separate time and space. A non-human actor, Demand Solution adjustment, and a human actor, forecasting managers' manual adjustment, are inseparable from the matters of creating a calculation and evaluating its implications.

The forecast manager either accepts or adjusts the system forecast before sending it to the collaborators. An example of a letter prepared by the forecasting manager to the collaborators is attached in Appendix 2. If she makes an adjustment, the modified total will be transported to the primary key in a pro-rata manner.

The dilemma that actors face in this episode is the choice between compromising, due to the constraints of the software and adhering to the S&OP purpose. The attempt to close a matter of concern on selection criterion on forecasting formula was eventually successful, but such a closure had huge implications on forecasting accuracy. Forecasting accuracy did not mean the magnitude of a deviation between the forecasts and actual sales. Instead it had to match the S&OP's purpose to smooth out monthly forecasting fluctuation, which was also suggested to affect the compensation system of sales. An attempt to close a matter of concern on selecting the formula to compute system forecast was finally displaced into two separate times and spaces. One is computing system forecasts and the other is evaluating forecasting accuracy. Actors participating in this episode included group demand chain, Demand Solutions, mean error, average error, forecasting managers,

historical sales and S&OP's purpose. Figure 17 below shows the outcome of the fabrication of the S&OP process in this episode. Absolute error was used to compute system forecasts, whilst mean error was proposed to evaluate forecasting accuracy. The figure also shows the construction of an S&OP sales forecast in the S&OP process, before it meets the factory forecast.

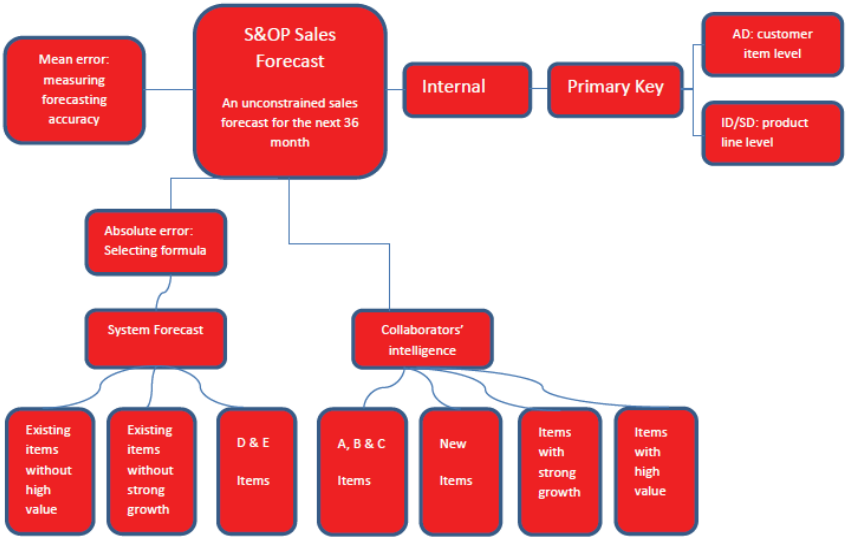


Figure 17: Outcome of the fabrication of the S&OP process in Episode 5

In terms of DCM, uncertainty in future market demand was translated into intra-organisational uncertainty on measuring forecasting accuracy within Demand Solutions. When the outcome contradicted the S&OP purpose, adjustments in Demand Solutions were made by forecasting managers to translate this uncertainty into certainty by creating the system forecast. This translation also constructed two spaces, a space of measuring forecasting accuracy by sales, and a space of modifying existing rewarding systems in sales.

In terms of uncertainty in integration, a task to address the struggle for selecting criterion for determining the formula for computing system forecasts was separated into two

spaces; selection of the formula for system forecasting, and evaluation of forecasting accuracy. The separation was transformed from friction through another actor, namely other available adjustments.

In this episode, there was a threat on forecasting accuracy which attempted to hamper sales' voice for speaking for customers. A fixed functionality in Demand Solutions contradicted with the S&OP's purpose; but other available adjustments by forecasting managers enrolled another calculation, mean errors, to restore its purpose to produce smooth sales forecasts. To speak for customers in this case did not mean to project customers' exact future business volume, but to speak for them in a way that was consistent with the purpose of a managerial technology, although this technology was used to speak for customers. The content of this voice was internalised into the language of the technology.

Market intelligence

A matter of concern on forecasting accuracy in episode 5 was translated into a form of adjusted system forecast, but the system only takes care of the past, and how specific knowledge of future customer demand was enrolled into the S&OP forecast became the next movement. The S&OP process brings another form of response to this, adjusted forecast by collaborators who input their own market intelligence.

There are three reasons why collaborators' market intelligence is compulsory. First, almost every interviewee agrees that the collaborators are close to the customers, hence, they should become the spokespersons of the external demand, because both forecast managers and Demand Solution do not directly contact the customers. Second, as was explained in the first series of circulating references earlier in this section, the S&OP forecast ought to be an unconstrained sales forecast which represents the pure market demand so that the company can in the long run gradually adjust its capacity to capture those lost customers. However, the system forecast comparing forecasts with the actual sales shows that the lowest average forecast error is constrained, for the history is constrained by SWEDTECH's current capacity. This was agreed by the S&OP manager,

> The history is also of course constrained.

The third reason why the collaborators' market knowhow is needed can be attributed from the following analogy illustrated by the same manager:

> …Demand solution is a statistical forecast tool. What they are doing is they look on the history, try to find out the trend of the history, try to find out certain seasonality, and then they say, OK, that was the past, the future will be basically continuation of the past. It's like you drive a car, you look at the back mirror…So when we know the system is weak, if the business cycle is completely changed, if it is bumpy today, and then nothing is coming then, if we are gaining market share, losing market share, also if we exit business…I mean this is always looking at the back mirror, this is if we are driving on the straight highway, straight down, no curves, nothing, then you can do it. But as soon as you are coming to a narrow road, you crash, unless we have somebody who's guiding you. There is somebody sitting next to you saying now you need to turn right and now you need to reduce speed, and now you need to accelerate and now there is a left turn coming. If there is somebody telling you that, then we may work that way. This is exactly the role of the collaborators. They need to say now you need to turn right, you need to accelerate…

This quote means that the system will do a professional job when business reaches a stable phase, but when I started my field study, the business environment was unpredictable, and sales had been erratic because the bearing industry had just entered the recovery period of the credit crunch. According to the manager's analogy, there were lots of left turns, right turns, accelerations and breaks. Similar situations also occur when there are new products, new solutions and new customer groups. Therefore, the boundary of the collaborators' intelligence was formed, that is, the ABC items, items with great value and strong growth, items with erratic sales history and new items for new customers (see Appendix 3 for the trees that help the collaborators to sort out their focus).

Later when I was viewing some of the forecasts figures for VW Germany generated by the system and the collaborators using the forecasting tool, I asked one forecasting manager why the collaborators adjusted the system forecast from 104m SEK down to only 66m SEK, and he replied,

> I think this collaborator realised that there will be a downturn in this business as if the trend is going up, the system forecast is always going upwards.

This means that the collaborators have the responsibility to foresee a reverse of existing trends that the system cannot project. In addition, the collaborators can use another reference if they believe this form offers a more reliable future, that is, the order book.

> The system is not by itself taking the order book into consideration in calculating the forecast. You can use it if you enter certain business rules, so for example, if you believe that the customer VW is giving us a very good order book for the next six months and this is the best information we have, then we can say, OK, we have business rule, for the next 6 months, we always use the order book from that customer for the forecast, but this is the specific rule for this specific customer. –The manager of S&OP

This shows that if some specific customers have a long and quality order book, relevant collaborators can use the order book to adjust the system forecast.

The last step of constructing the S&OP forecast from the sales side involves the sales directors of all the SWEDTECH regions, who review both the system forecast and the collaborators' adjustments, to make their final decisions on the final figure for which they will be responsible. This will occur in the forecasting meetings where forecast managers, collaborators and sales directors all sit together. The adjusted total will then prorate it down to relevant forecast primary key levels.

It was to this end that the S&OP sales forecast was calculated by the sales organisations. The ontology of the sales forecast was not fixed because it incorporated the very matters of concerns discussed from episode 1 to 6; the S&OP sales forecast, is thus, already many things. In the next sub-section a brief conclusion on the findings so far will be provided.

A short discussion

I have in this chapter followed the fabrication of the S&OP process in its making through the circulating references that translate matters into forms, which in turn point to further matters through their amplifications. A number of matters of concern around the S&OP process have been constructed. Ontologically they make the S&OP process multiple and fluid. DCM has also been theorised to follow the translations of uncertainty of future market demand into uncertainty in integration, and multiple voices for customers. Those actors, the series of matters of concern making up the S&OP process, thus, prevent it

from being closed into a matter of fact pre-maturely. Translations embracing uncertainties and multiple voices for customers in DCM are summarised in Table 4 below.

Episode	Matters of concern the S&OP has to incorporate	Actors	Translation of uncertainty in future customer demand into uncertainty in integration	Voices speaking for customers	Illustrating figure
1	The type of managerial technology	Consultants, the group demand chain, the two matters of concern around the S&OP process constructed, a visionary boundary object of being a knowledge-based company and the platform concept	Uncertainty in future customer demand was firstly translated into uncertainties in intra-organisational cooperation and information and methodology consistency. An inter-organisational problem was translated into two intra-organisational problems. Uncertainty in future customer demand was also translated into a movement towards integration. Striving for integration on management processes was not the outcome of either external or internal forces, but networking existing organizational problems and visionary boundary objects.	To speak for customers, sales were not enrolled in delineating the S&OP agenda, although their forecasts were proposed to be the OPP in the process. The group demand chain was initially speaking for customers by calling upon existing organisational problems and visionary boundary objects. In DCM, voices for customers may not necessarily be those close to customers. Instead their voices are capable of creating a space for customers if they ally attempts to solve existing problems and visionary boundary objects that are difficult to be against.	3
2	The boundary of S&OP	Group demand chain, consultants, attempts to close matters of concern in relation to cross divisional cooperation as well as information and methodology consistency, the platform concept, a visionary boundary object of being a knowledge-based company, an attempt to	Uncertainty in intra-organisational problems of cross divisional cooperation and information and methodology consistency was translated into uncertainty in inter-organisational problems of balancing demand with supply. When the S&OP sales forecast was calculated, it translated a problem of losing some of the	The group demand chain is still the voice speaking for customers. This voice is made more convincing even in the absence of customers and sales, who deal directly with customers. This is made possible by calling upon not only attempts to solve existing organisational problems and visionary boundary objects that are difficult to be against, but also inscriptions that represent these problems. Certain	5

		close a new matter of concern in relation to an imbalance between demand and supply, accounting inscriptions showing availability and delivery time, and a new visionary boundary object of being agile, demand and proactive.	customer volume into a set of operational, tactical and strategic plans of increasing capacity; meaning uncertainty in future customers would be translated into certainty in current productions. Time and space, are thus, shifting in a continuous flux. Uncertainty in future customer demand was also translated into certainty in integration. This uncertainty was on the object integration, namely capacity planning.	visionary boundary objects, such as the ability to be agile, proactive and flexible are also allied, even though they have been introduced in other time and space. They can easily be borrowed to speak for customers because they are difficult to be objected.	
3A	The primary key: customer-item level vs product line level	The group demand chain, the order books, SWEDTECH's customer relationship management, customers' supply chain management, business volume of different divisions and the type of customer groups to which SWEDTECH's products were offered.	Uncertainty in future market demand was translated into certainty on the level of aggregation on which forecasting was calculated. An inter-organisational problem of projecting future market demand was translated into an intra-organisational problem of constructing a starting level of forecasts. Uncertainty in future customer demand was also translated into uncertainty in integration. An attempt to integrate by setting primary keys for different divisions was delegated into separate spaces; which in this case were different divisions.	Sales were the voices speaking for customers in this episode. However, their ability to speak for the customer depended upon the order books, customers' supply chain management and customer segmentation. In this episode, to speak for customers is a matter of whether information on customers produces a primary key that can be used on a detailed level of forecasting or a compromised higher aggregate level. Demand information decides whether sales' voice for customers is strong.	10

			Separation fostered integration.		
3B	The primary key: internal S&OP sales forecast vs external BCF	The already set primary keys for the S&OP forecast, BCF, the central business unit in Brussels which speaks for SWEDTECH in determining the macro-economic trend, customers in their physical absences, the group demand chain and actors' perception of whether there is an out-there customer demand.	Uncertainty in future market demand was translated into uncertainty in forecasting logics. Customers were allied with the internal S&OP forecast, but SWEDTECH – represented by the central business unit in Brussels – became an alien to the S&OP forecast. Uncertainty in future customer demand was also translated into uncertainty in integration. The original idea of integration was supported by an internal S&OP sales forecast, whilst an external BCF supported another type of integration. Integration was translated into separation, but separation created competing types of integration.	The group demand chain wants the S&OP forecast to speak for customers, and therefore, it proposes that the primary key of the forecasts to more or less start with customers. Certain participants, however, prefer to have the central business unit in Brussels speak for customers. They consider a BCF as better able to represent customer demand because an inscription showing the overall macroeconomic trend is more reliable. They think customers cannot ascertain their future business plans, and therefore, to speak for customers, a calculation will keep customers at bay. These participants advocate that a BCF should guide an S&OP forecast to speak for customers. The S&OP forecast, however, gets through this time because it allies mundane problems and visionary boundary objects that are difficult to be against.	12
4	Distribution on workloads between the computer and collaborators.	Business volumes sold to the very types of customer groups, Demand Solution, collaborators, senior management, forecasting managers, sales directors and inscriptions showing ABC items, new items and items with strong growth and high value.	Uncertainty in future market demand was translated into certainty of setting priorities on the records of forecasting. This certainty was also shaped by attempts of closing a matter of concern on primary keys in episode 3A. Uncertainty in future customer demand was also translated into uncertainty in integration. An attempt to integrate DCM	To speak for customers does not mean that every item is to be taken care of. Sales' voice for customers is centred on those few items that represent 80% of the business volume of the company, items with high value and growth and new items. The computer speaks for the rest of the customers.	-

			processes via an S&OP sales forecast was separated into different spaces where different visualising inscriptions constructed different data allocation between computers and collaborators.		
5	Selection criteria for formula and forecasting accuracy.	Group demand chain, Demand Solutions, mean error, average error, forecasting managers, historical sales and S&OP's purpose.	Uncertainty in future market demand was translated into an intra-organisational uncertainty on measuring forecasting accuracy within Demand Solutions. When the outcome was contradicted with the S&OP purpose, adjustments made in Demand Solutions and by forecasting managers translated this uncertainty into certainty when creating the system forecast. This translation also constructed two spaces, a space for measuring forecasting accuracy by sales, and a space for modifying existing rewarding systems in sales. In terms of uncertainty in integration, a task to address the struggle of selecting criterion for determining formulas in computing system forecasts was separated into two spaces, selection of formula for system forecasting and evaluation of forecasting accuracy. The separation was transformed from friction through another	There is a threat on forecasting accuracy that attempts to hamper sales' voice for speaking for customers. Functionality in Demand Solutions contradicts with S&OP's purpose, but other available adjustments made by forecasting managers enrolls other calculations and mean errors, to restore its purpose to produce smooth sales forecasts. To speak for customers in this case does not mean to project customers' exact future business volumes, but to speak for them in a way that is consistent with the purpose of a managerial technology. Although this technology is used to speak for customers, the content of this voice is internalised into the language of the technology.	15 & 16

			actor, namely other available adjustments.		

Table 4 A summary of findings in episodes 1 to 5

It is shown in Table 3, that every closure of a matter of concern involved a number of actors, and oftentimes, intricate translations. For instance in episode 5, in order to close a matter of concern on the selection criteria of forecasting formulas that will lead to different representations of forecasting accuracy, group demand chain, Demand Solutions, mean error, average error, forecasting managers, historical sales and S&OP's purpose all participated in such a closure. In terms of DCM, the translations are even more complex. Uncertainty in future market demand was translated into intra-organisational uncertainty on measuring forecasting accuracy within Demand Solutions. When the outcome contradicted the S&OP purpose, adjustments in Demand Solutions by forecasting managers translated this uncertainty into certainty in creating the system forecast. This translation also constructed two spaces, a space for measuring forecasting accuracy by sales, and a space for modifying currently existing reward systems in sales. This means, that fabricating an S&OP process was proposed to foster demand chain integration and was delegated and separated into different spaces. In fact, when calculations started in Episode 3, integration was made possible by delegation or separation. In terms of multiple voices for customers, it shows that to speak for customers, in this case does not mean to project customers' exact future business volumes, but to speak for them in a way that is consistent with the purpose of a managerial technology; although this technology is used to speak for customers. The content of this voice is internalised into the language of the technology.

In terms of circulating references, matters from diverse time and space are translated into forms in a temporal manner. Historical problems lacking cross divisional cooperation, as well as information and methodology consistency were translated into the form of a companywide process. Historical problems of imbalance between demand and supply, as well as long delivery times were translated into a form of an unconstrained sales forecast covering the next 36 months. The matter of the level on which forecasts are calculated, was translated into the form of a primary key. A consideration on forecasting accuracy was translated into a form of selection criterion. Market knowhow was translated into a form of collaborators' intelligence. Forms, however, never fully mirrored the matter and

therefore, a gap exists between them (Latour, 1999a). Instead the inscription building process constructed emerging matters. For instance, forecasting accuracy is created by the formula chosen and it is related to the S&OP purpose of smoothing out forecasting fluctuations, and thus, does not neutrally represent forecasting accuracy. The matter, in a three-dimensional world, is constructed as visible by a two-dimensional form which creates a space for intervention because of its properties of stability, mobility and combinability.

Intra/inter-organisational relationships are always in a continuous flux. Customers were allied in the S&OP network, but an intra-organisational unit within SWEDTECH producing the BCF became alien to the S&OP when there was an attempt to close a matter of concern on forecasting logic, but in later episodes to be discussed shortly the BCF assisted the sales forecast, when the latter was challenged by factory forecasts. In that setting, this unit in SWEDTECH was allied with S&OP, but factories were not, and even later it will be shown that factories' challenges also contributed to the transformation of the S&OP forecast, meaning that factories were allied again. A seemingly taken-for-granted uncertainty in future customer demand in dominant DCM literature involves heterogeneous, fluid and multiple shaping and re-shaping of intra- and inter-organisational relationships in the process of fabricating an S&OP sales forecast. Translating this uncertainty not only involves complicated modeling in relation to forecasting (Van Landeghem and Vanmaele, 2002), but also intricate relations between humans and non-humans. These relations constantly shift, and accounting plays a vital role in mediating these relations.

There are also translations of multiple voices for customers. Calculations to be used to represent customer voices are delineated by the group demand chain instead of sales. Calculations make a voice stronger, not because numbers speak loudly, but because of an ally of attempts to solve existing organisational problems and visionary boundary objects borrowed from other times and spaces that are difficult to be argued against. Voices for customers are made even more convincing if these problems and visionary boundary objects are backed by inscriptions. Sales speak for customers when calculating a sales

forecast. However, to speak for customers does not mean being able to project their demands precisely. For the voice to be strong, it has to be consistent with the purpose of a managerial technology that is delineated to speak for customers. The content of this voice is to be internalised into the language of the managerial technology.

The fabricating of an S&OP sales forecast and an S&OP process, however, is far from its termination. Although the S&OP sale forecast is calculated by the sales, its fabrication includes challenges brought about by factories that possess their own forecast. The next section of a series of episodes will describe how a factory forecast is calculated.

The factory forecast

The factory forecast, per se, is not an S&OP forecast. It is prepared by factories to construct their own product plans and to foster product line management planning. But when it entered the arena to challenge the S&OP sales forecast calculated so far by sales, the factory forecast became part of the S&OP forecast. The S&OP forecast, is thus, multiplying. It is already many things because of matters of concern. It will continue to be many things because of new emergent matters of concern. This series of episodes describe the process of how a factory forecast is constructed. This construction, however, is only a reflection of histories, which means that this thesis did not follow the factory forecast in its making because it has existed for decades.

Episode 6: Closing a matter of concern on the starting reference of the factory forecast

Empirical studies on the use of S&OP indicate that S&OP is a relatively recent innovation and that in most companies it is still in its infancy because conflicts of interest between participants frequently arise. There is no natural process owner who has clear authority to resolve conflicts, and it takes a relatively long time to achieve a compromising solution (Rexhausen et al., 2012). The S&OP process at SWEDTECH is just one exemplar. The S&OP sales forecast could not be closed to a matter of fact because factories often distrust this calculation, thus, presenting their weapon; the factory forecasts. It is because of the factory forecasts that the circulation of the S&OP extends to a new time and space. This episode starts with the attempt to close a matter of concern on the starting reference of the factory forecast.

For factories to enter an arena for a debate, they must possess their own calculations for the forecasts. The question is what references the factories' forecasts start with. One of the starting references to capture a three-dimensional unknown demand is the business cycle forecast (BCF) already discussed before, also called the F18 curve (An extract of the business cycle report and the corresponding F18 curve is provided in Appendices 4 and 5). According to the manager of the S&OP,

> [It] is the pure macro economic forecast, saying if I mean, for let's say the car forecast, it is saying we look what is the forecast for the car market, and if the forecast of the car market is increased by 5%, then our business cycle forecast is +5%. So it's first trying to the translate the macro-economic forecast for SWEDTECH…we do not take care of any individual business, so if we know we came a business with BMW, this is not in the business cycle forecast. It is also not if we lose market share of another customer…But in the S&OP, the difference is that they need to add this new business with BMW, and they need to deduct the exit of business for a customer, so this is their task to bring the individual business knowhow in addition to this macro-economic forecast. The business cycle forecast is a pure translation of what is going on in the market to SWEDTECH. Without any specific business knowhow, so this is very important.

The business cycle forecast (BCF) is hence, an overall level of forecasts representing the macro-economic trend for each global industry of SWEDTECH, for instance, cars and OEM markets. It is prepared once a quarter by a central business unit in Brussels and has served SWEDTECH for more than 20 years. It was introduced because the factories needed to have long-term visibility for their planning, according to the manager of the SCP stream of the S&OP.

> Because we realized that the way we are organized…we need validation done by the business unit, we have always assuming that the factory demand chain is providing information, but in a longer term, most factories don't have a visibility of what is the demand.

This quote suggests that the BCF is proposed to give factories some kind of long-term development in the customer demand; but unlike the S&OP forecast, the BCF does not point to any customer groups and product lines, and in theory, the BCF is also an unconstrained forecast capturing how the whole market for a global industry is going. However, unlike the S&OP forecast, the BCF has no intention of competing against any

other calculations. It simply translates uncertainty in the macro economy into a factory forecast, taking into consideration factories' knowhow on customers.

Similarly to the S&OP forecast, the BCF is also made up of two inputs: computer and human intelligence, according to a manager familiar with the BCF computation,

> It's (based on) very complicated formula based on the history or test the history, what has the historical sales been, and then one is making seasonality factor, cleaning a factor etc. then the system uses this rather complicated aggregate, is calculating a proposal, but that is very often manually adjusted, one...based on the business cycle outlook, he is making up his mind that we are in the recession or going into recession, going up etc., so it's very...even if there is formula, there is very much manual, intelligence put into the total.

Starting with the BCF, the factories modify the calculation according to their own knowhow and end up with a counter-proposal. It is the latter that will be brought to the product group planning (PGP) meetings to compete against the sales forecast, but the S&OP manager said,

> The factories are doing a counter-proposal already today and in the future the counter-proposal will be the S&OP forecast. And this will start. It is just the understanding of where is the market going, this is the input you receive from the forecast part, and then the counter-proposal says this is based on all my specific knowhow of the market, this is what we believe the business is going.

It implies that the S&OP manager wants the factory to take the S&OP forecast as a matter of fact. This will be discussed later. In terms of the starting references for factory forecasts, the demand chain manager for large bearings then described how the factory forecast was constructed by referring to the BCF,

> This is the way we plan it. We plan it by looking at the last 12 months and the biggest weight is on the last 3 months, but we take history of 12 months and we see...then we can see based on the business development, what they say where the business is going. And we can take that sales, we can put on some %, for example now we are coming to an upturn in the business.

Thus, factories did not use the BCF directly. Instead they combined BCF and historical sales. The S&OP manager advocated the S&OP forecast to be the counter-proposal of the BCF, but this translation was too sharp for other lay actors to accept. In factories, BCF was considered to be an ally instead of an alien to their factory forecasts. In addition to

the BCF, there are also other references which are assigned priority depending on the type of product channels the factories are concerned with.

The S&OP sales forecast was constructed in a way that combines computer and human intelligences, and when asked about the composition of the factories forecast, the demand chain manager for large bearings commented,

> I think (there are) 3 different parts. We look at the shipment levels and the sales history that we have before. We look at order books and how long is the order book, for example in each channel, on that level do we think from the order book. Do we have 4 months of fully booked, or do we have only 1 month and then we know nothing? So second is the order book. And the third is the (info. for) key account customers. So three things, no, four, of course the input from the business cycle.

This quote indicates that there were 4 potential references, sales histories, BCF, order book and key customer accounts; but another attempt to close a matter of concern on which references to use emerged. Then, I asked if he could show me examples of how each was taken into consideration when preparing forecasts for a specific channel. He patiently replied,

> Normally (for) stock channels, if you have finished stocks, and you have a good service to the market, then there is no need for customers to put in orders, because it's already available from stocks, then customers wait. It's quite natural because if you for example buy food, then you will go to the store and put an order one week before. The order book for the supermarket is very short, they have to have everything available. The only thing they can react to how much they should be having on the shelf is based on historical demand and maybe the macroeconomics. So in stock channels, maybe you only one month order book. By that level we have to rely more on what is the historical shipment level and what is the macroeconomic trend…But if we take make-to-order (MTO) channels, when we have delivery time of 3 months, and then also customers that have quite big projects, maybe they already put in an order for the bearing they need in 6 months. And that bearing is a single bearing. It's not that the one that has high volume, but each demand has a specific customer, so it's a key customer.

The translation of how an attempt to close a matter of concern on starting references of factory forecast is displayed in Figure 18 below.

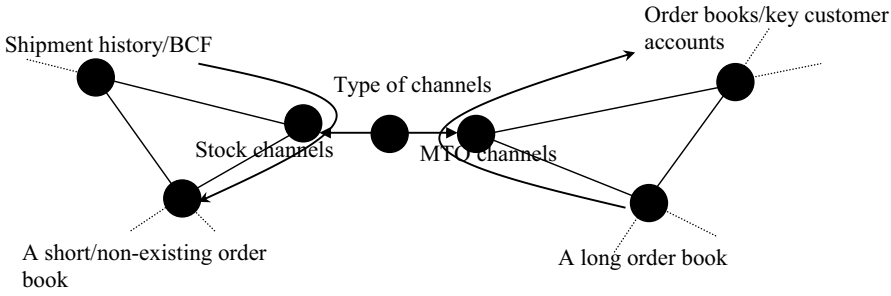


Figure 18: Translations of channels and order books into starting forms of factory forecasts

It is shown in the figure that on the factory side, to close a matter of concern on starting references of factory forecasts, there is also a network effect depending on the translation between the type of channels and lengths of the order book. According to the above quote, a stock channel featured by a short or non-existing order book gives rise to the reliance on shipment history and the BCF, whilst a MTO channel featured by a long order book generates a priority to rely on key customer accounts and the order book.

It is worth mentioning, that sales see product lines as what needs to be sold to customer groups, whilst factories see products as what needs to be shipped from individual channels. Channels are described universally by all interviewees as factories inside a factory. When materials or finished products are shipped to factories, it is the channel numbers (i.e. Ch. 29), rather than the factory addresses that are addressed. This difference, inherent in the planning structure between sales and factories, had not generated any tensions until the S&OP forecast was enrolled. The implications of this difference became so huge during the S&OP pilot process that in the end, it would be a substitute instead of an integration that would make the S&OP sales forecast a matter of fact for the factories. This will be discussed later in the thesis.

A closure of a matter of concern on the starting references for factory forecasts was straightforward. Actors participating in this closure included shipment histories, the order

book, key customer accounts, BCF, type of production channels in the factory and factory planners. An attempt to close a matter of concern on the starting reference of factory forecasts was thus separated into different production channels.

In terms of DCM, uncertainty in future market demand was translated into certainty in a consideration of selecting the right starting references in creating the factory plans. Customers were present in key customer accounts, shipment histories and order books, and there they were transformed from uncertainty in the future to be worried about, into certainty in a number of inscriptions representing past and present.

Factories wanted to use their forecasts to foster integration. Like the primary keys of the S&OP sales forecast, the task to define starting references for calculating the factory forecast was also separated into different spaces, which in this case was different production channels.

To speak for customers, factories need different inscriptions representing historical customer information. How these inscriptions are bundled depends on the type of production channel based on which forecasts are made. This demand information possibly makes factories' voice for customers convincing because whatever the production channels are, they can find inscriptions which are based on either concrete customer information or reliable histories.

Episode 7: Adding flexibility to managing availability

This episode describes a crucial movement in constructing a factory forecast that eventually makes it stronger when it faces the sales forecast in the arena. This is related to how a factory forecast incorporates multiple dimensions of managing availability. Whilst the S&OP sales forecast is calculated in order to foster medium to long term capacity management, the factory forecast, in addition, facilitates operational term availability management.

Before I discuss this matter of concern on availability, the concept of product hierarchy in SWEDTECH needs to be explained for the reader to better understand the mediations of

the factory forecasts. This concept, invented decades before the S&OP, was illustrated by the manager of product line planning for medium bearings,

> We have material families. Typically, it's the size of the bearings. If it's one size, which means you use one type of outer ring and one type of inner ring. Then you can have different variations with different balls and different cages and a lot of different things. There is also a decision linked to that. Then you have the main variant. When you have all the material, this is the type we want to produce and when this comes to the factory, then you can turn it in different ways, you can have balls in the inner ring… you make some variations in the turning. And that is what we call the turning variant. Then we have final variants. You can have different balls and cages. You can have difference clearance, the clearance between the rings. If grinding more or less in the rings, you will have different clearances…And there are different decisions linked to this. If you look at the same…this is M decision…M lead time, D lead time and E lead time. M for main variant, no, M is material family. D is main variant. E is final variant.

According to this manager, these are called a series of sequent product hierarchy decisions. M decisions are to be made regarding which material families (MFs) to produce, followed by D decisions on how to turn the bearings. E decisions are based on which final variants to produce and will be postponed as late as possible in order to better satisfy customer orders. These product hierarchy decisions were introduced to mediate the availability problem by adding a dimension of flexibility. The manager in charge of the product line planning stream of S&OP explained,

> So what they do is that they keep the full quantity open as long as possible for all possible variants. Then the order comes in and then we have total availability…So what they do is that they keep the full quantity open as long as possible for all possible variants…Let's say if we have 5 days lead time on the material, and then you can take this (D) decision 15 days, and then you are closer to the actual production date, then you know more about it's gonna be a tapered ball, that demand might have changed, or during those 5 days, you have a…you have more orders of the tapered ball, or it's the cylindrical, so you have increased the flexibility.

This means that the product hierarchy decisions translate the time of operations management into daily factory planning. Instead of deciding which final variant to produce today, the E decision is postponed so that the total volume of a MF is determined today (the M decision) and E decisions will be made when uncertainty is reduced later in

the time horizon, for instance, when a customer order is received later. Unlike the sales units who translate the current availability problem that causes the loss of certain business volumes into a medium to long-term unconstrained forecasts. Of course factories also need a medium- to long-term forecast, but they have another detour to translate such a problem into product hierarchy decisions in the operational time horizon. This translation is shown in Figure 19 below.

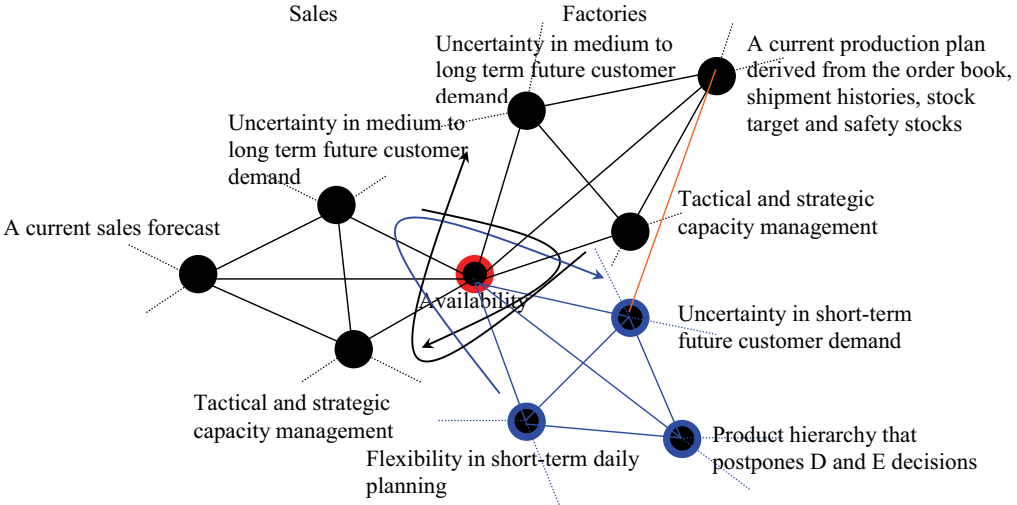


Figure 19: Translations of availability into different time and space between sales and factories

Figure 19 shows that for sales, current availability failures are translated into a forecast that domesticates tactical and strategic horizon capacity management. Market demand is the intended referent. For factories, this S&OP translation still applies, but there exists another translation of this current problem into a series of product hierarchy decisions covering a 20-day period. Customers are still the referents because a forecast of future demand still helps to decide what final variant should be produced when E decisions have to be made if order books are not sufficient; but this referent is mediated by the product hierarchy decisions that add a dimension of flexibility. Instead of bringing future customer demands into a present calculation, uncertainties in the future volume are postponed. The network entities painted in blue indicates this additional layer of adding flexibility to managing availability.

In terms of S&OP, according to Figure 19, there is a superposition of time and space between sales and factories, but factories have an extra translation of availability because they have to plan daily which was either confirmed or highlighted by all interviewees. It is this extra translation in time that makes the circulation of factory forecasts thick. All of the short-, medium- and long-term planning decisions are translated through the language of availability. Although this difference in the planning horizon does not affect the S&OP process directly, this monograph will show later that when participants in the S&OP ignored the medium to long term span of the sales forecasts, sales' voice in the S&OP network became weak because the S&OP's intention is to cover the tactical and strategic horizon. When this intended horizon was not enrolled in the network, S&OP only became an attractor for short-term capacity management, which ran in the opposite direction against its initial agenda. In this setting, the long translations of S&OP disentangled everything in relation to availability that it was intended to address from the outset. The sales forecasts could not help factories in short-term capacity planning because factories plan daily, but the sales do not. It should also be noted, that the S&OP sales forecast started in summer 2011 with a pilot S&OP process, but the calculative practice of factory forecasting can be traced back to the birth of the company.

The translations in Figure 19 are also in concert with theorising uncertainty in integration in DCM discussed so far. Similar translations are also illustrated in Figure 10 where different levels of primary keys bring about separate networks in AD and IN/SD, in Figure 15 where the enrolment of other adjustments in Demand Solution made by forecasting managers translate the tension between average and mean errors into separate time and space, and in Figure 18 where different types of production channels and order books construct different references for factory forecasts that can be used in separate time and space. Organisations today face enormous attempts to close technologies as matters of concern that bring about tensions that call for integrating mechanisms: for instance, to make forecasts possible in all divisions at SWEDTECH, to construct a system forecast that does not produce monthly fluctuations, to forecast consistently across all channels and to handle all operational, tactical and strategic horizon availability issues. The

fabrication of a forecast, however, shows that if the problem is with integration, translations between matters and forms will often tend to reject it. In all of the above scenarios, there is no integrating mechanism that constructs a mega-network that handles all these tensions in a single time and space. Instead, these tensions are translated in a gentle manner. They are translated into separate time and space and often, these translations are unintended. Associations between business characteristics, inter-organisational supplier/customer relationship management and order books construct different primary keys for AD and ID/SD, rather than a primary key that integrates all concerns across divisions. The availability of other adjustments in Demand Solutions was not an integrating mechanism that addressed the tension between average and mean errors in a single time and space, but translated this tension into separate time and space for creating system forecasts and evaluating forecasting accuracy, respectively. The inscription of availability is not a integrating mechanism that is deliberately introduced to address short-, medium- and long-term availability situations, but a form that is translated to bring such a concern into different time (short-, medium- and long-term) and space (sales, product line management and production channels). Circulation of a forecast is so long that continuously emergent matters of concern around itself cannot be addressed by coordination and integration that ally all of them in a single time and space. Dynamics occur when accounting inscriptions separate these concerns into a separate time and space when and where each of them is dissolved in local networks. Accounting inscriptions, thus, permeate in a separate time and space, rather than dominate in a single time and space. Separation creates integration.

