Inger Astrid Øygarden Gamme

Assessing integration in value chains

Assessing enablers and disablers of integration in different sectors

Inger Astrid Øygarden Gamme

Doctoral thesis

Doctoral theses at NTNU, 2018:45

◨ NTNU
Norwegian University of
Science and Technology

◨ NTNU
Norwegian University of
Science and Technology

◨ NTNU

Inger Astrid Øygarden Gamme

Assessing integration in value chains

Assessing enablers and disablers of integration in different sectors

Thesis for the Degree of Philosophiae Doctor

Trondheim, February 2018

Norwegian University of Science and Technology
Faculty of Engineering
Department of Mechanical and Industrial Engineering

NTNU
Norwegian University of
Science and Technology

"*Coming together is a beginning. Keeping together is progress. Working together is success***".**

Henry Ford

II

Preface

This doctoral thesis is a result of a PhD study performed at Norwegian University of Science and Technology (NTNU) Gjøvik and NTNU in Trondheim. The PhD project has been carried out within the period September 2010 to September 2017.

The supervisors during this project has been Bjørn Andersen, professor at the Norwegian University of Science and Technology, department of production and quality engineering at the, and Kristian Martinsen, professor at the NTNU Gjøvik.

The choice of topic reflects my personal interests and experiences, and through this research project I have had a unique opportunity to study and contribute to a theme that I believe will be given much focus in the future.

It is hoped that the outcomes from this PhD project will provide knowledge to practitioners and research scientists that have interest in what could influence on the integration of a value chain.

Gjøvik – September 2017

Inger Gamme

Acknowledgement

A PhD work encompasses a lot of work, and despite being an individual undertaking, this work could not have been accomplished without the contributions and support from others.

First, I would like to thank my main supervisor Bjørn Andersen, NTNU, for invaluable support, encouragement and for always being available to support me with valuable feedback and guidance during this PhD project. I would also like to thank my co-supervisor Kristian Martinsen for valuable contributions, encouragement and guidance, especially on the research methodology.

Others have also supported me and contributed to this work, and I would therefor further like to thank the following:

- Sverre Narvesen, Sintef Raufoss Manufacturing (SRM), for having belief in me and giving me the opportunity to start this PhD work.
- Svein Terje Strandlie, SRM, for giving valuable support and arrangements for the finish of the project.
- Geir Ringen and Odd Myklebust for support and inspiration during the PhD process.
- My colleagues Catrine Larsson, NTNU Gjøvik, Eirin Lodgaard and Silje Aschehoug, SRM, for good discussions, invaluable encouragement and support when things felt harder than usual.
- My colleagues at NTNU Gjøvik, Halvor Holtskog and Lars Krogstie, for interesting discussions and involvement, especially on the methodical part.
- My colleague Kristin Aune at SRM, for assisting me in performing some of the interviews.
- My co-authors: Eva Amdahl Seim and Geir Berg for useful and constructive discussions and contributions.
- The organizations who have participated in the research, for letting me in and allowing me to gather useful data. Without this willingness to respond openly this work had not been possible.

I would also like to thank my mother, stepfather, sister, brothers-in-law, sister-in-law and grandfather for always believing in me and supporting me during my PhD work.

Finally, but definitely not least, I would like to thank my cohabitant Rune Ulekleiv, my son Kristian, daughter Mari and bonus daughter Sigrid for always being there and believing in me, and being patient during all my travelling periods. This work could never have been accomplished without your loving support.

Abstract

Organizations currently face increasing and ever-changing demands from their environments, which forces them to continuously aim to improve their value chain. This increasing requirement of their environments, together with the demand for greater product/service adjustments requires more flexible and adaptable value streams. Success criteria for organizations are the ability to respond quickly to demands from interested parties and, more importantly, the ability to adjust to future needs, which requires that they control the integration between different actors and units in today's complex organizations.

Organizations within the health sector and the automobile, service and craft sectors encounter different challenges, but must all aim for an adaptable and efficient value chain that delivers the best quality for the patient or customer. Despite many years of research on the topic of integration, and the many different terms and definitions that exist, researchers continue to call for more research on the topic to develop a more thorough and consistent understanding of it. Given this inconsistency within the field, the aim of this research is to provide clarification and a holistic understanding of the cross-functional integration in a value chain.

By raising five research questions, this PhD thesis contributes to an increased understanding of the topic of integration by studying what enables and disables integration, and which mechanisms are used to facilitate integration in five different organizations within different sectors in Norway. The case-studies in examining the value-adding element of the value chain are a hospital, two mass producers, a service provider and a craft producer, all of which are in Norway. The research data are based on semi-structured interviews with selected persons from different levels within the companies, as well as on observations, document reviews and participation in meetings. Based primarily on operation management and organization theory, the main purpose of this thesis is to extend existing knowledge identifying the enablers and disablers of integration within the value chain for different sectors.

The research supports what is claimed by the literature, namely that integration is a complex and multidimensional concept in which the output of a process is dependent on the relationship between many different mechanisms such as management support, culture, facility and layout, formalization and standardization, measurements and rewards, information systems, and consensus integration.

The research data support what researchers emphasize, namely that management plays an important role in achieving integration. Furthermore, cultural factors such as functional silo thinking and trust in or compliance with standards are identified as having an impact on other mechanisms such as consensus integration and formalization, as well as standardization. One less obvious finding regards the fact that functional silos were experienced at organizations with very different sizes

and layouts. Even the smallest partitions were identified as contributing in the creation of functional silo thinking amongst employees. Even though some of the organizations dedicated some effort into transferring the overall strategy down to functional measures, the research data nevertheless indicated a mismatch between the overall goal and the functional focus. The literature cautions that unaligned bonuses could contribute to the creation of functional silos, as is supported by this research.

Another objective of this thesis is to build knowledge about what type of facilitators are used within the different organizations and how the use of these facilitators differs or is similar within different sectors. Based on both the theoretical and empirical findings on what is perceived to affect integration in value chains and what has been done to facilitate integration, a framework for maturity mapping of integration is suggested. This assessment framework provides guiding statements and questions to enable a rating of the degree of integration of the value chain, and further suggests a relationship between the mechanisms.
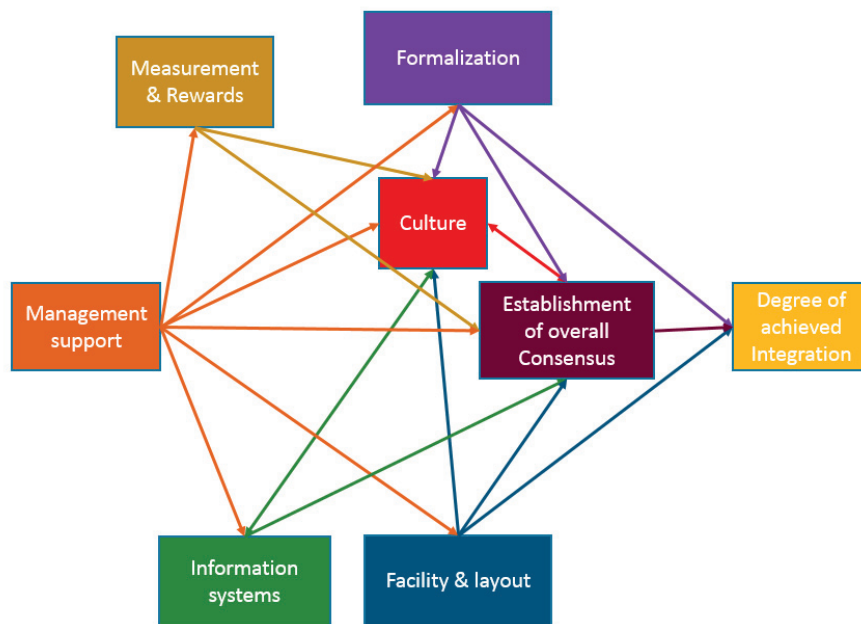
This relationship framework is intended to act as a guide for practitioners who seek to improve the integration of their value chain by taking actions on one or more mechanisms and who need to determine what possible mechanisms could be influenced by this action(s). Hence, this framework may contribute as guidance for practitioners who struggle to achieve an integrated value chain.

The results of this thesis provide several contributions to existing research. Firstly, this thesis provides supplementary theoretical insight into the topic of integration by providing an improved clarification of the topic. Unlike much research that focusses on integration within one single value chain, this dataset provides data from a broader set of sectors: a craft producer, two mass producers, a hospital and a financial service provider. Moreover, while earlier research is to a large extent based on surveys, this study offers empirical results from five case studies and responds to the call for more empirical studies.

The practical contribution of this thesis is an increased understanding of what employees within different value chains experience as contributing to or hindering integration. Furthermore, for practitioners within similar types of organizations, this thesis may contribute new insights which enablers, disablers and facilitators may consider if they aim to enhance value-chain integration. Finally, the framework that is proposed within this thesis may assist practitioners in evaluating the degree of integration of their value chain and further provide guidance on how possible actions may influence value-chain integration.

Sammendrag

Organisasjoner står i dag for økende og stadig skiftende krav fra deres omgivelser, noe som tvinger dem til kontinuerlig å ha fokus på å forbedre verdikjeden. Dette økende kravet fra omgivelsene, sammen med etterspørselen etter større grad av produkt / servicetilpasninger, krever mer fleksible og tilpasningsverdige verdikjeder. Suksesskriterier for organisasjonene er at de raskt skal kunne reagere på krav fra omgivelsene, og enda viktigere, ha evnen til å tilpasse seg fremtidige behov. Dette krever at de kontrollerer integrasjonen mellom ulike aktører og enheter i dagens komplekse organisasjoner.

Organisasjoner innenfor helse-, bil-, tjeneste- og håndverkssektoren har ulike utfordringer, men må alle søke mot å oppnå en tilpasningsdyktig og effektiv verdikjede som leverer den beste kvaliteten til pasienten eller kunden. Til tross for mange års forskning innen temaet integrasjon, og hvor det eksisterer mange ulike begreper og definisjoner, fortsetter forskerne å etterspør mer forskning på området for å utvikle en mer grundig og konsistent forståelse av det. Gitt denne inkonsekvensen innen feltet, er målet med denne forskningen å bidra til en avklaring og mer helhetlig forståelse av temaet som er relatert til kryssfunksjonell integrasjon i en verdikjede.
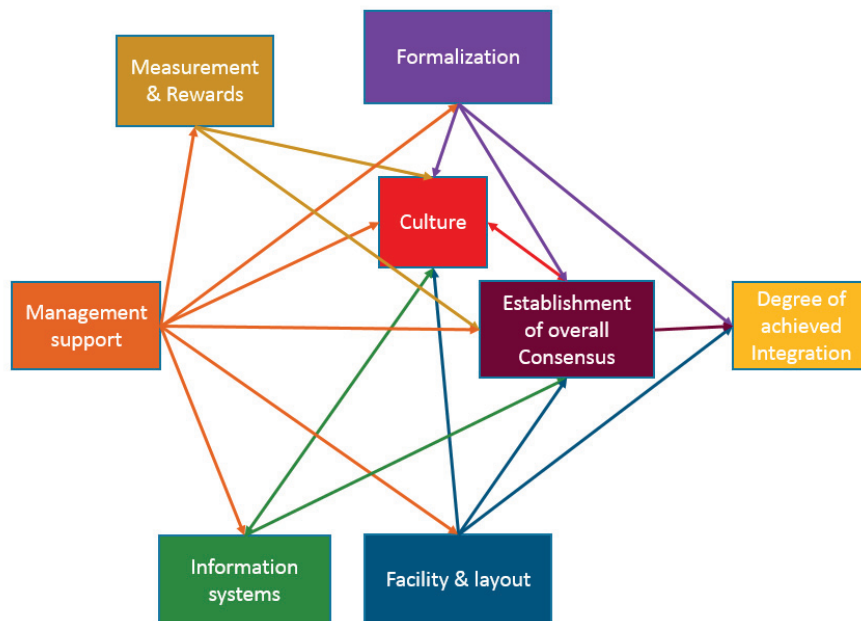
Gjennom fem forskningsspørsmål bidrar denne doktorgradsavhandlingen til en økt forståelse av temaet integrasjon ved å studere hva som muliggjør og hindrer integrasjon, og hvilke mekanismer som brukes for å lette integrasjonen i fem ulike organisasjoner innenfor ulike sektorer i en norsk kontekst. Case studiene som er utført for å studere den verdiskapende delen av en verdikjede er et sykehus, to masseprodusenter, en tjenesteleverandør og en håndverksprodusent, hvor alle er lokalisert i Norge. Forskningsdataene er basert på semi-strukturerte intervjuer med utvalgte personer fra ulike nivåer i selskapene, samt på observasjoner, dokumentgjennomgang og deltagelse i møter. Basert hovedsakelig på Operations Management og Organization Theory, er hovedformålet med denne oppgaven å utvide eksisterende kunnskap ved å identifisere hva som er muliggjørere og hindre for å oppnå en sømløs verdikjede innen ulike sektorer.