This episode unfolds in an unexpected way, how a matter of concern on availability was translated into a set of product hierarchy decisions in a distant time and space called product line planning management. Actors participating in this episode included an accounting inscription showing availability, channel planners, product line planners, customers, S&OP agenda, and product hierarchy decisions.

In terms of DCM, uncertainty in future market demand was translated into certainty in product line planning to manage availability not only on tactical and strategic horizons,

but also on operational horizons through a set of product hierarchy decisions. A struggle in coping with future market demand was translated into a confidence in handling short-term demand in a more flexible way. These product hierarchy decisions *re*-present time – postponing E decisions to improve flexibility – and space – factory forecasts differentiate from sales forecasts because they can cope with customers' orders in a more flexible way.

In this episode, factories' voice for customers was translated into existing mundane practices of inventory management. This reshaping of space also occurred in sales, but what made factories' voice stronger was the re-shaping of time that helped factories to manage their short-term inventory in a more flexible way. A voice for customers is made more convincing by an inscription showing a series of product hierarchy decisions.

Episode 8: Finalising the factory forecasts: connecting short-term to medium- and long-term capacity planning

This episode will end the process of constructing a factory forecast and a production plan.

As the sales propose a sales forecast, factories propose a production plan derived directly from the calculative practice associating the order book, shipment histories, stock targets and order book. The S&OP manager wanted the S&OP sales forecast to be the counter-proposal to the BCF. The factories, however, as was illustrated by the manager of the group demand chain taking care of product line planning in large bearing producing channels cogently pointed out, that they would not use the BCF as the only reference. The order book, shipment histories and key customer accounts all contributed to the construction of the factory forecast. Based on these references, factories forecast the expected shipment from the factories every month, and then each channel planner in the factory can project their target stock level according to some expected service related KPIs; for instance, availability failures every month, which, together with the beginning stock level, can determine the production volume for every month, according to a product line planning manager in the group demand chain.

> Yes, we have some service target levels, for instance, broken promises and availability failures, to determine the target stock level. In most cases, target availability failure is 5%.

These inscriptions also help the planners to calculate the safety stock level, which in turn again enrols a number of operational decisions, including the product hierarchy decisions mentioned above. According to the manager of the product line planning stream of the S&OP,

> Because if we produce the material family (MF) first then we have the order book, so customers can get what they order. So this is the next priority, and the last one is the practical distance from the safety stock. If we look at the final variant, in the normal case, we are looking at the distance from the safety stock, so this MF…they have the worse situation…if the distance from the safety stock is below certain level, we select this one. So we look at which material family has the worst situation.

The safety stock and order book, thus, shape the product hierarchy decisions with regard to which material family is to be produced first. The material family that is furthest to the safety stock will be produced first. The manager for the product line planning from medium bearings also gave similar comments,

> Our ERP systems compares all MFs and checks, compares the safety stock with the actual stock, and you get this standard stock curve, what it does is it looks on the prediction of the stock level, and looks which item has the prediction furthest away from the safety stock level, so it's the worst item, you can say, it's the MF that has the worst stock level compared to its safety stock level. You should probably produce that because as it looks now, the latest information we have, the forecasts etc. and the order books, this looks worst, then you should produce it. It does this per MF, I do this every day when I plan… I mean we actually don't look at MF, we look at its final variant, what the final variant is furthest away from the safety stock.

The safety stock levels and the order books on final variants become references upon which decisions of which material family to produce first are first shaped as was just mentioned. They also mediate the agenda for planners' daily planning because every day their responsibilities include deciding which MF to produce. Therefore, although it is shown in Figure 19 that there are two networks of factory planning (operational) and product line planning (strategic), with one calculating the proposed medium to long-term production volume and the other associating product hierarchy decisions with flexibility, the calculation of the projected safety stock in the long run mediates the decision making on which MF to produce first; and hence, there is a link connecting these two networks of

translations, represented by the (orange) line in Figure 19 which connects the node representing a current production plan derived from the order book, shipment histories, stock targets and safety stocks and the node representing uncertainty in short-term future customer demand. The current production plan for the medium- to long-term horizon mediates the short-term factory planning that is translated by a set of product hierarchy decisions.

The purpose of calculating these target and safety stock levels in factories was enrolled in the S&OP network for medium to long term capacity management, but in an indirect manner. In the operational time frame, capacity management is also discussed in the PGP meeting of the monthly S&OP cycle. In this setting, these calculative practices have a second amplification which determines what actions are to be taken after a channel projects constraints based on the distance to the safety stock. The manager in charge of the product line planning stream of S&OP gives an example of the supporting actions offered by over-capacity to under-capacity channels.

> In the case that if you have under capacity, the consequence will probably be that you need to constrain the forecast for this channel. We can't supply this market demand. And here, if there is a problem in this factory, a channel in US or China or somewhere in the world, they may support you in the production. In the product line meeting, they will discuss how to solve these different issues, whether they can be supported by different channels inside the factory or different channels…and if you don't have enough capacity or supplier capacity constraints, you will also need to discuss which customers will be affected because we can't produce that and then someone needs to suffer.

In this case, the calculative practice in the factory to manage medium- to long-term availability enables supporting actions offered by over-capacity to under-capacity factories.

The process of creating a factory forecast ends with an episode of connecting short-term with medium- to long-term management of availability. Actors participating included channel planners, product line planners, product hierarchy decisions, and inscriptions showing availability, shipment history, target stock level and the projected safety stock

level. Figure 20 below shows the outcome of fabricating a factory forecast narrated in Episodes 6, 7 and 8.

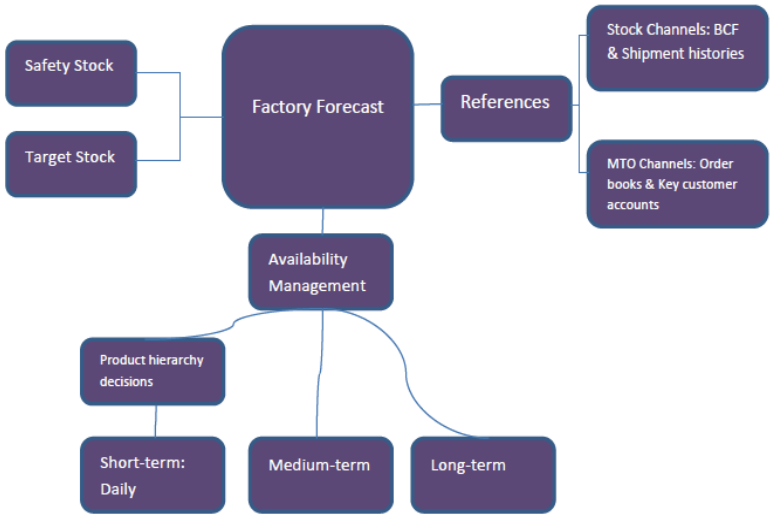


Figure 20: Outcome of the fabrication of the factory forecast

In terms of DCM, uncertainty in future market demand was translated into a connection between short-term, and medium- to long-term management of availability. A projection of the safety stock level is a key factor in this connecting endeavour. A plan on availability was delegated into separate times and spaces namely operational, tactical and strategic term availability management. Factories' voice for customers is made stronger by linking short-term, and medium- to long-term management of availability through an inscription of safety stock. This indirectly connects to an existing organisational problem with regard to availability that was indicated in episode 1. Solving this problem strengthens the voices of factories for speaking for customers.

A short discussion

Findings in episodes 6 to 8 are summarised in Table 5 below, which lists the matter of concern to be closed, actors involved, translations of uncertainty in DCM and issues on competing voices for customers in each episode. The crucial movements making the factory forecast stronger than the sales forecast are discussed in episodes 7 and 8. A set of

product hierarchy decisions translated availability management into operational tactical and strategic horizons. An extra dimension of flexibility was added into the ontology of a factory forecast. A projection of the safety stock level connected these three time horizons. A weakness of coping in the future with customers was translated into a strength in the present factory and product line planning. Factories' voice for customers became convincing because a set of product hierarchy decisions solved an existing problem of short-term availability.

Episode	Matters of concern the factory forecast has to incorporate	Actors	Translation of uncertainty in future customer demand into uncertainty in integration	Voices speaking for customers	Illustrating figure
6	Starting references for factory forecasts.	Shipment histories, the order book, key customer accounts, BCF, type of production channels in the factory and factory planners.	Uncertainty in future market demand was translated into certainty in a consideration of selecting the right starting references in creating the factory plans. Customers were present in key customer accounts, shipment histories and order books, and there they were transformed from uncertainty in the future to be worried about into certainty in a number of inscriptions representing past and present. Factories wanted to use their forecasts to foster integration. Like the primary keys of the S&OP sales forecast, the task to define starting references for calculating the factory forecast was also separated into different spaces, which in this case was different production channels.	To speak for customers, factories need different inscriptions representing historical customer information. How these inscriptions are bundled depends on the type of production channel based on which forecasts are made. This demand information possibly makes factories' voice for customers convincing because whatever the production channels are, they can find inscriptions which are based on either concrete customer information or reliable histories.	18
7	Availability	An accounting inscription showing availability, channel planners, product line planners, customers, S&OP agenda and product hierarchy decisions.	Uncertainty in future market demand was translated into certainty in product line planning to manage availability, not only on tactics and strategy, but also on operational horizons through a set of product	Factories' voice for customers was translated into existing mundane practices of inventory management. This reshaping of space also occurs in sales, but what makes factories' voice stronger is a reshaping of time that helps factories to manage short-term	19

			hierarchy decisions. A struggle in coping with future market demand was translated into a confidence in handling short-term demand in a more flexible way. These product hierarchy decisions *re*-present time – postponing E decisions to improve flexibility – and space – factory forecasts differentiate from sales forecasts and can cope with customers in a more flexible way.	inventory in a more flexible way. A voice for customers is made more convincing by an inscription showing a series of product hierarchy decisions.	
8	Connecting short-term and with medium- to long-term management of availability.	Channel planners, product line planners, product hierarchy decisions, and inscriptions showing availability, shipment history, target stock levels and the projected safety stock level.	Uncertainty in future market demand was translated into a connection between short-term, and medium- to long-term management of availability. A planning on availability was delegated into separate times and spaces, namely operational, tactical and strategic term availability management.	Factories' voice for customers is made stronger by linking short-term, and medium- to long-term management of availability through an inscription of safety stock. This indirectly connects to an existing organisational problem with regard to availability, which was indicated in episode 1. Solving this problem raises the voices of factories for speaking for customers.	19

Table 5. A summary of findings in episodes 6 to 8

Both circulations of sales and factory forecasts enrolled a network of heterogeneous human and non-human actors, but factories kept using their own forecasts in product line planning (PLP) and supplier capacity planning (SCP). This means that the supposed central calculation in the S&OP process and the S&OP sales forecast was de-coupled from the S&OP process. Factory forecasts were used because it managed availability in daily, operational, tactical and strategic time horizons. When tracing the debates between sales and factories on the accuracy of the forecasts, a business process analyst of the group demand chain commented,

> It's quite tough for the sales because the factory has a long experience of doing the forecasts.

This thesis will later show, that although the S&OP focuses on medium- to long-term capacity management, at SWEDTECH, participants tend to ignore the forecasting accuracy outside the 12 month period, for the sales forecast within the 12 months is problematic. As a result, the S&OP loses its connection with both short-term and medium- to long-term referents. Factories also struggle with medium- to long-term capacity shortage that is represented by high availability failure (around 20%), but at least they grasp the short-term volume via product hierarchy decisions. The paradox, hence, emerges. The S&OP process was intended to recapture the lost business volume through a calculation that fosters medium- to long-term investment in capacity, but in the end the medium- to long-term part of the calculation is disregarded. The S&OP sales forecast also lost the short-term part because they were challenged by factories as inaccurate, but the S&OP did not aim to reach short-term accurate representations of customer demand, instead its intention was to smooth out monthly forecasts to erase fluctuations. The inner purpose and its outer battling against the factories tear it apart. The dichotomy between design and implantation of a system is problematic in this case because the translation is so long and matters of concern around the S&OP process are so diverse, that some inscriptions contradict each other.

Concluding remarks

This chapter has illustrated Latour's (1999a) point that any fabrication of scientific facts involves a chain of circulating references, and each is simultaneously a reduction because of the loss of locality and amplification due to generality. This chapter, however, also offers a new insight advocating that the chain of circulating references is fragile, and thus, likely to be broken. For instance, the circulation would have been broken had the ABC analysis not been invited to become the judgmental criterion in deciding the workloads to be assigned to the system and its collaborators. In effect, using the S&OP for the purpose of smoothing out the monthly forecast was already flawed, for the system would not allow the mean error as the referee to select formulas. Circulating references not only refer to the ongoing collections of the locality in the a centre calculation, but also calls for help from somewhere else when the possibility of breaking the circulation is present. Therefore, circulating references mean that researchers studying science and technologies should pay attention to the seemingly continuous references accumulated one after another. This finding is consistent with Chua (1995) and Chua and Mahama (2007) who point out that accounting both simultaneously controls and creates controversies, but this study also adds to them by claiming that ongoing controversies may not be something that can be avoided, since controversies call for new references in order for the chain of circulating references to continue. In Chua and Mahama (2007), controversies help trials of new performance measures; whilst my study reveals that controversies may attract external references to be enrolled in the network to become *interessment devices*. In a sense, controversies themselves are *interessment devices attractors*.

To construct a sales forecast, thus, encompasses a long string of circulating references; but the constructing of a factory forecast, however, encompasses an extra layer of operational level inventory management through a series of product hierarchy decisions. The group demand chain's voice for customers is convincing because it calls upon attempts to close matters of concern on existing organisational problems, particularly on poor availability, inscriptions visualising these problems and visionary boundary objects that are difficult to be argued against. This network increases the strength of the S&OP sales forecast which is used to speak for future customers' demands. Because of this

network, speaking for customers in the S&OP is not about projecting the exact business volume to be proposed by customers, but it is about being consistent with the purpose of the managerial technology. Sales' voice for customers is less convincing than factories' due to two reasons. First, it does not incorporate the short-term management of inventories. Second, networking of inscriptions brings the possibility of breaking the circulating in sales, whilst networking of inscriptions in factories contributes to the circulation.

This chapter ends with the construction of two forecasts along two chains of circulating references. The next chapter will continue describing the fabrication of the S&OP process in the space where the sales and factory forecasts battle against each other to compete for speaking for customers. The central theme in the area is a series of translations to close multiple matters of concern on forecasting accuracy. These attempts to close matters of concern in fact make the S&OP process even more multiple.

CHAPTER 7

Fabricating an S&OP forecast: circulating references and matters of concern – Part II: debates on forecasting accuracy

An Illustration

This story unfolded when I was discussing the accuracy of the body shape of a recently released model, of the all-time greatest Ferrari 250 GTO by a hand-built model car producer, Make Up, in a forum with other fellow collectors. The top picture is from the Make Up official website, and the bottom one is from a collector who points out that the curve of the rear part of the model is not correct. The discussion of this uncertainty was then translated into a preference for the collector's model because of the details or the feeling of soul. The Make Up brand has been credited for displaying high levels of detail, but lacking a soul. This story shows that, in concert with the series episodes of fabricating a sales forecast in the S&OP process, accuracy of a model car becomes a set of matters of concern including preference of feeling over details. The accuracy of a car cannot be closed to a matter of fact quickly. Amazing, isn't it?

Introduction

When constructing the sales and factory forecasts in separate chains of circulating references displayed in Chapter 6, some tensions and controversies already emerged. These tensions, however, contribute to adding multiplicity to the S&OP process. In other words, because of the very attempts to close emergent matters of concern around the S&OP process, the S&OP process is already many things. When sales and factory forecasts meet each other in order to construct a consensus demand forecast, as per the S&OP conceptual framework, the constructed sales and factory forecasts completed so far will debate against each other to compete for speaking for customers. This debate generates more tensions and controversies, thus, making the S&OP process even more multiple.

In the series of pilot S&OP product group planning (PGP) meetings, which I describe as the arena or battle field in this thesis, the central theme of the debate between sales and factory forecasts is on forecasting accuracy of the calculated sales forecast. Attempts to close this matter of concern on forecasting accuracy around the S&OP sales forecast create extra matters of concern on forecasting accuracy, thus, making the boundary of the S&OP sales forecast more fluid. Factories' voice for customers is considered stronger because there is an extra matter of concern on forecasting accuracy regarding sales' tendency to under-forecast. Although this matter of concern is never closed to a matter of fact, exploring it unfolds new entities to be enrolled in the network. These entities include performance measurement systems, rewarding systems and new visionary boundary objects. How these entities affect the fabrication of the S&OP process will be described in detail in this chapter.

Episode 9A: A transformation in intra- and inter-organisational space

In the S&OP process, the product group planning (PGP) meetings were held monthly in SWEDTECH. These PGP meetings were to be held after factories received S&OP sales forecasts prepared by sales, through SWEDTECH's information systems called the cubes. The agenda in these meetings was to discuss what actions were to be taken on capacity shortage. The factories' challenge on the sales forecasts, however, transformed this

proposed agenda into the one that centred forecasting accuracy. This episode describes such a transformation and the reshaping of intra- and inter-organisational space.

In the previous chapter, is was mentioned that the purpose of a company-wide S&OP forecast was to translate an unconstrained market demand into medium- to long-term capacity planning for the factories, product line planning (PLP) management and suppliers. In the discussion of its implications on the operational horizon, the process analyst of the group demand chain emphasised that the quality of the sales forecast also affected the operational plans of the factories,

> Here I always talk about this part. The quality of the sales forecast sets the basis of the quality for operational plans. So we make people to focus (on) that it's not always a nice wish list, you are actually planning the factories with these figures. You need to do it with quality otherwise you can't expect to get anything good out of it.

This process analyst, thus, illustrated the importance of the quality of the sales forecast and how it would affect operational plans for the factories. The process analyst of the group demand chain articulated,

> It's a living thing we should captures changes every month in order to notice quirkier when it's time to take action. But I think just the fact that sales and production are talking to each other, at least discussing things is a big improvement to earlier. Also there are prejudices on sales, you can never rely on sales. There is always blablabla. So we do better than sales, but a mix of both is what probably the best way for success.

This means that the S&OP sales forecast becomes a contacting point where the factories see the number proposed by the sales and have the opportunity to question it. The question is where this contacting point is located. In SWEDTECH, after the long translation of sales forecasts is temporarily completed, the 36 month forecasting numbers will be visible in a cube from which other parties, not limited to the factories can export data. This demonstrates the potential mobility of sales forecasts. Combinability at this point, however, created another matter of concern on the accuracy of the sales forecasts because they were challenged by the factories who proposed the competing calculation, the factory forecast that represents their production plans. The disagreements between sales and manufacturing on forecasts ought to be discussed and addressed in an informal

way, so that any discrepancies could be dissolved before the PGP meeting, which is intended to be a space only for the discussion of capacity management. Unsolved issues will be brought to the S&OP 1st level meeting, after which, further remaining issues are to be escalated to the S&OP executive meeting. This initial intended process is illustrated in Figure 21.

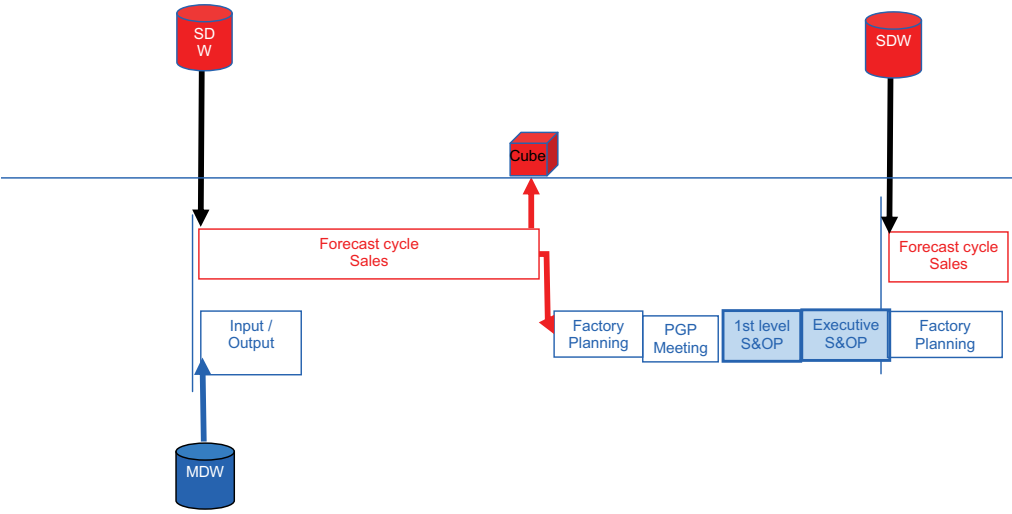


Figure 21: S&OP monthly cycle

SWEDTECH is a huge organisation, and thus, implementing the S&OP process across all product groups and factories was considered to be impossible. Before the summer vacation in 2010, the group demand chain responsible for implementing the S&OP process decided to run a pilot S&OP process on the product line of SRB/CARB. In later sections a series of episodes will show how this pilot process was manifested through a series of PGP meetings, and how the performativity of an accounting calculation makes the calculation multiple. The general reflection upon these meetings was that the differences between sales and factory forecasts were so huge that it became impossible to discuss purely on short-, medium- and long-term capacity adjustments. Instead, the PGP meeting was transformed into a meeting that unfolded controversies surrounding the sales forecast accuracy of the sales units. Forecasting accuracy, thus, became a matter of

concern again. This time, however, the closure took much longer translations than before because this matter of concern incorporated many things. The struggle is demonstrated in Figure 22 shown below.

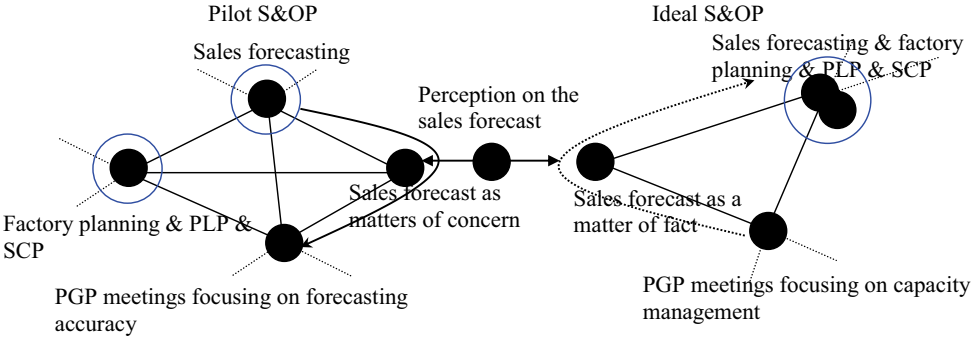


Figure 22: Translations of the space of PGP meetings and inter-organisational relations

This figure shows that in the pilot S&OP process, the S&OP sales forecast still attracted constellations of matters of concern on forecasting accuracy, which made it difficult for factories to accept in order to translate it to product line planning (PLP) and supplier capacity planning (SCP). Instead, factories in this case used their own forecast for PLP and SCP, and therefore, inter-organisational relations relevant for the S&OP process were re-shaped. Factories were allied with PLP and SCP. Factory planners, product line planners and suppliers were enrolled in a temporarily stable network. Sales were left to sort out the problems regarding the accuracy of their own forecasts. The ideal process is that the S&OP sales forecast should be treated as a matter of fact which translates the space of the PGP meeting into one that purely discusses capacity. The working stream of the S&OP, sales forecasting, PLP and SCP are acting as a collective whole. The circles surrounding the entities in the figure show the dynamic inter- and intra-organisational relationships in the making of an S&OP process. Although the ultimate relation is a collective whole comprising of participants in both demand and supply chains, a sales forecast that in its making is disentangled from intra-organisational factories, product line planning management, and suppliers, but inter-organisational factories, product line management and suppliers that are entangled. These inter- or intra- organisational relations, thus, cannot be presumed from the outset, for they are the effects of an actor-

network association between the ontology of the sales forecast, the space of the PGP meetings and their translations, accordingly. This time the central matter of concern was the forecasting accuracy. This monograph will later show that these relationships will be re-shaped when this matter of concern is also transformed and translated into extra matters of concern.

This episode has illustrated the re-emergence of a formerly closed matter of concern, forecasting accuracy. Although this matter of concern was closed within sales in episode 5, the entrance of the factories re-opened this matter of fact. Forecasting accuracy turned out to be many things when it was associated in different relations with other actors. The next series of episodes will discuss the debates on forecasting accuracy that takes place in the competition between sales and factory forecasts.

Episode 9B: Forecasting accuracy: the S&OP process – centralised vs. decentralised

This series of Episode 9 will start a series that re-opens a matter of concern in relation to forecasting accuracy. It will turn out that forecasting accuracy in the S&OP sales forecast is multiple and each episode will add a new property onto it. This series of episodes is a general description of how forecasting accuracy became a matter of concern again. Actors in this episode were supposed to discuss forecasting accuracy on the S&OP sales forecast, but they translated the discussion into one regarding the S&OP process. The dilemma they faced was the choice of the S&OP process between a centralised and a decentralised one.

The fabrication of a sales forecast, however, is not supposed to be an output of centralisation, but instead a product of joint efforts of both sales and production after the two reach a consensus demand forecast. The amplification of the consensus is significant in the sense that the prediction of the entire market volume was perceived as the centre of the S&OP. Controlling the terms of action, at a distance, was transformed into a decentralised process of calculating the future market demand. A calculation of a company-wide sales forecast was proposed to represent tactic and strategic term market

demands that were to be satisfied between 12 to 36 months. It was to be then translated into PLP and SCP.

The paradox was overt. On one side of the coin the S&OP was supposed to enrol both sales and manufacturing to foster bidirectional communication flow, whilst on the other side, the S&OP manager was worried about this bidirectional talk.

> If you are not careful, everybody will have his own number. So in S&OP, we want to have one consensus plan, which is used by all functions in the company, quite difficult.

"[It is] quite difficult." Although attempts to close matters of concern on forecast accuracy regarding a lack of cross divisional communication, inconsistent information structure and availability failure were translated into a sales forecast calculation, underneath its identity of "a company-wide" lie, waves surged turbulently. Not clearly reducing a "company-wide" calculation into a common language of either a decentralised or a centralised planning process from the outset, detained the sales forecast calculation from becoming a matter of fact; for this problematic node on the chain of circulating references induced more emerging matters of concern on forecasting accuracy, and thus, participants struggled with formulating a consensus demand forecast. The factories perceived such a company-wide calculation as another centralised order that they had to follow, even though, they were invited into the discussion after they had seen the S&OP forecasts in the cube, a virtual space where the factories are given the opportunities to challenge the sales forecast if they question their reasonableness. The centralised nature of the S&OP forecast was preferred and magnified by the manager of the S&OP,

> I mean in the end we say should have only one forecast for the demand chain, and today in SWEDTECH, we have two processes. One is sales forecast and the other is the product line forecast, but what we don't have in the actual process is that the sum of the sales forecast and the sum of the product line forecast should be equal. There is nowhere in the process what we decide on the factory side and what we decide on the sales side get the same total amount…we have all the details, as in this kind of bottom up forecast. So from that perspective, it's only a mathematics to come to product line forecast, so if we decide on the sales volume, we fix the volume on the product lines at the same point of time, so we will have at least a matching total.

This manager's interest of centralisation contradicts with that of the S&OP's to foster cross divisional communication. His idealised practice of the S&OP only involves some superfluous communication between sales and manufacturing, where factories should take the sales forecast and let their computers translate the total into lower level sub-totals. It, however, turned out later that not only did factory forecasts refuse to be settled as a space for practices of pure mathematics, but also the human actors outside the factories advocated a "challenge" to be initiated by the factories against the sales forecast. For instance, a process analyst for the group demand chain stated,

> But they can challenge it…I mean this is their task. If they think it's OK, here we have 50% increases, this is really correct, then it is their task to contact sales and get an explanation and verification and they should question this forecast saying this is not realistic or at least what is behind it… then in this meeting, this kind of issue will be brought up, say it's strange, Europe here has now 50% increase, why is that?

On the surface level, the output of the challenge is the adjustment modified to the sales forecast, according to the demand chain manager for large bearings. But in the future the extent of this challenge will be minimised to be in concert with a centralised identity of the S&OP.

> This is the way working now. They put in and we can make adjustments. But in the future, the S&OP should work like this, it should be there, and we should not change it. And if we want to change it, we have to have an approval to really agree on OK, we put this number. It should not be something that we can do very easily.

Although this has not happened yet, the demand chain manager for large size bearings expressed a worry that the S&OP sales forecast was proposed to be taken as a matter of fact in the future. However, in actuality, such centralised nature was assumed and disseminated before the pilot S&OP process; this led to reluctance from the factories and product line management. One example was the manager of product line planning for medium bearings who commented accordingly,

> I'm really positive towards S&OP in that turn because we will have to communicate with sales…I'm sure it will improve cooperation between sales and manufacturing, but it will probably take some time …we had actually one case when we had one final variant where the sales side says we are going to sell 2000 per month and we had only sold 1000 per month, and we only had orders for 1000

per month, and then we ask them, OK, we have only sold 1000 pieces per month, you say we are gong to sell 2000 pieces per month, either you have to place order, or decrease the forecast.

He added,

Then how you handle that is to have a large safety stock basically. But that will be a big problem, then we always have too little stock to service short term demand, I mean I make order today and they won't ship tomorrow. If the forecast is low, I will not have that stock. That really depends on what time perspective you are talking about. If you say a forecast, then my time perspective is per quarter, the smallest period for forecast is really per month for me, and I work for days, for hours. If forecast varies between months, that will not require many re-settings, I would say, because you will always have the safety stock, however, it will increase the safety stock, if you have less accurate forecast, you will have less optimal production because you will produce something that is not needed. You are not utilizing your capacity in a good way.

The quote of the product line planning manager indicates the amplifying effects of the quality of the sales forecast on operational capacity utilisation and inventory risk management. A large safety stock level was reserved to mediate the negative impacts of a poor sales forecast. The down side was that these stocks could have easily become obsolescent if the market was not so demanding. The S&OP forecast highlights the overall market needs between 12 and 36 months from the present. It actually tries to erase short-term fluctuation, meaning that the short-term monthly forecasts may not be sufficiently accurate. The factories, however, are concerned with daily planning, and hence, any mistrust in the sales forecast tends to be magnified in their operational planning. They understand that the S&OP is intended as a process for medium- to long-term demand chain planning, so that future business volume can be managed in a proactive way, but this is not strong enough for them to buy the process.

How can we manage the long-term if we cannot deal with the short-term correctly?

This worry that linked forecast accuracy to operational planning raised again the matter of concern regarding the debate between sales and factories, which is the forecast accuracy. The tension is shown below in Figure 23.

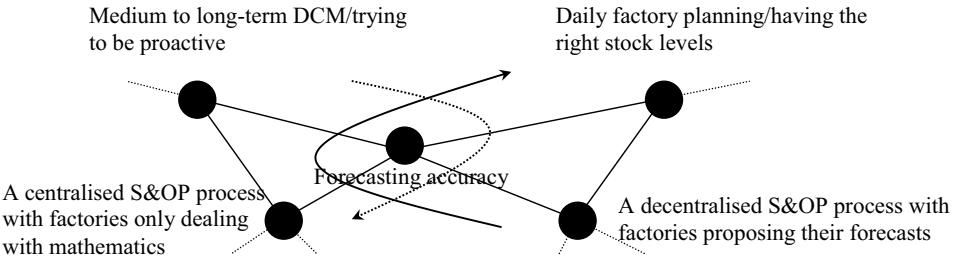


Figure 23: A matter of concern with regard to forecasting accuracy

Figure 23 indicates that according to the S&OP manager who speaks on behalf of the future S&OP process, forecasting accuracy is to be considered in order to foster medium- to long-term demand chain management, so that SWEDTECH can identify capacity shortage now in order to initiate actions and to proactively meet future customer needs. Factories should accept the forecast as a centralised process. For the factory, on the other hand, forecasting accuracy is crucial because their daily planning refers to the medium- to long-term horizon forecast, and if factories perceive a forecast as unreasonable, discussions ought to be stimulated on forecasting accuracies.

To translate this tension into a consensus, a link needs to be added, and this is S&OP's purpose to identify gaps and trigger actions. According to the process analyst of the group demand chain, the gap between the sales forecast and the factory forecast should be intentionally created by the S&OP to induce debates on the possibility of increasing production to satisfy an increasing amount of demand, thereby triggering actions accordingly.

> The gap is what triggers action. That's why I'm telling the people when they are doing the business plan. Don't put the same figures automatically in S&OP, if the figures become equal, I mean that's fine…So what they try to discover and figure out there is the reason for the deviation, is it due to data quality problems? Is it due to bad forecast? Or is it due to something in the process? Or is it simply this is just the case? So those kinds of discussions…is that gap. Then there will be, probably the customer is increasing, and they plan something like this, then there will be discussions at this first level SOP meeting about that gap. Then they will probably ask the sales manager, this is really…Yeah, we have these businesses, it's for real. Then we add a shift, we adjust according to

> that. Or we can get production support from somewhere else. And also that is good with S&OP is that now you are not within your own factory, I mean basically we have tapes produced in India, Europe and we should utilize all the resources, not only for your own little part of it. So we are trying to use our recourses in the best way.

She thus, expressed a concern for domesticating future capacity discrepancy and triggering current action that was not explicitly published in any of the formal documents of the S&OP. It was referred to as "a change of mindset" from many of the interviewees in the group demand chain responsible for introducing the "implementation" of the S&OP process. It will be shown later in an episode when the process was introduced in a pilot S&OP after Summer 2010, that it took about three months for both sales and factories to absorb and digest this deliberation. Continuing with Figure 16, adding an entity, a new link of identifying gaps and triggering actions translated the tension, with regard to forecasting accuracy, into a collective whole that is allied with S&OP's initial agenda. Figure 24 below shows such a translation.

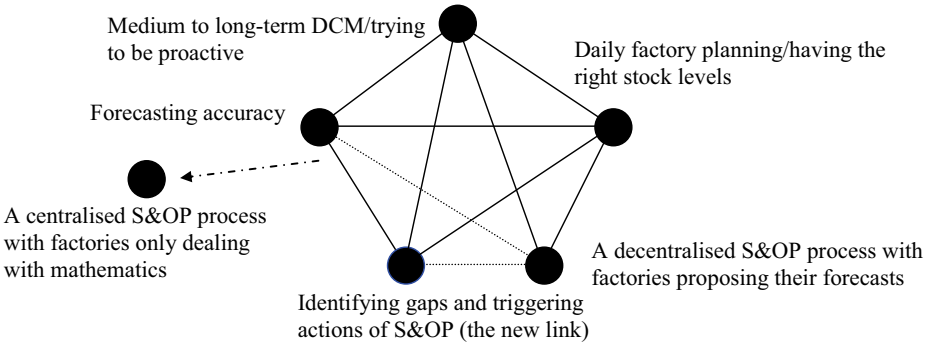


Figure 24: A translation by adding a link of identifying gaps, and triggering actions of the S&OP

This shows that the entity of identifying gaps and triggering actions, such as investigating data quality and finding cross-factory supports, indicated in the above quote is an effect of decentralised cross functional discussions between sales and manufacturing. In order to construct a gap for consequent actions, factories have to propose their production plan instead of taking the centralised S&OP sales forecast. In this sense, the claim that S&OP as a centralised process leaves the network is proposed by the S&OP manager. There is no heroic manager here. Actions to be triggered include identifying potential data quality

problems and system insufficiency that will lead to improving the sales forecast quality and facilitating cross-factory support in the short run as a result of identifying over- and under-capacity. Suddenly, over- and under-stocking are transformed from a risk to be avoided into an advantage that either helps one factory or is helped by others. Because of this new link, previously isolated medium- to long-term demand chain planning and operational daily planning become allied. Forecasting accuracy becomes debatable.

A debate on forecasting accuracy was in this episode translated into a competition between centralisation and decentralisation. This tension was in turn dissolved by a new property of the S&OP process, namely to identify gaps and to trigger actions. Actors participating in this included the group demand chain, the S&OP manager, sales, factories, the S&OP agenda, forecasting accuracy, a debate on centralisation and decentralisation and an emerging entity of identifying gaps and triggering actions. The S&OP process became multiple, although forecasting accuracy was debated. Figure 25 below shows the outcome of the S&OP process in this episode. It transformed the minimal configuration of the S&OP process fabricated in Episode 2, into one that has a decentralised property.

Figure 25: Outcome of the fabrication of the S&OP process in Episode 9B

In terms of DCM, uncertainty in future market demand was translated into a debate on the type of planning process of the S&OP. An inter-organisational planning issue was

translated into intra-organisational politics. An emerging property of the S&OP, namely its purpose was to intentionally identify gaps and trigger actions, transforming forecasting accuracy from an expense to an asset.

Both sales and factory forecasts wanted their calculations to be used to integrate DCM. In this episode, the debate was displaced away from the S&OP sales forecast towards the S&OP process. The dilemma was on the organisational structure to foster integration. Integration offered a working time/space where actors were enacted to create debates on integration, and this time the organisational structure was the object of the debate.

In this episode, the factories' voice for customers that was manifested in a decentralised discussion between sales and manufacturing on the S&OP process became stronger than the S&OP manager's voice for customers, which was manifested in his proposed centralised process that factories were to follow the sales forecasts. Factories' voice was more convincing for two reasons. First, decentralisation was allied with the S&OP conceptual framework advocating cross functional integration. Discussing the gap between sales and factory forecasts was considered a stimulator to trigger future actions. This allied a visionary boundary object to be proactive. Second, decentralisation was essential because forecasting errors would affect their daily factory planning. Decentralisation, was thus, allied with attempts to solve existing availability problems.

So far, the sales organisation has prepared their S&OP sales forecasts and factories have also proposed their forecasts, the S&OP initiatives have been disseminated and the deliberation of changing the mindsets of both sales and factories has been expressed. Now these two circulating references confront each other in order to identify gaps, trigger actions and reach a consensus. The next series of episodes will narrate how debates on forecasting accuracy unfolded more matters of concern on the S&OP process, and how the S&OP process became a fact to be translated into the PLP and SCP. Or is it even possible for it to do so?

The series of pilot PGP meetings

SWEDTECH is an organisation with the divisions AD, ID and SD, and it also produces five platform products: bearings units and housing, seals, lubrication solutions, mechatronics and services. Therefore, implementing the S&OP process across the whole organisation at once was, according to the group demand chain, a mission impossible. The decision was to select the bearing platform in ID in Europe as the location for the pilot S&OP process. ID was chosen because SD might find it too challenging to implement S&OP due to its business volume and customer distribution, and AD's availability failure was not that serious due to its quality and long order book. In particular, the product line of SRB/CARB was selected. According to a sales manager in the bearings and units platform, SRB/CARB is SWEDTECH's best seller and ensuring its long-term availability is of vital importance for the survival of SWEDTECH.

As was described in the previous section, in the monthly S&OP cycle, the product group planning (PGP) meeting ought to be a space for discussing capacity management. Any debates with regard to forecasting accuracy should be settled in an informal way once factories see the forecasts uploaded in the cube by sales. When, however, the pilot S&OP started on the bearing platform in the ID in Europe, the debates on the forecasting accuracy were so intensive, that the PGP meetings that I attended were filled with discussions on the gap between sales and factory forecasts. This series of episodes will describe how a singular object called forecasting accuracy creates multiple extra matters of concern, and how these emergent, ongoing and multiple extra matters of concern are translated.

Episode 9C: The September 2010 meeting – Forecasting accuracy: incentives to under-forecast

The first of these PGP meetings was held on the 28th of September 2010, to discuss the pilot process for September. The meeting started with the presentation of the divisional business cycle forecast (BCF) for each individual sub-product line of SRB/CARB in ID in Europe. Interestingly, although both sales and factories have the BCF as a reference in their circulations of constructing their forecasts, the BCF was not an object that attracted

any attention. Debates emerged when the following slide was presented (See Figure 26 where actual figures are hid to reserve confidentiality).

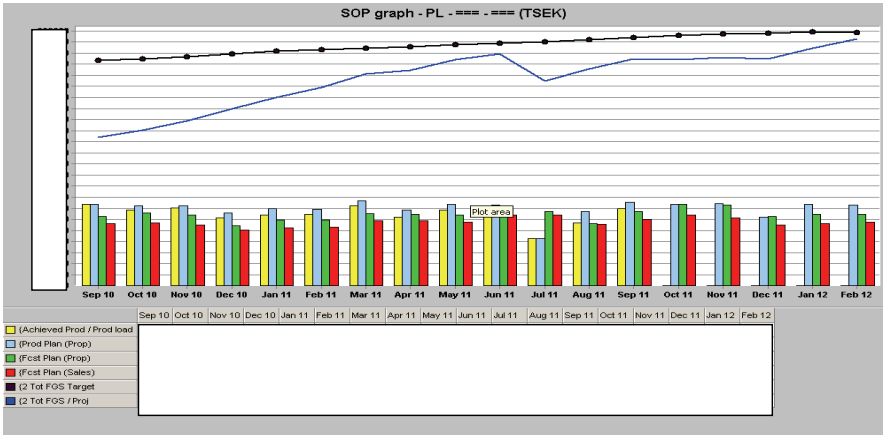


Figure 26: Sales and factory forecasts in September, 2010, pilot S&OP

In the figure, the second right (green) bar represents the factory forecast, whilst the first right (red) bar shows the sales forecast. These two bars were the objects that attracted intensive debates between sales and factories in the series of pilot S&OP PGP meetings. The first left (yellow) bar represents achieved production and the second left (blue) bar represents proposed production. These two bars were not discussed in the meetings that I will discuss below. On the top of the figures, the top (black) curve represents the target stock level, and the lower (blue) curve projects the expected actual stock level based on its capacity. If the black curve is above (below) the blue curve, it means a projected under (over) capacity issue.

What was debated drastically was the belief that sales was consistently underestimating the future market demand. The above graph represented a phenomenon that the sales forecasts were in every month lower than the factories forecasts. This was reflected in the September 2010 meeting by most of the participants as an outcome of lack of training of the sales people in using the S&OP.

> "There are some extra issues. For individual channels, (sales forecasts) have been ups and downs."
> "It's important to collect forecasts and other data."

"Hanover is being trained."
"Nilai is being trained."

These quotes mean that the training process was either absent or in the process. In the meeting, most participants deduced the fact that consistent lower sales forecasts compared to factories' costs were due to a lack of training in the S&OP process of the sales organisations, but no discussions focused on how such a lack of training could construct such low forecasts. When I later tried tracing the specific causes of this concern, one of the managers responsible for manufacturing and supply in the ID kindly explained,

> There was no alignment for sales. ID sales decided that the forecast should be the same as the financial forecast. There was no change in business thinking.

This reflection was that participants in sales were still sticking to the old business thinking of the financial forecast. They were not really thinking of the S&OP forecast as the one that represents the unconstrained market demand. In this setting, their S&OP forecasts were nothing more than a target that they committed to achieve at the end of each month, as they had always done. The above manager in ID elaborated,

> There is always an alignment on the aggregated level, but this is group management making that, not the individual unit, they are not aligned. You know sales, they have a financial forecast, so they keep it low because they want to have a bonus. Factories don't have that, they are more, trying to determine what kind of demand they should supply for.

As was narrated in the prior section, there was a preference by some human actors to advocate for a top-down forecast that communicates the management decision, rather than a bottom-up forecast which tries to predict future demand by best estimating prospective customers' business volumes by using customer information; because some argued that SWEDTECH was better at projecting the future than customers. The financial forecast mentioned in the above quote is also one of these top-down forecasts. Each sales director collects financial forecasts from its local sales forces in each region, and then the group management makes a decision on an aggregated financial forecast. The rewarding system however, is tied to such financial forecasts, which then raises the concern of under-forecasting by the sales.

The same business manager in sales and units cogently pointed out in the meeting,

> Review is important for top down. The worst forecast is the one that is aggregate to a high level because it is an aggregation of errors below.

Unfortunately, the forecasts actually presented in the September pilot S&OP meeting were a set of perceived under-estimated financial forecasts. These presented forecasts were just what the business manager considered as the worst forecasts, for they were "aggregations of errors below" because of the possible under-forecasting by sales.

The debates then went on to individual factories. In Luton, as was shown in Figure 27 below, there existed a huge gap between the target stock level and the stock projection, representing a serious under-capacity (the black curve is way above the blue curve on the top of the figure). In terms of forecasts, the factory's projections were significantly higher than the sales all the way up to November 2011, and the two parties' expectations since then have been the same. This was explained by one of the product line planning managers.

> We had a huge gap getting sales to give a realistic forecast for Luton…there were a lot of debates and frustrations with data quality from sales, so it was just pure, extremely pure data quality from sales. We had also problems with regional warehouses' stock targets, especially in Singapore where sales is much lower in 3mm SD. Actually, Luton is very much SD. SD had absolutely no (S&OP) process. And they said themselves that we need half a year more until we will have good process.

This implies that a lack of training in the S&OP process in Luton on the background of the pilot S&OP, actually brought the locals into the centre of calculation as a lack of data quality and the concerns of forecasts at regional warehouses. This will be summarised in the monthly S&OP report, which in turn amplifies its stability and mobility that these concerns need to be investigated and addressed if possible.

The reason why January and February 2012 sales and factory forecasts were equal was because no one cared about the long-term, as 2012 was too far away from September 2010.

> They didn't care about 2012. The front end was so bad, why should I…They tend to look at the next year or the next 12 months.

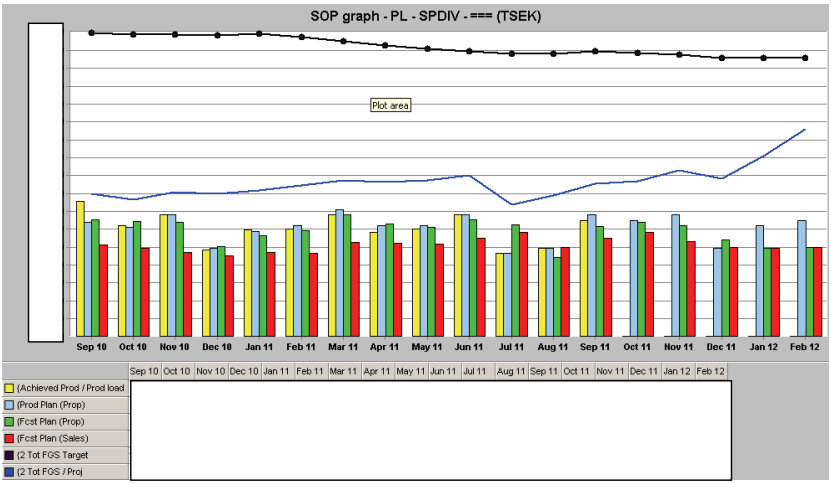


Figure 27: Pilot S&OP for Luton in September 2010

The case of Hanover was similar to that of Luton as it was discussed in the September meeting, that data quality was low. In particular, some product line data was missing from Hanover. Therefore, the debate of the forecasts in Hanover was skipped.

Then came the case of Nilai in Malaysia (See Figure 28 below).

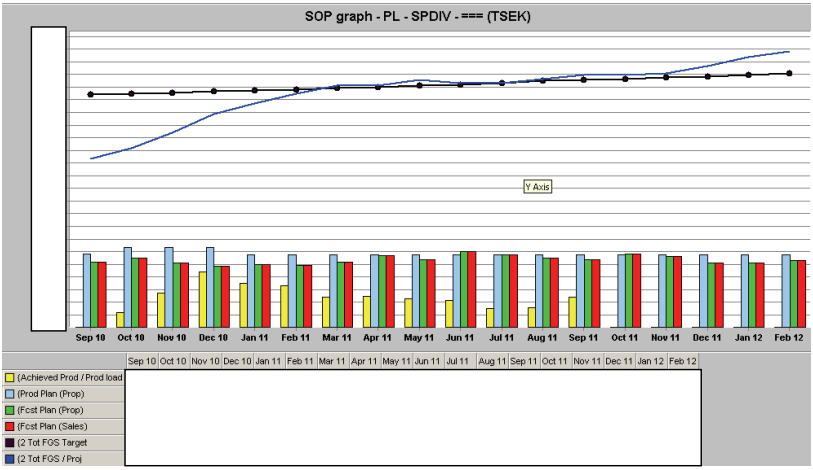


Figure 28: Pilot S&OP for Nilai in September 2010

The presentation above of Nilai unfolded two realities. First, in every month, the sales forecast equaled the factory forecast. Second, up to February 2011, an under-capacity was anticipated, but thereafter, an over-capacity was anticipated.

Because the September 2010 meeting was permeated by questions on the reasonableness of the S&OP sales forecasts due to a lack of training in the process in the sales organisations, the representations mostly pointed to under-capacity, and capacity management was not attracting too much interest. Although it appeared in Figure 20 that sales forecasts were the same as the factory forecasts, it did not mean that factories believed and took the sales forecasts. Instead, they put the sales forecasts in the figure simply because they did not bother arguing against the sales. They still used their own forecasts for factory and product line planning.

The September 2010 pilot S&OP PGP meeting, unsurprisingly, deviated from S&OP's agenda to discuss capacity management. The jump from using sales forecasts to managing capacity was too sharp and quick. The constructed sales forecast still generated significant matters of concern on forecasting accuracy that prevented it from being a matter a fact which could be forwarded to factory planning, PLP and SCP. The September meeting brought to present, the absence that would never have been represented had there been no S&OP process. The matters of concern on forecasting accuracy in this episode were a lack of training on the process, a lack of change of mindsets and poor data quality of sales. Uncertainty is not something that exists as such, but is the effect of an association between humans (sales, factories, group demand chains and product line planners) and non-humans (sales and factory forecasts). A lack of training in the process and a change of mindsets were anticipated effects, but a lack of quality data was unexpected. As a result, in September 2010, factories either challenged sales or did not even bother considering sales' forecasts. Although the sales forecast had passed through a long chain of circulating references, the calculation was disregarded and disconnected to factory planning, PLP and SCP. Factory forecasts, on the other hand, were not challenged because first, factories do not have an incentive to under-forecast, and second, factories have more experience of forecasting than sales. Therefore, in the

arena where sales forecasts met their factory counterparts in September, the triumph went to the factories. Matters of concern on forecasting accuracy, aforementioned, disconnected the S&OP sales forecasts from the S&OP process. Factories took the victory, but not because they were more accurate in domesticating future customer demands; customer demands were never mentioned in the meeting. Figure 29 below summarises the September battle in this arena. The red circle indicates the winning group.

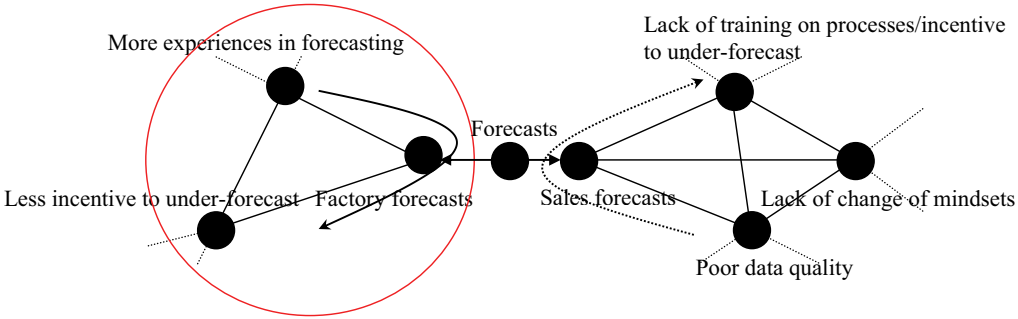


Figure 29: September 2010 battle at the arena: factory forecast triumph

Figure 29 shows that factories took the trophy because sales' forecasts were not reasonable, but factories were also more experienced and had less incentive to under-forecast. For sales, a lack of training in the process, a lack of change of mindsets and poor data quality were all identified in the meeting as weaknesses; but these downfalls also became stimulators because these problems may re-connect the sales forecasts to the S&OP network if they were solved.

In this episode, forecasting accuracy was again transformed into a quasi-object with a set of matters of concern. Forecasting accuracy was thus, de-black boxed into a lack of training in the S&OP process, a change in mindsets, and poor data quality of sales. A lack of training and a change of mindsets largely meant that sales regarded the S&OP sales forecasts as the same as the financial forecasts, which created an incentive to under-forecast because they are linked to the bonus system. On the factory side, forecasting accuracy was linked to an absence of under-forecasting and longer experience in forecasting. Customers were not actors in this episode. The actors participating included

the group demand chain, sales, factories, financial forecasts, rewarding systems and forecasting accuracy. Although the same actors were present before, their relations are continuously shifting because their properties are changing.

In terms of DCM, uncertainty in future market demand was translated into uncertainty in forecasting accuracy. Customers were not enrolled in this episode. An inter-organisational problem in forecasting was translated into an intra-organisational issue of disconnecting the present S&OP practice from the existing financial forecasting practice. Although inter-functional factories challenged the S&OP forecast, they helped reach a consensus, but the existing financial forecasting practices of sales de-constructed the S&OP practice. There was an integrating endeavour across functions, but a fragmenting endeavour within sales.

Before discussing how sales and factories competed for a voice for customers in this episode, an exploration on whether a matter of concern of under-forecasting can be closed will be necessary because forecasting the errors derived from possible under-forecasting arguably weakened the voice for speaking for customers. An investigation of the matter of concern on under-forecasting will be discussed in the following interlude, which is still part of this episode because it is related to the constructed matter of concern on a lack of training and aligning of the S&OP process.

Interlude: forecasting and performance measurement systems

This interlude attempts to explore how a possibility of under-forecasting could have impacted the fabrication of the S&OP forecast. The exploration turned out to include more new entities into the network of the S&OP process. Performance measurement systems (PMSs) and rewarding systems of sales and factories were found to neither detach nor attach the S&OP practice from or to the existing forecasting practices. This eventually influenced whose voice for customers was more convincing.

Matters of concern on sales' incentive to under-forecast

In this episode, sales were mentioned by some interviewees as having a "political" incentive to under-forecast. For instance, the demand chain manager for large bearings indicated,

> …I means, sales persons have, most of them have the sales bonus, if they sell more, they earn more. Of course they would like to sell more, if they say that they will, for example, for the next year, we will sell a little less, or we will not sell so much, then the bonus will be put at the level, then in reality, we will sell more, then we will get a high bonus, so I think they can play with the numbers. I'm not sure what is coming in the sales forecast, is it what we think that we will sell, or something that we wish that we would sell, or is it something that we most certainly, absolutely basic sales.

This message led to a question during my field study. What was the basis on which the sales generated their S&OP forecasts? Was it the output based on their optimistic, pessimistic or prudent assumptions? Could they actually provide a best estimate? These questions on sales forecasts could not be black boxed, hence, must be traced in order to comment on the fabrication of the S&OP forecast.

The common generalised perceptions of the sales can be raised in any organisation, but in the context of the S&OP world at SWEDTECH, these matters of concern were the incentive to under-forecast, which translated the amplification of networking inscriptions and had been problematised earlier in this thesis. This network is displayed in Figure 30 below.

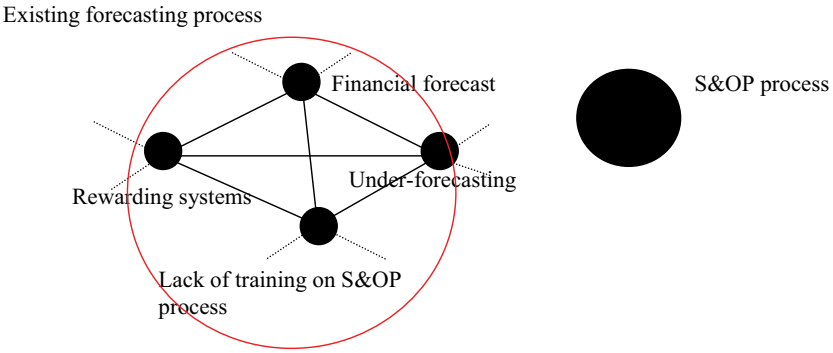


Figure 30: Existing forecasting practice and S&OP process 1

Figure 30 shows what sales used to prepare the financial forecast to which their bonuses were linked. Suddenly asking them to prepare an S&OP forecast, though instruction manuals were supplied, in order to ascertain the gap of capacity shortage in the medium- to long-term horizon actually created uncertainty in their existing forecasting practice. The existing management accounting practice of forecasting had been structured in a way that the calculation should be constructed to link their perceptions on the future with their commitments to achieve, via a financial forecast, the result of which was associated with the rewarding system of sales. It was this structure of intentionality (Ahrens and Chapman, 2007) that raised the incentive for sales to under-forecast. When the S&OP was introduced from autumn 2010, sales saw it as nothing different from the financial forecasts, that is, their promises and their commitments that would be linked to their bonuses. The lack of training on the process and the existing forecasting practices kept the S&OP process at bay.

But when the S&OP process was trained after the winter in 2010, sales still tended to use the financial forecast as the S&OP forecast. When I expressed the matter of concern on the tendency for the sales to under-forecast, a forecasting manager in SD commented,

> To some extent you replicate the financial forecast which has been existing in SWEDTECH for as long as I know, and you put those numbers into here. In the financial forecast, you have certain constraints, then what we want to forecast is the unconstrained demand. I think it's political. Local sales may not pay attention to this (S&OP) forecast because you know you will be questioned. And you might not be able to appropriately respond to those questions, or they will not be accepted. I myself have cases where we really and purely try to reflect on the demand outlook, and it was deviating compared to the financial forecast. The collaborators felt that felt that OK, since he was having two different trends, two different forecasts, he was getting a lot of unpleasant questions, which he had to respond to, so the conclusion for him was that if there are somewhat aligned, he gets a way easier.

This suggests that when the training of the S&OP process was not sufficiently provided and the mindsets of participants were not changed, sales people tended to use the financial forecasts as the S&OP forecasts. The forecasting practice illustrated in Figure 30 slightly changed during winter 2010, to Figure 31.

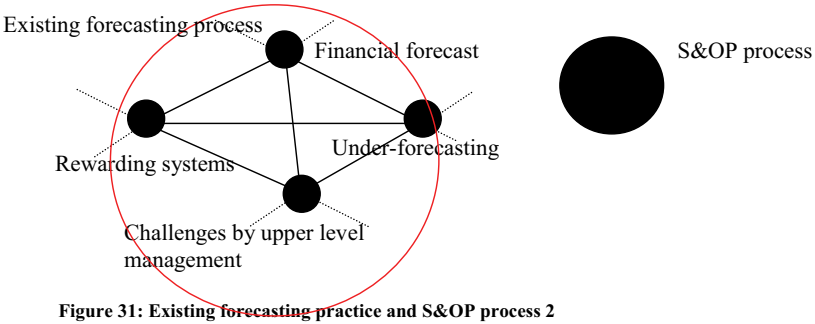


Figure 31: Existing forecasting practice and S&OP process 2

In figure 31, the rewarding system for sales was still linked to their commitments presented in the financial forecast, but his time the incentive to under-forecast was not merely attributed to the link between financial forecasts and the rewarding system. Moreover, sales again tended to use the financial forecast instead of the S&OP forecast to avoid challenging questions from upper level management because the latter was also not sufficiently informed about the S&OP process. This time sales tried to produce from scratch an S&OP sales forecast, but then became reluctant to do so, for once upon a time, the S&OP forecast was a trouble maker to them because it was challenged by upper level management. Therefore, the S&OP process was still kept at bay. The upper level management was an actor in this situation, but they were an ally with the existing forecasting practice because their challenges on the S&OP forecasts forced sales to revert to the use of financial forecasts. Here senior managers were alien to the S&OP process.

It is necessary to further trace these matters of concern of sales' incentive to under-forecast in order to find out whether this incentive during the implementation of the S&OP project was reduced, or whether it was reduced at all. Sales' responsible key performance indicators (KPIs) became the entities to be followed.

Responsible performance measures for sales

In the sales organisations, there are three human actors participating in computing the sales forecast for a particular region. The sales director, the forecast managers and collaborators who report to that sales director. According to the manager of the S&OP,

> …if you take the business unit, cars, automotive, there is one guy (the sales director), he's responsible for all sales in cars worldwide…So he has the overall responsibility for the process, so he's responsible for having enough resources in place to run the process and there is a focus on the process, so he's overall responsible for it. He's also responsible that his forecast review takes place, he's also the one in the end who approves the forecast, so he's the one in the end to say, this is my number.

Thus, the sales director's overall responsibility in the S&OP is to approve the initial sales forecast, which is to be debated informally after factories see the number in the cube. In the pilot S&OP process, this number was debated in the PGP meetings and amplified to raise the gap on perceptions between sales and manufacturing. A sales director has to make sure that their forecast managers and collaborators have the resources and are educated in the S&OP process. It is also in principle, their responsibility to open a dialogue with the forecast managers and collaborators when their perceptions result in a discrepancy of future demands. When the forecast was presented in the PGP meetings and subject to debates, the sales director became the spokesperson for the customers, the forecast managers and the collaborators. The incentive to under-forecast was mitigated via questioning by their peers and ultimately via the challenges imposed by factories in the PGP meetings.

The September 2010 and February 2011 presentations amplified their stability, for they conveyed an important message. The S&OP forecast should not be the financial forecast otherwise it was meaningless to introduce it. Problems on a lack of training on the process, changes of mindsets and data quality needed to be translated into action plans that would not only ally sales units to the S&OP, but also attract upper level management's attention. All human participants needed to be informed that the S&OP would try to identify future gaps so that capacity related actions could be initiated in the present time. There, however, had never been an official measurement of the senior management participation in relation to the S&OP process. On the other hand, implementing the S&OP was incorporated into the Balanced Scorecards (BSCs) of sales units, but only as secondary to major financial measures. One forecasting manager in the SD emphasised in June 2011,

> I would say, typically for a selling unit if we take Turkey, they will have a target that you should sell for 700m SEK, you should have x % of profitability, that's what they will be measuring us, plus other activity base like we should win 5 more contracts. Now the only target is that we should have an effective S&OP process, fully implemented S&OP process, but not a number, just yes or no, but that's not part of the payment system. We don't have a (numerical) target today which is based on S&OP forecast. It's disconnected. I mean the targets are based on the financial forecast. Therefore you could indirectly have an incentive to under-forecast, but this will be challenged by different levels of management.

It can be deducted from the above quote that the sales' BSC places financial measures to the centre of the practice of performance evaluation, which is similar with the case presented in Figure 30 earlier. The mitigating mediator in this setting is the challenge coming from upper level management.

The forecasting manager, however, does not have the knowledge of any specific customer groups according to the S&OP manager,

> The forecast manager, he's the one basically administrating the process. He runs the system, so he prepares the system forecast, he makes the analysis when the people have entered the data, so what has changed, what are the big exceptions, where is the change to last month, where is the change to last year, so those kind of questions he is answering. The one who's responsible for that can be for customer VW, for example. He's the one entering numbers.

The forecast manager's overall responsibility is to administer the forecasting process. They have specific knowhow with regard to the historical sales for a particular customer group, for instance, Volkswagen (VW). They have the responsibility to adjust the system forecast if they believe the future will be a discontinuous jump or fall. But as was indicated above, this was not connected to any numerical targets or rewarding systems.

The collaborators are the groups in SWEDTECH that have the closest contact with customers. They have very specific knowledge on the lodgment and withdrawal of particular customers' businesses. Their incentives to withhold the information that a customer will lodge a new business model cannot be mitigated by challenges from the sales directors and forecast managers, for they do not have direct contact with the customers. In addition, in the SD, as was discussed in the prior sections, the form of

pointing out existing items with material value and strong growth will affect the collaborators' judgments, but the primary keys for ID and SD on the higher level product lines lead to the process analyst's worrying about aggregation of forecast errors.

> So when it comes to ID, that's the aggregation of errors. SD, it's really poor because…I suppose what you should do is to evaluate the results, if you follow the process, then proper evaluation, what is really the result of the outcome.

The process analyst above pointed to the need for forecasting evaluation, and actually after the February 2011 PGP meeting, forecast evaluation was circulated in order to mitigate both the incentive to under-forecast and the possibility of aggregation of errors if forecasting was done at a higher level. It was revealed that the system automatically picks up the formula with the least average net errors in the forecasts for the last 12 months. This cannot be modified for it is built in the Demand Solution. The reference of average net errors contradicts with S&OP's purpose to generate smooth forecasts to foster medium- to long-term capacity planning, but it does not necessarily ensure the highest levels of accuracy for monthly forecasts. Consequently, mean error was selected to measure monthly forecast accuracy, but it was not officially implemented, as was highlighted by the manager of the S&OP,

> Then we have KPIs, and there is one important thing than everything else in the S&OP, that is the forecast measurement. We use mean error as a % to measure forecast accuracy. We are thinking about better solutions to make this more automatic in the kind of cube, but this is not happening this year, maybe next year, so we will put that on business next year. But I am sure that the forecast accuracy is not in their bonus scheme, both on sales and manufacturing. This is something that we may try in the long term to see if S&OP can bring this to the bonus system.

In short, matters of concern on sales' incentive to under-forecast underwent a number of trials that tried to mitigate such incentives including, as was mentioned in the above quote, to evaluate forecasting accuracy using mean error %. The group demand chain put in more efforts into training the sales in the S&OP process, and emphasised the crucial importance of identifying the discrepancy between financial and S&OP forecasts to both sales and upper level management. The debates between sales and manufacturing in this sense helped to reduce sales' incentive to under-forecast. Effectively implementing the S&OP has become a KPI in the BSC of the sales units and an indicator of mean error %

will be part of the performance system (PMS). These measures, however, were never made official, thus, remaining self-disciplinary and disconnected to the rewarding systems. Figure 32 below shows an interesting display of intra-functional fragmentation and inter-functional coordination.

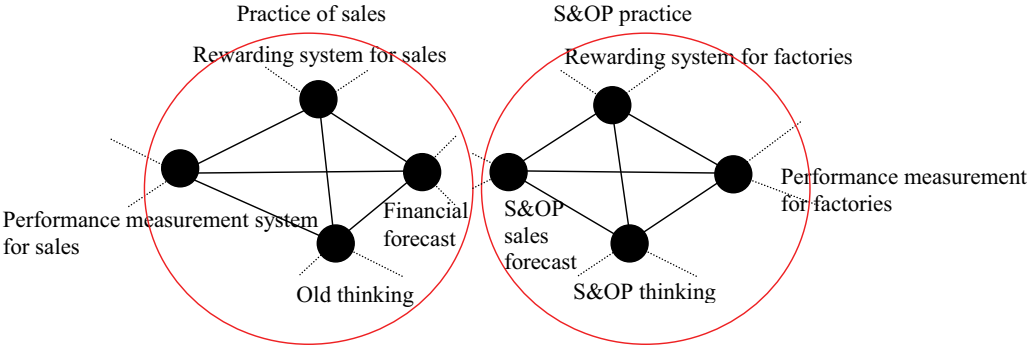


Figure 32: Existing sales practice and S&OP

Figure 32 indicates that the relation between the S&OP forecasts, financial forecasts and BCFs disconnected the S&OP forecasts from the existing forecasting processes in sales. Consequently, reverting to the existing forecasting practice disentangled the S&OP forecasts from the S&OP process in sales units. Factory forecasts were, however, trying to restore the S&OP forecast into the S&OP network, but there was no actor linking the S&OP process to the financial forecast and the rewarding system for the sales. The interesting finding here is that in the constellation of the matter of concerns of under-forecasting by sales, factories were allies in the S&OP network, but the PMS and rewarding systems of sales betrayed the process. On the demand chain of SWEDTECH, inter-functional competition on calculations contributed to the construction of a consensus number, but the whole network may fall apart because of the intra-functional frictions.

An even more interesting question emerges. What is the referent of the S&OP sales forecast? The answer will obviously be the customer demand. So this question becomes, *where are customers in the S&OP practice network?* According to ANT, Latour (2005a)

says that the objectivity of an account lies in its resistance to stay against objections. To stay against objections, an account has to ally other entities, to make its voice stronger. The importance of the sales to ally customers is magnified in the following quote from a business process analyst.

> Yes, I was working for Volvo and Scania, two truck manufacturing companies in Sweden, we actually were doing that internally, in the sales department, we made an prioritization saying that let's supply Volvo, and we told Scania that you are number two here. We lost from 60% market sure to 30-25%, then it took like 5 years, and now we are back there again. It doesn't necessarily mean forever but of course you can imagine as a sales guy coming to a customer saying that sorry we are in good relation, but you are not prioritized with SWEDTECH, I cannot supply you any more. It's not a nice thing. So sales is lot about building relations.

Customer relation management, was thus, indicated by this process analyst as an object that was placed into sales' responsibilities. In theory, building relations with customers helps compute a better forecast, for both parties have the opportunity to be familiar with each other. SWEDTECH may have built relations with several customers, but did it ally customers' voices in producing the S&OP sales forecast? In the first pilot S&OP PGP meeting, one sales manager offered a surprising account,

> The more you ask the customer, the less likely the customer knows the future. Our guess/assumption is better than the customers.

This traces the concern of locating customers' voices back to the matter of concern on forecasting logic with top-down and bottom-up forecasts. In theory, the S&OP process deliberately constructs gaps between S&OP sales forecasts, financial forecasts and factory forecasts. These gaps ascertain a future capacity shortage that is supposed to be a typical feature of the S&OP process. SWEDTECH can, thus, inform customers of a shortage earlier or better yet, serve them later. The internal S&OP forecasts try to predict future customers' needs according to different primary keys with the help of inscriptions such as order books, sales histories, key customer accounts and of course BCF, but the external BCF and financial forecasts translate top management perception on market trends into guidance that either forms a starting point for S&OP forecasts or generates commitment promised by sales (the financial forecasts). The external forecasts pay no attention to order books, sales histories and key customer accounts. Actually, it was

shown earlier that netwroking these inscriptions can cause circulation to be broken. This finding indicates that the matter concerning the networking of internal and external forecasts slows down the fabrication of the S&OP forecasts. It may not break the circulation, but from time to time it brings the possibility of disconnecting the calculation from its referent, the customers.

To summarise, the extra matter of concern on the incentive for sales to under-forecast in the S&OP process attracts enormous translations that render the S&OP network fragile. Existing rewarding and performance systems that are linked to the financial forecasts make the forecasting practice for sales detached from the S&OP practice. The factories, and their challenging of the S&OP sales forecasts, on the other hand, try to contribute to the development of the S&OP process. In the S&OP network, sales units are fragmented under the two practices, but factories and sales are united in the S&OP process. In addition, the matter of concern about the choice of top-down and bottom-up forecasts distracts the attention of S&OP participants and brings the likelihood of disconnecting the referent of the calculation – the customers - to the calculation itself. It was shown in the last chapter that the incentive to under-forecast was not kept at bay by disconnecting existing practices of sales, but by offering more training of the S&OP process. In the May and June 2011 pilot PGP S&OP meetings, sales increased their forecasts significantly.

On the factory side, the factory forecast became a stronger voice in the S&OP actor-network because it allied a number of entities and networks that are allied in the actor-network of fabricating the factory forecast. Their PMS's played an important and interesting role. This will be discussed in the following section.

Matters of concern on factories' incentive in the S&OP process

This section will open the black box of factories' incentive and their PMS in the S&OP process. This incentive is also treated as a set of matters of concern instead of a matter of fact because it involves fluid and multiple relations between factory forecasts, the S&OP and PMS.

When the state of purpose of the S&OP to let the factories follow the sales forecast was originally expressed to the factory planners, responses on the factory side soon pointed to the increased burden of responsibilities and loss of controllability of these responsibilities, which altogether encouraged them to strengthen the voice of their factory forecasts. The product line planning manager for medium bearings defended,

> It (the S&OP) sounds logic. However, there is one problem, that is, all of a sudden, we [are] removed from the control of forecast from here, we don't have a say about it, but we are obliged to fulfill it, and if the forecast is wrong, then we will get the blame that we have too much stock, because then we have produced more than we sold, and then we will have obsolescence, and that will end up on our result, our income statement…And we will be responsible for something that is out of your control.

The product line planning manager expressed a reluctance to accept the S&OP logic because of controllability. Matters of concern on factories' incentive in relation to their responsibility and its controllability, however, are shared with the S&OP's agenda to intentionally identify a gap between the sales and manufacturing to proactively identify problems and causes for problems, and to visualise the consequence of deviations. The same manager uses the term "cooperation" to address the concern on responsibilities.

> It would require a good cooperation. I personally really love cross border cooperation. I'm not really hierarchical. I'm for the matrix thinking, so it would be wonderful.

The term "cooperation" here was translated by bringing about a "challenge". Cooperation cannot be settled in a short translation where sales forecast can be translated into factory planning of PLP and SCP. Cooperation in this case involves a long translation where tensions on responsibility and controllability are translated into a factory forecast and a final collision between the sales and the factories forecasts. Suddenly, cooperation equals battling and competition. The same manager once commented,

> No, we don't take the sales forecast, we take the…our own forecast, which we have create from the sales forecast, we don't have exactly the same forecast as the sales, we don't take that forecast and just put it into our own system, but we take that as an input to create our own forecast, we are not taking exactly what they say. If we see something, OK, this is not reasonable, so we are not just applying, OK, give us the forecast.

It is this coherence of cooperation and competition that contributes to restoring the S&OP sales forecast that is disconnected from the sales practices. Sales tended to merely take the financial forecast as the S&OP forecast. As a result factories questioned its accuracy, which in turn initiated competition that eventually allied sales' and factories' perceptions on future volume, thus, re-entangling the sales forecasts with the S&OP practice. The disconnection between the S&OP practice, and the rewarding and performance evaluating practice for sales does not make a solid S&OP sales forecast, thus, postponing the calculation from being carried forward to factory planning, PLP and SCP. It was difficult to trace whether more training on the S&OP process contributed significantly to mitigating sales' incentive to under-forecast, but the debates between sales and factories did contribute to constructing a stronger S&OP process.