Forskningen støtter det som hevdes innen litteraturen, nemlig at integrasjon er et komplekst og flerdimensjonalt konsept hvor resultatet av prosessen er avhengig av forholdet mellom mange ulike mekanismer slik som ledelsesstøtte, kultur, fasiliteter og layout, formalisering og standardisering, målinger og belønninger, informasjonssystemer og konsensus.

Forskningsdataene støtter forskning som legger vekt på at ledelsen spiller en viktig rolle for å oppnå integrering. Videre identifiseres kulturelle faktorer som funksjonell silotenking, tillit til eller overholdelse av standarder, som å ha innvirkning på andre mekanismer som konsensusintegrasjon og formalisering,

samt standardisering. Et mindre åpenbart funn er det faktum at funksjonelle siloer ble opplevd hos organisasjoner med svært forskjellige størrelser og layouter. Selv de minste enhetsskillene ble identifisert som å kunne bidra til å skape funksjonell silotenking blant ansatte. Selv om noen av organisasjonene har gjort en innsats for å bryte den overordnede strategien ned til funksjonelle mål, viste forskningsdataene likevel et avvik mellom det overordnede målet og det funksjonelle fokuset. Litteraturen advarer om at dersom organisasjonen ikke har bonuser som er koordinerte i forhold til overordnet mål, så kan dette bidra til å skape funksjonelle siloer. Dette støttes også av denne forskningen.

Et annet mål med denne oppgaven er å bygge kunnskap om hvilken type tilretteleggere som brukes i de ulike organisasjonene, og hvordan bruken av disse tilretteleggerne er forskjellig eller lik i ulike sektorer. Basert på både de teoretiske og empiriske funnene på hva som oppfattes å påvirke integrering i verdikjeder og hva som er gjort for å lette integrasjon, foreslås et rammeverk for en modenhetskartlegging av organisasjonens integrasjon. Dette rammeverket gir veiledning på hvordan det kan muliggjøres en vurdering av graden av integrasjon av verdikjeden, og foreslår videre et forhold mellom de ulike mekanismene som påvirker integrasjon.

Measurement & Rewards · Formalization · Culture · Management support · Establishment of overall Consensus · Degree of achieved Integration · Information systems · Facility & layout

Dette rammeverket som viser forhold mellom mekanismer er ment å fungere som en veiledning for praktikere som ønsker å forbedre integrasjonen av verdikjeden ved å gjøre tiltak på en eller flere mekanismer, og en rettledning for hvilke mulige mekanismer som kan påvirkes av disse handlingene. Derfor kan dette rammeverket hjelpe organisasjoner som har som mål å oppnå en integrert verdikjede.

Resultatene av denne oppgaven bidrar på flere måter til eksisterende forskning. For det første gir denne oppgaven et bidrag til teorien ved å gi en forbedret avklaring av emnet. I motsetning til mye forskning som fokuserer på integrering innenfor en enkelt verdikjede, gir dette datasettet data fra et bredere sett av sektorer: en håndverksprodusent, to masseprodusenter, et sykehus og en finansiell leverandør. Videre, mens tidligere forskning i stor grad er basert på undersøkelser, gir denne studien empiriske resultater fra fem casestudier og svarer derfor på etterspørselen etter mer empiriske studier.

Det praktiske bidraget av denne oppgaven er en økt forståelse av hva ansatte innen ulike verdikjeder opplever som at bidrar til eller hindrer integrasjon. Videre kan denne avhandlingen bidra til ny innsikt for praktikere innen tilsvarende typer organisasjoner om hva som muliggjør, hindrer og fasiliterer integrasjon om de vurderer å jobbe mot å øke verdikjedenes integrasjon. Til slutt kan rammeverket som foreslås i denne oppgaven bistå utøvere med å evaluere graden av integrasjon av verdikjeden og gi videre veiledning om hvordan mulige tiltak kan påvirke verdikjedeintegrasjonen.

X

Table of Contents

XIII

List of Figures

List of Tables

List of Abbreviations

CP – Craft producer

CFI – Cross-functional Integration

CFPI – Cross-functional process integration

ERP – Enterprise resource planning

HES – Health, Environment and Security

ISO – International Organization for Standardization

MP – Mass producer

NPD – New Product Development

OM – Operations management

OT – Organizational theory

R&D – Research and development

SBU – Strategic business unit

SCI – Supply-chain integration

SCM – Supply-chain management

SME – Small and medium enterprise

SP- Service provider

TQM – Total quality management

XX

List of Publications

Number	Publication	Declaration of Authorship
1	**Title:** *Operational integration in a craft-oriented small enterprise* **Authors:** Inger Gamme, Eva Amdahl Seim, Eirin Lodgaard & Bjørn Andersen. **Journal paper:** Published in TQM Journal	I composed the interview guide and conducted the interviews. Observations on the shop floor were collected together with Eva Amdahl Seim. I conceptualized the paper together with Eva Amdahl Seim and Eirin Lodgaard. I performed most of the analyses and the paper was written together with Eirin Lodgaard, Eva Amdahl Seim and Bjørn Andersen.
2	**Title:** *Enablers and Disablers for Operational Integration in a Craft Oriented-versus a Mass Production Enterprise* **Authors:** Inger Gamme, Catrine Larsson. **Conference paper:** APMS conference, published by Springer	The data were collected and transcribed together with Catrine Larsson. I performed most of the analyses and Catrine Larsson contributed to the methodology section of the paper.
3	**Title:** *Operational Integration in Health Care versus Mass Production* **Authors:** Inger Gamme, Geir Berg **Conference paper / Journal:** Presented at the QMOD conference, published in Quality Innovation Prosperity journal	I performed the main collection of the data, but had some assistance from Kristin Aune with the registration of five of the interviews. Geir Berg assisted with the structure of the paper.
4	**Title:** *Assessing Leans' Impact on Operational Integration* **Authors:** Inger Gamme, Silje Aschehoug **Journal paper:** Published in International Journal of Quality and Service Sciences	The data were collected and transcribed by the project group of Lean Operation, while I performed the coding and analyses of the data. I wrote most of the paper and Silje Aschehoug contributed with the methodology section.

PART I: THEORETICAL BACKGROUND AND KEY FINDINGS

Chapter 1

1 Introduction
1.1 Background

Organizations currently face increasing requirements from their environments, which forces them to focus on improving their value chain. A value chain is by Porter (1985) defined to be "a system of interdependent activities, which are connected by linkages". To be able to adjust to these demanding future needs, companies must, in addition to ensuring optimal process steps, aim to achieve a smooth and efficient interface between different actors to gain control of the collaboration process in the value chain. It is often observed that many companies only focus on the optimization of each process step or function, and forget to secure and optimize the interfaces between them in working towards the optimization of the value chain (illustrated in figure 1-1).
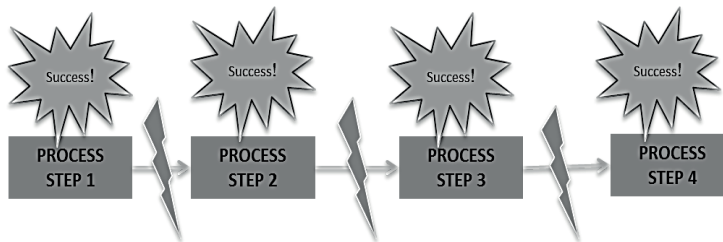
Figure 1-1 Illustration of lack of integration between process steps

Many companies have focused on philosophies such as Lean to improve the end results of their value chains. Even though many of them experience good results from their efforts, there continues to be great potential for improvement. When the objective is that the value chain should provide the best ratio between the maximum customer value and minimal cost, it is necessary to have a strong commitment between the actors in a value chain (Stank, Keller, & Daugherty, 2001). Furthermore, the dynamic interaction between the different roles is important in achieving knowledge creation in a value chain (Nonaka & Takeuchi, 1995). According to Basnet (2013), a value chain that is well-integrated *"should result in excellent customer service and company performance."*

It is commonly accepted that the "handover of the baton" between two consecutive process steps becomes a challenge when factors such as lacking documentation or systemization, existence of functional silos or different cultures are possible

Introduction

sources of difficulty (Basnet & Wisner, 2012; Pagell, 2004). Moreover, lacking flexibility in written descriptions and infrastructure may also create unreliable processes if the involved persons either choose to create their own routines, or opt for solutions that are not quality assured. It is of importance that all value-creating processes act together to achieve a well-managed value chain, and intra-organizational customer demand- and supply capabilities should be aligned and balanced (Stank et al., 2001). To have a well-managed value chain can be said to be synonymous with an integrated value chain that provides optimized value for the customer (Morash & Clinton, 1998; G. N. Stock, Greis, & Kasarda, 1999).

Even though interdepartmental relations have been studied for decades, there continue to be many unanswered questions, according to authors such as Autry, Rose, and Bell (2014); Barratt and Barratt (2011); (Basnet, 2013); Basnet and Wisner (2012); Childerhouse and Towill (2011); Ellinger, Keller, and Hansen (2006); Griffin and Hauser (1996); Kenneth B Kahn (1996); Mackelprang, Robinson, Bernardes, and Webb (2014); Turkulainen and Ketokivi (2012). In fact, as Frankel and Mollenkopf (2015) describe it: "*Rather than being a passé´ and over researched concept, cross functional integration represents an exciting and challenging avenue for future research.*" As several authors emphasize, research within the field encompasses such different definitions, operationalization and levels of analysis that future research is necessary and should be especially grounded in theory (Autry et al., 2014; Frankel & Mollenkopf, 2015; Mackelprang et al., 2014).

As previous research on integration is mainly survey-based and only a small share of it focuses on the antecedents of integration (Basnet & Wisner, 2012), authors call for more empirical research on how to achieve integration and what it involves (H. Chen, Daugherty, & Roath, 2009; Ellinger, Keller, & Ellinger, 2000; Ellinger et al., 2006; Mackelprang et al., 2014; Pagell, 2004). In addition to studies that focus on moderators that directly influence integration, Mackelprang et al. (2014) call for studies that identify unknown moderators that indirectly influence integration.

Based on the literature, there is a need for future research to contain various key informants from different areas of an organization to produce more generalizable results (Ellinger et al., 2000; Ellinger et al., 2006). To discover whether there are any possible similarities or differences in the integration of value chains belonging to different sectors, it is suggested to perform studies of integration within different organizations and sectors (Carlsson, 1991; Flynn, Huo, & Zhao, 2010; Schoenherr & Swink, 2012; Turkulainen & Ketokivi, 2012; Vallet-Bellmunt & Rivera-Torres, 2013). To achieve more flexible and adaptable value chains, both internal and external factors are important. In this thesis, organizations' internal chain of value-adding activities is studied.

The first chapter presents a general introduction of the topic and the background for conducting this research. Firstly, the research object is presented together with a description of the knowledge that this thesis aims to provide. The scope of the

research describes context in which the study was carried out, after which the research process and publications are presented. Finally, an overview of the thesis structure is given.

1.2 Research objectives, scope and questions

The main aim of this PhD is to achieve a holistic understanding of the integration of the value-adding element of a value chain. Moreover, this thesis contributes to a better understanding of what enables and disables integration between two or more process steps in value chains in different sectors. By reviewing the existing literature that focuses on integration and collecting empirical data from practices within five different Norwegian organizations, the aim is to gain thorough knowledge of the field within a Norwegian context.