The next section will trace these matters of concern on factories' incentives regarding their PMS to the construction of the factory forecasts under the context of the S&OP practice.

Responsible performance measures for factories

Factory channel planners have a number of KPIs for which they are responsible. These were explained in great detail by the manager in charge of the product line planning stream of S&OP.

> ATP, which is availability to promise. If they ask us to deliver on the 1st of July, if we have certain quantities that we can promise availability, what we have in stock and what we plan to produce before that. When we are doing that today, we are taking customers. In that warehouse, we have stocks, we can promise customers on that base. ATP is linked to our product hierarchy, the M, D and E decisions. So in this example, they have a 100 pieces of pack variants, that is the customer order, belonging to material family B. This one is a make to order. It's nothing that we have in stock, we only produce this we have the customer order. Since we don't have anything on stock, then we need to check our production schedule, when do we produce this the next time, and in that case, you found that material family B is out here. Then we can give the customer answer at real time, and we will say that…the only thing that we have decided in this case is we have to produce 1000 pieces of that size of that bearing, nothing else…This is also that if you have during this time, they want to keep this as flexibly as possible.

As is indicated in the above quote, one of the customer-oriented service based KPIs is the ATP. Factory planners translate their responsibilities to ensure availability of a set of product hierarchy decisions. This translation improves ATP by mobilisation of time, as was explained in Chapter 6. By making M decisions first, that is, to decide which material families (MF) to produce, the translation of ATP into product hierarchy decisions creates flexibility in availability by postponing D and E decisions. For such a translation to be possible, the factory forecasts mobilise the daily operational planning of product line planners. Those planners, hence, will be able to decide which MFs to produce first by referring to BCF, key customer accounts, shipment history and in the example above the order book. The importance of forecasting accuracy in higher MF levels precedes the accuracy in lower final variant levels due to the mobilisation of time via product hierarchy decisions. These translations are ultimately linked to ATP in the factory's BSCs for which factory staff are responsible. Forecasting aims at improving ATP, but it does not ensure its happening. Neither do product hierarchy decisions, they instead postpone the time of making decisions on final variants so that ATP will be higher, compared to a situation where there are no such product hierarchy decisions; but factory forecasts are crucial because the M decisions are to be made from the outset. In this vein, the S&OP forecast is allied with the factory and product line planning network because all the factory based interviewees agreed that medium- to long-term capacity management will certainly foster short-term planning. Factories have longer experience in forecasting than sales, but they challenged sales' forecasts in the pilot S&OP meetings not because they wanted to claim their calculations were superior per se, but because the S&OP process was linked to their KPIs. This explained the finding described in the previous section that whilst sales were fragmented in the S&OP process, factories were allied.

Actually, forecasts become vital to the channel planners because they are responsible for free availability on a daily basis. According to the product line planning manager for medium bearings, the translation of the responsibilities for the ATP into product hierarchy decisions also transforms the notion of time for the channel planners.

> Daily planning! I would say the objective or the goal of the daily planning, to maintain free availability. Free availability means you should have the right products on stock all the time. So we can service the market…Also the daily includes you should book the dispatch order everyday, you should order material everyday, yes, you have made your M decision what to produce, so we do this, we have a loop of tasks that we do each day…Here says core tasks for the supply chain manager, to daily or rather continuously maintain free availability, so it's every second, it's not reasonable, optimal free availability per product at every moment.

This quote means that channel planners think of ATP on daily intervals. They are responsible for availability on an everyday basis. The factory forecasts are also crucial for the channel planners since they are also responsible for the availability in the warehouses. Hence, the boundaries of availability against which channels planners' responsibilities lie are also extended.

> The manager in the warehouse is responsible for planning of the warehouse and the stock level in that warehouse. If the service is bad, he claims that it depends on supplies from the factories, then it's the factory responsible for the service level because if he has a bad planning, but not his fault. It's the factory and the channel responsible for that performance in the warehouses.

The interessment device of performance measures in the factory BSC and ATP enrols the S&OP sales forecast, factory forecast, channel planners, product line planners and warehouses through the mobilisation of time by product hierarchy decisions (see Figure 33 below). Debating the S&OP sales forecast in this case assists the improvement in the KPIs, thus, making the associations in the network tighter.

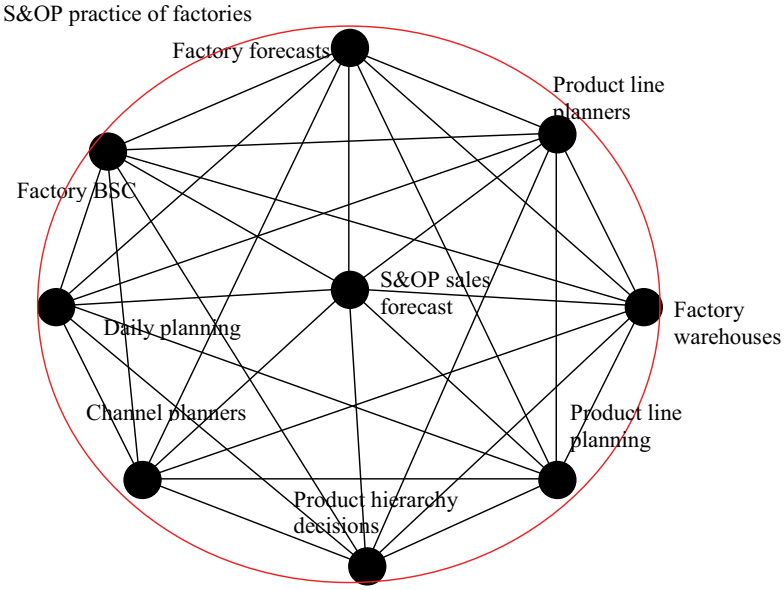


Figure 33: Practices of factory S&OP

Figure 33 shows a detailed translation. The factory S&OP practice is now an intricate network of heterogeneous actors including humans and non-humans. The S&OP sales forecast and factory forecast are tightly coupled to ally interests of channel planners, product line planners and factory warehouses who are responsible for KPIs in the factory BSC. They also have impacts on product line planning and daily planning based on product hierarchy decisions. This explains why factory forecasts have been considered as a stronger voice in the S&OP process than the sales', and the S&OP sales forecasts were later transformed into shipment forecasts, the language that is used by factories. It will be difficult to object against such a network, for to do so, all links and associations in the figure have to be broken.

The narratives of PMSs pertaining to sales and manufacturing produce more insights than have been theorised by the literature of strategic performance measurement systems

(SPMS). In the storyline of the S&OP process in SWEDTECH, a PMS translates various participants' interests through calculations (a factory forecast) and decision making (product hierarchy decisions) that mediates the relationship between visionary boundary objects (to be proactive, demand driven, agile and so on) and the centre of calculation (a S&OP sales forecast). This is the case of the factory BSC. The sales BSC, however, fails to generate such a huge network. In addition, a mere financial forecast could easily fragment the S&OP practice in the sales organisations because their PMS is not part of this collective whole. Both sales and factory BSCs are multidimensional and strategically oriented according to the theory of SMPS, but one betrays the S&OP process and allies the existing practice with the centre of calculation of a financial forecast, against which the S&OP practice wants to disconnect in order to reconnect future customers. The other kept its loyalty to the S&OP practice, though it promotes a calculation that challenges the S&OP sales forecast. It is not competition between calculations that objects the solidarity of a network, as long as the competition is embedded in the network. Instead, it is this dis-embedded nature that objects if this dis-embeddedness allies the existing practices. Resistance of change is not only an individual effect of any level of management, technologies or managerial technologies; it is an outcome of practice that new technologies and new managerial technologies are fragmented by forces of the existing practices. However, the proposed new practice can still perform, as long as these new matters of concern and technologies are supported by a competing group whose interests are enrolled by the mediation of the relation between its PMS and the purpose of the new practice. An intra-functional practice may strengthen the resistance of change, but an inter-functional competitive practice may dissolve such a resistance.

The translation of improving the KPI for availability, however, was then turned in an unexpected and somewhat surprising direction when more matters of concern on incentives pertaining to a factory producing large size bearings were enrolled. This long translation was first discovered during an interview with the product line planning manager for medium bearings when he was elaborating the usefulness of following this KPI.

> Your question was if I get blame if I get bad KPIs, that I didn't get, I mean everybody understood you can't get good KPIs if no order is coming etc…I had bad availability, that doesn't tell e what to

> do. I had to investigate that further by doing that, I use my own KPIs, I mean that I look at the stock mix, maybe I produced something too much and that takes up stock and I'm only allowed to have certain level of stock. There can be a lot of reasons, which really don't show up in the availability arrow. Even in theory, I could have 100% availability failures, but only one day later, because it's very black and white, then I can have other channels having 100% errors three year wrong, I mean they would look equally bad while the three year delayed channel is a lot worse than one day channel…because it's aggregated and it doesn't show any details. It shows that something is wrong, not what is wrong.

In this case, this manager problematised the BSC in terms of its capacity of what is actionable, to identify the causes of the problems and means to solve them accordingly. This trace in the factory BSC provided an opportunity to follow the fabrication of the BSC. The next section will show a narrative of the fabrication of the BSC in the Gothenburg large bearing producing factory, and its association and performativity in the S&OP network. This is considered interesting because the large size bearings will be added into the S&OP process in December 2011, and the production channels in the Gothenburg factory have been regarded as more aligned with the S&OP process. This thesis now provides a narrative of the BSC to explore its trajectory of how it was embedded in the S&OP process.

A fabrication of the Balanced Scorecard

This sub-section describes a fabrication process of the Balanced Scorecard (BSC) in the factories, especially the Gothenburg factory which produces large size bearings. This fabrication is associated with the matters of concern on factories' incentives and the fabrication of the S&OP sales forecast. It offers a narrative on how strategies, BSC and the S&OP are relational to each other.

When allying the bunch of literature on performance measurement systems (PMSs), the Balanced Scorecard (BSC) in particular, aforementioned by the quote in the last section, points to the performativity of ATP as a KPI. According to the manager, ATP is an aggregate level measure, hence, it does not tell anything about how to improve the availability. I further followed this line of argument and finally traced the construction of the BSC in the Gothenburg factory. According to the demand chain manager for large

bearings in the factory, each department in the same factory has a similar BSC. An example of the BSC is depicted in Figure 34.

> This is the scorecard from 2010's large bearings demand chain. Our vision is to become.. it starts with this part, to see the link from vision to the perspectives, and then the critical success factors, to the 2012 breakthrough targets, and then parameters of 2010…you can see we have the customers, we have the business processes, employees and shareholders. And the critical success factor is to create and capture value for market leadership, standardised and continuous improvement, attract and develop more competencies and motivate people and focus on profits. So everything is coming from the vision, manufacturing excellence is the manufacturing program at SWEDTECH, like Toyota.

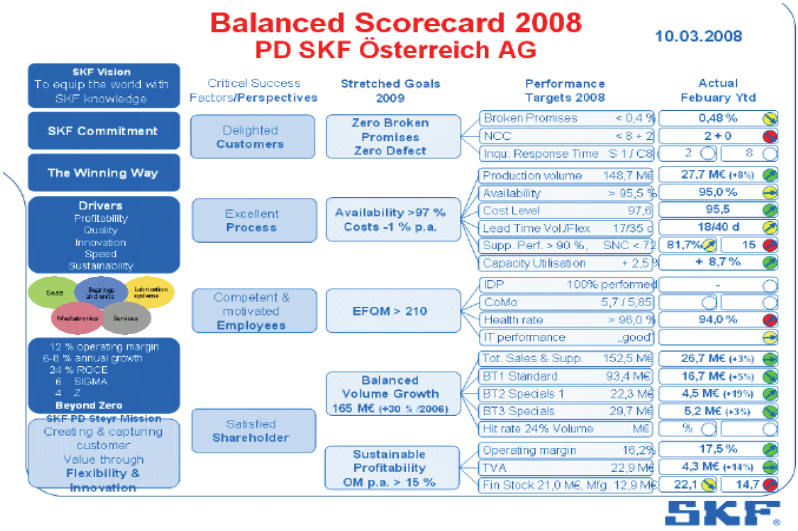


Figure 34: An old BSC for a large bearing producing factory

The BSC from his quote above can be regarded as a strategic performance measurement system (SPMS), for it has multiple dimensions and is claimed to be linked to the vision of the ID. The manager continued with the emphasis moving onto the KPIs, which he described as a dashboard,

> Yes, KPIs. We had, um.. every month, we had results, and we compare that to the targets of that month. Then we have key activities that should support these KPIs. This is our old way of looking at it, but this becomes very much as a dashboard that… like… follow up the results month by month… here we are running three different activities that we believe we can reach 1.75 here but we are not

quite sure. We are very much focusing on the result instead of the process, on the improvement process.

This means that the traditional BSC is to him only a dashboard for focusing merely on results, rather than processes. Apart from the availabilities, another commonly used reliability measure, broken promise, was highlighted. A promise is broken when SWEDTECH says to the customer that there is something in stock, and then the customer comes to ask to have that order fulfilled in 2 days, and then SWEDTECH cannot ship it to the customers within 2 days because in actuality it did not have the stock. The factory in this example identified some causes that it perceives will reduce broken promises in an ad hoc manner.

Here we have broken promise 10%. We have a heat treatment flow project that should be giving some effects during quarters 1 and 2. And we have some training. We have some supplier development. We have some communication with warehouses, and S&OP implementation. All these together, we just make assumptions that this should give something good for the broken promise, but we don't know how much. So we just simply put. Ok, we saw that 2, now we should reach 1 at the end of 2010.

Although these causes were not built into the BSC as performance measures, they provided a space where processes in the factory were to be improved. In the above quote, an S&OP implementation was considered as a cause to affect broken promises. The S&OP process was suddenly linked to a PMS in factories. This connection will be analysed later in the interlude.

So far, the discussion has gone in alignment with most of the BSC literature in terms of multi-dimensionality and a strategic fit, but the storyline unfolded in an unexpected manner when I asked the manager how they built the cause-and-effect relationship between measures in the BSC. It turned out that the factory had found an alternative way of defining the causal relationships in the BSC, which the manager called the new BSC.

In this one (the old BSC), we didn't do it, but in the new one, I will show you, we have done it…you understand what didn't want to have this just to follow up numbers and results, we want to go into the processes and focus on the improvements, activities instead of focusing on the results.

He meant that the BSC should be more process-oriented, and further described that the new BSC would bring a change of mindsets.

> It's a big mindset difference because if we only focus on the results, we could make sub-optimization, and of course we will reach this target, but maybe in that case, we can do something that will harm other KPIs. We want to see more the total picture, and focus on the activities and processes, and then the manufacturing excellence will be…The manufacturing excellence is like the Japanese, the Toyota model. We have some values and principles. So in all our decision making or improvements, we should always think out of these principles. In that way, we hopefully can avoid making sub-optimization for specific parts of the flow, for the whole processes. We look for the whole processes instead.

A visionary boundary object of manufacturing excellence, thus, originated the idea of using a new BSC. Building a set cause-and-effect relationship in this new BSC was proposed to go beyond performance measures and KPIs. Developing causal relationships to improve one KPI may cause danger that will hamper other KPIs. The factory in this case saw all the processes involving all KPIs as a collective whole. Manufacturing excellence was enrolled to initiate the change of mindset for improving the overall processes in the factory, which was believed to have the potential to benefit all KPIs spontaneously.

The traditional view of the use of a SPMS was problematised by this factory. BSC's features of multi-dimensionality and strategy orientation were reduced into a property that was only results driven, through the notion of a dashboard. Kaplan and Norton's BSC became insufficient here. Normative design features of the BSC, proposed by Kaplan and Norton, were suddenly transformed into a weakness that could compromise factory processes. The old dashboard result oriented BSC, that aimed at improving KPIs through setting standardised targets across factories, was perceived by a visionary boundary object of manufacturing excellence as suboptimal; for each factory may have already displayed a different status of performance. Customisation must be put in place so that each factory can continue pursuing improvements in their overall processes.

> We can see in the industrial division, manufacturing and supply part, they have both some hard targets, like this, availability failure less than 6%, but they also have some activities, like this lead time and frequency, they don't put a number, this just say, this is a focus area, and here we need to

> be better, but they don't put we should be like this because then, it could also limit the thinking, if it is already decided that all factories, all channels should be 15 days lead time, then some channels may have a already 14 days, OK, then nothing for us to do. But maybe in that area, what customers need is to reach 8 days. So I think to put more focus on processes and then look at each area, how can we improve it rather than putting a number here.

This quote indicates that customisation was preferred to standardisation because each factory possessed different process statuses. The Gothenburg factory, however, explored this opportunity of customisation even further by modifying the whole identity of the BSC, rather than individual targets in the BSC. The key difference between the old and new BSCs is that the new scorecard does not specify even targets for KPIs for channel planners, as these targets are perceived as irrelevant for some particular factories that have already achieved them. The new BSC suggests some strategic challenges that the factory perceives as crucial. Any initiatives are invited, and successful ones are stored as tool boxes for future references. According to the same manager,

> This is our way of working. In this we have values, we have our principles, and guidelines. And here is the vision. And in these perspectives, we have these strategic areas. So here is high motivation, this is flexible competence. This is clear leadership. This is attractive working places…And it will also affect the service in the market, availability and reliability from stable processes. So we will affect, in a positive way, the customer. Since we have increased cost efficiency and effectiveness, we will also contribute to the shareholders of increased productivity. If we have stable processes, we will have short and effective response time. If we have customers want something, we can react on that much faster if we have stable processes. So more or less, everything here reaches to that we can increase our turnover.

The cause-and-effect across the four perspectives in the BSC, was thus, translated by manufacturing excellence into identification of the key strategic challenges, for instance, leadership, internal communications, stable manufacturing processes, flexible productions and so on, where improvements in these areas are expected to improve KPIs in all of the four perspectives in the BSC. ATP and broken promises are still KPIs to follow, but a common space was created to improve them, namely stable manufacturing processes. When this manager was presenting his perception of the new BSC to me, the notion of stable manufacturing processes were repeatedly highlighted. During winter 2010 and spring 2011, having manufacturing processes had been one of the critical

strategic challenges in the new version of BSC. KPIs such as ATP and broken promises, were not only given a space in the customer perspective, but also seen as effects of a network of stable manufacturing processes that were yet to be delineated. They are therefore, no longer the leading indicators that lead to increased performance in lag indicators in a pre-determined direction. Instead, it is the strategic challenges that colour those KPIs. Strategic challenges were pre-defined not only in their names, such as stable manufacturing processes, but also their contents were to be filled in the new BSC practices. ATP and broken promises are continued to be KPIs for which planners are responsible, but the space for improving these KPIs is under delineation, namely stable manufacturing processes.

Constructing a network of new BSC practices, however, needed further translations because "free thinking" did not concretise its purpose to have stable manufacturing processes. Having stable manufacturing processes had no essence until *others* gave it its colour. The new BSC, was thus, transformed into a strategy map to translate "free thinking" into something actionable, some priorities were,

> So this is our new… we call it strategy map from 2010 to 2015. And the bold square here is our priority. So this is what we start with during this period from 2010 to 2015 because we have limited resources. We cannot work on everything at the same time. But if we work on the leadership and empowerment, and we work with improvement activities, we'll get stable processes and we will affect here. Then in parallel, we have some big projects to move all our channels to this side of the river as I told you 2 days ago. That will give a high impact on reduced cost. So the bold is more like we decide to have a focus and when we communicate this strategy to all employees in the factories, we also want to communicate something that they can work with. So even we have some other things going on with big projects, this will not stop big projects but we are running it in parallel.

Strategic challenges, for instance, having stable manufacturing processes, acquired their essence by adding a translational link to the new version of the BSC, namely the strategic focuses or activities that represented priorities perceived as urgent by relevant demand chain managers. The BSC was simultaneously transformed into a strategy map that visualised the theoretical cause-and-effect features in a way that started with strategic focuses/activities, to strategic challenges and up to improving the KPIs.

The implementation of the strategy map was transformed into a process where a common factory practice of process improvement was constructed. Autonomy attributed from manufacturing excellence was realised by identifying strategic focuses/activities to address strategic challenges. A new type of scorecard is illustrated in Figure 35, and Figure 36 inserts a specific box describing a specific strategic focus/activity to foster identified strategic challenges, thus, transforming the new BSC into a strategy map.

> We have each box, for example, lower cost. We have made a description about how do we see it. It's like a [micro]vision, just or this, we make a visualized picture of what do we want to achieve, in this text here. And then out of this text, we pick out some key words, what we need to do, for example, this is to move over the river, and why we need this KPI, and now we are in the middle of the work here, to create how we should measure the successfulness of this KPI, the moving, shall we follow it in a projected way or should we follow the specified rows in the finance report. Because to move the factory from this side to another side, it will affect a lot of rows in the financial report, the monthly report. And what should we measure on the KPI to meet a success. Maybe we should measure time, how far we have come according to plan…So this is what we are creating now. We have the strategic focuses or activities.

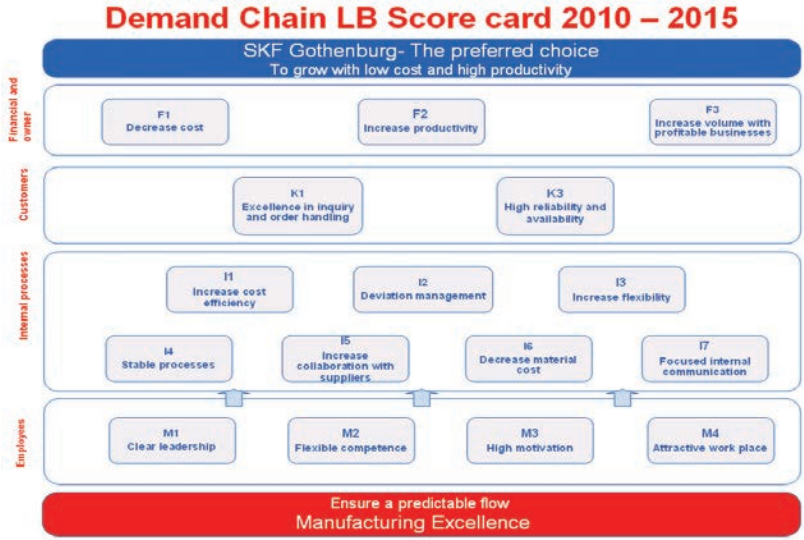


Figure 35: A new BSC for a large bearing producing factory

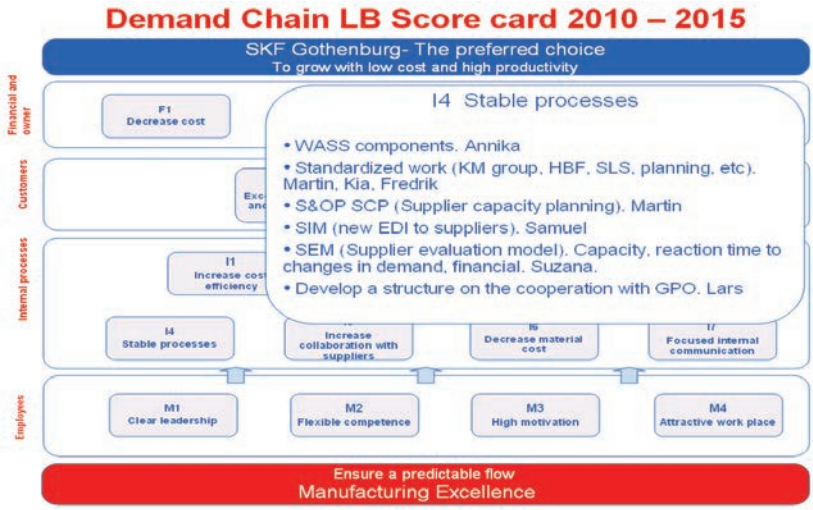


Figure 36: A strategy map for a large bearing producing factory

The strategy map above indicates that each strategic challenge, for instance, to have stable processes, contains different strategic focuses/activities; for instance, S&OP SCP. In addition, a sponsor was also nominated for a specific strategic focus/activity.

> The only way we managed it was that we had a sponsor for each KPI. So I was the sponsor for the service, broken promise, availability and delivery time were my KPIs….And I should measure if these activities are enough to meet our target. And everything came from…OK… we should reach 5% and now we are 7%. OK, this 2%, can we close the gap or not? In the end I think we'll have much greater effects if we focus on the process goals and we focus on making improvements, we focus on having a positive trend instead of just doing things to reach the targets.

As is shown in the above quote, the strategy map made process improvements in the factory actionable, but it differentiates from Kaplan and Norton's strategy map where it is those performance measures that make strategy actionable. What makes a strategy improve processes is a network that connects a visionary boundary object of manufacturing excellence, a strategic challenge of having stable manufacturing processes and a set of strategic activities. The strategy map, which was allied with the idea of manufacturing excellence not only enlarged the space for improving KPIs, for which the sponsors were responsible, but also mediated the perceptions on achieving targets.

Targets were deliberately mentioned by the manager as limiting the possibilities for manufacturing excellence. KPIs were no longer crude objects to be improved. Instead, they became matters of concern that involved a long translation which sponsors, activities, and strategic challenges were cascaded. The irony was that targets and KPIs became even stronger, albeit, the human actors had been trying to lower their voices because their identities were perceived to be the only results oriented. More entities were now allied to back them up.

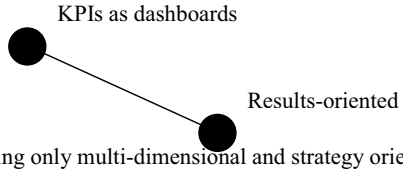
Surprisingly, in Figure 36 above, S&OP was considered a strategic activity used to foster the strategic challenge of having stable manufacturing processes. Relevant sponsors were still responsible for KPIs, but they defined the S&OP sales forecast as a crucial element to enable the stable manufacturing process; thus, improving their KPIs. S&OP sales forecasts now became allied with the factory's interests to improve KPIs. The strategy map in this setting became a mega-process in which the S&OP process was embedded. As was narrated in earlier sections, factory forecasts challenged S&OP sales forecasts not because their interests were disentangled, but because they were allied in the S&OP process. Moreover, the PMS in the Gothenburg factory producing large bearings, unlike other factories, became a larger network of which the S&OP network was enrolled as a strategic focus/activity in the strategy map. In other factories, KPIs in the original version of the BSC were merely interessment devices enrolling other entities such as channel planners, product line planners, warehouses and S&OP forecasts. In the case of the strategy map, the S&OP process became the lay actor contributing to the fabrication of the strategic challenge of having stable manufacturing processes, and hence, constructed a PMS.

The strategy map, however, plays a vital part in the S&OP process here because the planners' financial rewards are not linked to the improvements of the KPIs in the strategy map, for any poor performance cannot be attributed to any individual planner, but is considered the effect of the overall process in the factory. Responsibilities are not translated into financial rewards, but into the overall performance on the entire process of the factory.

> …if the efficiency is worse than planned, it will affect all these parameters. But for the planners, they can do nothing. If they have a breakdown in the machine, it's out of their controls. These KPIs, service parameters are measurements on the success of the whole factory more or less, not only production, not only planning, not only product design, not only purchasing, all functions need to take their parts in getting the channel in a good way. If maintenance department doesn't repair the machine, it will affect this.

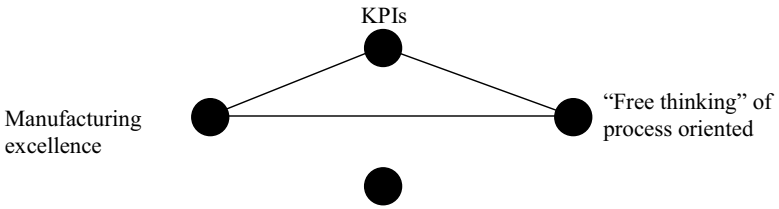
This leads to an interesting finding. The rewarding system of the factory was not linked to KPIs such as ATP and broken promises. Instead, it was linked to the factory financial forecasts promised as their commitments. If they can fulfill their promises of shipments, they will get a bonus. However, unlike the sales organisations, where financial forecasts and their rewarding and performance measurement systems betrayed the S&OP process, factories' financial forecasts and their rewarding systems did not betray the S&OP process in terms of an under-estimated factory forecast. In factories, other than the Gothenburg factory channels producing large size bearings, there exists a huge network displayed earlier where the S&OP practices of factories allies enormous entities whose interests are allied. Factory BSCs are lay actors contributing to this collective of the S&OP process. S&OP is a mega-network. In production channels, manufacturing large size bearings inside the Gothenburg factory, financial forecasts and the rewarding system still cannot object against the S&OP practice because the strategy map has become a mega-architecture where any incentive to hamper the forecasting quality will compromise relevant strategic activities, challenges and even the purpose of improving the whole process of the factory. KPIs in the PMS are not stand alone numbers to be achieved; rather they are an integral part of this mega-architecture. In this case, S&OP becomes the lay actor and the strategy map becomes the mega-network. The development of the strategy map is shown in Figure 37 below.

Stage 1: BSC as a SPMS



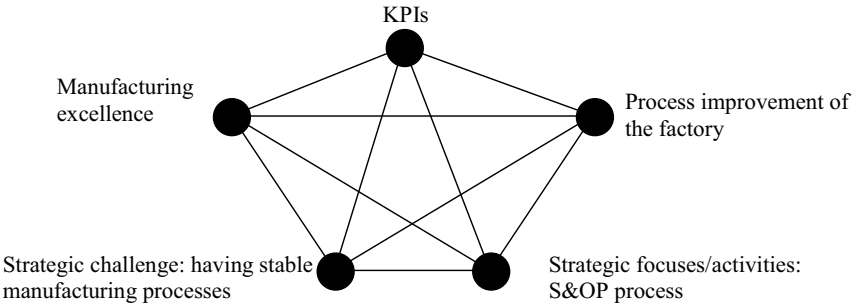
Narrative: Being only multi-dimensional and strategy oriented is not strong because there is no network.

Stage 2: BSC as a SPMS for improving processes



Narrative: There is a network for the KPIs to be stronger, but the strategic challenge has no essence because it cannot be connected to the network.

Stage 3: A strategy map has a SPMS for improving processes where S&OP is only a lay actor.



Narrative: This is a stronger network for KPIs. Instead of contributing to the S&OP process, the S&OP is now embedded in the mega-architecture of the strategy map.

Figure 37: A three stage evolution of the factory PMS

At stage 1 of Figure 37, the old BSC was abandoned in the Gothenburg factory producing large size bearings because there was no network. There were no *others* giving a dashboard and a result-oriented PMS colour although the BSC was an SPMS (strategic PMS) because it was multidimensional and it was claimed to link to the vision of the company. At stage 2, a new BSC was constructed. KPIs were linked to a visionary boundary object of manufacturing excellence, and a strategy to improve processes in the

factory. Although a strategic challenge of having stable manufacturing processes was proposed, it was not enrolled in the network because the new BSC was still not actionable. At stage 3, the strategy map was constructed because an extra actor, a set of strategic focuses/activities, was successfully enrolled. Each actor at this stage became stronger because of their relations with other actors. A strategy to improve overall processes in the factories became more convincing because it was linked to a visionary boundary object of manufacturing excellence. KPIs and S&OP now became more objective because they disconnected factories' incentive to under-forecast, for any incentive to under-forecast would hamper those KPIs, and thus, the overall progress of process improvement. A PMS becomes an SPMS not because it is multidimensional and strategic oriented, but because it disconnects any other threats to hamper the strategy. The outcome of the fabrication of the S&OP process is shown below in Figure 36. It indicates that a matter of concern on forecasting accuracy was translated into an extra matter of concern on both parties' incentive to under-forecast. Sales did under-forecast because of their existing financial forecasts and rewarding systems. Factories did not under-forecast, and therefore, factory forecasts were used for PLP and SCP. Although the S&OP sales forecast was supposed to guide the S&OP process, it was the factory forecast that became the central calculation in the actual S&OP process.

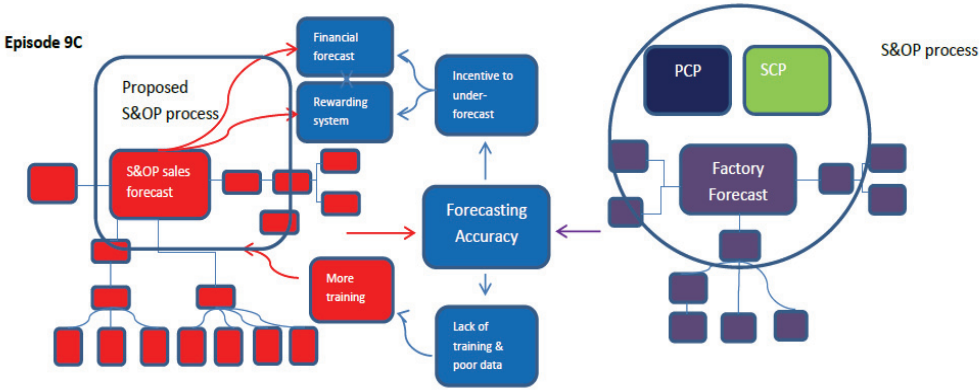


Figure 38: Outcome of the fabrication of the S&OP process in Episode 9C

In terms of DCM in this episode, uncertainty in future market demand was translated into a process of ensuring that the possibility of under-forecasting, which compromises the forecasting accuracy, was disconnected. Inter-organisational uncertainty was translated into an intra-organisaitonal manoeuvre of building an SPMS that fosters process improvement, whereby KPIs in relation to customer services were made stronger.

In terms of integration, the attempt to integrate in this episode was hampered by the likelihood of both parties to under-forecast. The task of mitigating such likelihood was delegated into separate spaces; forecasting practices in sales and factories.

A short reflection

The narrative of the PMS in factories yields another finding. The S&OP process does not keep existing forecasting and performance evaluating practices in sales at bay. It does not change these practices in factories either. However, factories' BSCs link their forecasts in an intricate manner that allies a number of interests pertaining to a number of participants. Connecting S&OP to this repetition of existing practices makes the factory forecasts stronger. In a specific case where the Gothenburg factory was introducing a new practice of using a strategy map, factory forecasts were still stronger than sales forecasts because this new practice was transformed from a repetition of existing practice of performance evaluation, the old BSC. On the contrary, the S&OP process did significantly change the forecasting practice in sales organisations. Sales' BSCs were allied with their financial forecasts and their practice of performance evaluation. There was no actor making the repetition of existing practice support the S&OP practice. When fabricating a managerial technology that aims at domesticating the future, past and present, repetitions of existing practice play vital roles. Repetition of existing practices constructs accounting inscriptions that are stronger than those that are produced by new practices.

According to my theorisation on SMPS and whether a PMS is an SPMS if it disconnects any threats to hamper the strategy, the PMS in sales is not an SPMS because if the strategy is to align the S&OP process, the PMS fails to keep the threats, which are

existing forecasting and rewarding practices, at bay. The BSC and the strategy map in the factory are SPMSs because they keep these threats away from a strategy of improving processes, which fosters the S&OP process in an unexpected way.

It is time to go back to where I inserted this interlude to discuss how multiple voices for customers are competing in this episode. In the September 2010 meeting, factories' voice for customers was more convincing than sales' because factories were described to have had less incentive to under-forecast. After exploring the relations between the S&OP forecasting practice, existing forecasting practice and performance evaluation practice, I concluded that factories have a stronger voice for customers because the factory and sales forecast are tightly coupled to ally interests of channel planners, product line planners and factory warehouses, who are responsible for KPIs in the BSC; and the KPIs are achieved through product line planning and daily planning via a set of product hierarchy decisions. In the special case of the Gothenburg factory, its voice for customers is convincing because the S&OP process is built in its strategy map to ally a visionary boundary object, a strategy, a strategic challenge and a set of strategic activities. Sales' voice is weak because their existing forecasting and performance evaluating practices fragment the S&OP practice. This fragmentation cannot keep sales' incentive to under-forecast at bay.

Episode 9D: The February 2011 meeting – Forecasting accuracy: a constrained or unconstrained S&OP sales forecast

The group demand chain decided not to meet and host the monthly PGP meeting until some training had been provided and processes had been aligned. The next meeting was hosted in February 2011 to discuss the S&OP monthly representations for January 2011. This time, the meeting started with representations of the macroeconomic trend (the BCFs) and its associated impacts on the perceived growth of business volume for ID product lines in 2011 and 2012 by the central business unit in Brussels and product line management, respectively. The Brussels unit projected a growth rate of 8.1% from 2010 to 2011 and 9.8% from 2011 to 2012. The product line management in ID anticipated a growth rate of 8.5% from 2010 to 2011, and 14.6% from 2011 to 2012. Because the BCFs were nothing more than telling a storyline of the macroeconomic trend, meaning they did not visualise any expectation with regard to individual product lines, they were

not attracting too many concerns, but the February meeting produced and consumed another new inscription (see Figure 39 with figures erased to reserve confidentiality) that showed the numerical difference between sales and factory forecasts and the decision taken to influence factory planning, PLP and SCP. This inscription showed the stability of the forms amplified through the two circulations in the numerical content of the two forecasts. Mobility lied in its transportability that carried these calculations to the PGP meetings. Combinability was also shown in this inscription because now sales forecasts and factories were both presented in the same time and space together with the decision taken and stock levels projected.

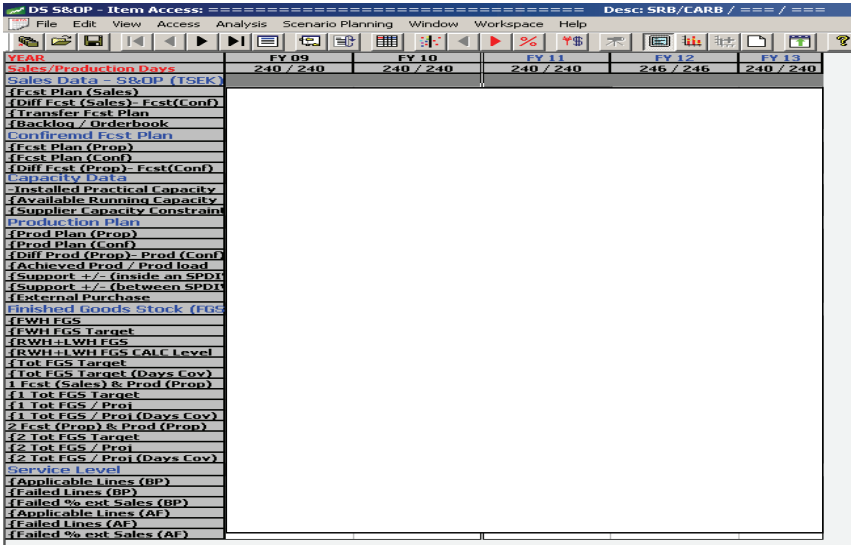


Figure 39: Combination of sales and factory forecasts

In was indicated in the above figure that for the year 2011, the sales forecast was 1.25 billion (these figures were hypothetical in order to reserve confidentiality) SEK, whilst the factories believed that there should have been 1.48 billion SEK. The consensus reached was 1.32 billion SEK; meaning factories had to decrease their perceptions on future demands.

> "The factories' decision was based on…began with very closely to what was decided in the last period".

The factories' decision made in the last month (December 2010) was 1.44 billion SEK and accordingly they expected the new volume to be 1.48 billion SEK, but the general trend as per the BCF experienced a decrease in the growth rate. Sales on the other side claimed that they had been trained in the S&OP process for several months and now were aware that the sales forecasts should represent pure customer demands. Actual sales for the last few months also reflected an increasing rate of growth. As a result, sales expected a growth rate of 11.9% from 2010 to 2011, significantly higher than both the central unit and product line planning management anticipation. This confirmed how huge the gap was in September 2010. This time, sales had increased their forecasts, but their numbers were still lower than the factories'. The consensus in the February meeting was more "aligned with the sales forecast" because, as I will describe shortly, sales' referred to the BCF and factories were struggling with increasing their capacities. They still believed actual business volume would be higher, but they yielded because the quality of the sales forecasts had been improved. This, however, was mainly driven by the case in the Gothenburg factory, who claimed improved processes, and referring to the BCF and actual sales for the last few months prior to January 2011, drove the increases in the sales forecasts, allowing sales to become the spokesperson for market demands. How sales had dealt with the problems identified in the September meeting was not discussed on this level. For the same reason in September 2010, both groups and product line management did not pay any attention to years 2012 and 2013, said the manager of manufacturing and supply.

> No one looks at that. It's too far way. Look at the first year, 12 rolling months only. There is no quality beyond that. Someone put in a figure; you never know what it is. We are not covering the full horizon yet. Just look at the first 12 rolling months. Long-term, forget about the data.

The horizon beyond the 12 month period tended to be ignored by all participants. Attention was instead turned to the same representation that was discussed in the September meeting 2010, shown in Figure 40 below.

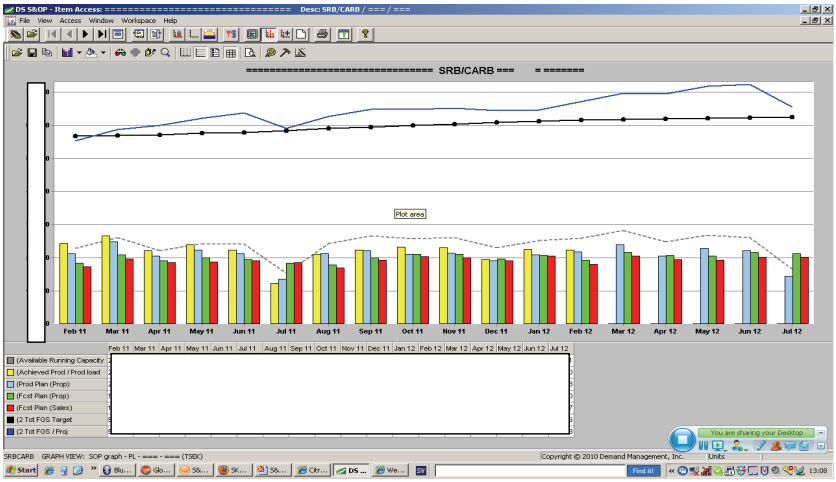


Figure 40: Sales and factory forecasts in January, 2010, pilot S&OP

Figure 40 shows that there was a decrease in the gap between sales and factory forecasts (see the gap between the first and second right bars). This spoke for improvements in aligning the S&OP process in sales. Improvements were mentioned, but the meeting did not reveal any specific means of how the process had been improved, and therefore, I tried tracing these local matters from a manager who takes care of the manufacturing and supply in the ID, and he specified,

> It's more focused, more focused. I mean focus is what is important here., and also that sales organisations have decided that we should always, what we decided in the F18 (BCF), we should always reflect in S&OP. That drives improvement. The process is much focused, focused, focused.

When I pushed him to elaborate what he meant by focused, he added,

> You have two alternatives. You don't look at or you really get to have it reported in a standardised way. Now you have spent a few days in reviewing, adjusting and you don't sent it away until you are all happy with what is in it.

To be focused in the sales organisations suddenly meant that forecasts should refer to the BCF, which was indeed why factories' forecasts yielded this time. Based on the BCF representation, sales showed higher growth rate in future forecasts. When the sales forecast was constructed through its own circulating references in episodes 1 to 5, the

circulation was once facing the possibility of being broken, for some managers believed that SWEDTECH was better than customers in calculating their future business volumes, thus, advocating an external BCF representing general market trend. When deciding the primary keys for the three divisions at SWEDTECH, the relation between the two inscriptions brought about the possibility of breaking the circulation of generating the forecast. In February 2011, when challenged by the factory forecasts, the relation between the two inscriptions, on the contrary, helped the circulation of the sales forecasts, letting them be carried forwarded to factory planning, PLP and SCP.

Having observed that the monthly sales forecasts presented in the February meeting were higher than that of the September 2010 meeting, I wanted to see if this was in fact linked to the matter of concern on forecasting accuracy that was raised in September 2010, regarding the changing of the mindsets of participants in the S&OP, that the process should aim to predict what should be the market demand without any capacity constraints. I asked the S&OP manager,

> Compared with Sept. 2010, both sales and factory forecasts have been increased. Is this because they are now aware that the forecasts need to be unconstrained?

He explained,

> Of course, the process now has been improved. S&OP forecasts should be unconstrained. We have decided late last year that within 12 months, forecasts can be constrained because we cannot adjust capacity in the short run, but outside that horizon, forecasts should always be unconstrained.

There was a decision taken to re-shape the S&OP agenda. The S&OP sales forecast was to be constrained if there were capacity constraints, but to remain unconstrained thereafter. The cut-off of 12 months was later confirmed by the manager in the ID, responsible for manufacturing and supply,

> That is decided, yes. Outside 12 months, forecasts need to be unconstrained, but within 12 months, if we have considered that I cannot guarantee, the decision is that the process should be, if we have any constraints, (in) short-term we should consider it in the forecast. The ideal is that in 12 months, we should be able to fix those constraints with our own manufacturing with all possible supplies. Actually now we should have been able to see quite some product lines because they are so in

shortage that for 12 months the forecast should be constrained, and then in 3 years, everything is available, just produce what they forecast.

The decision was ad hoc, simply because capacity is not adjustable within a 12 month-time hence, forecasts therein should be constrained. This change of "design", the agenda of S&OP, was not made from the outset, but constructed during its "implementation", when factory challenged the sales. The January 2011 battle between sales and factories became a mediator transforming the S&OP agenda. This is shown in Figure 41 below.

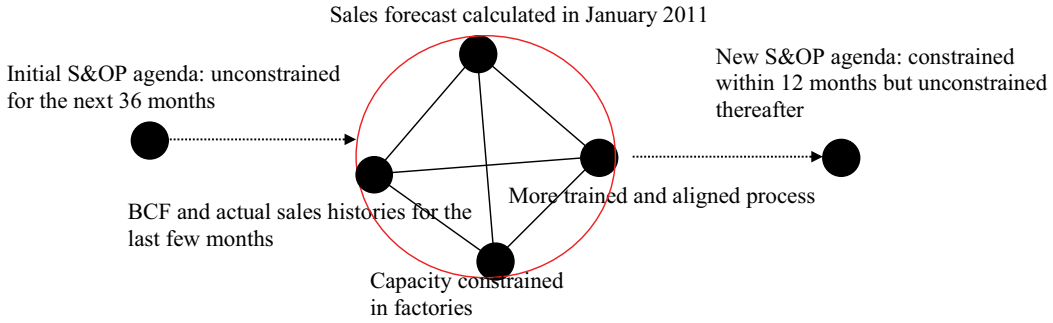


Figure 41: January 2011 battle at the arena and the re-shaping of the S&OP agenda

Figure 41 shows that after taking into consideration the BCF and sales histories for the last few months, as well as being offered more training on the S&OP process, sales organisations constructed a forecast that was not challenged by factories. This does not mean that their forecast was sufficiently accurate. Factories took the sales forecast because they had capacity constraints, although they believed the forecast should have been even higher. This network indicates that if the factory has capacity constraints, a universal unconstrained forecast for the next 36 months will transform into one that constrains the forecast within the 12 month-period. After 12 months, forecasts are unconstrained, for factories are believed to be able to address their capacity shortage within this 12 month-period. Although sales and factories were battling against each other, the network of the new S&OP agenda would not have been constructed if there

was no such a battle. Intra-organisational competition constructed a new agenda of the S&OP forecast.

The paradox was that since all managers in the meeting and participants advised me to disregard forecasts outside the 12 rolling months, the performativity of the S&OP process was only considered relevant in the short-term forecasting horizon. The September 2010 meeting constructed the matters of concern on forecasting accuracy, with regard to aligning the process and changing the mindsets. These were closed into a reference to the BCF and a decision to re-shape the agenda of the S&OP process, in relation to the cut-off between constrained and unconstrained forecasts. The former gave the sales the triumph this time, but the latter pointed to the self-contradiction of S&OP between its inner identity and its outer performativity. In its initial circulation, its agenda was shaped as an inscription representing unconstrained market demand for the next 36 months. In the arena where sales' and factory forecasts were competing against each other, however, a matter of concern on forecasting accuracy alerted S&OP participants to the unconstrained nature of the process that was attributed to the disagreement between sales' and factory forecasts. The capacity constraints of factories forced product line management to transform the original identity of the S&OP from being unconstrained for the entire 36 months into an actionable new identity of being constrained within 12 months, but unconstrained thereafter. Paradoxically, no entities paid any attention to forecasts produced after the 12 rolling months, meaning its unconstrained horizon was not even connected to the S&OP network, which left the originally proposed purpose of medium- to long-term capacity management at stake. The re-shaping of the identity of the S&OP, thus, restored the status quo so that in the short-term the forecast would be constrained, and that in the medium- to long-term the unconstrained forecasts would be disregarded. Circulation of the S&OP now drifts back to the current organisational space where a constrained sales forecast always exists. S&OP tends to intentionally create a gap between a current status of capacity and a future unconstrained demand, but no one pays any attention to the unconstrained part of the S&OP, in terms of the numbers presented in the pilot S&OP meeting.

In trying to trace the impossibility of short-term capacity adjustment, I contacted one product line planning manager at the Gothenburg factory, which is just a few minutes walking distance from the headquarters, because I noticed that for the Gothenburg factory, when September 2010 was compared with January 2011, although the sales forecasts had increased, factory forecasts almost remained the same. To this he replied,

> We have no possibility to improve our production capacities, which means that we could not ship out more than what we could produce and therefore factories could not increase our forecasts because it won't happen. So our forecast must be constrained.

Therefore, factories in this setting might have believed the sales forecast, or at least agreed that true demand should be higher. Their forecasts were not increased simply because they did not have the capacity.

Figure 42 below shows the situation of Luton factory in January.

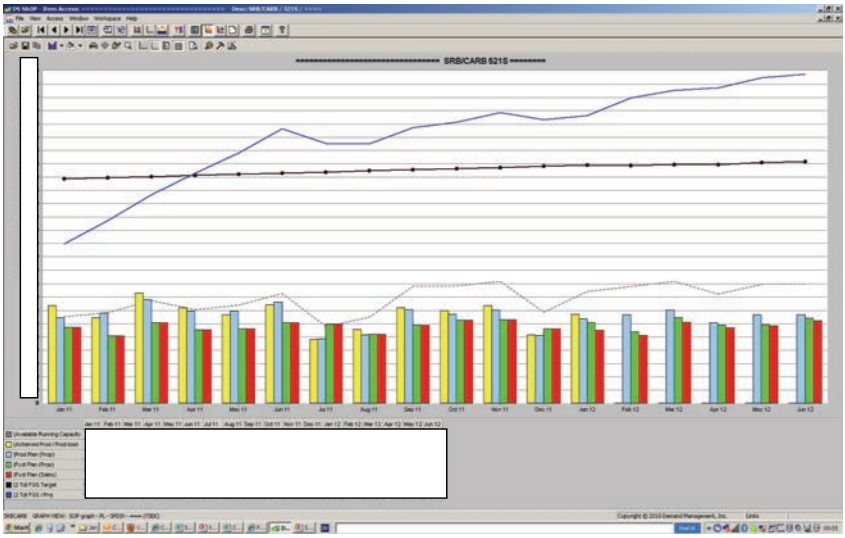


Figure 42: Pilot S&OP Jan. 2011, Luton factory

The figure above shows that there was a huge difference in Luton between the September 2010 and the January 2011 representations. In September 2010, there was a huge gap between stock targets and stock projections, whilst in January 2011, for most months,

stock projections were higher than stock targets; meaning over-capacity would occur up to April 2011. For the two forecasts, they were equal in January, whilst there was a huge gap back in September 2010. In the meeting, it turned out that the "alignment" between sales and factory forecasts was not in fact a consensus. Factories were just taking the sales forecasting without any maintenance, but yet continued using their own forecasts in factory planning and PLP. They did not bother putting their forecasts in the figure.

> In Sept. 2010, they had no good processes in SD, so the quality of the sales forecast was bad, extremely bad. Now there is no maintenance either, because they (factories) gave up the process.

Sales forecasts were presented, not because there was a consensus between sales and factories, but because factories gave up on inputting their numbers. The Hanover and Nilai factories were skipped for the same reason. The overall situation appeared better, simply because the Gothenburg factory had capacity constraint and the process was better aligned in relation to the Gothenburg factory's product lines. They believed the forecasts should be higher than their forecasts. Figure 43 shows the translation in this episode.

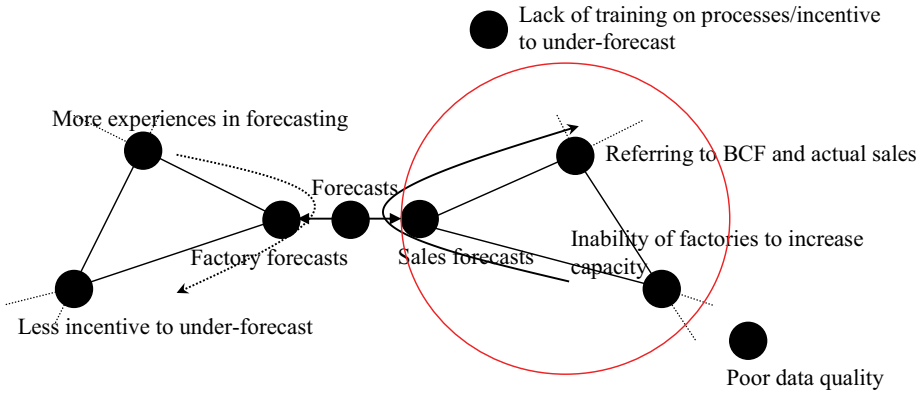


Figure 43: January 2011 battle at the arena: sales forecasts triumphed

It thus, indicates that sales' forecast triumphed this time, not because they reasonably convinced the factories, thus, defeating the factories, but because of the relational inscriptions and the impossibility of Gothenburg to increase their short-term capacity. Capacity in the February meeting preceded forecast, but not the other way round as

intended by the S&OP. The problems of lack of training on the process, and poor data quality still existed in other factories.

After the February PGP meeting, I conveyed to one process analyst of the group demand chain the fact that overall sales forecasts had been lower than those of factories and the ID would have under-capacity problems in the future. According to this process manager, these types of references, visualising the gap between the two forecasts, domesticates future consequences of capacity constraints into the present time so that proactive plans can be proposed. She viewed this gap as a necessity instead of a worry.

> Everyone has invented their things and some are good, some are bad. But maybe the most important thing is that we do it equally. I think this is what for me is the most important coz in was in this situation many times especially in customer service where I was fighting for my customers, you know, and I was…was using my skills, my knowledge, my personality, my contacts, everything to service my customer…sometimes I was just fighting for weeks and almost got there, and then suddenly someone else got the bearings, then I was told ah because the CEO decides this customer we must have them…if I would have known, then I could have saved my time because then I know it would be a management decision, that's why I respect that, but I didn't know.

In this quote she expressed with anger how it felt to lose a customer due to a decision making process that almost erased all her efforts in fighting for her customers. The gap identified in the S&OP helps to domesticate this uncertainty. She then added,

> So before it was like the one shouting the most got the pieces, to certain extent, it is still (happening), but this gives more possibility to it…But as soon as you have a gap, then decisions need to be made…Even if my customers may not get any bearings, then at least I know this and also my customers have the possibility to prepare for something else if we in advance can say, sorry we do not have the capacity, even this means that this customer may not come back to us again. But I think just the fact that you are honest…

This quote illustrates two concerns. First, the difference between sales and factory forecasts translates the very early matter of concern on the lack of cross-functional communication and consistent information and methodology into standardised ways of informing and acting. There is a critical translation of time and space. Uncertainty such as customer priority is now to be reported, discussed and informed during the monthly cycle between sales and manufacturing when factories see the sales forecasts from the cube and

the PGP planning meeting. What happened before was that these uncertainties originated from various time and space and were disseminated and informed at different points of time, which constructed another uncertainty inherent in making timely decisions. Sometimes a decision was cancelled after new information was received. The debate between sales and factories will ascertain that all relevant information will be dealt with by the top management in a structured way and local decision making will follow with necessary information. It became a centre of calculation that collects information needed for decision making from diverse time and space and emits it in a consistent manner. This re-shaping of time addresses those problems that originated from circulating references of the S&OP sales forecast. Indeed, the gap does not automatically carry forward the calculation further, and it may even break the circulation, but it unexpectedly connects the problems at the far starting point of the circulation, namely methodological and information consistency.

Second, the gap between sales and factory forecasts not only constructs a space for future actions, but also domesticates future consequences of capacity constraints where customers who are absent in the S&OP meetings are brought forth. Inter-organisational relationships with customers will be re-shaped so customers can get an early notification of whether or not SWEDTECH can supply the customers the products they need in the future. The reference to gap in this sense interferes with customers' operational and even strategic planning. Uncertainties in future customer demand suddenly become certainties, so that customers can be notified of SWEDTECH's ability to serve them before they actually place orders. The S&OP was originally planned to enrol suppliers with medium- to long-term capacity management. In this case, domesticating uncertainty in future dealings with customers is unexpectedly realised. These translations of time are shown in Figure 44.

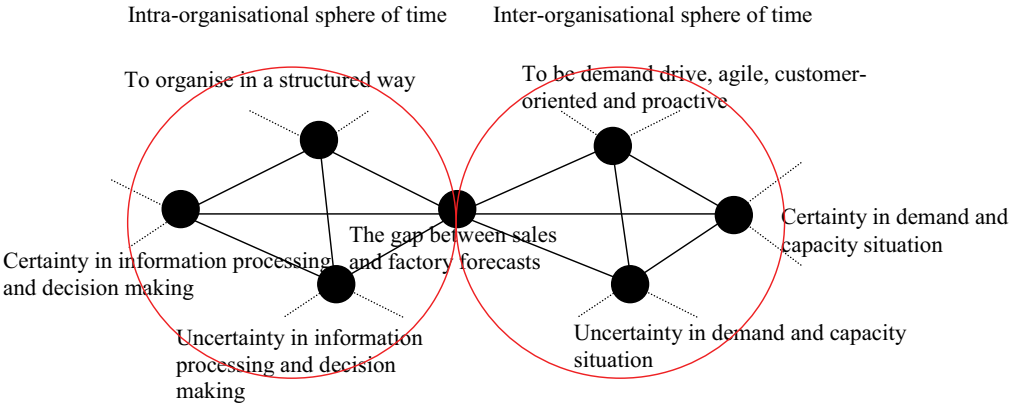


Figure 44: Intra- and inter-organisational spheres of time emancipated by the gap between sales and factory forecasts

In Figure 44, there are two translations of time. First, it translates intra-organisational time with regard to information processing. The time of decision making becomes a certainty. Second, it translates inter-organisation time with regard to customer notification, even before ordering. The future capacity situation was presumed to be certainty. In this milieu, the debate in relation to forecasting connects the top management's intention of being agile, customer-oriented, demand-drive and proactive.

But these debates also constructed a new puzzle. If sales was aware that their forecasts should be unconstrained and the factories could not increase their numbers due to capacity constraints, what could explain the fact that in both September and January's stories, sales' forecasts were still lower than factory's forecasts? This concern leads to a second question, were the factory forecasts constrained or unconstrained? The origin of the factory forecast may be the BCF, which is also an unconstrained forecast intended to represent the pure macro-economic trend; or the order book, shipment histories and key customer accounts, which are constrained, depending on whether the production channel is a stock or a make to order channel. If the reference is the theoretically unconstrained BCF, the factories then will propose a counter-proposal that finally becomes the factory

forecast. The third question is, is the counter-proposal constrained or unconstrained? This was clarified by the manager of manufacturing and supply of the ID,

> It started with the BCF of course. It depends on the situation. I mean if you have enough capacity, I mean...you don't always utilize all the capacity, if you don't need it from the demand point of view, so the agreement can be constrained or unconstrained depending on the situation…Well I mean if you have a capacity issue, it will be constrained by the capacity. But if you don't have that, it should be unconstrained also from the factory.

This quote traces the matter of concern on constrained and unconstrained back to the ad hoc decision mentioned in the meeting where capacity became the reference for the distinction between the unconstrained and the constrained forecasts. Even though BCF is unconstrained, its counter-proposal needs take into consideration the capacity situation of each factory. In the short run, when a factory does not have capacity limitations, its counter-proposal to the BCF is the unconstrained forecast.

Domestication of the two spheres of time in Figure 44 also indicates an interesting ramification. When presenting forecasting numbers in the pilot S&OP PGP meeting, the S&OP agenda is transformed to have a constrained forecast if factories have capacity constraints, but after 12 months forecasts should be unconstrained. Forecasts after the 12 rolling months, however, are disregarded by S&OP participants. When a business process analyst illustrates the importance of having a gap between sales and factories, she implicitly assumes that forecasts are unconstrained. A ramification unfolds with regard to the new S&OP agenda. When actors are reflecting upon inscriptions, the new S&OP agenda becomes their reference, albeit there is a paradox. When they are reflecting upon how to domesticate the future or DCM, their S&OP forecast is always unconstrained, albeit nobody pays attention to the unconstrained part of the new S&OP agenda, that is, forecasts beyond the 12 month period.

After clarifying the constrained/unconstrained puzzle, I traced the reasons for the low sales forecast contrasting it with the factory forecast. The first reason pointed to the limitation pertaining to the system forecast, as was argued by the process analyst, who was surprised that the sales forecast was below the factory forecast.

> It should be at least higher I think! I think it could be, if not consider(ing) that the system forecast is based on history, and during certain period, we had a very down turning trend, and let's say that in the beginning where the collaborators were not working so actively, maybe the pure system forecast in this case, then of course the system forecast is showing a declining trend, so it has not yet realized that…I would say if generally there has been a declining history for three years, the system will probably decline, further decline, so that could be an explanation for that. But generally what you would expect now, now it's in up for some months again, so now that should be quickly changed.

This quote indicates that, during autumn 2010, the bearing industry was still struggling to recover from the financial crisis, hence, history in the system showed a declining pattern. Furthermore, the S&OP was also in the beginning phase of its implementation and all relevant actors were still being educated. The collaborators were yet not participating actively in the process; so much of the work was done by the system. The result was reasonable. If history showed a declining trend, the sales forecast would tend to be underestimated because the system could not anticipate a reverse in historical trends. The manager of manufacturing and supply in ID also confirmed that at the very beginning, sales' expectation was conservative.

> If it differs from the sales forecast, it can be due to constraint, but it can also be that the factory believes we can grow more than the sales expects. There can be a mismatch based on that. That was very much happening in the beginning, more so than today.

Then there was the matter of concern on the lack of sufficient training in the S&OP process raised in the September 2010 meeting. During that winter, the sales forecasts for SRB/CARBs produced in the Gothenburg factory, were accordingly referred to the BCF and increased to reflect their revised perception on future sales volumes. This was because these production channels were located next to the headquarters. The group demand chain responsible for implementing the S&OP process could easily meet with each other. Actually, most participants in the aforementioned two PGP meetings were from the group demand chain and the Gothenburg factory. Sales forecasts from production channels in Luton, Hanover and Nilai were still not taken seriously.

The second reason is related to the lack of changing of mindsets pinpointed in the 2010 September meeting. The same process analyst pointed out,

> …we have…there are a lot of difficult discussions and, we have more than 1 forecast in SWEDTECH, we have volume forecast, we have financial forecast, then you have this which should be a pure demand forecast…This [S&OP] is a process thing and mindset which is difficult. We have some discussions where some of the collaborators, these are the people with business knowledge, they are actually saying, hah, but on the volume forecast, the business plan what I set was like this, so I put it in the S&OP as well, or at least they try to adjust according to that. Then we have a hard time to explain to them, that's not how you should think. If you put in the S&OP the same as your volume forecast in the business plan, then no actions will be taken, and we will anyway not be prepared for the increases coming in the future.

She continued with her reflection on the S&OP as a mediator of changing mindsets for relevant participants,

> The thinking with S&OP is that we should, it's like a wish list, this is something I would like to set if I can have all the items, all the product lines, everything. So it should be different. This is what we can produce and this is what the customer wants, then there should be a gap. And if there is no gap, there will never be actions taken…But for the time being, we have very difficult time to say, forgot about that, thinks what…this is a pure demand forecast, don't think about your business plan and your volume, think about it as your demand forecast. We are trying to squeeze that.

The lack of changing mindsets of sales, was thus, translated into a gap between sales and manufacturing, the performativity of which was discussed earlier in the re-shaping of intra- and inter-organisational spheres shown in Figure 35; but her problematisation also pointed to the theorisation on the networking inscriptions. Under the vein of the matter of concern on changing of sales' mindsets, this network also betrays the re-shaped S&OP ontology as a space for translating intra- and inter-organisational time in information processing and decision making as well as in domestication of future demand and capacity. Collaborators were so used to relying upon the BCF and financial forecasts as references for their S&OP forecasts. The sales forecast was low because the collaborators still generated a constrained forecast by referring to the BCF and the financial forecasts. According to the business process manager, collaborators should disconnect from the BCF, financial forecasts and all forecasts whatsoever, and start from scratch so that their forecasts can be a set of wish lists. In order to displace intra- and inter-organisational time, a single inscription is a stronger spokesperson. The relation of these forecasts became

weak in this scenario. Adding onto Figure 44, I therefore drew Figure 45. To enlighten the two spheres of time, the connection between the two forecasts has to be kept at bay.

> It could be because they still don't think this is an unrestricted forecast. It's really hard to get into their mind. That they still try to...I mean when they do their business plan, they...The purpose is this is what I will sell for the next year. They have a problem to see...OK, we have restrictions there, for example, in large bearings. I can't take order from that customer because I know we don't have capacity, so they still do that kind of thinking. I think the S&OP problem is...it's more a mindset, how you think. That is the most difficult thing with it. – by one business process analyst

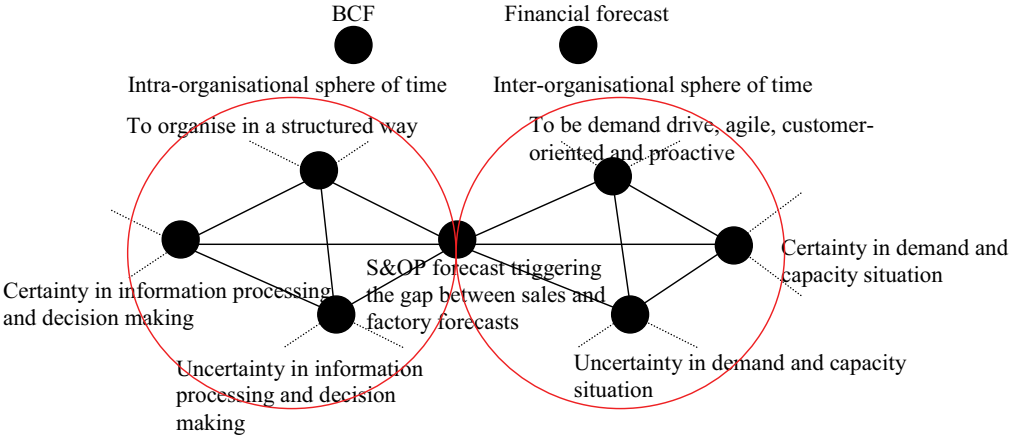


Figure 45: Relational inscriptions and intra- and inter-organisational spheres of time emancipated by the gap between sales and factory forecasts

The above figure shows that in order to make the two spheres possible, BCFs and financial forecasts must be disconnected from the network.

The third reason was mentioned by the manager of the S&OP in June 2011, the industry was in recovery mode, meaning that the system will now have been generating a positive trend and collaborators will have also been enrolled in the S&OP for quite a few months. It would be reasonable to expect the unconstrained sales forecast to be higher. The reality, however, was during winter 2010, in most factories, sales forecasts were still lower than the factory forecasts, albeit the gap was smaller. His perception was that in the business

upturn from the recovery, sales had been pessimistic when doing the forecasts; therefore, they were not able to catch up with the steeper sales growth.

> We knew whenever if two people make the forecast, they will always have some different opinions on what the future will be…which is very easy depending on how optimistic or pessimistic we are. Now I would say we have a tendency to under-forecast, this is what our accuracy measurement shows on a higher (product level) level, we are under-forecasting. But it's also probably linked to the actual business situation. We are now in the business upturn, so we will tend to under-forecast this… What we have seen so far is with few exceptions, they (factories) are more optimistic than sales.

In the 2011 January PLP meeting, however, sales indicated a higher growth rate in 2011 than the BCF. Hence, the above S&OP manager's reflection means that actual business climate was recovering in a rate even higher than sales could expect.

The gap between the sales forecast and the factory forecast was the key reference in the pilot S&OP PGP meetings. Interestingly, the gap was intentionally created by the S&OP principle in order to displace intra- and inter-organisational time via domesticating future uncertainties. Enormous problems were constructed by this gap such as the lack of training in the process, the lack of changing of mindsets and poor data quality such as missing customer information, were consequently closed into a report; a form that closed the gap. An example of this final report is attached in the Appendix 6. Some of them, for instance, finding missing customer information, were even represented by another process, 6 Sigma, which was also introduced to improve S&OP forecasting accuracy. Under this circumstance, it is not only the combination of inscriptions, but also the combination of processes and networks that harmonise the two competing chains of circulating references, letting the resulting chain continue to reach factory planning, PLP and SCP.

This episode continues with episode 9C to follow how matters of concern on forecasting accuracy were translated. The translations were unexpectedly complex and involved a number of theoretical premises including networking of inscriptions, DCM and reshaping of time. Therefore, I would like to summarise this episode by dividing them into two halves.

In the first half, the matter of concern on forecasting accuracy was transformed from a quasi-object containing the lack of training in the S&OP process, the changing of mindsets and poor data quality, into another a quasi-object on the change of the S&OP agenda. In other words, the matter of concern on forecasting accuracy that was centred on lack of training in the S&OP process as well as a change of mindsets and poor data quality was translated to one that is centred on a matter of concern on whether the S&OP sales forecast is to be constrained or unconstrained. Actors participating in this half included group demand chain, sales, factories, product line planning management, BCFs, financial forecasts, the S&OP agenda and capacity situation in factories. In terms of DCM, uncertainty in future market demand was translated into an internal contradiction between the new S&OP agenda and its purpose to foster medium- to long-term capacity management. The relation between the S&OP sales forecast and the BCFs helped sales and manufacturing reach a consensus. The competition between calculations drew attention to existing S&OP agenda and questioned its relevance when factories had constraints. This movement contained both an integrating and separating endeavour. A new minimal configuration of the S&OP process was constructed because the old one obstructed integration when there were capacity constraints in factories. Sales' voice for customers became a bit stronger than last time because it referred to other calculations. Factories were not competing with sales for a voice for customers because they had capacity constraints. Under these circumstances, the group demand chain became the voice for customers this time by modifying the S&OP agenda. This voice was also weak because it contradicted with the S&OP's purpose to foster tactical and strategic inventory management.

In the second half, a matter of concern on forecasting accuracy was assumed to be unproblematic, that is to say, a matter of fact. The gap between sales and factories in this half was constructed assuming forecasts were accurate. This gap was translated from a problem to be closed, into a purpose, intentionally created to translate time and space. Because of this gap, information processing and decision making became timelier, and customers were earlier informed of whether they could be supplied with products before they actually placed the order. Actors participating in this half included group demand

chain, sales, factories, product line planning management, senior management, BCFs, financial forecasts, a visionary boundary object of being agile, proactive and demand driven and customers. In terms of DCM, uncertainty in future market demand was translated into certainty in information processing, decision making and early signaling to customers. This not only helped SWEDTECH to be more demand driven, but also positively affected customers' decision making. The relation between sales forecasts, BCFs and financial forecasts were considered alien to making these possible. Competing voices for customers between sales and factories were considered assets in this setting because in the end it does not matter who speaks for customers. As long as those competing voices exist, information possession and decision making will be undertaken in a more structured manner, and customers will be served proactively.

The outcome of the fabrication of the S&OP process is now depicted in Figure 46 below. The minimal configuration of the S&OP process incorporates new purposes of making timely decisions and better serving customers. The S&OP sales forecast is to be constrained within the 12 months when factories are capacity constrained and unconstrained thereafter. Factory forecasts are still used for PLP and SCP, meaning that they are the central calculations in the S&OP process.

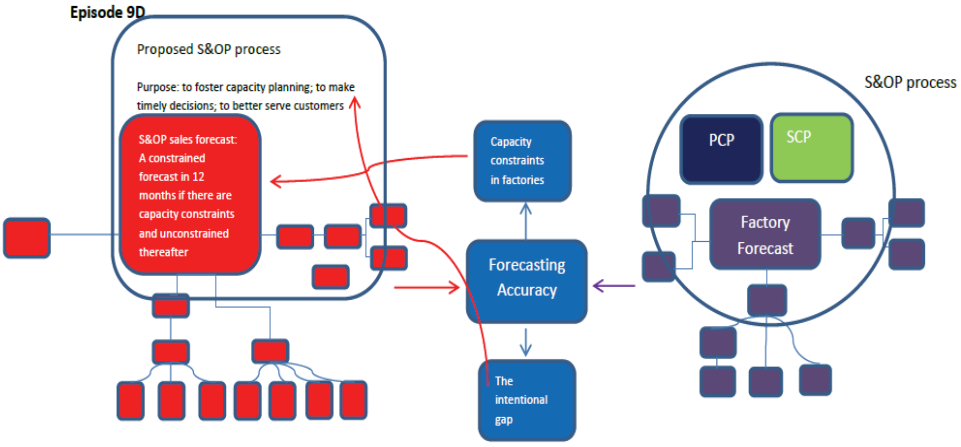


Figure 46: The outcome of the fabrication of the S&OP process in Episode 9D

Episode 9E: The May & June 2011 meeting - Forecasting accuracy: objects of forecasting

I did not physically attend the pilot S&OP PGP meetings in May, June, August and September 2011 due to other responsibilities at the business school. Therefore, the limitation of this study is that for these meetings, I could not observe the trajectory of debates. I therefore, went to the case company to conduct a few face-to-face interviews as well as some telephone interviews to try and trace the movements of the debates happening in the arena between sales and factory forecasts. Inevitably as a result, the narrative for these meetings cannot be as detailed and local as the September 2010 and February 2011 meetings. The May and June 2011 meetings are discussed together because all the interviewees mentioned to me that there were not huge differences in the content between these two meetings.