The theoretical backbone for this study has its main grounding within operation management and organizations theory. The preliminary literature review of this thesis reveals that, even though much research is performed on the topic of the integration of value chains, there continues to be a need for more empirical evidence. The vast majority of the existing literature that is based on studies into the integration of two or more functions is survey-based and there exists a scarce amount of research that focuses on how individuals perceive integration (Ellinger et al., 2006).

The objective of this research comprises four parts. The first consists of an elaboration of the concept of integration, and the question of what might be possible enablers and disablers in achieving integration of the value chain, which is pursued by studying the existing literature. In the following phase, five different types of organizations from different sectors are studied to determine which elements employees perceive to be enablers or disablers of integration in the value-adding aspect of the value chain. The third phase presents the types of facilitators that each organization uses to achieve integration. Based on both the theoretical and empirical findings, the last section suggests a framework for achieving integration within different sectors.

For the study of the concept of integration within different sectors, practices from interdepartmental collaboration processes within five different case companies were studied: a craft producer (CP), a mass producer (MP I), a hospital (H), a second mass producer (MP II) and a service provider (SP). For these five different organizations, this thesis covers the principles and methods that are used to create a smooth and efficient interface between actors, as well as which pitfalls they may have experienced and possible aspects of learning. The aim is hereby to achieve and present a thorough understanding of the topic of integration, of the different research methods and of the practical implication of the concept.

To accomplish the research aim, five research questions have been formulated. The research questions focus on how the topic of integration is addressed in the

existing literature, what the possible enablers and disablers of achieving integration might be, and which types of facilitators are used to achieve integration within the case organizations from the different sectors. Finally, by combining existing theory on the topic with a comparison of experiences of integration within different value chains, the aim is to develop a framework for how to assess the maturity and improve the integration of a value chain.

The research questions are addressed in this PhD report, in four publications that were published in three journals and in one conference proceeding. The five case studies within different sectors formed the basis for the publications.

A research project was pursued based on the more specifically formulated five research questions:

RQ1: How are the topics of integration covered in the existing literature?

RQ2: Which enablers and disablers affect integration of the main value chain in the different sectors?

RQ3: What are the significant differences in integration in different sectors?

RQ4: Which facilitators for integration are used within each industry?

RQ5: How can an integration maturity assessing model be developed to be a valuable tool for value chains that aim towards increasing the degree of the integration of the value chain?

A more detailed presentation of these questions and the rationale behind them is presented in chapter three.

1.3 Research process and publications

A research plan was developed at the beginning of the research process. It contains the initial framing of the research topic and an identification of the research gaps, the research topic and research questions. Based on the identified research gaps, the authors' personal interests, the available resources as case organizations were defined and the sub-objectives were developed. According to the scope of this research, as presented in the previous section, these sub-objectives formed the basis for the individual publications.

In writing this thesis, it was necessary to review the background and motivation for the study, the background for framing the research questions, which methodology to use in pursuing the research and how this work contributes to answering the research questions. Additionally, each publication's main findings were discussed. All the published articles went through a peer-review process in which each article was revised according to the reviewers' comments.

Figure 1-2 on the next page briefly illustrates the research timeline with the publications and cases.

C1 – C5 indicate the following:

C1: Case 1 – Craft producer
C2: Case 2 – Mass I
C3: Case 3 – Hospital
C4: Case 4 – Mass II
C5: Case 5 – Service provider

P1 – P4 indicate publications 1-4.

| 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016/2017 |

C1

P1

P2

C2

P3

C3

C4

P4

C5

Literature study

Write up
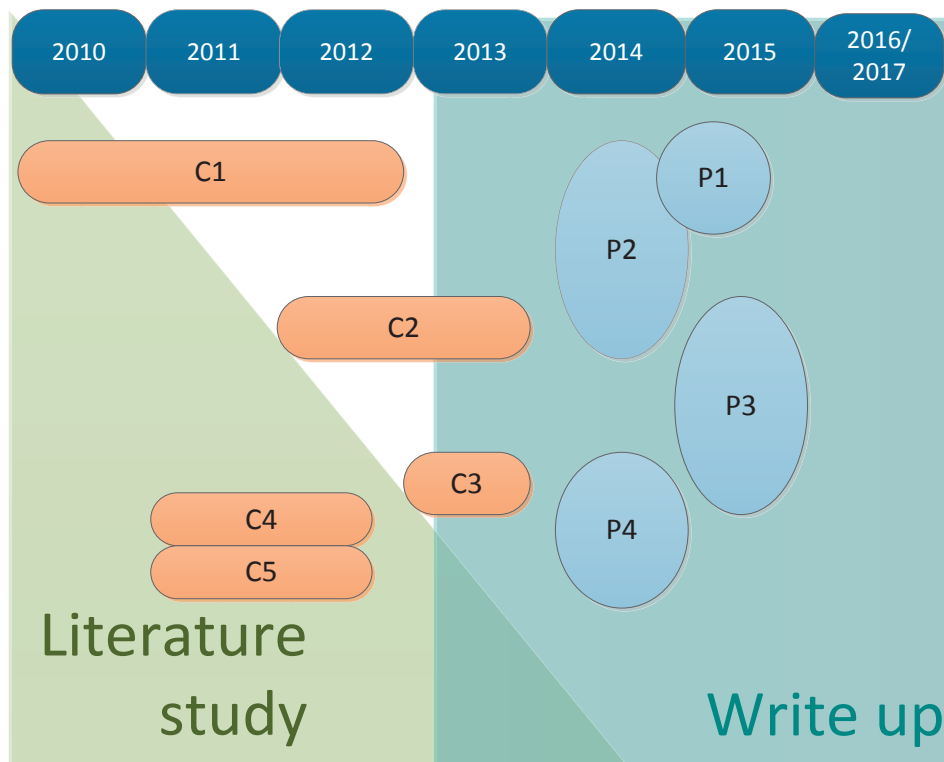
Figure 1-2: Brief overview of the research timeline versus publications and cases

1.4 Thesis Structure

The thesis contains two main parts: the theoretical background and key findings (Part I), and the individual publications (Part II). Part I is divided into six chapters

that offer a summary of the theoretical background, a brief presentation of the research area and research approach, a synthesis of the publications, the key findings, the analysis and the discussion. A framework for mapping the integration maturity of a value chain is subsequently proposed. Finally, the conclusions, the thesis' contribution to theory and practice, the quality and limitations of the research, and suggestions for further research are presented (see figure 1-3).
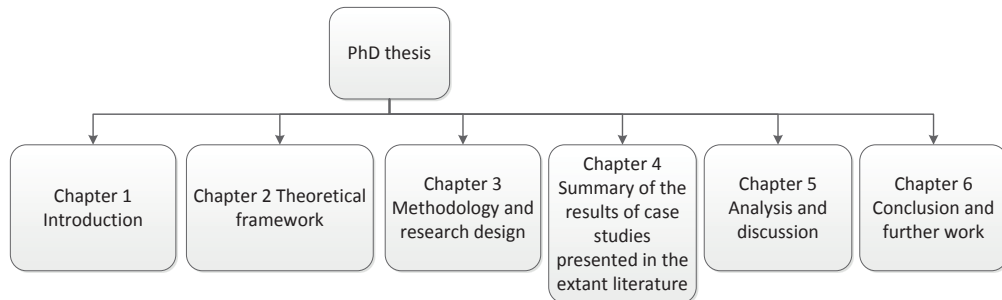
Figure 1-3: Structure of part I

The main thesis builds on the four research articles that were published during the PhD project and refers to these articles for additional details of the main results. Part II includes these four research articles, which were published in international journals or conference proceedings.

Chapter 2

2 Theoretical framework

This chapter presents an overview of the most relevant theories and concepts for the focus area of this thesis. It firstly introduces the concept integration, followed by definitions of the construct based on current literature on the topic. Thereafter, the effects of integration, the difference between internal and external integration, integration in the context of New Product Development (NPD), integration related to supply-chain management, transparency and lean are presented. Section 2.2 discusses antecedents and mechanisms that can affect integration. Finally, the chapter is summarized in section 2.3.

```
                        ┌─────────────────────────────┐
                        │   2 Theoretical framework   │
                        └─────────────────────────────┘
        ┌───────────────────────┼───────────────────────────┐
        ▼                       ▼                            ▼
┌──────────────────┐  ┌──────────────────────────┐  ┌──────────────────────┐
│ 2.1 The concept  │  │ 2.2 Antecedents /        │  │ 2.3 Chapter summary  │
│   integration    │  │ Mechanisms that affect   │  │                      │
└──────────────────┘  │      integration         │  └──────────────────────┘
        │             └──────────────────────────┘
        ▼                          ▼
┌──────────────────┐  ┌──────────────────────────┐
│ 2.1.1 Effects of │  │ 2.2.1 Culture, social    │
│   integration    │  │ mechanisms and creation  │
└──────────────────┘  │   of lateral relations   │
        │             └──────────────────────────┘
        ▼                          ▼
┌──────────────────┐  ┌──────────────────────────┐
│ 2.1.2 Internal   │  │ 2.2.2 Management support,│
│  vs. external    │  │   vertical integration   │
│   integration    │  └──────────────────────────┘
└──────────────────┘              │
        │                         ▼
        ▼             ┌──────────────────────────┐
┌──────────────────┐  │ 2.2.3 Consensus on       │
│ 2.1.3 Integration│  │      integration         │
│  in a NPD context│  └──────────────────────────┘
└──────────────────┘              │
        │                         ▼
        ▼             ┌──────────────────────────┐
┌──────────────────┐  │ 2.2.4 Formalization and  │
│ 2.1.4 Supply     │  │    standardization       │
│ chain management │  └──────────────────────────┘
│ and integration  │              │
└──────────────────┘              ▼
        │             ┌──────────────────────────┐
        ▼             │ 2.2.5 Information systems │
┌──────────────────┐  └──────────────────────────┘
│ 2.1.5 Transparency│             │
│ vs. integration  │             ▼
└──────────────────┘  ┌──────────────────────────┐
        │             │ 2.2.6 Facility and layout│
        ▼             └──────────────────────────┘
┌──────────────────┐              │
│ 2.1.5 Lean and   │              ▼
│   integration    │  ┌──────────────────────────┐
└──────────────────┘  │ 2.2.7 Measurement and    │
                      │       rewards            │
                      └──────────────────────────┘
```

Figure 2-1: Structure of chapter two

2.1   The concept of integration

Focusing on the interfaces between functions or process steps has been relevant for decades. The concept has its theoretical foundation within organizational theory and design (Galbraith, 1994; Lawrence, Lorsch, & Garrison, 1967; Mintzberg, 1983; Thompson, 1967; Turkulainen & Ketokivi, 2012), though it is equally relevant for operations management (OM) (Turkulainen & Ketokivi, 2012) and is adopted in several other disciplines as well (Turkulainen, 2008). Based on Basnet and Wisner (2012), research that covers the improvement of internal integration is still in a nascent phase. Of the existing conceptual, theory-building and theory-testing work, quite little research exists that is related to theory-testing.

Pursuing a study into the integration of a value chain is an extensive and complex task (Frankel & Mollenkopf, 2015; Pagell, 2004) and has been compared with working towards achieving supply-chain excellence (Bowersox, Closs, & Stank, 1999; H. Chen, Daugherty, & Landry, 2009; Childerhouse & Towill, 2011; Fawcett & Magnan, 2002). This is illustrated by the title of an article by Frankel and Mollenkopf (2015): "*Cross-Functional Integration Revisited: Exploring the Conceptual Elephant*".

Even though integration is one of the most well-known concepts for management study and practices, Barki and Pinsonneault (2005) claim that it is "*ill-defined in the literature*". Additionally, existing research on the topic may be inconclusive and sometimes contradictory, according to Autry et al. (2014); Leuschner, Rogers, and Charvet (2013); Mackelprang et al. (2014); Turkulainen and Ketokivi (2012). The literature contains several studies that in one way or another cover the interdependencies among two different process phases or functions, but their content and framing varies and perspectives on the concept differ within different disciplines and between authors. Diverse terms such as "cross-functional integration", "intrafirm integration", "inter-functional integration", "supply-chain integration" and "operational integration" are used, often in alternation (Frankel & Mollenkopf, 2015). Additionally, many authors refer to the topic without presenting any precise definition (Pagell, 2004), which may confuse and reduce the possibility to improve research on the topic (Frankel & Mollenkopf, 2015).