In both the May and June 2011 meetings, sales forecasts were around 1.45 billion SEK, and factory forecasts were around 1.70 billion SEK. Both were higher than the levels in January 2011 because efforts had been put in place to increase shifts and manpower. The meeting minutes of these two meetings listed some examples with regard to the actions taken by factories to increase availability, for instance, in Nilai, running all available hours (24/7) started in Feb. 2011; In Gothenburg, manning all medium channels on 4 long shifts (152 hours per week); In Luton, running overtime in several channels and having temporary extra night shifts and increasing manned hours from 71% in March to 77.6% in September; and in Haonver, Channel 12 running 6 days for 24 hours. Interestingly, these capacity-related plans ought to have been raised in the idealised S&OP PGP meetings, but instead the pilot S&OP PGP meetings were flooded with debates in relation to sales forecast accuracy. This, however, had a reflexive effect. In the February 2011 meeting, due to factories' capacity constraints, sales forecasts triumphed and the S&OP agenda was transformed into one that had a constrained forecast within the 12 month horizon. Although this transformation caused a paradox, which was discussed in the last episode, factories were trying to fix these capacity constraints so that when the 12-month period passed, forecasts could be switched back to being unconstrained. A discussion on capacity, which was planned to be presented in those PGP meetings, was

enacted, but in a different way than what was mediated by a change in the agenda of the S&OP. Figure 47 below shows this mediation.

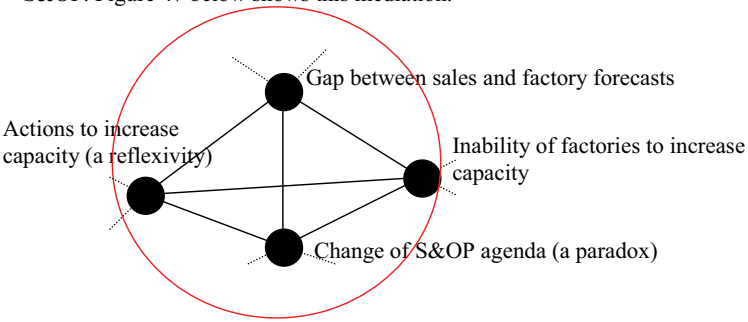


Figure 47: The construction of a gap, a constraint and a paradox from February to May 2011

This figure shows that a paradox was transformed into actions of improving capacity which were consistent with the S&OP purpose. This also adds to the ramification caused by the new S&OP agenda. When uncertainty in domesticating the future was translated into physical actions of improving capacity, it was always the unconstrained forecast that was the ultimate reference. Future forecasts cannot be reverted to unconstrained unless actions are taken to increase capacity in the short run. In this setting, unconstrained forecasts after the 12-month period were only disregarded on inscriptions presented in the pilot S&OP PGP meeting. When uncertainty in future market demand was translated into action plans, they were re-regarded. A paradox, a gap, and a constraint were constructed. A paradox only existed on paper, and reflexivity attributed to actions taken to increase capacity reverted from the S&OP agenda to consider medium- to long-term capacity management.

Despite the above translation, the base line is that factory forecasts were still higher than sales forecasts (see Figure 48 for a graphical representation). This gap, however, was less significant compared with the January 2011 situation. It was in May 2011 that this form, the graphical representation below, raised an important amplification.

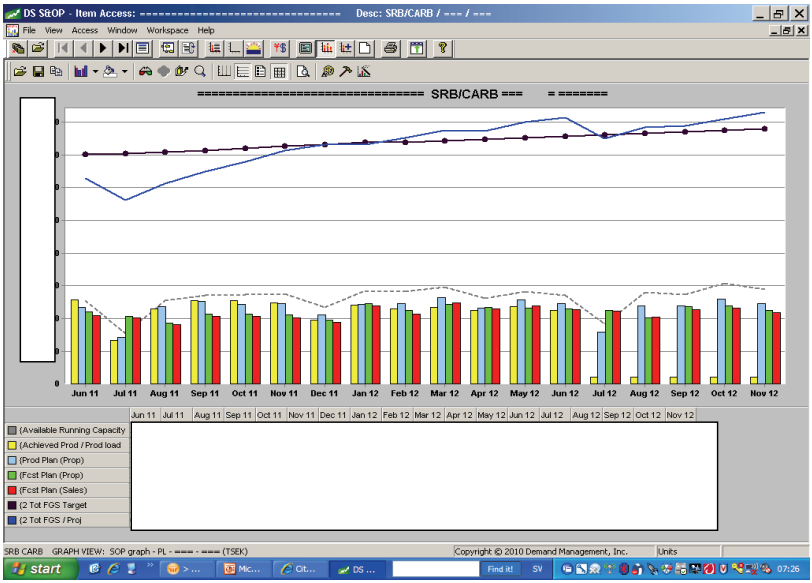


Figure 48: Sales and factory forecasts in June 2011, pilot S&OP

A product line manager from the group demand chain cogently pointed out that,

> More or less all factories now realize their forecasts refer to the shipment out of factories. During this period (February 2011 to May 2011), there was a huge up-stocking in regional warehouses for example Singapore and a number of factory warehouses. As a consequence, factories put sales forecast aside as they speak a different language. Sales always consider the volume sold to customers but the factories always think in terms of shipment to the warehouses or directly to customers.

He pointed out a critical matter of concern regarding the gap between sales and factory forecasts, the objects based on which forecasts are calculated. Sales forecasts refer to the total demand expected to be sold to external customers. Factory forecasts refer to the total shipments out of factories to both warehouses and customers. He then turned to discuss individual cases in factories,

> In May and June 2011, the Gothenburg factory didn't bother challenging the sales forecast because the language was different. In Luton, the stock-outs went up from 110 million SEK to 150 million due to the increase of shipments to the regional warehouses. In Hanover, the story was a bit different,

they were going to support to channels in other factories outside Hanover, therefore their forecasts were higher than sales. Sales didn't take this into consideration.

This was a turning point in the implementation of the S&OP. Factory warehouses ship to regional warehouses, local warehouses and directly to customers. This was considered as a reason underneath why sales forecasts had been consistently lower than factory forecasts. In September 2010, sales tended to under-forecast, but as the S&OP process was claimed to have streamlined during the pilot phase, sales had increased their forecast significantly as was shown in the forecasts from February, May and June of 2011. The struggle to close the gap between sales and factories forced the group demand chain to consider whether there are problematic logics in creating the sales forecast. From February to June 2011, factories with over-capacity were supporting others with under-capacity in order to enhance the capacity situation. This supporting action, unexpectedly, became a mediator that enabled the group demand chain to realise the different languages which sales and factories were expressing. Sales forecasts only considered the inter-organisational sales to "external" customers, whilst factories took into account both "internal" warehouses and "external" customers. Sales forecasts were lower than factories' because sales did not include shipments to "internal" warehouses. In addition, sales forecasts did not take into consideration the supporting actions undertaken by the Hanover factory. This means that if the factory continues supporting other factories, its forecast will be increasing, and if the sales do not see this, the gap between sales and factory forecasts will be huge (See Figure 49 for the situation in Hanover).

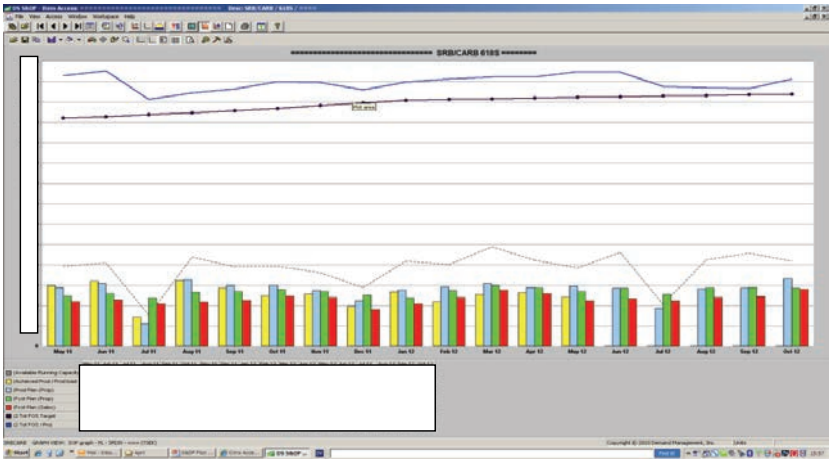


Figure 49: Pilot S&OP, Hanover factory, May 2011

This figure shows that the gap between sales and factory forecasts was huge in Hanover. The reason was as follows. The Hanover factory had been offering supporting activities to other factories with under-capacity since February 2011, and therefore, in their factory forecasts, these supporting activities were included in the calculation. Sales, on the other hand, did not incorporate this information. As a result, the sales forecasts were lower than the factory forecasts.

The translation of May and June 2011 meetings is displayed in Figure 40 below.

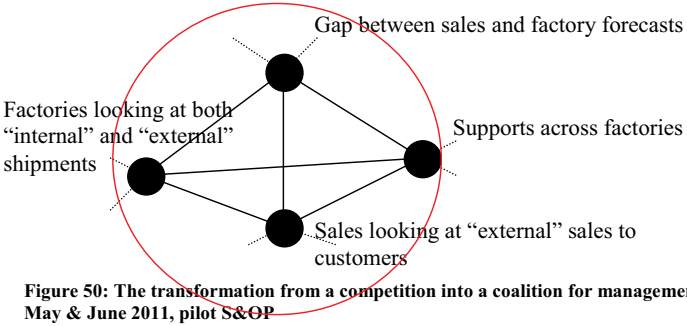


Figure 50: The transformation from a competition into a coalition for management intervention in May & June 2011, pilot S&OP

The above figure indicates that this time at the arena there was no winner or loser. Instead, the competition led to a *de facto* coalition, albeit there was still a *prima facie* ignorance of the sales forecasts by the factories. The gap between sales and factory forecasts was mediated by supporting actions that were enacted from the February meeting and translated into a matter of concern on the objects of forecasting. This amplification set the base for the August and September 2011 meeting, where an integrative endeavour was replaced by a substitutive one. The group demand chain, instead of trying to have a consensus between sales and factories, decided to introduce a replacement forecast to take over the existing sales forecast.

In this episode, a matter of concern on forecasting accuracy was premised on its referents, instead of on its own content. It was translated into an extra matter of concern on the objects of forecasting. This translation brought a closure on the existing minimal configuration and a creation of a new minimal configuration of the S&OP process that was yet to be figured. Actors participating in this episode included group demand chain, sales, factories, local and regional warehouses and supporting activities across factories.

In terms of DCM, uncertainty in future market demand was translated into a substituting endeavour, replacing the existing calculation and aiming at representing this future demand. Supporting activities across factories dissolved the contradiction of the new S&OP agenda created in the last episode. This contradiction only existed on paper. As the S&OP sales forecast was to be replaced by a new forecast that could be understood by factories, factories' voice for customers was considered to be stronger. Factories' performance evaluating and forecasting practices that mitigated their incentive to under-forecast, as discussed in earlier episodes, forced sales to adjust their language into that would that would be understandable to factories.

Episode 9F: The August & September 2011 meeting - Forecasting accuracy: a new S&OP sales forecast

In both August and September 2011's meetings' representations of the sales and factory forecasts, sales showed a prediction of 1.45 billion SEK and factories showed a projection of 1.70 billion SEK for their respective beliefs in future volumes. These

figures were exactly the same as those presented in May and June 2011 meetings. According to a product line manager of the group demand chain,

> It doesn't make sense to talk about these figures any more. Factories care about their shipment forecasts, not the sales forecasts to customers.

This indicates that all the graphical and numerical representations that were presented in the form before were meaningless for discussion, due to the matters of concern around the sales forecast regarding the difference in forecasting language identified in May and June 2011. The same product line manager added,

> Actually stock-outs [from all factories] were increased dramatically during this period because the regional warehouse in Uruguay and the local warehouse in Brazil were included in the calculation.

This quote showed another reason why existing forms of representations for customer demands were abandoned. Warehouses' purchases from the factories in the pilot S&OP process were never included in existing calculative practices of sales. The fact that sales forecasts were lower than factories can be attributed to the incentive to under-forecast and the lack of training early in the process, but once those concerns had arguably been addressed, there was only one reason left; namely the difference in objects of forecasting, which became more obvious when the up-stocking in Uruguayan and Brazilian warehouses was identified.

Since the September 2011 meeting, the group demand chain had been concentrating on the construction of a new sales forecast that would be meaningful to the factories. It was then that a delineation of the lead time adjusted shipment based (LTASB) forecast that was constructed. Sales needed to produce a forecast in the language of the shipment that would be understandable to factories.

In order for the substitution of a LTASB forecast in place of a sales forecast to be acceptable, factories brought in a new entity, namely the lead time between geographically different warehouses. The manager in charge of the PLP stream of the S&OP process explained,

In general we have four geographical areas, North America, South America, Europe and Asia. The rule is that there is no lead time between the shipping factory and the "receiver" if they are in the same geographical area. When they are in different areas, there is a 1 to 2 month lead time.

Hence, an LTASB forecast is a forecast that is transformed from a sales forecast, taking into consideration the lead time if factories are to ship to a warehouse or to support a factory that is located in a different geographical area. A product line manager showed me the numerical example shown below,

Shipment Forecast	111	118	114	106	106	110	105	107	108	104	107	110	107	103	104	103	106	108	109	106
S&OP forecast	105	111	107	107	109	105	111	105	109	107	103	109	111	100	105	107	101	110	104	110

Figure 51: A numerical example of LTASB forecasts transformed from sales forecasts

The figure shows that, for instance, if the sales forecast of the volume to external customers is 105, but considering there is a lead time of 2 months for the shipment from Gothenburg to get to the Dalian factory warehouse, the Gothenburg factory also needs to ship 6 more today so the LTASB forecast will therefore, become 111.

The translation induced by the lead time between factories and warehouses in different geographical regions is depicted below in Figure 52. This proposal of using the LTASB forecast prepared by the sales is to be implemented in December 2011, where a substituting forecast will battle against the factory forecast.

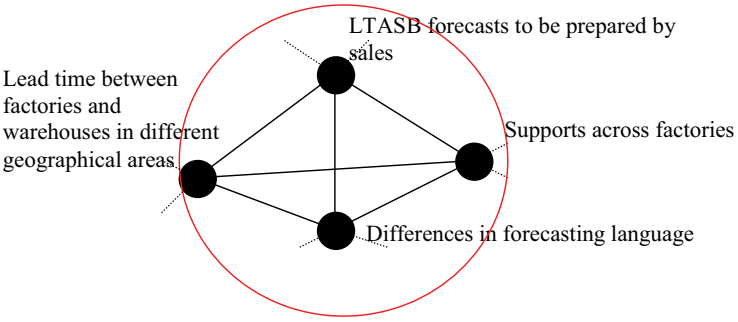


Figure 52: Translation of an LTASB forecast in August & September 2011, pilot S&OP

Figures 52 shows that although the arena has unfolded diverse matters of concern surrounding forecasting accuracy that all point to an integration between the sales and

factory forecasts throughout the period from September 2010 to September 2011 when a series of pilot S&OP PGP meetings were held; the enrolment of the local and regional warehouses and the transportation lead time between factories and warehouses in different geographical areas suddenly constructs a delineation of a substituting calculation, LTASB forecasts, thus, extending the circulation of the S&OP sales forecast.

In this episode, an extra matter of concern on forecasting language was translated into a concern on what forecasts were to be constructed. This matter of concern was closed by recognising the lead time between factories and warehouses in different geographical areas. The construction is a new minimal configuration of the S&OP process. The process will start with a LTASB forecast. Actors participating in this episode were the same as in episode 9E, plus the lead time between factories and warehouses.

In terms of DCM, uncertainty of future market demand was translated into a new identity of an S&OP forecast. The field study concludes here, and therefore, whether the resulting LTASB was finally to be closed to a matter of fact will be followed up in future studies. The long lead time between factories and warehouses in different geographical regions strengthened factories' voice for customers because warehouses are customers to factories.

Fabrication leads to integration in Episodes 9E and 9F because a new type of S&OP sales forecast is to be used in the S&OP process. Although the S&OP process starts with a sales forecast, the forecast has to be in the language of factories, because factories and suppliers are the objects of management, as well as to build capacity for future customer demands. There is integration between the objects of management and entities that make the central calculation in the S&OP process.

The outcome of the fabrication of the S&OP process is shown in the figure below. The figure shows that the S&OP sales forecast is transformed to an LTASB forecast because

factories ship not only to customers, but also to warehouses and other factories of the company, as well as other warehouses that are geographically located around the globe, which affects the lead time of shipping products. The field study ended at this point. Although, whether or not the new LTASB forecast will be used in the S&OP process still remains a question, factories indicate that they will consider the new sales forecast.

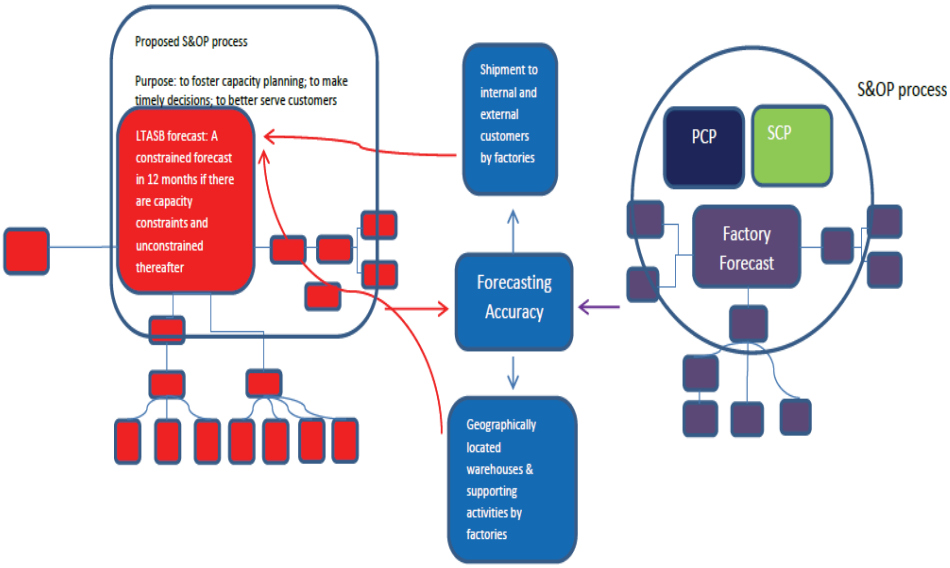


Figure 53: The outcome of the fabrication of the S&OP process in Episodes 9E and 9F

A short discussion

This series of episodes has shown a series of plays at the arena where sales forecasts competed against their factory counterparts. The central theme was forecasting accuracy. These episodes have shown that forecasting accuracy was a set of matters of concern, and thus, many things already. The S&OP forecast is thus, a superimposition of matters of concern. The S&OP forecast has to close a matter of concern on forecasting accuracy in order to become a matter of fact, but a matter of concern on forecasting accuracy in turn, has multiple extra matters of concern which include lacking training in the process, lacking changes of mindsets in sales, poor data quality, a struggle between constrained and unconstrained, forecasting language and delineation of a new forecast. Table 6 below

summaries findings in this series in terms of the very matters of concern, the actors involved, the translations of uncertainty in future customer demand and integration and who speaks for customers.

Episode	Matters of concern on forecasting accuracy	Actors	Translation of uncertainty in future customer demand into uncertainty in integration	Voices speaking for customers	Illustrating figure
9B	A debate between centralisation and decentralisation.	Group demand chain, the S&OP manager, sales, factory, S&OP agenda, forecasting accuracy, a debate on centralisation and decentralisation and an emerging entity of identifying the gap and triggering actions.	Uncertainty in future market demand was translated into a debate on the type of planning process of the S&OP. An inter-organisational planning issue was translated into intra-organisational politics. An emerging property of the S&OP, namely its purpose to intentionally identify gaps and trigger actions, transformed forecasting accuracy from an expense to an asset. Both sales and factory forecasts wanted their calculations to be used to integrate DCM. In this episode, the debate was displaced away from the S&OP sales forecast towards the S&OP process. The dilemma was on the organisational structure to foster integration. Integration offered a working time/space where actors were enacted to create debates on integration, and this time the organisational structure was the object of the debate.	Factories' voice was more convincing than the voice of the S&OP manager for two reasons. First, decentralisation is allied with the S&OP conceptual framework advocating cross functional integration. Discussing the gap between sales and factory forecasts was considered as a stimulator to trigger future actions. This allied a visionary boundary object to be proactive. Second, decentralisation was essential because forecasting error would affect their daily factory planning. Decentralisation was thus, allied with attempts to solve existing availability.	23 & 24
9C	Sales: lack of training in the	Group demand chain, sales, factories, financial	Uncertainty in future market demand was translated into	Factories have a stronger voice for customers because the factory and sales	29

	S&OP process, lack of change of mindsets, poor data quality. Factories: less incentive to under-forecast and long experience in forecasting.	forecasts, rewarding systems and forecasting accuracy.	uncertainty in forecasting accuracy. Customers were not enrolled in this episode. An inter-organisational problem in forecasting was translated into an intra-organisational issue of disconnecting the present S&OP practice from the existing financial forecasting practice. Inter-functional factories, challenged the S&OP forecast though, were helpful in reaching a consensus. But the existing financial forecasting practice in sales was de-constructing an S&OP practice. There was an integrating endeavour across functions, but a fragmenting endeavour within sales. In terms of integration, the attempt to integrate in this episode was hampered by the likelihood of both parties to under-forecast. The task of mitigating such likelihood was delegated into separate spaces and forecasting practices in sales and factories.	forecast are tightly coupled to ally the interests of channel planners, product line planners and factory warehouses who are responsible for KPIs. In the BSC, the KPIs are achieved through product line planning and daily planning via a set of product hierarchy decisions. In the special case of the Gothenburg factory, its voice for customers is convincing because the S&OP process is built in its strategy map to ally a visionary boundary object, a strategy, a strategic challenge and a set of strategic activities. Sales' voice is weak because their existing forecasting and performance evaluating practices fragment the S&OP practice. This fragmentation cannot keep sales' incentive to under-forecast at bay.	
9D 1st half	S&OP agenda: constrained vs. unconstrained.	Group demand chain, sales, factories, product line planning management, BCFs, financial forecasts, the S&OP agenda and capacity situations in the factories.	Uncertainty in future market demand was translated into an internal contradiction between the new S&OP agenda and its purpose to foster medium- to long-term capacity management. The relation between the S&OP sales	Sales' voice for customers became a bit stronger than last time because it referred to other calculations. Factories were not competing with sales for a voice for customers because they had capacity constraints. Under this circumstance, the group demand chain became the voice for customers this	41 & 43

			forecast and the BCFs helped sales and manufacturing to reach a consensus. The competition between calculations drew attention to the existing S&OP agenda and questioned its relevance when factories had constraints. This movement contained both an integrating and separating endeavour. A new minimal configuration of the S&OP process was constructed because the old one obstructed integration when there were capacity constraints in factories.	time, by modifying the S&OP agenda. This voice was also weak because it contradicted with the S&OP's purpose to foster tactical and strategic inventory management.	
2nd half	As a matter of fact	Group demand chain, sales, factories, product line planning management, senior management, BCFs, financial forecasts, a visionary boundary object of being agile, proactive and demand driven and customers.	Uncertainty in future market demand was translated into certainty in information processing, decision making and early signaling to customers. This not only helped SWEDTECH to be more demand driven, but also positively affected customers' decision making. The relation between sales forecasts, BCFs and financial forecasts were considered alien to making these possible.	Competing voices for customers between sales and factories were considered assets in this setting because it does not matter who speaks for customers in the end. As long as these competing voices exist, information possession and decision making will be undertaken in a more structured manner, and customers will be served proactively.	44 & 45
9E	Objects of forecasting	Group demand chain, sales, factories, local and	Uncertainty in future market demand was translated into a	As the S&OP sales forecast was to be replaced by a new forecast that could	50

		regional warehouses and supporting activities across factories.	substituting endeavour replacing an existing calculation aiming at representing this future demand. Supporting activities across factories dissolved the contradiction in the new S&OP minimal configuration created in the last episode. This contradiction only existed on paper.	be understood by factories; factories' voice for customers was considered stronger. Factories' performance evaluating and forecasting practices that mitigated their incentive to under-forecast, as discussed in earlier episodes, forced sales to adjust their language into one that would be understood by factories.	
9F	Figuration of a new type of forecast.	Group demand chain, sales, factories, local and regional warehouses, supporting activities across factories and lead time between factories and warehouses in different geographical areas.	Uncertainty of future market demand was translated into a new type of forecast. Fabrication leads to integration in Episodes 9E and 9F because a new type of S&OP sales forecast is to be used in the S&OP process. Although the S&OP process starts with a sales forecast, the forecast has to be in the language of factories because factories and suppliers are the objects of management, namely to build capacity for future customer demands. There is integration between the objects of management and entities that make the central calculation in the S&OP process.	The long lead time between factories and warehouses in different geographical regions even strengthened factories' voice for customers because warehouses are customers to factories.	52

Table 6. A summary of findings in episodes 9B to 9F

Though competing in nature, the intended translation was to transform the gap between the two into an integrative consensus. A number of unintended translations were also shaped, for instance, a translation of multiple time spheres and a reshaping of the S&OP agenda were constructed by a matter of concern on forecasting accuracy. When the concern was realised, of the different language that sales and factories were using, as well as the entity of lead time was enrolled, the integrative endeavour was transformed into a substitutive one. The S&OP sales forecast was to be replaced by an LTASB forecast.

There were also intricate translations of intra- and inter-organisational spaces. First of all, inter-functional competition does strengthen the circulation of the S&OP process, albeit in a competing nature. This will be discussed in more details in the next chapter, when I discuss the network of performance measures. Second, in the space of the PGP meeting, during the integrative phase, sales were fragmented, and on the other hand, inter-organisational factories, product line management and suppliers were allied. It was proposed that during the substituting phase when LTASB forecasts are to be implemented in December 2011, sales, factories, product line management and suppliers would be allied as a collective. Third, when undertaking calculative practices, sales only concern is the inter-organisational space of customer demands, whilst factories concern is both the intra-organisational space of shipments to regional and local warehouses across the globe as well as the inter-organisational space of customer demands. The S&OP process unexpectedly enacted a space odyssey that could not have been designed from the outset. There was also a time and space odyssey. When a gap between sales and manufacturing was transformed from a worry into a stimulant, a future uncertainty in estimating customer demands was translated into a current certainty in information processing and decision making, and an early notification of capacity shortage to customers. Customers were surprisingly included in the network when the original focus was only on sales and factories.

Integration also became fluid and multiple in this chapter. The initial purpose of the S&OP was consistent with the S&OP literature that advocated integration in DCM across

functions. To integrate, however, meant to debate. This meant that integration was possible after sales and factory forecasts competed against each other. Integration was hampered by the likelihood of both parties' incentives to under-forecast. A task to mitigate such likelihood was delegated into separate spaces of forecasting practices in sales and factories, respectively; where PMS and rewarding systems played a role. The competition transformed the existing minimal configurations of the S&OP process into new ones because the old ones obstructed integration. Once integration was made possible again, its performativity was separated into different times and spaces, including making decisions in a more structured matter and serving customers more proactively.

When attempting to speak for customers, factories' dominated sales' voice for customers in most cases in this series. It became stronger when it supported a decentralised S&OP process that allied the visionary boundary object of being proactive, and again an attempt to solve existing problems on availability. Factories' voice was not challenged because it attached the S&OP forecasting practice to their existing practices of forecasting and performance evaluating. This bundling allied interests of channel planners, product line planners and warehouses who are responsible for KPIs in the BSC. These KPIs were achieved via a set of product hierarchy decisions. This networking of PMS and the S&OP process finally forced sales to modify its forecast to the language of the factories.

It should be noted, that although the LTASB forecast was proposed to be the new S&OP sales forecast, its fate in the S&OP process remains a question because the field study ended at this point. When the study was completed, the factory forecast was still the calculation guiding the S&OP process, which means it was carried forward for PLP and SCP. Figure 54 below shows that although the LTASB forecast was suggested and proposed, it was still the factory forecast that was used in the S&OP process. Albeit, fabrication of the S&OP process had taken a long time (from 2007 to 2011) and underwent a long journey (see the 9 episodes narrated), the process of DCM was not changed significantly in the case company.

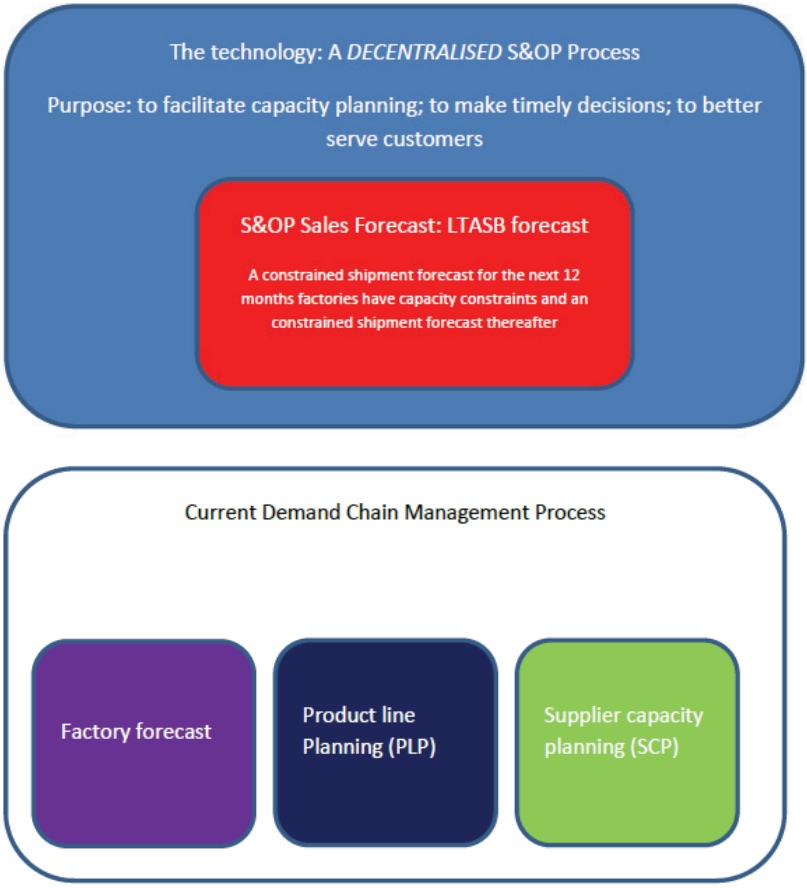


Figure 54: Status of the process of DCM when the field study completed

Concluding remarks

This chapter has shown the fabrication of the S&OP process at the arena where sales and factory forecasts competed against each other. The central theme was on a series of attempts to close matters of concern on forecasting accuracy. The factories' voice for customers have been stronger than sales' because it attached the S&OP forecasting practice to their existing practices of forecasting and performance evaluating. This bundling allied the interests of channel planners, product line planners and warehouses

who are responsible for KPIs in the BSC. These KPIs could be achieved via a set of product hierarchy decisions. This superimposition of multiple networks thickened the circulation of a factory forecast. The competition between the two forecasts, however, contributed to the fabrication of an S&OP process because attempts to close matters of concern on forecasting accuracy created more extra matters of concern, which made the S&OP process more multiple.

What is an S&OP process then? It has been taken into consideration as a black box, a matter of fact, in extant literature in DCM. This chapter shows that an S&OP process that is intended to domesticate future uncertainty in market demand is a superimposition of matters of concern over extra matters of concern. Although actors may remain the same in different episodes in their appearance, their identities are always shifting because their relations to *others* shift, for instance, the relation between S&OP sales forecasts, BCFs and financial forecasts made the S&OP forecast stronger in some contexts, but weaker in others. Consequently, the boundary of the S&OP process is always re-shaped.

Quattone and Hopper's (2006) notion of "heteromogeneous" applies to the ontology of the S&OP forecast. Homogeneity refers to the abstract term and minimal configuration of an object that people refer to. The S&OP process is homogenous as it represents the abstract terms of integration and common. This entices multiplicity because in order to bring these absent terms present attracts more entities that have been mentioned from the first to the ninth episode. People also refer to the S&OP in this minimal configuration, as a technology that attempts to increase availability in the long-term. The construction of the agenda of the S&OP process enhanced such homogeneity as people referred to it as an unconstrained sales forecast covering the next 36 months. As a series of attempts to close emergent, ongoing and multiple matters of concern took place, the S&OP process became heterogeneous, but people still referred to it in its homogeneous form. Although the homogeneity part of the S&OP was later transformed into a new type of forecast due to attempts to close matters of concern on forecasting accuracy mentioned in Episodes 9E and 9F; how the heterogeneity part of the S&OP would be constructed remains unknown because the field study ended before the implementation of the LTASB forecasts.

The fabrication of S&OP also has implications on theorising how to deal with uncertainties in DCM. Extant literature tends to avoid embracing uncertainty in customer demand. This chapter shows that in fabricating a managerial technology that aims at embracing such uncertainty, the uncertainty travels in random movements between intra- and inter-organisational tensions. Uncertainty in future market demand can be translated into uncertainty in forecasting logic of the sales forecast. It can also be translated into ongoing debates on forecasting accuracy. Some of these debates can be regarded as worries, and others can be regarded as assets. Integration also becomes uncertain because it is oftentimes separated into different times and spaces; and is sometimes re-defined. DCM is thus, in a continuous flux, but it does not mean that fabricating a managerial technology to DCM is pointless. The fabrication process re-shapes time and space so that sometimes an uncertain future regarding customers can be translated into certainty in present decision making processes. Customers can now be signaled earlier if SWEDTECH cannot serve them in the future.

Finally, translations via circulating references unfold enormous new tensions. When modern organisations tend to coordinate all these tensions into a single time and space, accounting inscriptions oftentimes reject this concern, for integration or coordination of it is almost impossible to construct a mega-network that is capable of addressing all these tensions. Accounting dissolves them by translating them into separate time and space. Small networks are able to handle separate tensions in their own time and space. Accounting is thus, not a coordinating technology trying to ally these tensions and solve them simultaneously. Instead, it is a permeating instrument that disperses these tensions and dissolves them in separate networks. Delegation/separation makes integration possible.

CHAPTER 8

Critical reflections and conclusions

A long journey comes to an end. Really? I do not think so. The S&OP process in the case company is still continuing. This monograph will be converted into journal papers to enrol matters of concern on theorisation constructed editors and reviewers, meaning theorisation will also continue. But this monograph, it has to end. What a pity!

An atmospheric panorama (Source: http://rsd.gsfc.nasa.gov/rsd/images/Panorama_lg.jpg)

Please enjoy the panorama of the S&OP world narrated.

Critical Reflections

Prelude

In concert with Latour (2005a), the narratives illustrated so far show a panorama of the S&OP world, but it is possible for the readers to zoom in to view the detailed translations of matters of concern on the S&OP process. It you are tired of reading the paragraphs, the series of constellation-shape figures drawn can be resting spots on this long journey. These figures are reductions of the narratives because there are no arrows indicating the directions of mediations, but they are amplifications because they are stable in the sense that they are drawn in a more or less consistent way and mobile in the sense that ten to twenty pages are easier to compare than a 300 page monograph, and combinable in the sense that figures combined with paragraphs construct my thesis. Now it is time to discuss the findings in the S&OP world and let them respond to the research question and talk to extant literature.

Fabricating an S&OP process: a tabular summary

Table 7 below summarises the empirical findings of how an S&OP process is fabricated. The table shows how a series of matters of concern around the S&OP process keep it from becoming a matter of fact are problematised and what the outcomes of the fabrication of the S&OP process are in each episode. Please note that detailed translations of uncertainties in future customer demand and integration are summarised in Tables 4, 5 and 6, and that the outcome of the fabrication of the S&OP process are visualised at the end of each episode in Chapters 6 and 7.

Episode Themes/ De-*finition*	Problem/Dilemma	Process of Fabrication	Outcome of Fabrication
Calculation of an S&OP sales forecast			
1 What is the proposed technology?	The problem was to define a technology according to identified organisational problems of corridor thinking and inconsistent information processing.	The fabrication was made possible by networking a set of visionary visualisations including consultants' findings on existing organisational problems and visionary boundary objects such as, being knowledge based and the platform concept.	A technology was proposed to integrate management processes across the demand chain where cross-functional communication was to be enhanced and information processing was to be standardised. A minimal configuration of the technology was constructed.
2 What is the boundary of the proposed technology?	The problem was to define what calculations are to be constructed and what time horizon the calculation was to cover in the proposed technology.	Calculative practices in the proposed technology were created by other visionary visualisations and accounting inscriptions showing serious availability failure and long delivery time.	The S&OP process was constructed to foster capacity planning to reduce the magnitude of availability failure and to regain the lost revenue due to such failure. The S&OP process is to be guided by an S&OP sales forecast prepared by sales to estimate the pure market demand for the next 36 months. This forecast is then to be used in product line planning (PLP) and supplier capacity planning (SCP). The object of integration was made specific, namely capacity planning. The minimal configuration of the technology is filled with calculative and time properties.
3A What is the primary key of the S&OP sales forecast?	The problem was to define the primary key, the starting level of the S&OP sales forecast in the S&OP process. The dilemma was to choosing between the degree of accepted forecasting accuracy and the degree of manageability.	The dilemma actors are facing was delegated into separate spaces, namely divisions in the company. This fabrication generated non-competing calculations, namely two primary keys.	The primary key for AD lies on the customer–item level, whilst the primary key of ID/SD lies on the product line level.
3B What is the appropriate forecast in the technology?	The problem was to define an appropriate forecast with particular logic on setting the primary key. Should the forecast be an internal S&OP sales forecast with primary keys set in Episode 3A or an external BCF with its primary key on the macro-economic trend?	Customers became allies with the internal forecast, but opponents to the external forecast. These competing calculations were settled by an accounting inscription showing availability failures. The accounting inscription allies customers, and thus, the internal forecast.	The appropriate forecast was the internal S&OP sales forecast, meaning the original primary keys set in Episode 3A were kept. The external BCF starting with the macroeconomic trend was not included in the S&OP process because of the support of the inscription showing availability failure.

	The dilemma was to choose between forecasts whose accuracy depends upon customers and the general market trend, respectively. If customers are perceived to help create a reasonable forecast, the internal S&OP forecast will be appropriate. If the market trend is a better predictor, the external BCF will be more appropriate.		
4 In calculating forecasts, which records were to be calculated by the computer system and collaborators, respectively?	The problem was to define data organisation in calculating the S&OP sales forecast. The dilemma was to choose between the degree of accepted forecasting accuracy and the degree of business importance to the company.	Different visualising inscriptions help forecasting managers and collaborators decide which items are to be forecasted manually, and hence, they separate the task of distributing workloads between computers and collaborators. Data in these visualising inscriptions was organised differently referring to customers and products. Forecasting managers usually combined different inscriptions to make their adjustment on the distribution of forecasting records between computers and collaborators. This means that different forecasting managers might construct different data allocation because of different combinations of inscriptions.	Collaborators' manual forecasts deal with A, B, C items, new items and items with strong growth and high value. Computer forecasts deal with the remaining items.
5 Which selection criterion is to determine the formula to be selected for system forecast?	The problem was to define the selection criteria for the formula to be used for system forecasts. The dilemma was to choose between the software's operational capacity and the ideal purposes of the S&OP process. Absolute error was judging which formula was to be selected for the system forecast, but it produced forecasts that	The struggle of selecting criterion for selecting formulas was translated into two separate spaces, the selection of a formula for system forecasting and an evaluation of forecasting accuracy. The competing calculations were transformed into non-competing ones through another actor, other available adjustments in the forecasting process.	Absolute error was used to select a formula for the computerised system forecast, whilst mean error was used to measure forecasting accuracy for the whole S&OP sales forecast and to be possibly linked to rewarding systems in the future.

	were fluctuating monthly. This contradicts with the S&OP purpose, but cannot be changed as the criterion is built in the software. Mean error yields smooth forecasts, which is consistent with the S&OP purpose.		
Calculation of a factory forecast			
6 What is the starting reference in calculating a factory forecast?	The problem is defining the starting references for factory forecasts. The dilemma was to choose between the degree of accepted forecasting accuracy and manageability.	The task to define starting references for calculating the factory forecast was separated into different product channels.	Shipment histories and BCFs are references for calculating forecasts in stock channels, whilst key customer accounts and order books are references for make-to-order channels.
7 & 8 How do factories manage their availability?	The problem was defining how factories calculate their forecasts to manage availability. The dilemma was to create a forecast that helps manage daily, short-, medium- and long-term availability.	An operational actor in factories, product hierarchy, showed availability levels on daily terms. This made factory forecasts more convincing compared to sales. A planning issue on availability was delegated into separate times and spaces, namely operational (even daily), tactical and strategic term availability management.	The factory forecast used an inscription showing a set of product hierarchy decisions to manage availability. This means that factories, in addition to managing availability on medium- and long-terms, manage availability daily. Finally, they also calculate target stock and safety stock levels in order to construct their final forecasts.
Competition between sales and factory forecasts			
9B Should the S&OP process be centralised or decentralised?	The problem was to define the organisational structure of implementing the S&OP process, i.e.centralisation or decentralisation. The dilemma was to choose between creating more debates and frictions between sales and factories and implementing the S&OP process as proposed. If actors believe that more debates lead to better capacity planning, then decentralisation will be preferred. If actors believe that strictly following the	In this episode, the competition induced the debate, but the debate was displaced away from calculations to the S&OP process. The debate in this episode was on the organisational structure to foster integration. Integration offered the space for the debates and organisational structure was the object of the debates. This time a decentralised type of S&OP process won because of a new entity, namely the S&OP's potential to identify gaps and trigger actions. Intentionally identifying a gap between sales and factories helped trigger actions in a	The S&OP process was defined as a decentralised process to intentionally create gaps and trigger actions.

	sales forecast leads to better capacity planning, then centralisation will be preferred.	more proactive manner.	
9C Are sales or factories under-estimating their forecasts?	The problem was to uncover whether sales and factories had under-calculated their forecasts? And if so, the task was to find out whether they had disconnected this possibility in the S&OP process.	The attempt to integrate was hampered by the likelihood of both parties to under-forecast. The task of mitigating this likelihood was separated into different spaces, sales and factories' forecasting, performance evaluating and rewarding practices in particular. Competition in this episode revealed that existing financial forecasting and performance evaluating practices in sales betrayed the S&OP sales forecast. Existing factory forecasting and performance evaluating practices in factories contributed to the S&OP process because S&OP allied a number of actors' interests. Factory forecasts, thus, won in this episode.	The competition also uncovered that sales had under-forecasted because their rewards were linked to their financial forecasts. As a result, they had an incentive to use financial forecasts as the S&OP sales forecast. Factory forecasts were not understated because they allied interests of many actors. The competition, thus, provoked the sales to improve their data quality and to provide more training in the S&OP process. Too many forecasts for sales prevented them from being encouraged to calculate the S&OP forecast. Provision of more training was believed to change the mindsets of sales with regard to the S&OP forecasting accuracy.
9D Should the S&OP sales forecasts within 12 months be constrained or unconstrained?	The problem is in re-defining the boundary of the S&OP process or the S&OP sales forecast, if factories have capacity constraints. The dilemma was to choose between the ideal S&OP purpose to estimate the pure market demand and the compromised version of S&OP process when factories have capacity constraints in the short run.	The competition between calculations drew attention to the existing S&OP agenda and questioned its relevance when factories had capacity constraints. This movement contained both an integrating and a separating endeavour. A new S&OP agenda was constructed to foster integration because the old agenda made integration impossible when there were capacity constraints in factories.	The S&OP sales forecast will be constrained within the next 12 months if factories have capacity constraints, but it will still be unconstrained thereafter. The minimal configuration of the S&OP process was modified. The decentralised process was reinforced when an intentionally created gap between sales and factories was considered to translate the time of decision making and serving customers.
9E & 9F What is the new S&OP sales forecast?	The problem is in defining a new S&OP sales forecast that is consistent with the objects of forecasting in factories.	Competitions between sales and factories' forecasts pointed to the difference in the objects of forecasting by each party. Sales forecasts are calculations for volume to be sold to external customers. Factory forecasts are calculations for volume to be shipped to	The new S&OP sales forecast will be a lead time adjusted shipment based (LTASB) forecast to estimate demands from external customers and internal warehouses and factories. Although factories claimed that they would consider using the new S&OP forecast, implementation of the

		internal warehouses, other factories and external customers. LTASB forecasts were to be calculated by taking into account two other actors, namely supporting activities across factories and lead time due to warehouses located in different geographical areas.	S&OP process still disconnected PLP and SCP from the S&OP sales forecast. The demand chain management held together factory forecasts, PLP and SCP. This movement led to integration because a new type of S&OP sales forecast is to be used in the S&OP process. Although the S&OP process starts with a forecast calculated by sales, the forecast is to be in the language of factories because factories and suppliers are the objects of management under the S&OP process. There is integration between the objects of management under the technology and entities that make the central calculation in the technology.

Table 7: Summary of the empirical findings on fabrication of an S&OP process

Table 7 above shows both the process and the outcome of fabricating the S&OP process. The column summarising processes of the fabrication indicates that, during the fabrication, actors create matters of concern around the S&OP process and attempts to close them are delegated by the group demand chain to separate local times and spaces. A variety of problems with regard to the process and integration are settled by local actors in their own local settings. The column summarising outcomes of the fabrication indicates that, as a result of the processes of the fabrication, although the S&OP process is evolving episode by episode, its constituents are dispersed in diverse times and spaces, instead of being coordinated in a single time and space. The next section will discuss these findings in a detailed manner and explain how fabricating an S&OP process is relational to uncertainty in future customer demand, uncertainty in integration, multiple voices for customers, and intra- and inter-organisational calculative spaces.

Empirical findings and claims

In this section I will discuss the empirical findings and generate claims of this thesis. The next two sub-sections will try to answer the research question of how an S&OP process is fabricated. I will discuss the processes and the resulting outcomes of its fabrication. This will be followed by discussions on impacts of fabricating an S&OP process, on translating uncertainty in future customer demand, integration, on performativity of multiple voices for customers and on framing intra- and inter-organisational calculative spaces.

Process and outcome of fabricating an S&OP process

This sub-section generates claims on the process and outcomes of fabricating an S&OP process based on a further discussion of empirical findings. The discussion starts with describing the fabricating process through delegating matters of concern around the S&OP process into separate times and spaces, and then goes through specifically the four types of translations in relation to such delegation, followed by a brief summary on the outcome of the S&OP process.

The claim on processes of the fabrication of an S&OP is that, in order to fabricate an S&OP process to foster integration on the demand chain, diverse local actors are attracted

and create a set of matters of concern around the S&OP process, thereby constructing new problems in the S&OP process. Although attempts to close these matters of concern and dissolve these problems are initiated by the group demand chain, it is the local actors that undertake these closing and dissolving actions. I therefore conclude that fabricating an S&OP process to foster integration involves delegating matters of concern around the S&OP process into separate local times and spaces.

During the fabrication process, diverse human actors such as managers in the group demand chain, business analysts, consultants, product line planners, customers in their absences, forecasting managers, sales, non-human actors such as BCF, inscriptions showing availability failure, Demand Solutions, financial forecasts, supporting activities across factories and geographical locations of warehouses, created matters of concern and management problems around the S&OP process. These matters of concern and problems constructed a series of dilemmas involving, for instance, a trade-off between forecasting accuracy and business reality (see Episode 3A), logics of setting primary keys in the forecast (see Episode 3B), data organisation (see Episode 4), a conflict between computing forecasts and evaluating forecasting accuracy (see Episode 5), organisational structure (see Episode 9B), incentive problems (see Episode 9C), and coordination problems in sales, factories and warehouses (see Episodes 9D, 9E and 9F). Although the S&OP process was initially proposed by the group demand chain, most problems and matters of concern were created by local human and non-human actors attracted to the fabrication process. For instance, the S&OP process was proposed by the group demand chain because of existing organisational problems that were pinpointed by consultants and inscriptions showing availability failure (a local actor); and the problem of setting primary keys was created by local actors, namely differences in business volume and customer distribution across divisions and order books. These findings show that although the group demand chain proposed and was responsible for guiding the implementation of the S&OP process, it was the local actors who created and separated matters of concern around the S&OP process into diverse times and spaces. When local actors created emergent matters of concern around the S&OP process, attempts to close them were delegated by the group demand chain into separated local times and spaces,

instead of being coordinated into a single time and space by the group demand chain. As a result, the group demand chain and vast local actors formed a collective in fabricating the S&OP process. Delegation by the former leads to separation of different local networks. This will be discussed in more detail in the following paragraphs.

The process of fabrication shows that when local human and non-human actors created matters of concern and problems around the S&OP process, the group demand chain delegated attempts to close these matters of concern and problems back to those local actors. Then when those local actors were networking in order to close matters of concern and problems, they created separate local times and spaces. There are four types of translations that lead to such separation. I will now discuss them one by one. The first type is shown below.

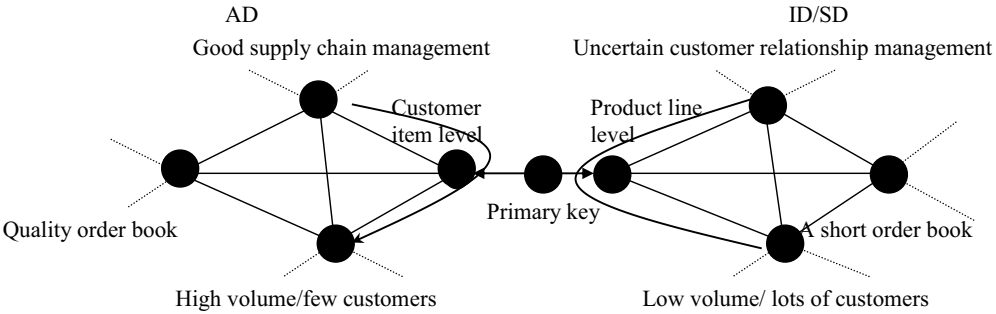


Figure 55: Translation into a primary key for AD and ID/SD

Figure 55 is a re-capture of how local actors, namely customers spoken of by business volume, order books and inter-organisational relationships with customers, closed the matter of concern on primary keys of the S&OP sales forecast in Episode 3A. This is just one of the examples of how a problem is translated into co-existence in two spaces. Similar translations also take place in Episodes 4, 6, 7, and 8, albeit some of these episodes produced co-existence of more than two spaces. In Figure 55, the attempt to close this matter of concern was delegated into two separate spaces, namely different divisions. The aforementioned local actors in these spaces (divisions) translated a problem on constructing primary keys into a separation where problematisation of

primary keys led to two networks as is shown in the figure. Separation means that the two (or more) spaces now co-exist in the S&OP process.

The second type of translation is similar with the first type of translation mentioned above, but the difference is that in the second type of translation, separation occurs after a moment of tension, where separation in the first place is impossible. An example is depicted in the following figure where the attempt to close the matter of concern on selecting criteria for computing system forecasts was delegated by the group demand chain to local actors in Episode 5.

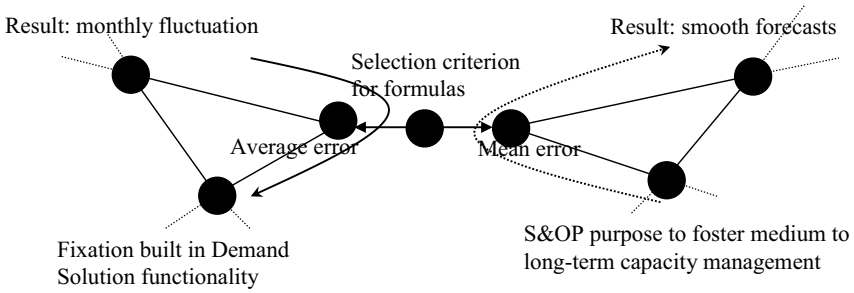


Figure 56: Matters of concern of measurement of forecasting accuracy between average error and mean error

As is shown in the above figure, the problem of selecting formulas in the S&OP sales forecast was first translated into a tension, rather than directly into a separation. Tension here means it is impossible to settle the dilemma in two separate spaces, implying that one space has to be disregarded for the existence of the other. In Episode 5, the network comprising the mean error was disregarded (this is why the arrow is dotted) by both the group demand chain and local actors, shown in the figure, because it could not be used due to software constraints in Demand Solutions; although both the group demand chain and local actors wanted to use mean error as it is consistent with S&OP process' purpose to smooth forecasts across months. This tension, however, was then transformed into a separation by enrolling a local actor, namely other available adjustments in forecasting, which is shown in the figure below.

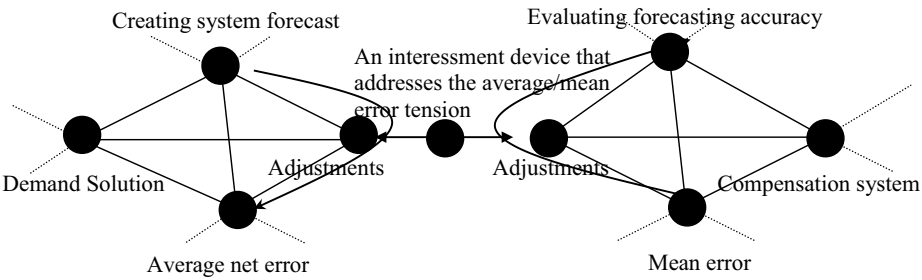


Figure 57: An enrolment of other adjustments in translating the matters of concern for the choice between average and mean errors

These adjustments overcome the limitation of the software and created a new space for evaluating forecasting accuracy. Consequently, there was a separation that led to the co-existence of both spaces for creating system forecasts and evaluating forecasting accuracy. In short, a problem was first translated by local actors into a tension, but the tension was later translated into a separation that led to the co-existence of two spaces by enrolling a new actor in the local setting.

The third type of translation also occurs when delegation by the group demand chain leads to separation of times and spaces, but this time the focus is on investigating local actors in these separate networks in order to help the weak calculation be more convincing in the future. This occurred in Episode 9C, where a matter of concern around the S&OP process was related to incentives of both sales and factories to under-forecast. The attempt to close this matter of concern was delegated by the group demand chain to local actors in two spaces, namely sales' and factories' existing forecasting practices. It, however, turned out that the group demand chain was not trying to close the matter of concern, but to unveil why the unconstrained S&OP sales forecasts were lower than the constrained factory forecasts. Therefore, delegation in this episode was more like an investigation by the group demand chain of forecasting practices undertaken by sales and factories. The investigation concluded that sales did under-forecast, but factories did not. The investigation unveiled new local non-human actors, namely financial forecasts and rewarding systems in sales, the BSC in factories, channel planners, product hierarchy decisions and warehouses. These local actors indicated to the group demand chain that

sales under-forecasted because their existing financial forecasting and rewarding practices kept the S&OP sales forecast at bay. Factories did not under-forecast because their existing forecasting practice allied a number of actors, including the S&OP process. Investigation into this case clarified why one calculation dominated the other, but it also constructed new management intervention to strengthen the weak calculation. Management intervention was initiated by the group demand chain not to withdraw the S&OP sales forecast, but to disconnect financial forecasts from the S&OP process by offering more training to sales and letting them understand that the S&OP sales forecast is to be different from the financial forecast. Although it could not be concluded whether such disconnection occurred at the end of the study, it created more management actions (e.g. trainings) to increase the magnitude of sales forecast. In short, delegation here led to investigation by the group demand chain, which unveiled new local actors. Investigation on one hand created a winning calculation, and on the other hand constructed new management actions to save the losing calculation. Separation is still the outcome of delegation, but delegation in this case initiates an investigation in relation to the calculations in separated local settings.

The final type of translation is that delegation leads to separation, but separation also has impacts on the minimal configuration of the S&OP process. This took place in Episodes 9D, 9E and 9F, where the group demand chain delegated the attempt to close the matter of concern on forecasting accuracy into different times and spaces, namely factories capacity planning, factories' customers (internal warehouses and external customers) and long lead time due to different geographically located warehouses. The impacts of delegation in these three episodes, however, differed from previous episodes. In previous episodes, each matter of concern was closed by delegating the attempt to closing it into separate times and spaces. In other words, matters of concern around the S&OP process were translated into a set of separations where separate networks co-exist, either directly or indirectly through translating problems into tensions first. In Episodes 9D, 9E and 9F, this is also the case, but in addition, the translations did not stop after the group demand chain delegated a matter of concern on forecasting accuracy into separate local times and spaces. In Episode 9D, after delegation by the group demand chain to sales and factories,

the minimal configuration of the S&OP process was transformed anew by both the group demand chain and the local actors including factories' capacity, channel planners and sales. The S&OP sales forecast was transformed to be constrained within the 12 month period, instead of being unconstrained when factories had capacity constraints. In Episodes 9E and 9F, after group demand chain's delegation of the attempt to close the matter of concern on forecasting accuracy to sales and factories, the minimal configuration of the S&OP process was transformed by both the group demand chain and local actors including sales, factories, warehouses located in different regions around the globe and lead time from a sales forecast into an LTASB forecast. Although separate times and spaces still co-exist, their impacts have arrived at the same time and space, namely the minimal configuration of the S&OP process.

Because these aforementioned translations were taking place in diverse separate local settings, the outcome of the S&OP process was that its constituents were located in diverse times and spaces, instead of being coordinated in a single and space. The evolvement of the S&OP process is visualised in the series of figures at the end of each episode. It should be noted that, in Figure 53 where the outcome of the whole S&OP process is depicted, although its constituents are gathered in a single drawing, in a three-dimensional reality, they are separated in diverse times and spaces. Its primary keys reside in different divisions, its logic is set within the S&OP team, its computation is realised in Demand Solutions and collaborators' intelligence, selections of calculative criteria are dealt with in spaces of computing system forecasts and evaluating forecasting accuracy respectively, its organisational structure of implementation is determined by two potential times and spaces of standardising decision making processes and proactively serving customers and its new minimal configuration is built from the relationship between sales, factories, warehouses and customers. The S&OP process is thus, separated into different times and spaces, instead of being coordinated in a single time and space.

In summary, the claim on the processes of fabricating the S&OP process is that diverse human actors such as managers in the group demand chain, business analysts, consultants,

product line planners, customers in their absences, forecasting managers and sales, and non-human actors such as BCF, inscriptions showing availability failure, Demand Solutions, financial forecasts, supporting activities across factories and geographical locations of warehouses participating in the S&OP process create emergent, ongoing and multiple matters of concern around the S&OP process; and the attempts to close these matters of concern to foster integration are delegated into separate local times and spaces, instead of a single time and space coordinated by the group demand chain (the process proposer and guide). Although delegation is predominantly proposed by the group demand chain, it is the networking of local human actors such as managers in sales, factories and product line management, and local non-human actors including computers, different forecasts and the BSC that create separate co-existing times and spaces that tame these matters of concern. There are four types of such delegating translations that close matters of concern. First, a problem is directly translated into a separation that leads to the co-existence of different times and spaces. Second, a problem is translated into a tension that creates a time and space by disregarding the other, but enrolling a new local actor to translate the tension into a separation. Third, delegation leads to an investigation by the group demand chain on the constituents making up forecasting calculations in separate local settings. The investigation produces a winning and a losing calculation, but the purpose is to create new management intervention to help the losing calculation become acceptable to debunkers. Finally, delegation leads to the co-existence of spaces (separation), but sometimes these co-existing spaces also transform the minimal configuration of the S&OP process. As a result, the outcome of the S&OP process is that its constituents are located in diverse times and spaces, instead of being coordinated in a single time and space.

Accounting as dispersion instead of coordination

Based on the theorisation of the fabrications of an S&OP sales forecast and an S&OP process, this thesis claims that accounting plays a dispersing role because, according to the narratives of the S&OP implementation, accounting as a set of matters of concern is dispersed into separate times and spaces and its constituents constructed accordingly in local networks. These constituents are not located in a single time and space that is capable of coordinating demand chain issues. Local actors create separate primary keys

in different divisions (spaces), instead of producing a primary key in singular that addresses such a problem across divisions. Local actors construct different inscriptions to dissolve a matter of concern on the starting level of factory forecasting after which, this matter of concern is translated into different production channels (spaces), instead of producing a unitary inscription that coordinates such a problem across all channels. Availability is transformed into different terms (times) in order to dissolve a matter of concern on capacity management so that it can be translated into operational and strategic time horizons (times) and sales, channel planning and product line planning (spaces). Matters of concern and problems around the S&OP process are dissolved, instead of solved at once. Accounting is thus, dispersed into separate times and spaces instead of being coordinated and unified in a single time and space.

Accounting as dispersion, instead of coordination also explains why networking of inscriptions yields different effects in different local settings. When local human actors try to close matters of concern around the S&OP process, they network accounting inscriptions. This thesis claims that the impact of networking inscriptions is dependent upon what matter of concern actors are attempting to close. When local actors such as business volume, customer types, order books and relationships with customers were closing a matter of concern on primary keys, allying the order book and inscriptions visualising the type of products sold to different groups of customers constructed the primary keys of sales forecasts. When local actors such as the primary keys of the S&OP sales forecast, macro-economic trends and humans' belief on future customer demand closed a matter of concern on the logic of setting primary keys, the relation between a business cycle forecast (BCF) and an S&OP forecast obstructed the fabrication of the S&OP process because the BCF was used by a manager who questioned the S&OP forecasting logic and claimed that the macro-economic trend was more reliable than the customers' prediction of their business volume; but when later the S&OP sales forecasts were challenged by the factory forecasts, the relation between the same group of inscriptions strengthened the S&OP sales forecasts because sales used the BCF as a weapon to argue against the factories, by stating that the S&OP sales forecast had taken into consideration the BCF. When the S&OP sales forecast was competing against the

factory forecast, the relation between the S&OP forecast and the financial forecast obstructed the fabrication because the financial forecast motivated sales to under-forecast, but the relation of sales and factory forecasts contributed to the birth of a new minimal configuration of the S&OP process. We cannot conclude that the networking of inscriptions always constructs the managerial technology. Instead, it is mobilised by human actors when they are facing different issues around the managerial technology. Because the S&OP process is fluid and multiple and its constituents are delegated into separate times and spaces, the impacts of networking inscriptions become heterogeneous. It is possible that networking different inscriptions always contributes to the constructing of a managerial technology that is capable of coordinating all problems in a single time and space, but when its constituents are separated in diverse times and spaces, these relational inscriptions constructs the managerial technology in some local settings and obstructs it in others. If networking always constructs, there will be fewer frictions, problems and tensions, there will also be less need for local actors to participate in creating separations, and therefore, there will be fewer co-existing times and spaces for the S&OP process. It is because the relations between inscriptions sometimes obstructs the fabrication that the temporal and spatial distribution of constituents of the S&OP process increase, for instance, the relation between sales and factory forecasts created new properties on the S&OP process, namely a decentralised process, a process that re-shaped the timing of making decisions and serving customers, and a process that took into consideration the demands from factories and warehouses.

Fabrication of the S&OP process, multiple voices for customers, and uncertainty in future customer demand & integration

The S&OP sales forecast in the S&OP process aims to domesticate uncertainty in future customer demand by representing this uncertainty as the numerical difference between the current capacity and the pure market demand. This calculative difference was proposed by the group demand chain to create a space where management actions are created to bridge the capacity shortage. Therefore, the purpose of the S&OP process was to encourage actors to move discussions away from calculations to management plans, but in the series of Episode 9, when actors were engaging with the S&OP process, debates on uncertainty in future customer demand focused back on calculations again.

There was not much discussion on the management plans of capacity. Debates were centred upon creating a consensus forecast across the demand chain that is to say, taming the differences between sales and factory forecasts.

The empirical episodes in Chapters 6 and 7 have shown the fabrication process of a consensus S&OP sales forecast and indicated that emergent and ongoing matters of concern around the S&OP sales forecast were delegated into diverse separate times and spaces. Integrating management processes across the demand chain was made uncertain because delegation of the series of attempts to close emergent matters of concern to local actors attracted them to displace integration into unknown territories. This means uncertainty in future customer demand was translated into uncertainty in the S&OP process as a cross functional process, that is to say, uncertainty in integration.

The thesis found that the fabrication of the S&OP process has largely conditioned its target purpose, integration. The claim on integration is that, when actors participating in the S&OP process are moving towards integration, on one hand they continuously create new matters of concern and problems around the S&OP process thus, postponing the achievement of integration, but on the other hand they create new management possibilities with regard to the S&OP process and integration because of the newly attracted local actors. These new management possibilities include, for instance, generating different primary keys of forecasting in different divisions, mobilising different inscriptions in different settings, using mean error to evaluate forecasting accuracy, connecting different visualisations such as ABC analysis and items with high growth rate and value to collaborators' intelligence, creating new potentials for more consistent decision making and more proactive customer service, creating new actions to help the under-estimated sales forecast and transforming the minimal configurations of the S&OP process. As a result, the process of fabrication in fact creates new paths to move towards integration, instead of overcoming the distance between existing DCM problems and the ideal status of integration. In this sense, fabricating an S&OP process to foster integration postpones integration as new management possibilities are continuously created. Consequently, the loss of the fabrication means that the destination of integration

will never arrive. The reason for this is that the destination of integration only exists in textbooks, normative frameworks in S&OP literature and group demand chains' minds and that the complexity in its use often creates new problems when using it. The gain is that the S&OP process becomes multiple and heterogeneous when local actors create new calculative practices and thus, new properties on the S&OP process. Different constituents of integration are created in different local times and spaces. As a result, there is no unified coordination for integration, but there are elements of integration that have been created and dispersed in heterogeneous times and spaces. Paradoxically, attempts to integrate DCM through a consensus forecast leads to separating problems of DCM and the S&OP process into diverse times and spaces. In short, to integrate is not to integrate, but to separate.

Finally, multiple voices for customers both contribute to and obstruct the fabrication of the S&OP sales forecast and the S&OP process. Some of these multiple voices for customers are represented by competing forecasts across the demand chain, namely sales and factory forecasts, but these competing calculations contribute to the fabrication by delegating a central matter of concern on forecasting accuracy into further translations by local actors on organisational structure, incentives to under-forecast and the minimal configuration on the S&OP process. Local actors comprising of sales, channel planners, product line planners, warehouses located in different geographical areas and the BSCs add new properties to the S&OP process such as decentralization and a new type of forecast. In short, although sales and factories have competing voices for customers, they create new properties for the S&OP sales forecast and the S&OP process thus, creating new paths for integration. There are also other voices for customers, for instance, represented by a BCF and a financial forecast. Because these calculations are backed by networks that have existed for a long time, they resist the S&OP process by either challenging the logic of setting primary keys on the S&OP sales forecast in Episode 4B, or attracting sales to move away from the S&OP network in the series of Episode 9. In summary, competing voices for customers may contribute to the fabrication by adding new properties onto the S&OP sales forecast and the S&OP process. However, long

existing voices for customers may obstruct the fabrication by distracting actors away from the S&OP process.

Fabrication of the S&OP process, and shaping and re-shaping of intra- and inter-organisational spaces

Fabrications of an S&OP sales forecast and an S&OP process also frame and re-frame intra- and inter-organisational times and spaces. When local actors are closing different matters of concern around the S&OP process, they mobilise intra- and inter-organisational spaces differently. Please note that intra- and inter-organisational spaces here refer to calculative spaces because they are the effects of fabricating the S&OP process. Generating theories on intra- and inter-organisational relationships require further studying on the performativity of the S&OP process in the company to trace issues such as trust and relationship ties. Given the time constraint of this project, this study cannot generate claims on relationships. There are four types of how intra- and inter-organisational calculative spaces are shaped and re-shaped.

First, in my story, there was both a contradiction and a confusion between the financial forecasting practice and the S&OP forecasting practice inside the sales organisations, when the group demand chain investigated whether sales' and factories' had incentives to under-forecast. The investigation revealed that existing practices of performance evaluating and rewarding of sales was connected to a financial forecast. This meant that the financial forecast was a constrained forecast that had a connection to the company's financial resources. Indeed, the S&OP process was almost torn apart by this existing forecasting practice because the latter created an incentive for sales to under-forecast, whilst the S&OP forecast was supposed to be an unconstrained market based forecast. In addition, early in the process sales used the financial forecast as the S&OP sales forecast because there was confusion that these two were the same. However, the contradiction and the confusion were revealed by a competition between the S&OP sales forecast and the factory forecast. An inter-functional competition between sales and factory forecasts alerted the sales to the fact that the S&OP forecast ought to be different from the financial forecast; thus, contributing to the fabrication of the S&OP process by allying the S&OP process to other actors such as the BSC, channel planners, product line planners, product

hierarchy decisions and so on. This narrative of intra-functional contradiction and confusion, and inter-functional competition is displayed below.

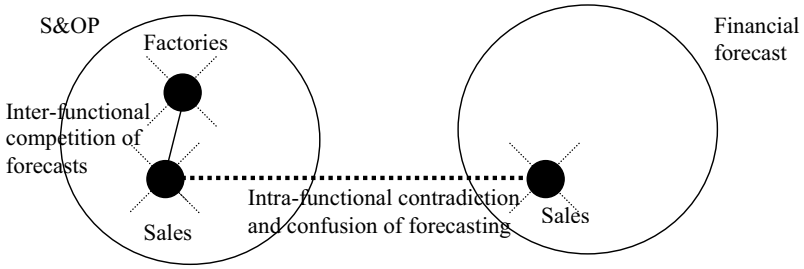


Figure 58: shaping and re-shaping of intra- and inter-organisational calculative spaces – inter-functional competition and intra-functional contradiction and confusion

Figure 58 shows that inter-functional competition between factories and sales forecasts contributes to constructing the S&OP forecast according to the S&OP agenda, whilst intra-functional contradiction and confusion of forecasting practices within sales pulled them from the S&OP process. Fabricating the S&OP process re-shaped the calculative space inside the sales.

Second, later when both group demand chains and local actors dealt with a series of matters of concern on forecasting accuracy derived from the competition between sales and factory forecasts throughout Episode 9, integration was made possible by a substituting calculation, a shipment forecast that allied actors such as lead time (time) of moving from factory warehouses to regional warehouses (space) and supporting activities across factories (space). Early in the process, sales and factory forecasts were constructed with the purpose to integrate them as a consensus, but they failed. However, the S&OP process did not die after the group demand chain, sales, factories and product line management agreed that the original sales forecast would be transformed into an LTASB forecast. The actor that enacted this transformation was the difference in the forecasting objects (forecastees) between sales and factories. Sales only considered the "external" customers, but factories paid attention to both "internal" local and regional warehouses, and "external" customers. The claim here is that the difference in the forecasts between the two competing groups shapes the intra- and inter-organisational calculative spaces.

Once this difference is closed and a substituting forecast is created, the intra- and inter-organisational calculative spaces will be re-shaped so that the space of sales forecasting (the left sphere in the figure below) will be dissolved into the space of factory forecasting (the right sphere in the figure below). This type of shape and re-shape of intra- and inter-organisational spaces is shown below in Figure 59.

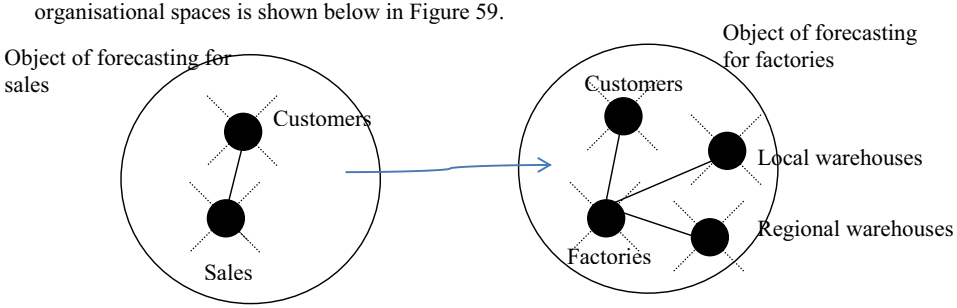


Figure 59: shaping and re-shaping of intra- and inter-organisational calculative spaces – difference in the objects of forecasting and inter-organisational calculative spaces

This figure shows that the S&OP forecast is adapted from sales' "language" into factories' "language" because the latter incorporates customers, local and regional warehouses and factories, whilst the former only considers customers. This adaptation re-shapes intra- and inter-organisational calculative spaces by networking customers, factories, local and regional warehouses as a collective. This adaptation also creates a new minimal configuration of the S&OP sales forecast, thus, making integration possible.

Third, the inter-organisational calculative space referring to the ideal S&OP process proposed by the group demand chain differs from the ones referred to in the actual fabrication of the process by both the group demand chain and diverse local actors. This means fabricating an S&OP process re-shapes the boundary of inter-organisational calculative space. This can be depicted in Figure 60 below.