Table 2-1: Example references of terms used in existing literature

Used terms	Author(s)
Collaboration	Mentzer, Foggin, and Golicic (2000), Horvath (2001), Sanders and Premus (2005), Nabavizadeh, Momeni, and Saidi (2013).
Collaboration and information sharing	Montoya-Torres and Ortiz-Vargas (2014)
Cooperation	Calantone, Dröge, and Vickery (2002)
Coordination, interdepartmental interdependences	Adler (1995)
Cross-functional coordination	Sherman (2004)
Cross-functional integration (CFI)	Frankel and Mollenkopf (2015)
Functional integration, functional alignment	D. A. Mollenkopf, Frankel, and Russo (2011)
Information sharing	Fawcett, Wallin, Allred, and Magnan (2009)
Integrated supply chains	Moberg, Speh, and Freese (2003)
Integrated value chains	Papazoglou, Ribbers, and Tsalgatidou (2000)
Integration	Gimenez and Ventura (2003), R. G. Richey, Roath, Whipple, and Fawcett (2010), Swink and Song (2007), Stank et al. (2001), Moberg et al. (2003), Pagell (2004), de Menezes, Wood, and Gelade (2010), Leenders and Wierenga (2002), Lawrence et al. (1967), Griffin and Hauser (1996)
Integration, cooperation	Carlsson (1991)
Interdepartmental integration	Kenneth B Kahn and Mentzer (1998)
Interdisciplinary coordination	Malone and Crowston (1994)
Inter-functional interaction	Parente (1998)
Inter-functional process integration	Morash, Dröge, and Vickery (1996)
Supply-chain integration (SCI)	H. Chen, Daugherty, and Landry (2009), Power (2005), Morash and Clinton (1998) Mackelprang et al. (2014), Leuschner et al. (2013), Stevens and Johnson (2016), Chang, Ellinger, Kim, and Franke (2016); Wong, Wong, and Boon-itt (2017), Childerhouse and Towill (2011)
Supply-chain alignment	Wilding et al. (2012)

There continue to be many questions on the topic that need to be answered (Barratt & Barratt, 2011; Basnet & Wisner, 2012; H. Chen, Daugherty, & Roath, 2009; Childerhouse & Towill, 2011; Ellinger et al., 2000; Frankel & Mollenkopf, 2015; Griffin & Hauser, 1996; Hayes & Wheelwright, 1984; Turkulainen & Ketokivi, 2012). Frankel and Mollenkopf (2015) call for scholars to dedicate their efforts towards clarifying this "conceptual elephant".

Much of the existing literature only focuses on modes or levels of integration, in which the construct is defined as information flow. On the other hand, some studies have performed an operationalization of the construct to additionally include cooperation and collaboration, in which the definition of integration includes mutual understanding, common goals, sharing resources and cooperativeness in assisting an interdependent unit. Previous mainstream OM

Theoretical framework

research treats integration as a unidimensional concept. Turkulainen (2008); Vallet-Bellmunt and Rivera-Torres (2013) argue for the multidimensionality of the construct of integration, claiming that organizations react differently to different aspects of integration. They further claim that there is a difference in how much effort organizations dedicate to achieving efficient integration. This interpretation appears to have received little acknowledgement in prior research. Such differences in the definition and operationalization of integration may form a possible explanation for the mixed findings in the literature (Sherman, 2004).

According to Turkulainen (2008), research on integration can be grouped into three categories, depending on the research focus: 1) exogenous, 2) endogenous and 3) other. The first type focuses on the effects of integration, while the second focuses on the antecedents of integration and the third contains studies that focus on integration, but that do not directly address effects nor antecedents.

H. Chen, Daugherty, and Roath (2009) attempted conceptualize integration by referring to the following definition in the Merriam-Webster Dictionary (2007):

> "*The act or process or an instance of integrating*."

Furthermore, integration is defined as follows:

> "*To form, coordinate, or blend into a functioning or unified whole.*"

On the basis of OM, Pagell (2004) formulated the following definition:

> "*Integration is a process of interaction and collaboration in which manufacturing, purchasing and logistics work together in a cooperative manner to arrive at mutually acceptable outcomes for their organization.*"

This definition originated from the work of O'Leary-Kelly and Flores (2002), and Kenneth B Kahn and Mentzer (1998), who founded it on the two key components of *collaboration* and *interaction.* According to Frankel and Mollenkopf (2015), this definition is "*one of the clearest definitions of CFI*". In it, the focus lies on the integration between three functions. Monczka, Handfield, Giunipero, and Patterson (2008) present a more generic definition:

> "*the process of incorporating or bringing together different groups, functions or organizations, either formally or informally, physically or by information technology, to work jointly and often concurrently on a common business-related assignment or purpose.*"

Supply Chain Integration (SCI): With a focus on the supply chain and using the term supply-chain integration, H. Chen, Daugherty, and Roath (2009) argue that a process view is important in achieving integration and present the following definition of process integration:

10

> *"Process integration refers to the management of various sets of activities that aims at seamlessly linking relevant business processes within and across firms and eliminating duplicate or unnecessary parts of the processes for the purpose of building a better-functioning supply chain."*

Stevens and Johnson (2016) also use the term "supply-chain integration" and present the following definition:

> *"We posit that supply chain integration is the alignment, linkage and coordination of people, processes, information, knowledge, and strategies across the supply chain between all points of contact and influence to facilitate the efficient and effective flows of material, money, information, and knowledge in response to customer needs."*

Cross Functional Integration (CFI): The definition presented by Frankel and Mollenkopf (2015) is found to be the most adequate within the focus of this thesis. They use the construct of cross-functional integration (CFI) with the following definition:

> *"a process of interdepartmental interaction and collaboration in which multiple functions work together in a cooperative manner to arrive at mutually acceptable outcomes for their organization."*

An organization is defined by Lawrence et al. (1967) as "*a system of interrelated behaviors of people who are performing a task that has been differentiated into several distinct subsystems, each subsystem preforming a portion of the task, and the efforts of each being integrated to achieve effective performance of the system.*"

Interdepartmental integration: Kenneth B. Kahn and Mentzer (1996) use the term "*Interdepartmental integration*" in their research and claim that it constitutes the superior process of interaction and collaboration. Based on these two terms, a formal definition of interdepartmental integration is formulated as follows:

> *"a process of interdepartmental interaction and interdepartmental collaboration that brings departments together into a cohesive organization."*

The term "interaction" is related to interdepartmental activities that are *tangible*, which comprises activities that can easily be monitored, such as exchanging verbal and documented information, attending meetings, faxing, teleconferencing, making conference calls and memoranda, and transmitting standard documentation between departments. The term collaboration is defined as a "*department's willingness of working together, where they share resources, understand and have consensus on common vision and goals.*" This can be characterized as typically intangible, is difficult to monitor and requires a common effort to achieve and sustain.

Theoretical framework

Cross-functional integration (CFI) and supply-chain integration (SCI): Frankel and Mollenkopf (2015) urge researchers to separate CFI and supply-chain integration, as the former focuses on the integration of the internal element of the value chain, while the latter focuses on the entire supply chain.

Furthermore, they argue for the importance of academics coming to an agreement on and clarifying elements such as the following:

- Locus and domain: who is involved and what do they do?
- Substance: what is integrated?
- Range: is CFI a state of being, or does it occur in degrees?
- Level: where does it occur within a firm?

They also claim that the boundary conditions of CFI should clearly be defined by academic research to better understand and predict issues such as the following:

- To what degree and when is CFI most beneficial?
- Which role does CFI play in dynamic supply-chain competitive situations?
- The relationships between terms such as CFI and broader concepts of supply-chain integration

Based on Childerhouse and Towill (2002), the term "integration of the supply chain" stems from a system perspective (Christopher, 2005, Parnaby, 1979), in which it is perceived that the optimization of a whole value chain achieves better performance than the optimization of a chain of sub-systems. They claim that an organization that achieves increased integration will also be more competitive. Childerhouse and Towill (2011) present the following visual illustration of an integrated value chain (Figure 2-2):
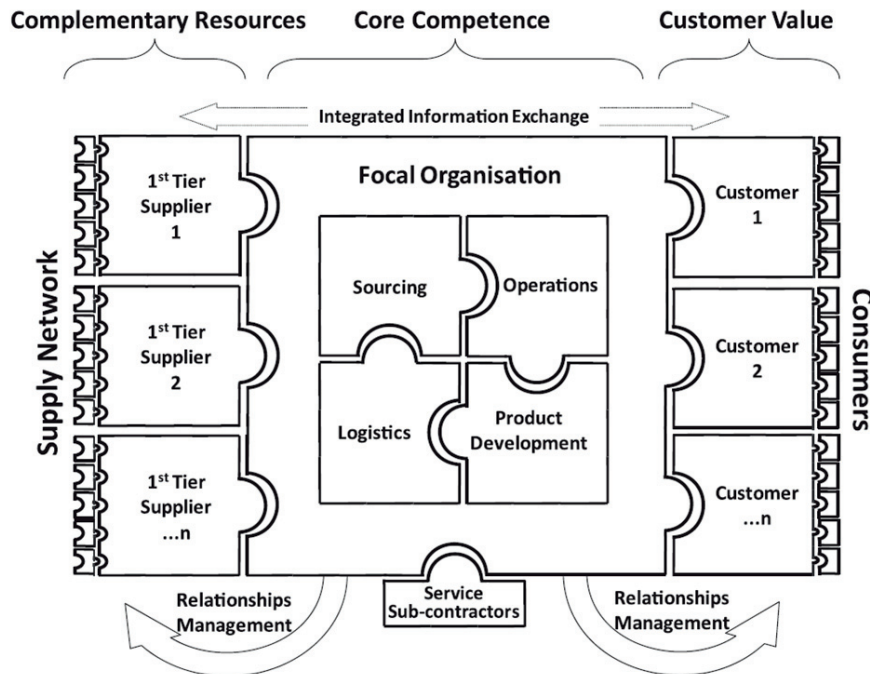
Figure 2-2: Integrated value chain (Childerhouse and Towill, 2011)

The figure focuses on the importance of integrating the internal functions. Moreover, it illustrates the downstream integration with customers and consumers, the upstream integration with first-tier suppliers and the rest of the supply network.

Why should an organization then aim for integration? R. G. Richey et al. (2010) define the *objective* of internal integration as follows:

> "*To develop a process- oriented focus that discourages sub-optimization of specific functional areas in order to develop a more effective overall process solution.*"

The integration or coordination of work in organizations has been defined by Mintzberg (1989), and Glouberman and Mintzberg (2001) as containing six basic mechanisms: mutual adjustment, direct supervision, standardization of work, outputs, skills and norms (see figure 2-2). The first mechanism, *mutual adjustment*, enables individual workers to coordinate themselves by adjusting their own work to the work of others during the unfolding of activities and requires an understanding of ongoing activities. *Direct supervision* can be explained as the activity of someone who does not perform the work, but functions as a "supervisor" by directing issues to those who do the work. The third mechanism,

standardization of work, refers to standardized procedures and the development of specified procedures through which coordination takes place. The fourth mechanism, *standardizing of the output*, focuses on the standardization of results. The fifth mechanism, *standardization of skills and knowledge*, entails that employees are trained to know exactly what they can expect from each other at any time, whereby nearly automatic coordination takes place. The sixth mechanism is *standardization of norms*, by which socialization is used to establish common values and beliefs so that employees can work towards mutual goals.
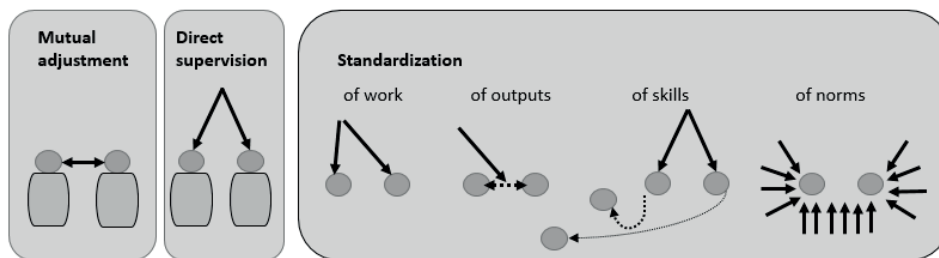
Figure 2-3: Reprinted from (Glouberman and Mintzberg, 2001)

Barki and Pinsonneault (2005) state that there is a low degree of understanding of what influence high levels of integration. From a literature review of several fields, they propose "*the concept of organizational integration*" (OI), which they define as "*the extent to which distinct and interdependent organizational components constitute a unified whole*."