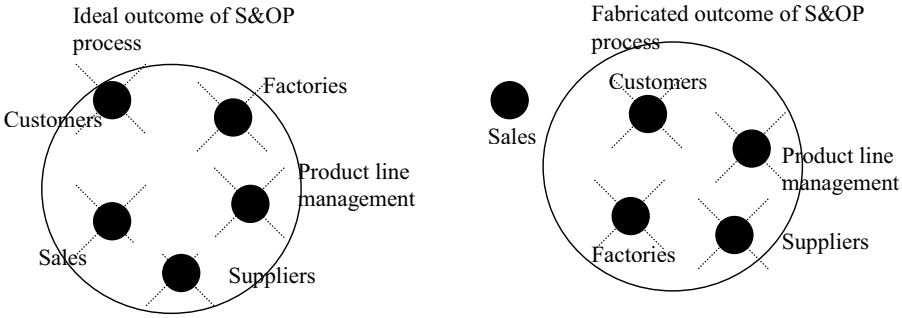


Figure 60: re-shaping of intra- and inter-organisational calculative spaces

Figure 60 shows that, in the ideal S&OP process, the S&OP sales forecast is intended to be used to integrated the demand chain and thus carried forward to factory planning, product line planning (PLP) and supply capacity planning (SCP). In this scenario, customers, sales, factories, product line management and suppliers are enrolled in a collective whole. During the fabrication of the pilot S&OP process by both the group demand chain and local actors, a matter of concern on forecasting accuracy obscured the S&OP sales forecast from becoming a matter of fact; and in most cases factories did not bother taking the sales forecast and thus, carried forward their own factory forecasts for PLP and SCP. In this case, sales was disenrolled from the process, whilst factories, product line management, suppliers and customers were integrated. When later an LTASB S&OP forecast was proposed, factories seemed to be willing to use the new forecast, although this was to be implemented in the upcoming December. The claim is that the intra- and inter-organisational calculative spaces can be shaped and re-shaped by the fabrication of the S&OP process. When an LTASB S&OP forecast are used, sales, factories, PLP and SCP may be integrated, but more matters of concern may also be created. This may further re-shape inter-organisational spaces.

Fourth, framing inter-organisational calculative spaces in the context of S&OP can also be affected by inter-functional competition between sales and factory forecasts. This was explained in Chapter 6, when a gap between sales and factory forecasts domesticated two

times and spaces, namely intra-organisational decision making and inter-organisational customer service (see below in Figure 61).

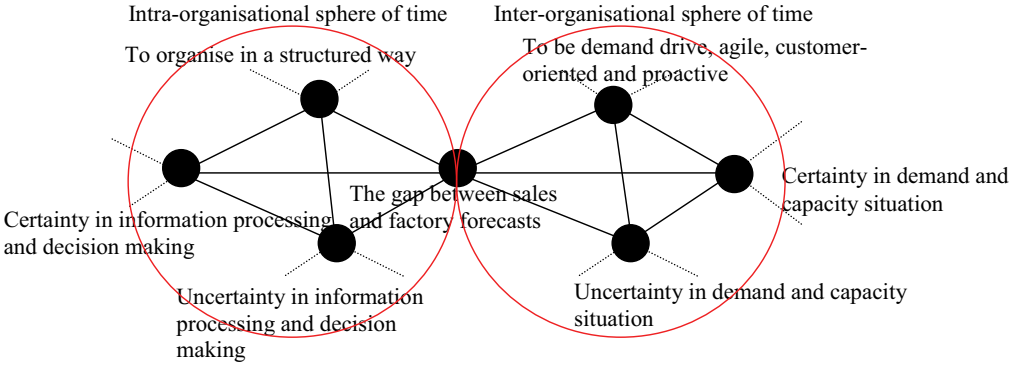


Figure 61: Intra- and inter-organisational spheres of time emancipated by the gap between sales and factory forecasts

In this case, because the numerical difference between sales and factory forecasts was discussed and communicated to senior managers in a more structured manner; according to the S&OP process, intra-organisational (space) decision making has the potential to be made more consistent (time) so that negotiation with customers will not be interrupted, and inter-organisational (space) customer service has the potential to be made more proactive (time) so that when there is an inability to service customers, they can inform the customer much earlier. The S&OP process suddenly creates more possibilities in DCM and it has the potential to convert these possibilities into realities.

In summary, there are four types of shaping and re-shaping of intra- or inter-organisational calculative spaces during the fabrication of the S&OP process. First, inter-functional competition between sales and factory forecasts contributes to the fabrication of the S&OP process by allying the S&OP process to other actors such as the BSC, channel planners, product line planners, product hierarchy decisions and so on, whilst intra-functional contradiction and confusion of forecasting practices in sales distracts sales' attention from creating an S&OP sales forecast. Second, when differences in the objects of forecasting between two competing calculating groups are closed, suppliers,

sales, factories, product line management and customers may be grouped and therefore, intra- and inter-organisational calculative spaces will be re-shaped. Third, although the ideal S&OP process aims to create a stable and lasting inter-organisational calculative space between suppliers, sales, factories, product line management and customers, fabricating the S&OP process constantly re-frames such a space. Forth, inter-functional competition between forecasts creates more possibilities in DCM and it has the potential to convert these possibilities into realities.

Contributions to extant ANT inspired accounting literature

This section relates the findings of this thesis discussed thus far, to extant ANT inspired accounting research, thus, detailing the contributions. In particular, the following sub-sections will relate the major finding on fabrications to *matters of concern* and *circulating references,* respectively.

Matters of concern & separation

One of the contributions of this study lies in theorising the fabrication of the S&OP process via creating and closing matters of concern by local actors. It shows how the S&OP process as a set of matters of concern becomes complex, fluid and multiple. When local actors create matters of concern around the S&OP process, they actually create new management possibilities in relation to implementing the process because the delegation of different matters of concern into separate times and spaces attracts local actors to engage with the S&OP process in heterogeneous ways. The findings show that every time a task to close a matter of concern is delegated into local settings, new local actors are attracted and create new properties of the S&OP process. This is consistent with Quattrone and Hopper's (2006) reflection upon the Latin etymology of definition, "every de-*finition* (a closure) is also a *de*-finition (an incomplete order)" (p. 234) because the latter attracts new entities. In addition it expands on Quattrone and Hopper (2006) by claiming that when matters of concern around the S&OP process attract new local actors, they create new properties that are dispersed in separate times and spaces. I agree with Quattrone and Hopper (2006) on the claim that the managerial technology is fluid and multiple, but I add to their claim by stating that new properties produced by this fluidity and multiplicity are dispersed.

This thesis found that there are four types of delegating translations. This adds new properties to Mouritsen et al.'s (2009) theorisation on long translations. While Mouritsen et al. (2009) claim that competing calculations generate a long translation that in turn creates more management possibilities, this study adds to that by concluding that, competing calculations create new spaces of management by creating and closing emerging matters of concern in four specific ways. Firstly, a problem may be directly transformed into a separation where different local times and spaces may co-exist. In this milieu, new management spaces are created in these co-existing local settings. Secondly, when a problem is translated into a tension where one of the times and spaces will be disregarded, enrolling a new actor may transform this tension into a separation. Thirdly, new management spaces emerge after an investigation on what constitutes a winning and a losing calculation in local settings is undertaken. The investigation creates new management intervention and properties on the losing calculation. Finally, the minimal configuration of the managerial technology may be transformed by both the guide of the technology and local actors who separate accounting as a set of matters of concern into local times and spaces.

This thesis also wants to contribute to Quattrone and Hopper's (2001) theorisation on organisational change as a *drift*. The findings of this study are consistent with their claims. They *(Ibid.)* claim that when organisations propose to change, they share an understanding of the "right" destination, but they cannot define their actual location and time to move towards the destination, though they are always trying to do so. When implementing the S&OP process, actors share the idea that the technology is to foster integration; but when they create matters of concern around the technology, the loci of integration is dispersed into diverse time and space that actors cannot anticipate from the outset. The nuance this thesis wants to add is that drifting occurs because when attempts of matters of concern are delegated to local actors, moving towards integration actually postpones integration because they continuously create new matters of concern around the managerial technology. Actors are always moving towards integration, but never arrive at the destination because there are always emergent matters of concern around the

technology to foster integration. Drifting, thus, occurs because actors are continuously creating new management possibilities and making managerial technologies a set of matters of concern instead of matters of fact.

Following how the S&OP process and integration are fabricated when there are competing calculations, this study finds that competition between calculations may create new constituents of the technology. This is made possible by encouraging actors to create new matters of concern induced by competition, which in my case is forecasting accuracy, and delegating the attempts of closing them into local actors in local settings. Such delegation may displace challenges of the managerial technology into new management possibilities. When new properties of the managerial technology are created in local times and spaces, debunkers' voices are likely to be tamed. This adds nuance to Chua (1995), Chua and Mahama (2007), Briers and Chua (2001) and Preston et al. (1992) by claiming that taking debunkers' voices, creating new matters of concern on the managerial technology and delegating the task of closing them into local settings may ally debunkers' interests. The four types of delegating translations may be used as strategies to make this possible.

Circulating references & delegation/separation

This study follows Latour's (1999a) process of inscription building – circulating references – to explore how an S&OP process is fabricated. A series of matters – tensions, conflicts and dilemmas – are translated into a series of forms including the S&OP agenda, primary keys, mean and absolute errors, system and collaborators forecasts, a decentralised process and a new S&OP sales forecast. In other words, there is a reversible chain so that readers can always pinpoint what the matter is and what actors are constructing a particular form in each episode. Therefore, readers can see the temporal layout between matters and forms. In addition to this, the contribution of this study on circulating references lies in the spatial distribution of matters and forms because of delegation and separation. As is discussed in prior sections, delegating matters of concern into separate local times and spaces makes both the S&OP process and integration actor-networks because those forms are now distributed in diverse times and spaces that co-exist; for instance, in different divisions, in the S&OP team, in computers and

collaborators' minds, in the space of computing system forecasts, in the space of evaluating forecasting accuracy, in different production channels, in sales and factories, in processing information, in serving customers and in different warehouses. In addition to the original version of circulating references, where forms making up the technology are evolving in a temporal manner, this study claims that forms are also distributed spatially in diverse times and spaces. In addition to a temporally constructed reversible chain, there is a spatially dispersed network of constituents of the managerial technology.

As is discussed in prior sections, when constituents of the S&OP process are dispersed and separated in diverse local times and spaces, instead of being coordinated in a single time and space, the relation between inscriptions does not always construct the managerial technology because local actors may mobilise multiple inscriptions in different ways based on what matters of concern they attempt to close. The relation between BCF and the S&OP sales forecast was used by sales organisations to defend against factories' challenges. This relation was also used by certain managers to question the reasonableness of the bottom-up S&OP sales forecast. In the first case relational inscriptions were mobilised by sales to close a matter of concern on forecasting accuracy, whilst the in the second case it was mobilised by debunkers of the S&OP process to create a matter of concern on forecasting logic. Therefore, this study disagrees with Dambrin and Robson (2011) who state that bricolage of inscriptions contributes to constructing the managerial technology. Bricolage may also create frictions in local settings; thereby creating new matters of concern around the technology, but this in turn creates new constituents of the managerial technology after local actors close them in their local settings.

To conclude, the contribution of this study to circulating references lies on the spatial distribution of circulating references in diverse times and spaces making up the S&OP process, and additionally to the temporal evolvement of matters and forms because of the separation of matters of concern around the technology. Networking different inscriptions may close matters of concern, but may also create new matters of concern around the

S&OP process. This means that relational inscriptions contributes to adding new properties to the S&OP process.

Contributions to extant DCM literature

This thesis agrees with Landeghem and Vanmaele (2002) and claims that uncertainty in future market demand cannot be overlooked because this is the core purpose of using forecasting technologies; although how to domesticate it is oftentimes referred to in the absence of customers. In addition, this thesis also claims that studying forecasting technologies only from a technical perspective tends to take the ontology of these technologies for granted. An S&OP forecast is both technical and social. It is the fabrication of this twin that translates the uncertainty in market demand into unexpected territories. How to domesticate uncertainty is not only an inter-organisational problem that can easily be addressed via mathematical modelling, but also a series of intra-organisational tensions that displace this uncertainty.

The contribution of this thesis to extant DCM literature lies on theorising the fabrication process of an S&OP process and linking fabrication to integration. Most mainstream DCM research either discusses the technical perspective on technologies or proposes a normative framework on integration in DCM, but it has not explored the intricate relationships between a managerial technology to foster integration and integration itself. Lots of studies have recommended a cross functional team to implement the S&OP process, but have not paid attention to the impacts of having a cross functional team and the frictions that are created by such a team. This study offers some insights into how frictions created by the cross-functional team help actors in DCM move towards integration by delegating these frictions into separate local settings. This thesis also adds to the literature by claiming that DCM is about creating new management possibilities to move towards integration, instead of actually achieving integration. In the case of DCM in this study, these new management possibilities include, for instance, generating different primary keys of forecasting in different divisions, mobilising different inscriptions in different settings, using mean error to evaluate forecasting accuracy, connecting different visualisations such as ABC analysis and items with high growth rate and value to collaborators' intelligence, creating new potentials for more consistent

decision making and more proactive customer service, creating new actions to help the under-estimated sales forecast, and transforming the minimal configurations of the S&OP process. Fabrication of the S&OP process and integration may never stop because they are sets of matters of concern. Rexhausen et al. (2012) find that implementing the S&OP process is difficult. This study concludes that perhaps it is problematic to judge whether the level of implementation is high or low, or successful or unsuccessful. Using whether or not integration is achieved as a judgment criterion is problematic because integration may never be achieved. When actors are moving towards integration, they actually postpone integration by creating new problems in integration, which also construct new management possibilities. Companies may not achieve integration, but they may still be satisfied with the integrating process because new management agenda gets constructed when moving towards integration.

Whilst extant accounting literature on inter-organisational relationships predominantly explores the use of accounting in supply chains and subcontracting relationships (Mouritsen, 1999; Mouritsen et al., 2001; 2009; Mouritsen and Thrane, 2006; Chua and Mahama, 2007; Dekker, 2003; 2004; Anderson et al., 2000; Wouters et al., 2005; Carr and Ng, 1995; Cooper and Slagmulder, 2004; Kajuter and Kulmala, 2005; Seal et al., 1999; 2004; Baimen and Rajan, 2002; Thrane and Hald, 2006; Coad and Cullen, 2006), this study contributes to this literature by studying the role of accounting in translating future uncertainty on the demand chain. When mainstream DCM literature focuses on a set of practices that manage the supply chain from end-customers backwards to suppliers (Landeghem and Vanmaele, 2002; Frohlich and Westbrook, 2002; Heikkila, 2002; Vollmann et al., 2002, Williams et al., 2002; S. de Treville et al., 2004), it tends to assume that DCM is about *transporting* demand information backwards to operations and supply chain management. This thesis, following a fabrication process of a DCM technology, contributes to this literature by claiming that DCM is about *translating* uncertainties on the demand chain into diverse times and spaces. Uncertainties are not domesticated by passing on information backwards along the demand chain. Instead constituents of uncertainties are created and separated into diverse local times and spaces where local actors *enlarge* possibilities for DCM.

Conclusions

This monograph is premised on the fabrication of an S&OP sales forecast and an S&OP process, and the impacts of such fabrication on translations of uncertainty in future customer demand and in pursuing integration, multiple voices for customers and their impacts on intra- inter-organisational calculative time and space.

The main finding of this thesis is that when actors are fabricating the S&OP process, local actors create emergent, ongoing and multiple matters of concern around the S&OP process. The group demand chain, the actor who is responsible for guiding the implementation of the process, delegates the attempts to close these matters of concern to local actors located in separate times and spaces. As a result, constituents of the S&OP process are dispersed in diverse local times and spaces, rather than being coordinated in a single time and space by the group demand chain. When local actors are closing these matters of concern, they create new properties on the S&OP process and new management possibilities in relation to integration. These new management possibilities may include, for instance, generating different primary keys of forecasting in different divisions, mobilising different inscriptions in different settings, using mean error to evaluate forecasting accuracy, connecting different visualisations such as ABC analysis and items with high growth rate and value to collaborators' intelligence, creating new potentials for more consistent decision making and more proactive customer service, creating new actions to help the under-estimated sales forecast and transforming the minimal configurations of the S&OP process. Consequently, integration on the demand chain becomes uncertain because actors are always creating new possibilities to move towards integration, but will never arrive at the destination of integration. To integrate is, thus, to postpone integration because there are always emergent matters of concern around the technology to foster integration. Because constituents of the S&OP process are separated in diverse times and spaces, to integrate is also to separate constituents of integration.

This study has, thus, identified new possibilities for studying how accounting is fabricated in demand chain management. Future research may focus on how and where

constituents of accounting are distributed and located in other organisational settings. This may offer new insights into how spaces between customers, sales, factories and suppliers are shaped and re-shaped, and how integration is made possible by creating new problems on the accounting technology to foster integration. Moreover, although this study has followed how intra- and inter-organisational calculative spaces are shaped and re-shaped in an S&OP setting, it cannot offer insights into intra- and inter-organisational relationships because to understand relationships, issues such as trust and ties between sales, factories, suppliers and customers will have to be followed. Future research on the S&OP process may also explore how these intricate relationships are shaped and re-shaped. This will require an even longer and slower journey with local human and non-human actors.

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Summary in English

Domain Theories

This thesis has a primary research interest in the fabrication of an accounting calculation and a demand chain technology, the translation of uncertainties of future market demand and the impacts of multiple voices for customers on integrating demand chain management. This interest, however, is not a reality that is out-there but an effect of a translation of my original focus on accounting in inter-organisational relationships (IORs) which is mediated by reviewing extant literature in that domain.

Method Theories

To contribute to the abovementioned three domains, this thesis deploys a method theory, namely actor-network theory (ANT), to follow the construction of the forecast in its making and its performativity in IORs and integration in demand chain management. In particular, such inscription building (Latour, 1987) processes are narrated through two of the recent ANT methodological lenses, circulating references (Latour, 1999a) and matters of concern (2005a). Circulating references aims at documenting a series of translations between matters and forms that produce a potential matter of fact. Forms amplify and induce unintended matters, which in turn emancipate new forms. Translations can be very long and accounting calculations are, thus, fragile. Matters of concern aim at restoring the symmetry between humans and non-humans in order to make objects disputable, and as a result, more objective.

Research Methods

This thesis uses a field research in a Swedish based bearing manufacturing organisation to follow the fabrication of an S&OP forecast. Research strategies are not used to discover an out-there reality that is independent, pre-existing, definite and singular but are deployed to mediate theorisation in produce a reality that is dependent, an effect, fluid multiple (Law, 2004). More specifically, methods are used to identify and follow controversies.

Findings and Claims

The main finding of this thesis is that when actors are fabricating the S&OP process, local actors create emergent, ongoing and multiple matters of concern around the S&OP process. The group demand chain, the actor who is responsible for guiding the implementation of the process, delegates the attempts to close these matters of concern to local actors located in separate times and spaces. As a result, constituents of the S&OP process are dispersed in diverse local times and spaces rather than being coordinated in a single time and space by the group demand chain. When local actors are closing these matters of concern, they create new properties on the S&OP process and new management possibilities in relation to integration. These new management possibilities may include, for instance, generating different primary keys of forecasting in different divisions, mobilising different inscriptions in different settings, using mean error to evaluate forecasting accuracy, connecting different visualisations such as ABC analysis and items with high growth rate and value to collaborators' intelligence, creating new potentials for more consistent decision making and more proactive customer serving, creating new actions to help the under-estimated sales forecast, and transforming the minimal configurations of the S&OP process. Consequently, integration on the demand chain becomes uncertain because actors are always creating new possibilities to move towards integration but will never arrive at the destination of integration. To integrate is, thus, to postpone integration because there are always emergent matters of concern around the technology to foster integration. Because constituents of the S&OP process are separated in diverse times and spaces, to integrate is also to separate constituents of integration.

Summary in Danish / Resume på Dansk

Domæneteorier

Denne afhandling har som sin primære forskningsinteresse fabrikationen af en specifik accounting kalkulation og en demand chain teknologi, oversættelsen af usikkerheder om fremtidige markedsefterspørgsel og påvirkningen af multiple stemmer fra kunder om integrering af demand chain management. Denne interesse er imidlertid ikke en realitet, der er 'derude', men derimod en effekt af en oversættelse af mit oprindelige fokus på regnskab i interorganisatoriske relationer (IORs), der er medieret af gennemgang af den eksisterende litteratur indenfor domænet.

Metodeteorier

Med henblik på at bidrage til de tre ovenfor nævnte domæner anvender denne afhandling en metodeteori, nemlig aktør-netværksteori (ANT) for at følge konstruktionen af et forecast i dets skabelse og dets performativitet i IORsog integrationen ved ledelse. I særdeleshed er sådanne inskriptionsbyggeprocesser (Latour, 1987) fortalt gennem to af de nylige ANT metodologiske linser, cirkulerende referencer (Latour, 1999a) og 'matters of concern' (2005a). Cirkulerende referencer sigter mod at dokumentere en serie af oversættelser mellem anliggende (matter) og udformning (form), der skaber et potentielt 'matter of fact'. Udformninger forstærker og foranlediger ikke-intenderede anliggender, der til gengæld frigiver nye udformninger. Oversættelser kan være meget lange, og regnskabsmæssige kalkulationer er således skrøbelige. 'Matters of concern' tilstræber at genskabe symmetrien mellem mennesker og ikke-mennesker med henblik på at gøre objekter diskutable, og som resultat mere objektive.

Forskningsmetoder

Denne afhandlinger anvender feltstudier i en Svenskbaseret kugleleje producerende organisation for at følge fabrikationen af et S&OP forecast. Forskningsstrategier er ikke anvendt for at opdage en realitet 'derude', der er uafhængig, allerede eksisterende, definitiv og singulær, men er anvendt for at mediere teoretisering i produktionen af en virkelighed der er afhængig, en effekt, flydende multipel (Law, 2004). Mere specifikt anvendes metoder for at identificere og følge kontroverser.

Resultater og konklusioner

Denne afhandlings primære konklusion er, at når aktører fabrikerer S&OP processen, skaber lokale aktører vedvarende, emergente, og multiple matters of concern omkring S&OP processen. Koncernens demand chain, aktøren der er ansvarlig for at guide implementeringen af processen delegerer forsøgene på at lukke disse matters of concerns for lokale aktører i separate tider og rum. Som en konsekvens spredes bestanddelene af S&OP processen i forskellige lokale tider og rum snarere end at koordineres i et enkelt tid og rum af koncernens demand chain. Når lokale aktører lukker disse matters of concern skaber de nye egenskaber ved S&OP processen og nye ledelsesmuligheder i relation til integration. Disse nye ledelsesmuligheder kan eksempelvis inkludere at, generere forskellige nøgler til forecasting i forskellige divisioner, mobilisere forskellige bricolager af inskriptioner i forskellige omgivelser, anvende 'mean error' til at vurdere forecasting nøjagtighed, forbinde forskellige visualiseringer så som ABC analyse og emner med høj vækstrate og værdi til samarbejdspartneres analyseenheder, skabe nye muligheder for mere konsistent beslutningstagning og mere proaktiv kundebetjening, skabe nye handlinger til at hjælpe det underestimerede salgsforecast, og transformere de minimale konfigurationer af S&OP processen. Som følge heraf, bliver integrationen af usikker fordi aktører altid skaber nye muligheder og bevæger sig mod integration men vil aldrig ankomme ved destinationen 'integration'. At integrere er, således at udsætte integrationen fordi der altid er emergente matters of concern omkring teknologien til at fostre integration. Fordi bestanddelene af S&OP processen er adskilte i tid og rum, er at integrere også at separere integrationens bestanddele.

Appendix 1: A checklist to create a system forecast for forecasting managers

Sales and Operations Planning (S&OP)

Checklist for Forecast Managers

Monthly checklist for Forecast Managers

- (Verify that the new monthly file has been loaded (check date) and is available in the data folder for DSFM
- Run XX1 - Load of last month Sales data
- Compare DSFM data with SDW to verify that correct file is loaded.

- Run XX2 - Create system forecast
- Run XX3 - Export Forecast to Pipeline → Create back-up

- Import data into Pipeline (done in Pipeline admin)

----------COLLABORATION PROCESS ----------

- Check that all collaborators checked in the data (done in Pipeline admin)

- Export Notes to DSFM (done in Pipeline admin)
  → will create extract.not file in your ftp directory

  In case of new items: Download additional date

- Export Forecast from Pipeline

- Run XX4 - Upload Forecast from collaborator to DSFM

Analyze Forecast

- Run XX5 –save Forecast as basis for Forecast Accuracy Measurement

Appendix 2: A sample letter from forecasting managers to collaborators

Dear Collaborators,

In the meantime you can start working on November cycle. The system forecast is already on your server, so it is just to start as usually.

I ask everyone again to use the agreed forecast during the Management Forecast August meeting for working with the November cycle and upload the forecast latest on **Friday, November 11 at 6 pm CET.**

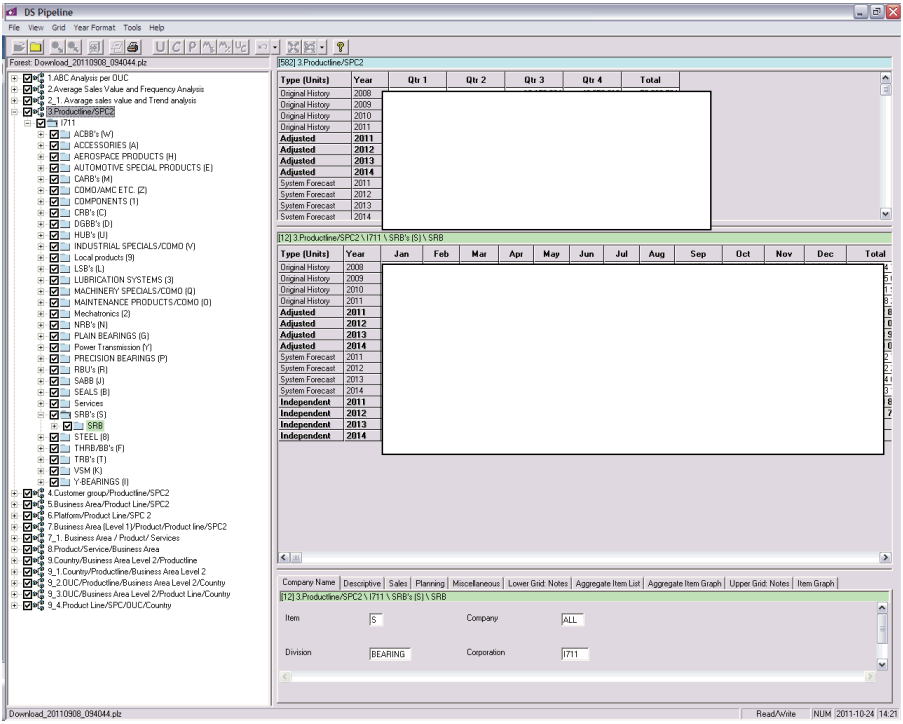
Please remember this cycle is extra important, the results will be discussed on the Forecast Management meeting on November 28.

In case of any questions you can always contact me, Jörg or Dennis Rühl from the central S&OP team.

Good luck and all the best with the November cycle.

Best regards

Appendix 3: Trees representing ABC analysis, items with high growth and sales value, new items and so on



Appendix 4: An extract of the analysis for the business cycle

Chapter 2. The Main Economies
Section 2.3 The Euro Area

Following renewed tensions about the Eurozone debt crisis, and despite the fact that the Euro area policymakers agreed recently on a package of measures and finalized a second program of loans for Greece, risks and uncertainties continue to rise at a fast pace for the area as a whole.

In stark contrast to earlier in the year, **more moderate data are also coming out of Germany** (i.e. the eurozone's export powerhouse and growth engine), **providing evidence that slowing economic growth could become a threat to Europe's efforts to extricate itself from a debt crisis that has so far been concentrated in Greece, Ireland and Portugal but could also involve Spain and Italy.**

In order to avoid as much as possible a contagion spreading from the "periphery" to the "core" countries, **policy makers agreed on July 21st on a broad package which should help Greece to return gradually to debt sustainability and ease stress on the others. Indeed, according to the new agreements:**

• **Greece,** which has currently a total debt of €xxx billion, **will receive a new support package of €xxx billion.** This said, **while this has the merit to put less pressure on Greece's debt burden, it will not be sufficient to resolve the overall situation.** Indeed, this help will also have to be successfully accompanied by domestic measures which include, in addition to the successful implementation of a fiscal austerity plan, a real fight against fiscal evasion (estimated to around €xxx billion per year) as well as the completion of a privatization program of about €xxx billion.

• **Loans to Greece, Ireland and Portugal will have a reduced borrowing cost** (xxx% per year instead of xxx%), a grace period of 10 years, and a maturity of between 15 and 30 years.

• **The private investors holding Greek bonds maturing in 2012 will be offered a menu of options in the form of rollover, debt exchange and buybacks.** This, however, will prompt the credit rating agencies to deem Greece in "selective default" as the loss for the private sector will be around xxx percent.

• **The European Financial Stability Fund (EFSF) has been given the authority to make precautionary loans to sovereigns that are not yet in a formal program** (such as Spain or Italy for instance). This authority could be used to recapitalize banks or to make purchases in both the primary and second markets.

Yet, although most analysts argue that the EFSF has by now become a kind of regional IMF, having the possibility of directly buying bonds from any eurozone country, **its current lending capacities seem nevertheless too little.** Indeed, with a total fund of €xxx billion, out of which €xxx billion has already been set aside for Greece, Portugal and Ireland, one needs to hope that solvency problems will not hit either Spain or Italy. As a matter of fact, **in the event that the EFSF would need to accommodate Spanish and Italian borrowing and redemption requirements through to 2014,** it would then need a total amount of €xxx billion (xxx for Spain and xxx for Italy). This, in turn, would then mean that **the EFSF would require, on top its budget of €xxx billion, an expansion of its lending capacity of €xxx billion.** Such an expansion of the EFSF may seem like the next logical step in the resolution of the crisis if stress persists, but **its adoption presents significant issues. First and foremost, the size of the new commitments means that the sponsoring sovereigns would accumulate large amounts of liabilities,** something that would risk impairing their own financial solidity without the support of an appropriate governance framework. **Added to this, there are concerns regarding the resulting incentives for sovereigns to make fiscal adjustments,** and questions on the governance structure of the EFSF itself. **This explains why Germany remains so far completely opposed to such an extension of the EFSF fund. Overall, this underlines why risks are more than ever a main component in the analysis of the business cycle.**

In addition to the uncertainties related to the debt issue in the periphery, recent weeks saw also large declines in the overall Euro area PMI due to a slowdown in manufacturing which suffered from a weaker global backdrop associated to an inventory adjustment. The latest data tend to indicate that over the past two months, the PMI dropped four points to xxx, i.e. a level below its pre-recession average. **On the manufacturing side, this is consistent with the orders/inventory ratio which fell in both May and June**.

As far as the third quarter is concerned, the forward-looking orders/inventory ratio seems to have declined further in July, prompting most forecasts to be revised downwards. JP Morgan, for instance, now estimates that following a growth rate of xxxq/q a.r. in 11Q1, GDP rose at only xxx%q/q a.r. in 11Q2 and will at best stagnate in 11Q3. As far as industrial production is concerned, following a strong first quarter when output expanded at a pace of xxx%q/q a.r., **recent estimates indicate that growth slowed to only xxxq/q a.r. in 11Q2 and that 11Q3 could also be close to stagnation**.

Capacity utilization in manufacturing, an important survey-based measure of output, **fell slightly in 11Q2.** While this was a surprise because industrial production had still been expanding in the Euro area during 11Q2, it also raises the possibility of another decline in capacity during 11Q3, especially given the weak output momentum signaled by the latest PMI. **Overall, the near-term growth momentum is now looking very weak for the third quarter.**

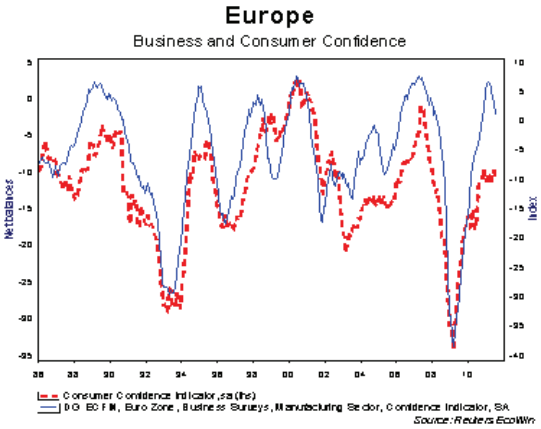
Looking ahead, most analysts expect that the quasi-stagnation in 11Q3 will continue in 11Q4 and that at best only a slight improvement could take place in 12H1. Overall, it

appears more and more that the region is at risk. A recent study indicates indeed that, in the seven quarters since the start of the upturn, the Eurozone regained only two-thirds of the losses in activity of the 2008-2009 downturn and that **a return of the economy to pre-crisis activity levels should not take place before at least the fourth quarter of 2012.**

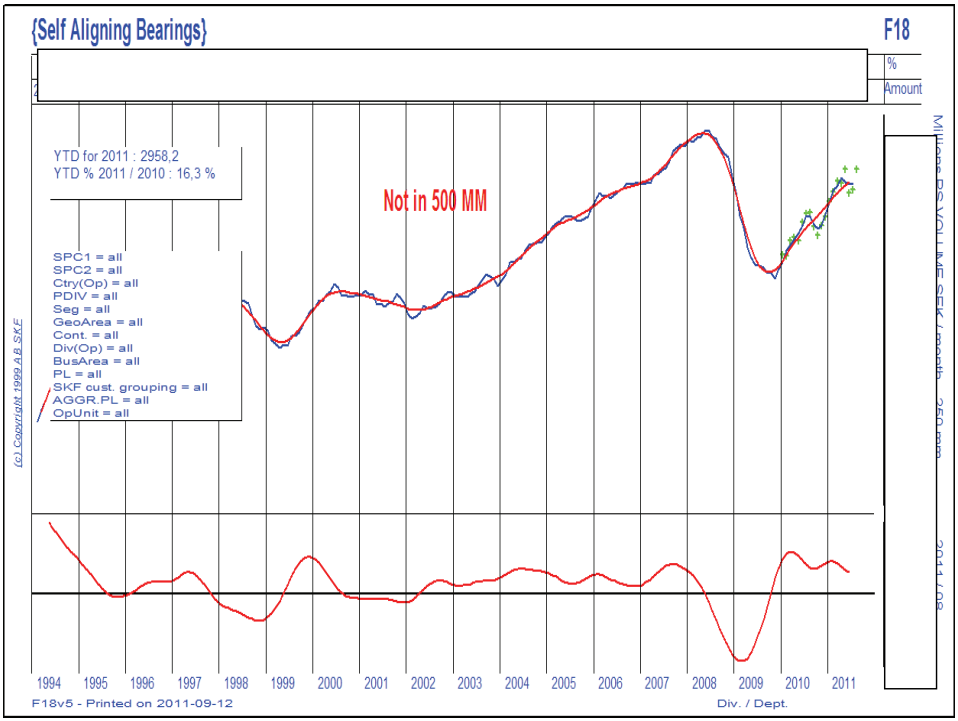
The composition of growth between external and domestic activity is expected to be characterized by a very moderate support from net trade while the recovery in domestic demand will continue to be very slow. Moderate job growth, fiscal austerity programs and falling real wages will hold back private consumption which is foreseen to rise by only xxx%oya in 2011 and xxx%oya in 2012.

ANNUAL GROWTH OF	2010	2011	2012
GDP	xxx	xxx	xxx
INDUSTRIAL PRODUCTION	xxx	xxx	xxx
BUSINESS INVESTMENT	xxx	xxx	xxx

Source: JP Morgan/Oxford Economics/Consensus August 2011



Appendix 5: An example of F18 Curve



Appendix 6: An example of one pilot S&OP report on how the gap is closed (Numbers have been changed to reserve confidentiality of the company.)

S&OP Reporting template

Date: 2011-09
Product Line: SRB, SRTB, CARB

Factory 109L

Sales forecast:

	2011 Factory FC	2011 S&OP FC	2011 S&OP FC adj	S&OP FC/Factory
22				
23E	268 inc vestas	227 exc vestas		
23	169	178		
24-1		233		
25	155 MSEK	157, 2 MSEK		
LCK3	113 MSEK	116 MSEK		
AFZ				
29	234 MSEK	231 MSEK		
Tot				

Above in MSEK

Channel 22
2012 Sales Fc 280 MSEK, Factory BP 2012 260 MSEK. 20 MSEK to Dalian?

Channel 23 + 23 E
2012 Sales Fc MSEK, Factory BP 2012 268 MSEK. 227/950 vestas included from k30

Channel 29:

Channel 25:
2012 FC 157 MSEK Factory BP 2012 MSEK .

Channel LCK3:

Channel 24-1:
29434 E moved from 24-1 to channel 25.
S&OP forecast has decreased and I think 29434 E is the reason for that.
No updated factory forecast available.

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