From a review of existing literature and in an attempt to summarize the literature on organizational integration, Ettlie and Reza (1992) propose the following four categories:

1) Contingency models of integration
2) Interdependency of subunits in organizations
3) Interfirm and interindustry connections
4) Technology as an alternative to the technological and organizational imperatives

Furthermore, they identify six types of OI arcs: two intra-organizational OI's, namely internal-operational and internal-functional; and four inter-organizational OI's, namely external-operational-forward, external-operational-backward, external-operational-lateral and external-functional. As the focus of this thesis is on internal integration, the internal arcs are presented in the table on the next page.

Table 2-2: A research framework for integration (Barki & Pinsonneault, 2005)

Internal (Integration within a firm)						
Types of OI	Definition	Inter-dependence types	Barriers to OI	Mechanisms of OI	Integration effort	Potential benefits of OI
Operational	Integration of successive stages within the primary process chain (workflow of a firm)	Sequential Reciprocal	(S-GD) (PO)	(PL) (DS) (SO) (SW) (MA)	High	• Greater manufacturing productivity • Greater firm competitiveness • Strategic advantages • Lower production and inventory cost • Reduced errors • Improved coordination
Functional	Integration of administrative or support activities of a company's process chain	Pooled	(S-FD) (PO)	(SN) (SSK)	Low	• Products more attuned to market • Improved inter-functional synergy • Improved new product success • Higher innovation rate

(S-GD) – Specialization - Goal differences
(PL) – Planning
(DS) – Direct supervision
(PO) – Political consideration
(SO) – Standardization of output
(SW) – Standardization of work
(MA) – Mutual adjustment

Thompson (1967) distinguishes between three types of organizational interdependencies, namely pooled, sequential and reciprocal interdependencies, which are identified and explained as follows:

Pooled interdependence: With this type of interdependence, each part of the organization makes a distinct contribution to the whole and is supported by the whole organization. However, each part does not necessarily depend on or support every other part directly.

Theoretical framework

Sequential interdependence: In sequential interdependence, a serial relationship exists among different parts and the output of one part gives input to another. There is a direct interdependence between the two parts of the organization and the order of the interdependence can be determined, that is, Part A must act properly before Part B can act.

Reciprocal interdependence: In the case of reciprocal interdependence, the output of each unit gives the input for the other units so that each interdependent unit is penetrated by the other: Unit A has an output, which gives the input of Unit B and the output from Unit B gives the input of Unit A. Typical of this type of interdependence is the mutuality of the connection between units, where each part starts an incident for the other units: the first part's output gives the input to other parts and conversely, simple and structured tasks become integrated while few individuals are involved.

POOLED   SEQUENTIAL   RECIPROCAL
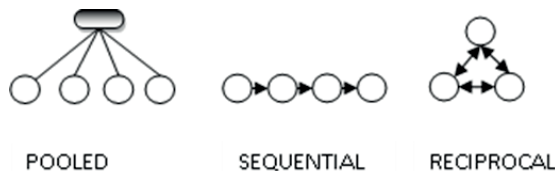
Figure 2-4: Pooled, sequential and reciprocal interdependencies – illustrated based on Thompson (1967)

Even though much research has been performed on the topic, there continues to be a need for a greater understanding of "*how to achieve integration and what is involved*", according to H. Chen, Daugherty, and Roath (2009). They propose that integration should be characterized as a "*higher-order*" construct due to the complexity of unifying different functions or organizations. The two integration-related constructs of *connectivity* and *simplification* are highlighted as key components of integration. The authors explain the relation as follows: If there exist seamless connections between internal processes or external organizations, there is evidence of integration. Likewise, reducing waste and improving processes by which to achieve better results also indicate integration. *Connectivity* has, also in relation to *willingness*, been identified by Fawcett et al. (2009) as positively influencing customer satisfaction and productivity.

Study of work processes: If a relationship between an internal supplier and a customer can be presumed to be reciprocal and evaluate inter-functional relations, the systems theory (Cusins, 1994; J. R. Stock, 1996) and value chain of Porter (1985) is suggested to be the appropriate basis for evaluation (Parente, 1998). Porter (1985) states that, in viewing work processes as a value chain, it is possible to consider them independently of the environment and line of business. Within marketing and organization theory, the dominant system-structural perspective (Griffin & Hauser, 1996; Ruekert & Walker Jr, 1987) is used to explain behavior within social systems. This perspective states that it is possible to study a social

system by investigating its interrelationship with its surroundings, the structure and processes of the organization, and the outcomes. Figure 2-5 (reprinted from Ruekert and Walker Jr (1987) shows the connections between the three dimensions:

(1) Environmental situation
(2) Structure and process
(3) Outcome dimensions of an inter-functional social system
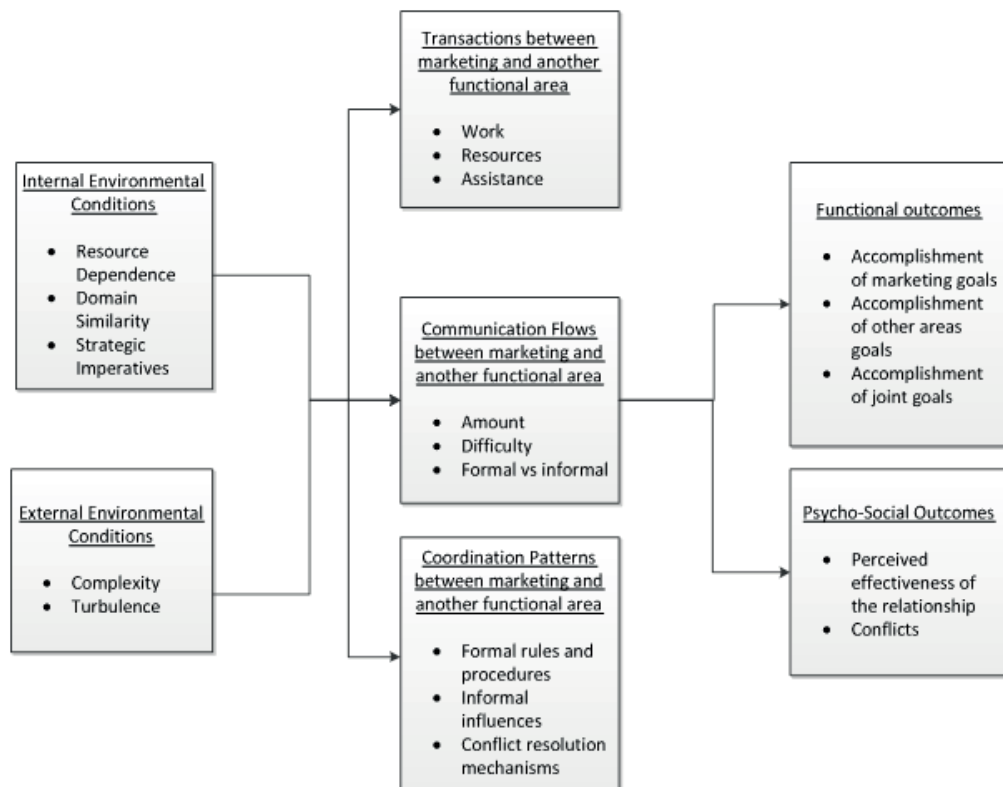
Figure 2-5: Framework for assessing marketing's interaction with another functional area (Ruekert & Walker Jr, 1987)

Coordination and coordination theory: When the dependencies between value-creating activities are known, it is possible to identify which type of coordination process can be used to manage them. To describe how coordination can occur in different kinds of systems, Malone and Crowston (1994) use the term "*coordination theory*". After studying the concept on the basis of several different disciplines (computer science, organization theory, management science, economics, linguistics and psychology), they define coordination as the process of managing dependencies among activities and arranging the work tasks of two or

more groups so that they can work together efficiently and achieve a common understanding of the work that is performed by other group(s). The groups should have common and aligned goals, but each of the group participants are separately responsible for performing their personal work tasks (Cao, Zhang, To, & Ng, 2008). When coordination is performed well, it is seldom recognized. It is not until coordination is missing that people become aware of it (Malone & Crowston, 1994).

Many managers appear to agree on the conceptual importance of integration but experience difficulty in achieving it at the practical level (D. Mollenkopf, Gibson, & Ozanne, 2000). On the other hand, many experience that the need for integration increases the more complex and unpredictable tasks with which a company needs to deal (Turkulainen, 2008) and integration is also viewed as a requirement to be competitive in the current global market. To achieve a well-managed value chain, it is important that all value-creating processes act together and that the intra-organizational customer-demand and supply capabilities are aligned and balanced. Hence, a well-managed value chain is an integrated value chain, which is important in providing optimum value for the customer (Morash & Clinton, 1998; G. N. Stock et al., 1999). Horvath (2001) emphasizes the importance that each participant in a value chain understands the needs of their customer's customers as well as those of their supplier's suppliers when working towards the optimization of their own operation. This is also claimed by Calantone et al. (2002), who model knowledge as an antecedent to communication, as when one department has good knowledge of another department, the better they can direct the communication that the other department needs to fulfil their tasks. According to Ruekert and Walker Jr (1987), two departments that have similar objects and tasks are more likely to communicate well and experience a minor amount of difficulties.

Authors use the term "integration" very differently, depending on the actual context (Childerhouse & Towill, 2011). From a logistics perspective, integration is often discussed within a "channel" context, while focusing on the concept within an inter-departmental context is equally important (Kenneth B. Kahn & Mentzer, 1996). Frohlich and Westbrook (2001) define integration as something that "*involve[s] coordination (...) the forward physical flow of deliveries*" and "*the backward coordination of information technology.*" Mentzer (2004) mentions *coordination* as one and the most important of twelve drivers of competitive advantage. Moreover, functional coordination has been presented by Min (2001) in five different proportions, as follows:

- **Cooperative arrangements** which comprise both
  - Interaction: committee meetings, calls, informal communication and exchange of standard documents
  - Collaboration: interdepartmental relationships as teams and resource sharing

- **Management control:** how strategic processes are made (i.e.. how management responds to input from employees) and have an effect on the coordination of team members.
- **Standardization:** Standards set norms for how people act and could hence function as a tool for coordination.
- **Functional expertise:** Despite the need for cross-functional coordination, there is a need for functional in-depth expertise. Hence, employees are needed who can manage both to have in-depth knowledge and to work efficiently with other multifunctional team members.
- **Organizational structure:** an integrated supply-chain process with a unified stream of information, products and finances is an ultimate organizational structure for coordination.

Several examples show that poor internal communication, functional myopia, indistinct organizational boundaries and short-term perspective planning may cause poor organizational performance (Shub & Stonebraker, 2009). To achieve internal process integration, there needs to be a coordinated and necessary obligation to process excellence throughout the value chain and thereby attain a high level of basic service at the lowest cost. Bowersox et al. (1999) further claim the following:

> *"Process excellence is achieved by linking operations into a seamless, synchronized operational flow to satisfy customer requirements. Process integration unleashes a synergistic effect that enhances overall performance."*

The findings of Griffin and Hauser (1996), Ayers et al. (2001), and Stank et al. (2001) support the claim that the collaborative relationships between functions directly affect the outcome of processes in a positive way. However, this effect is relative to what is perceived as a positive outcome. Furthermore, they found that, to achieve this type of relations, the different roles should be clear and the decision-making process should be decentralized.

Cost of achieving integration: There is no doubt that integration is important (Pagell, 2004). However, much of the existing literature lacks a focus on the cost of achieving integration (Clark & Wheelwright, 1992; Kenneth B Kahn & McDonough, 1997a; Turkulainen, 2008). Childerhouse and Towill (2011) provide proof that supply-chain integration is valuable, but highlight that value-chain integration is not easy to attain. They state that managers must know struggling with integration in the value chain is not unusual and mention the obstruction of cooperation as an element that is experienced to negatively affect the integration process.

Swink, Narasimhan, and Kim (2005) suggest that research on supply-chain integration should consider including strategy integration. They describe *strategy integration* as "*the organizational practice of achieving such synergies across manufacturing and business units is strategy integration...consideration and synthesis of internal constraints, strengths, and weaknesses, along with external*

market demands, opportunities, and threats."

The concept of integration and the degree to which it influences performance are also discussed by many authors. The following section presents a brief overview of the related literature.

2.1.1 Effects of Integration

Having a well-integrated value chain may positively influence an organization's efficiency capabilities and enable a faster response to changes in customer requirements. As the term "integration" encompasses such an extensive area, it may cover several different structural connections between departments and organizations (H. Chen, Daugherty, & Roath, 2009). For instance, operational elements can be integrated differently for internal versus external integration. As previously mentioned, the concept of integration has been theorized, defined and operationalized by authors in considerably different ways: either as an organizational state or as a set of practices and mechanisms that can lead to that state. Moreover, several authors state that the level of analysis of existing research on the concepts of integration-performance and supply-chain integration creates confusion (Turkulainen & Ketokivi, 2012). Research on how cross-functional integration affects performance is inconsistent due to various definitions of the term. Additionally, much of the literature only focuses on customer and supplier integration, while excluding internal integration (Flynn et al., 2010). Due to the complexity of the integration–performance relationship, Mackelprang et al. (2014) argue that considering performance as something that universally improves integration should be avoided. Existing studies on integration only focus on what mechanisms to use to achieve integration, while few studies concentrate on whether integration has actually been achieved within an organization (Mackelprang et al., 2014; Turkulainen & Ketokivi, 2012). There also a degree of indistinctness in much of the existing research, as the use of mechanisms for achieving integration does not immediately result in an integrated organization. Mackelprang et al. (2014); Turkulainen and Ketokivi (2012) argue that the ambiguity of the concept can be traced to the original theory, as the pioneers in the field, namely Lawrence et al. (1967), use the concept to describe both the quality of the state of collaboration between two functions and the mechanisms by which to achieve that state. This is unfortunate, according to Turkulainen and Ketokivi (2012), as "*states, processes, and outcomes are clearly theoretically distinct."*

When an organization needs to respond quickly to changes in customer requirements, internal processes of integration have been found to have a positive influence on efficiency (H. Chen, Daugherty, & Landry, 2009). This is in line with Horvath's (2001) position, who states that collaboration may be a driving force in achieving effective supply chains. However, an optimal level of integration does not necessarily result in good performance (Sherman, 2004). The level of integration should correspond relatively to the needs that arise in different situations (Kenneth B. Kahn & Mentzer, 1996).

Turkulainen and Ketokivi (2012) focus on cross-functional integration, which they found to have an effect on performance, depending on which dimension of performance is measured. They state that performance has previously been discussed as a single topic, whereas it should have been disaggregated. Concerning the performance-integration concept, they claim that different definitions and types of operationalization are used in the literature. Table 2-3 presents an overview of some of the literature that covers integration in relation to performance.

Table 2-3: Integration in relation to performance (based on Turkulainen and Ketokivi (2012) and additional supplementation from this thesis' literature review

Topic	Authors
Financial performance	(Chang et al., 2016; Kenneth B Kahn & McDonough, 1997b; Nahm, Vonderembse, & Koufteros, 2003; O'Leary-Kelly & Flores, 2002)
Competitive capabilities	(Rondeau, Vonderembse, & Ragu-Nathan, 2000; Swink & Song, 2007)
Competitive advantage	(Hausman, Montgomery, & Roth, 2002; Swink & Song, 2007)
Customer satisfaction	(Moffat, 1998; Parente, 1998; Parente, Pegels, & Suresh, 2002)
Time-based performance measures related to product development	(Bergen & McLaughlin, 1988; Droge, Jayaram, & Vickery, 2004; Kathleen M Eisenhardt, 1989; Ettlie, 1995)
Manufacturability in an NPD context	(Ettlie & Reza, 1992; Swink, 1999)
Cross-functional integration - performance	(Turkulainen & Ketokivi, 2012)
Strategic supply-chain integration and performance	(Mackelprang et al., 2014)

Turkulainen and Ketokivi (2012) state that these indicators differ both in content and level of analysis, namely the team-, project-, plant- and SBU (strategic business unit) levels.

Several examples showing that integration may have a positive effect on performance appear in the literature. For instance, Parente et al. (2002) found that an internal relationship between production and sales positively affects the outcome of the process and consequently customer satisfaction. The study of Ettlie (1997) found that the integration between marketing, R&D and production contributes to an increased market understanding and further increases product success. A larger survey within Chinese manufacturing companies was performed by Flynn et al. (2010),who investigated the correlation between SCI and performance. This study indicates that SCI is related both to operational and business performance. Moreover, internal and customer integration were found to be more closely associated to enhancing performance than to supplier integration.

Even though Gimenez and Ventura (2003) also found evidence of a positive relationship between integration and performance, they did not find integration to contribute to competitive advantage. The high level of integration among the studied companies is suggested as a possible explanation.

A study by Chen et al. (2007) focusing on finding the relation between the scope of integration and its effect on performance was performed through a widespread survey-based literature analysis and further pretested with selected qualified professionals and academics. This study found that dyadic collaboration (i.e., collaboration between marketing and logistics) additionally needs a larger degree of integration of other functions in for it to have a positive impact on an organization's performance.

According to Kenneth B Kahn and McDonough (1997b), most of the integration-related literature focuses mainly on single-country companies. Therefore, they performed a study of 500 marketing, manufacturing and R&D managers to find what effect interaction and collaboration have on performance from a global perspective. They compared the degree to which organizations used interaction and collaboration across regions, suggested a global framework and found collaboration to affect the success of performance. Interaction was also found to affect performance positively, though to a lesser degree than collaboration.

Research by R. G. Richey et al. (2010) supports the claim that performance can be improved by controlling facilitators for integration, even though barriers for integration exist. They claim that organizations should aim for being aligned, communicative and commonly structured. Furthermore, they should aim for having quantified metrics and being open to mutual dependency with partners.

Flynn et al. (2010) claim that there continues to be a need for more theoretical and empirical research on how integration can stimulate higher performance, in addition to studies of whether the effect of integration differs depending on which aspects of performance are measured.

The following section discusses the relationship between internal and external integration.

2.1.2 Internal vs. external integration

Barki and Pinsonneault (2005), and Pagell (2004) classify integration studies by distinguishing between external and internal integration. Internal integration occurs within an organization, while external integration occurs between an organization and its external companions (H. Chen, Daugherty, & Roath, 2009). As interaction and collaboration take place within and across organizations, several academics find it essential to study both internal and external integration (Morash & Clinton, 1998; Stank et al., 2001). In the book "Twelve Drivers of Competitive

Advantage" by Mentzer (2004), the first driver that is presented is internal alignment. According to Mentzer (2004),

". . . it is a fundamental concept of supply chain management that you cannot coordinate functions across companies within the supply chain if you cannot do this coordination first within your own company . . . the remaining 11 drivers will come too little if this first one cannot be accomplished."

Stank et al. (2001) experienced that external cooperation influences internal cooperation, which may form an argument for organizations to focus on both. However, they claim that organizations should be careful in letting internal collaboration set the premises for external collaboration, as this could affect the focus on the customer. On the other hand, they state that external integration may provide better conditions for good internal integration, as an organization needs to stress the internal focus in striving to meet external requirements. In contrast, Braunscheidel, Suresh, and Boisnier (2010); Flynn et al. (2010); Gimenez and Ventura (2005); Lambert, García-Dastugue, and Croxton (2005); Stevens (1989); Zhao, Huo, Selen, and Yeung (2011) present internal integration as the foundation for external integration efforts to succeed.

Childerhouse and Towill (2002) also argue for the importance of putting "one's own house in order" before working towards the integration of the rest of the value chain. Once this is achieved, the focus should be placed on integrating suppliers and thereafter, the customer. The research of Barratt (2004), and Van Hoek and Mitchell (2006) also supports this. Van Hoek and Mitchell (2006) express skepticism towards literature that focuses only on external alignment, such as that with suppliers, customers and business partners. They claim that it is important to "speak with one voice" towards customers.

To realize the potential of a value chain, Frohlich and Westbrook (2001) argue that it is important to not only focus on one of its parts. They present the arcs of the integration concept, which visualizes both the direction (towards supplier and/or customers) and degree of integration. This is further modified by Childerhouse and Towill (2011), as illustrated in the following model:

Theoretical framework
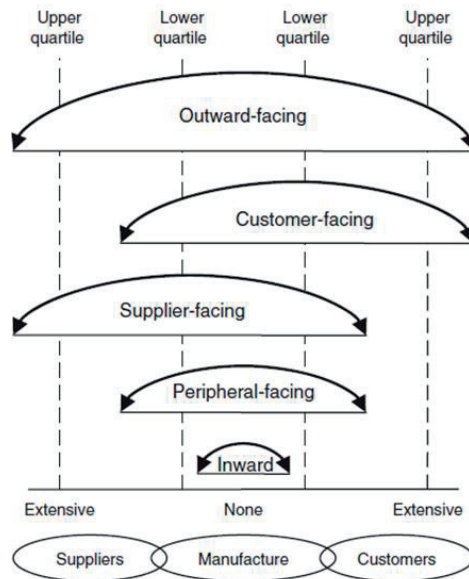
Figure 2-6: Five alternative arcs of supply-chain integration. Reprinted from (Childerhouse & Towill, 2011)

This model presents a rare and valuable way of classifying supply-chain integration. The figure visualizes that the highest degree of integration lies in external integration, while the least integrated is inward-facing integration.

The concept of Frohlich and Westbrook (2001) was revisited by Schoenherr and Swink (2012), who carried out a survey with 403 supply-chain professionals. They performed a cross validation of Frohlich and Westbrook's framework with multi-dimensional performance measures that were taken by the supply-chain managers, based on the relational and resource-based view of their firms. The study was extended into how internal integration is related to the arcs of integration and performance. In conformance with information-processing theory, the findings indicate that internal integration improves the impact of external integration on delivery and flexibility performance. However, neither quality nor cost performance were supported. A novel study by Wong et al. (2017) provides empirical evidence that different supply-chain configurations exist within different sectors. These differences in SCI configurations are found to provide different performance related to quality, delivery, cost, flexibility and innovation.

A review of literature focusing on the impact of information sharing and collaboration in supply chains reveals that challenges that existed 10 years ago are equally relevant for today's future research (Montoya-Torres & Ortiz-Vargas, 2014). Moreover, internal and customer integration are found to have a greater positive influence on performance than supplier integration.

24

A study of first-tier suppliers to the "Big Three" car companies (OEMs) in North America was performed by Droge et al. (2004) to determine what effect integration practices were experienced to have on time-based and overall performance. The CEOs from 57 strategical business units responded and categorized integration practices into the following two groups: external strategic-design integration (integration across company boundaries) and internal design-process integration. Both internal and external integration were found to be related to time-based performance and the results suggest that, by combining external and internal integration, a synergistic effect on a firm's performance is achieved.

The research of X. Koufteros, Vonderembse, and Jayaram (2005) indicates that both internal and external integration have a positive effect on quality, product innovation and cost-effectiveness.

Looking deeper into literature related to internal integration, it appears that much of it focuses on integration in an NPD context. Some of this literature is therefore covered in the following section.

2.1.3 Integration in an NPD context

According to Turkulainen (2008), mainstream research on cross-functional integration is performed from the NPD perspective, whereby she refers to authors such as Griffin and Hauser (1996); M. Song and Montoya-Weiss (2001); Swink (2000); Tatikonda and Montoya-Weiss (2001). She further claims that literature describing the interface between R&D and manufacturing is mostly, although often indirectly, based on the research of Hayes and Wheelwright (1984), and in primarily related to integration in an NPD context.

Several authors, namely Brown and Eisenhardt (1995); J. Chen, Damanpour, and Reilly (2010); Gonzalez-Zapatero, Gonzalez-Benito, and Lannelongue (2016); Griffin and Hauser (1996); Leenders and Wierenga (2002); Montoya-Weiss and Calantone (1994) refer to the integration of involved functions during the product-development process as a key parameter by which to achieve a successful NPD process (X. Koufteros et al., 2005). The degree of the perceived need to reduce uncertainty may affect an organizations need for integration during the product-development process (Gupta, Raj, & Wilemon, 1986).

According to X. Koufteros and Marcoulides (2006), integration forms the cornerstone of the concurrent engineering (CE) approach by inspiring information collection and processing. Because of sequential processes, the activities of the product-development process are reorganized into a concurrent process with overlapping activities from marketing, product engineering, process engineering, manufacturing, planning and sourcing. The aim is thereby to reduce uncertainty and equivocality, and to be better prepared for possible changes. Companies that

use CE practices report an improved performance in product innovation and quality (X. Koufteros, Vonderembse, & Doll, 2001).

The existing literature contains several studies into how the involvement of marketing, development and manufacturing departments affect performance in the new product-development phase (Morash et al., 1996; M. Song & Montoya-Weiss, 2001; X. M. Song, Montoya-Weiss, & Schmidt, 1997). When needed within the different NPD phases, the involvement of relevant functions is found to be more successful than having all functions involved continuously, as the right combination of involvement may differ throughout the development process (Adler, 1995; X. M. Song, Thieme, & Xie, 1998).

Organizations that experience insecure conditions are more likely to use higher levels of integrated new product-development processes than organizations that operate under a lower degree of uncertainty (X. A. Koufteros, Vonderembse, and Doll (2002).

The following table on the next page presents some exemplary literature that covers NPD in an integration context.

Table 2-4 Example literature on NPD and integration

Author(s)	Departments involved				
	Marketing	Development	Manufacturing	Purchasing	Others
(X. M. Song et al., 1997), (X. M. Song et al., 1998), (Sherman, Souder, & Jenssen, 2000), (Griffin & Hauser, 1992)	x	x	x		
(Sherman et al., 2000) (Nihtilä, 1999), (X. Koufteros et al., 2005)		x	x		
(Swink, 2000), (Swink, Narasimhan, & Wang, 2007), (Calantone et al., 2002), (Yu, Ramanathan, & Nath, 2014)	x		x		
(Swink, 1999), (Morash et al., 1996)		x	x		x
(Gonzalez-Zapatero et al., 2016)	x			x	
(Ayers, Gordon, & Schoenbachler, 2011), (Griffin & Hauser, 1996; Perks, Kahn, & Zhang, 2009)	x	x			

The concept of integration is to a large degree also discussed in literature focusing on supply-chain management. The following section discusses integration within this context.

2.1.4 Supply chain management and integration

The term "supply chain management"(SCM) is sometimes related to the management of processes and sometimes to the structural organization of businesses (Harland, 1996). According to Cigolini et al. (2004), founding works that view SCM as a management approach are those by Jones and Riley (1985), Houlihan (1985), and Novack and Simco (1991). The notion of SCM is also related to the concept of integration, as it can be defined as follows:

"*the integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders*" (Lambert, Cooper, & Pagh, 1998).

In fact, H. Chen, Daugherty, and Landry (2009) define supply chain integration as a key component of SCM. Hence, SCM comprises integration, coordination and collaboration through organizations and throughout the supply chain, and involves internal and external integration. There has been a focus on SCM since the 1980's

and companies developed an interest in it as they saw the positive effect it could have on performance (Gimenez & Ventura, 2005).

The Council of Supply Chain Management Professionals (CSCMP) developed the following definition of SCM:

"*Supply Chain Management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers. In essence, supply chain management integrates supply and demand management within and across companies.*"

Taking this definition together with other definitions and their focus on integration as SCM's main objective, Frankel, Bolumole, Eltantawy, Paulraj, and Gundlach (2008) suggest that integration can be considered as SCM's focal concept of interest and call for more research on the concept. This is in line with Horvath (2001), who refers to collaboration as the driving force towards achieving effective SCM.

A research performed by Fawcett and Magnan (2002) reveals that the ways in which SCM is practiced are seldom similar to the ideal that is described in the literature. They identify three different levels in SCM practices. On the first level, SCM is perceived as the implementation of new information technology. The second level takes it a bit further by recognizing that core building blocks are important in achieving closer channel interactions. They describe the building blocks as interrelated information systems, integrative inter-organizational processes, aligned objectives, consistent measures, mutual risks and rewards, and managers who have cross-experience. The third level builds on the two previous levels, but the cultural aspect is recognized as being important for SCM. To succeed on this level, they mention supply-chain design and supply-chain integration as being important.

Based on a literature review focusing on SCM integration, Power (2005) found the importance of taking a holistic and systemic view of the interactions among supply chain participants to be an essential theme.

The integration concept is also related to concepts of transparency, which is discussed in the following chapter.

2.1.5 Transparency vs. integration

In OM, transparency is considered as an improvement tool, as transparency is vital in revealing and eliminating waste. Womack and Jones (1996b.) formulate the following definition of transparency:

 "The placement in plain view of all tools, parts, production activities, and indicators of production system performance, so the status of the system can be understood at a glance by everyone involved."

Transparency is found to support greater involvement and gives stakeholders the ability and authority for decision-making (Klotz, Horman, Bi, & Bechtel, 2008). With the following statement, Drucker and Maciarello (2009) call attention to the importance of the human factor of transparency:

> *"There are, indeed, some principles of organization. One is surely that organization has to be transparent. People have to know and have to understand the organization structure they are supposed to work in. This sounds obvious – but it is far too often violated in most institutions (even in the military)."*

Erens and Hegge (1994) found that transparency, in addition to having a consistent and shared view on product information and specification, is a vital element within sales and manufacturing coordination.

Transparency is shown to contribute to providing more feedback on performed activities, facilitating coordination by revealing interdependencies, supporting decision-making and enabling improvements (Bauch, 2004; Økland, Lillebo, Amdahl, & Seim, 2010). To achieve effective interdepartmental collaboration, the activities, behaviors and processes that influence it need to be identified (Ellinger et al., 2000). To enhance a value chain's visibility, it is important to recognize that internal and external information-based connections have a combining role (Barratt & Barratt, 2011). The research of Drupsteen, van der Vaart, and Van Donk (2016) shows that a lack of process visibility may be a major hindrance to integration if it reduces the possibility to achieve an overview of other processes and make plans for unexpected occasions.

One way by which to achieve a transparent value chain is to establish elements from lean. The following section discusses the ways in which lean can contribute to achieving integration.

2.1.6 Lean and integration

As one of the main focuses within lean is to develop a streamlined value chain (Womack & Jones, 1996b.), lean is also relevant in an integration context. Muckstadt, Murray, Rappold, and Collins (2001) present five principles that are

important in striving towards supply-chain excellence: 1) to know the customer, 2) to construct a lean supply-chain organization that eliminates waste, variability and uncertainty, 3) to build tightly coupled information infrastructures, 4) to establish business processes that are closely attached and 5) to construct tightly coupled decision-support systems. Importance is also given to addressing uncertainty, as this may form an issue in any supply chain.

Lean thinking is found to be valuable for information management in using exchange processes as well as sharing and cooperation throughout the value chain to enable information flow (Hicks, 2007). This is confirmed in a research by Mazzocato et al. (2012), who experienced that lean positively influenced collaboration and teamwork between caregivers during a lean intervention in a hospital. After the lean intervention, the connection between the caregivers shifted from being occasional to having more defined roles and responsibilities.

To ensure the value of the information that is shared, a focus should be placed on how it is represented, structured and visualized.

Visual planning: To visualize means to give a "*presentation of data, information and knowledge in a graphic format which is conducive to acquiring insights, creating a vivid picture, developing an elaborate understanding or communicating experiences*" (Eppler & Burkhard, 2007). Within lean, there is typically a focus on visualization (such as team boards) of different kinds of information to improve communication processes and operational integration (Lindlof & Soderberg, 2011). This is also emphasized by Liker (2006) in the following exhortation:

> "*Align your organization through simple, visual communication*."

Such tools are found to facilitate the development and implementation of strategy, enable performance measurement and review, improve the commitment of employees, enhance internal and external communication, improve collaboration and integration, and foster a culture for continuous improvements and innovation (Bateman, Philp, & Warrender, 2016; Bititci, Cocca, & Ates, 2015; Lindlof & Soderberg, 2011). Furthermore, tools for visualization could enable the persons involved to see and understand different aspects and statuses of a process at any time, as well as create discipline within the process, as it contributes to process transparency. Furthermore, such tools may act as an *'in-line'* tool to assist in scheduling and allocating resources (Parry & Turner, 2006). Related to the visualization of performance measures for SMEs and based on Bresciani and Eppler's (2015) suggested pitfalls for visualization, the research of Larsson and Säfsten (2016) reveals five perceived challenges and one opportunity: 1) visual communication not used in all parts of the organization, 2) lack of visualization of essential elements, 3) no communication of continuous improvement, 4) intricate and confusing visualization, and 5) guiding the conversation in a specific direction. The opportunity that of communicating measures daily.

Due to the enhanced operational transparency of the value chain, it becomes easier to reveal bottlenecks. The speed and quality of knowledge transfer is thereby improved and may contribute to a faster response if problems occur (Eppler & Burkhard, 2007; Hines, Francis, & Found, 2006; Lindlof & Soderberg, 2011; Olausson & Berggren, 2010; Womack & Jones, 1996b.). However, difficulties may be experienced if a visualization is perceived to be a tool for management to control employees, in which case employees may be reluctant to share information. Additionally, it may be difficult to level workload if employees have different competences. If visualization tools are manual, having meetings with teams that are positioned at different sites, may be complicated, and tracking the causal link between activities and saving historical data may also be difficult (Hines et al., 2006; Lindlof & Soderberg, 2011).

Visual planning can in many cases be a useful tool, but to make such a system work it is important to have a regular coordination of activities and deliverables (Lindlof & Soderberg, 2011). It is very important that demand and support from management is in place, but the overall control of team boards should remain with team members (Parry & Turner, 2006). Moreover, as claimed by Whyte, Ewenstein, Hales, and Tidd (2008), "*managers need greater visual literacy to understand, manipulate and use the materials that are right in front of their eyes.*" They emphasize that managers should dedicate more effort to understanding which potentials visualization tools can have in enabling considered choices to control the outcome of processes.

To achieve an effective visual management system, it is important that team members are involved and empowered to create their personal visual-process board. The board should be kept simple and manual, and the use of colors to visualize is recommended, while the use of electronic systems is not recommended. Moreover, only figures that are needed to control the process should be displayed and there should be a visualization of the process with parameters that show progress at any time (Parry & Turner, 2006).

Visualization is a powerful tool, not only for manufacturing, but for other sectors as well. In many cases, visual planning is a useful tool, but it is important to remember that there should be a regular coordination of activities and deliverables for such a system to work. With visual planning, weaknesses may be revealed, which may make employees reluctant to use these kinds of tools (Lindlof & Soderberg, 2011).

The previous section of this chapter focused on explaining the concept of integration and related topics. In the following section, the different antecedents and mechanisms that may influence the integration of a value chain are discussed.

Theoretical framework

2.2 Antecedents / mechanisms that affect integration

Any type of managerial tool with which to facilitate integration within an organization can be said to be a *mechanism* or *antecedent* of integration (Galbraith, 1973; Lawrence et al., 1967). For an organization to become a fully integrated, it is important to understand and control the integration mechanisms (Carlsson, 1991).

Based on literature review, Pagell (2004) developed the following model (see figure 2-7 on the next page), which shows the key drivers for integration:
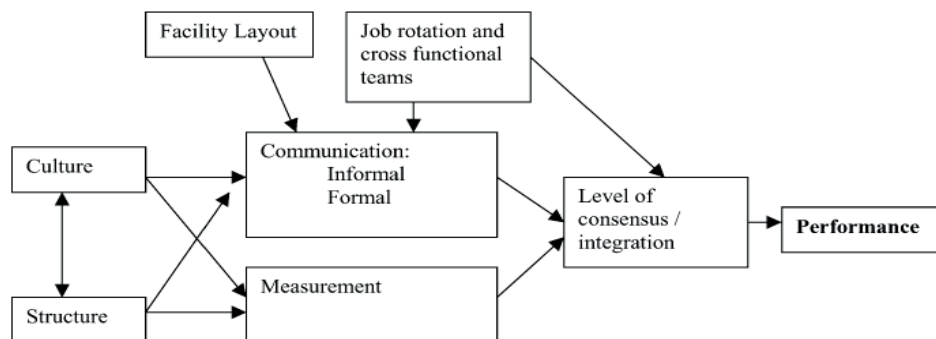
Figure 2-7: Key drivers for integration (Pagell, 2004)

Pagell (2004)states that this model offers some proposals but is incomplete. He further claims that not all the different constructs were identified at the same time and that a guidance of the interrelationship between them is absent in the existing literature. Hence, this model presents a description of what Pagell (2004) acquired through his research.

According to Basnet and Wisner (2012), and Gattiker (2007), few empirical studies exist that focus on finding antecedents of integration, such as job rotation, co-location, management support and so forth. There is also a lack of studies that connect these mechanisms (Basnet & Wisner, 2012; Pagell, 2004). A considerable amount of the current literature focuses on why organizations should focus on integration, while a comparatively small amount focuses on how to achieve good integration (Basnet & Wisner, 2012; H. Chen, Daugherty, & Roath, 2009; Pagell, 2004). Given that most studies only focus on one or two mechanisms, comparing the relative effectiveness of mechanisms may be difficult (Leenders & Wierenga, 2002).

It is important that managers have an understanding of the relationship between what the facilitators and barriers are for integration to determine on which aspects to dedicate future efforts (R. G. Richey et al., 2010). R. G. Richey et al. (2010)

suggest that facilitators for integration have five organizational dimensions: *aligned, communicative, structured, quantified* and *interdependent*. The dimension *aligned* includes the establishment and control of roles that members of a supply chain can fulfill and leads to a relational collaboration that acts to increase cohesion among members. The second dimension, *communicative*, refers to the degree of information sharing that organizations employ. The dimension *structured* refers to an attempt by organizations to find ways to share risks and rewards, establish strategies by which to reduce the interactivity cost, and create normative recommendations for how to manage and select allies. The element *quantified* refers to the expression of a given task or process through a numerical amount. The last element, *interdependent*, refers to the establishment and training of cross-functional processes and teams, as well as the use of software to formalize interdependencies. The following three barriers for integration are suggested: *unidirectional, incongruent and internalized*. Unidirectional refers to a one-way flow of information and a lack of willingness to share desirable information. The dimension incongruent refers to having goals that are inconsistent and have divided performance measures. According to R. G. Richey et al. (2010), the last dimension, internalization, can be viewed as a barrier for integration, as it can be said to transform the external regulation of a behavior into an internal regulation. If an organization performs self-monitoring and excludes external constituents, it no longer has a need for external contingency.

Turkulainen (2008) found a relationship between the use of mechanisms for integration and the achieved level of integration. She further found that organizations with a high need for integration enlarge their use of integration mechanisms.

In better achieving value-creation for the customer, it is essential to understand the enablers and disablers of integration (Ellinger et al., 2000). Several factors can influence the integration in organizations, including facility layout, job rotation, cross-functional teams, amount of formal and informal communication between functions, structure and culture at a plant, level of consensus and performance measurements (Basnet & Wisner, 2012; Bowersox et al., 1999; Kenneth B Kahn & McDonough, 1997a; Pagell, 2004).

Through a literature review, Singh (2011) found 32 enablers of coordination in a supply chain, which are grouped into the following six categories: 1) top management commitment, 2) organizational factors, 3) mutual understanding, 4) flow of information, 5) relationship and decision making, and 6) responsiveness. This study reveals a strong interconnection between all of these factors, in which the commitment of top acts as the main driver.

Based on a literature review, Barki and Pinsonneault (2005) identify the two categories of *specialization* and *political* as barriers for organizational integration. The specialization *barrier* can be described as functional units that possibly have

different objectives. Furthermore, the existence of different political perspectives may be a source of conflict.

Basnet and Wisner (2012) performed a survey with respect to internal supply-chain integration to test various premises for achieving integration. They found that promoting a positive attitude towards other departments made it is possible for line managers to enhance operational integration. Furthermore, they found that if departments are mutually responsible for achieving aligned company goals, the degree of operational integration also improves.

Interviews conducted by Ellinger et al. (2006) with six logistics and six marketing managers from 12 U.S. companies suggest a number of facilitators for collaborative behavior (see table 2-5 on the next page).

Table 2-5: Facilitators of collaborative behavior as presented by Ellinger et al. (2006)

Facilitators of collaborative behavior	
Emergent themes:	**Sub-themes:**
Inclusive communications	• Inclusion of functional counterparts at early stages • Informally opening lines of communication to educate functional counterparts
Strong working relationship	• Working together for the good of the organization • Longevity • Trust • Constructive problem solving
Joint accountability for outcomes	• Mutual rewards for success • Mutual responsibilities for failures
Involvement of senior management	• Encouraging interaction between functional counterparts • Clarifying expectations

Furthermore, the following inhibitors are identified:

Table 2-6: Inhibitors of collaborative behavior as presented by Ellinger et al. (2006)

Inhibitors of collaborative behavior	
Emergent themes:	**Sub-themes:**
Insufficient knowledge of the other function	• Insufficient working knowledge of functional counterparts' constraints and limitations • Lack of cross-functional training
Lack of communication	• Bringing other functions into planning processes too late • Tendency to operate in isolation • Lack of proactivity in communicating customer-service problems
Poor working relationships	• Lack of trust • Inability to compromise • Defensiveness • Lack of appreciation
Conflicting goals	• Incongruent functional objectives • Pulling in different directions
Lack of direction from senior management	• Insufficient effort to promote functional integration • Unclear expectations

Another study performed by X. M. Song et al. (1997) reveals that professionals from marketing, manufacturing and development perceived internal factors such as an organization's evaluation criteria, reward structure and management expectations to have a greater effect on cross-functional cooperation than external factors. Additionally, all the respondents perceived that cross-functional cooperation has a positive influence on NPD performance.

Theoretical framework

In establishing categories of integration to sort the findings from this PhD research, the studies of Pagell (2004), Leenders and Wierenga (2002), Singh (2011), Basnet and Wisner (2012), and Turkulainen (2008) are used. The categories represent both horizontal and vertical integration, and are presented in table 2-7 on the following page.

Table 2-7: Categorization of enablers and disablers, based on Basnet and Wisner (2012), Leenders and Wierenga (2002), Turkulainen (2008), Pagell (2004), and Singh (2011)

Category	Explanation and influence
Culture, social mechanisms and the creation of lateral relations	• Sets of values, guiding beliefs, understandings, ways of thinking • Liaison roles • Task forces and teams • Integrative departments or integrators • Informal communication • Meetings • Conferences • Transfer of managers • Connecting links • Cross-functional teams • Transfer of managers • Job rotation • Co-location ⇨ Increases capacity to process information ⇨ Influences decision making, judgment and information sharing ⇨ Reduces equivocality without overloading the vertical organization ⇨ Creates potential for more creative ideas
Management support/ vertical integration	• The level on which decisions are taken • Vertical transfer of strategy • Horizontal communication between managers ⇨ Simplifies information processing when decision maker gathers, controls and processes information
Formalization and standardization	• Policies, rules • Job descriptions • Standard procedures, technical reports • Charts, information-processing practices, etc. • Strategic planning, functional plans, scheduling • Performance control • Team boards and visual systems ⇨ Formal platform for information processing ⇨ Standards for communication processing - reduce need for further communication
Facility and layout	• Plant size • Physical distances • Partitions ⇨ Impacts the ability to communicate
Information systems	• Information technology • Increasing scope of database and degree of formalization of information flows ⇨ Enhanced capacity of information processing ⇨ Rapid information exchange without overloading the hierarchy

Table 2-7 Continued

Consensus integration	• Functional strategies must support the business strategy and each other
	• All functions support the business strategy and each other, and all managers know this is the case
	⇨ Increased understanding of common tasks
Measurement, rewards	• Bonuses
	• Formal measurement systems
	⇨ People tend to perform the activities for which they are rewarded

Figure 2-8 forms an attempt, as part of this thesis, to illustrate the relationships between the antecedents:
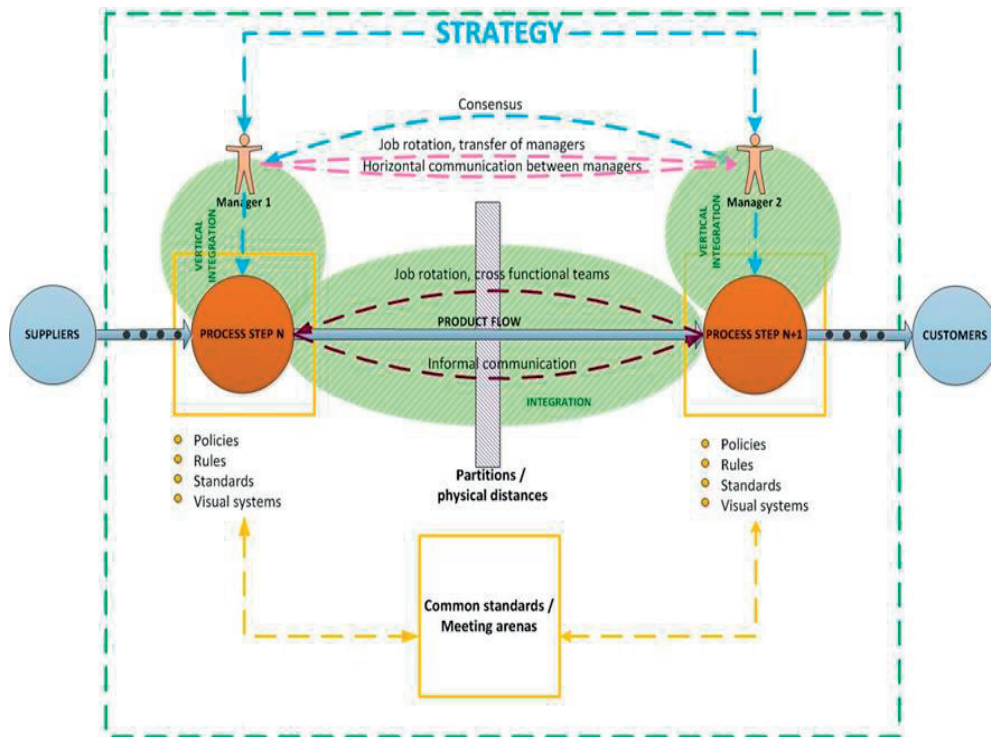
Figure 2-8: Integration in the value chain.

This figure presents a brief overview of most of the parameters that affect the integration of the value chain. The outer dotted line illustrates the organizational borders.

The focus of this thesis lies on internal mechanisms. The following sections discuss each of the mechanisms in more detail and under the following main categories:

- Culture, social mechanisms and the creation of lateral relations
- Management support / vertical integration
- Formalization and standardization
- Facility and layout
- Information systems
- Consensus integration
- Measurement, rewards

It is important to note that some mechanisms may fit under several categories.

2.2.1 Culture, social mechanisms and creation of lateral relations

Many companies struggle with barriers for collaboration caused by differences in personality, culture and language [which entails both native and "professional" language (Griffin & Hauser, 1996)]. Organizational culture has been the subject of thorough study since the beginning of the 1980s (Hofstede, 1984) and several authors have formulated different definitions of the concept. From a review of previous work, Deshpande and Webster Jr (1989) present the following definition:

> "*Organizational culture is a set of shared assumptions and understandings about organizational functioning.*"

An organization's culture is proven to influence its ability to achieve integration in the value chain. Hence, when managers experience challenges in achieving integration, it may be helpful to try to change the culture, according to Braunscheidel et al. (2010). Of course, the authors are aware that changing an organization's culture is usually not an easy task. However, being aware of how culture may affect integration may contribute to understanding why the outcomes of certain initiatives are positive, while those of others are not. In any event, even when an organization experiences barriers for integration, this may contribute to increasing its performance as there is a need to dedicate more effort into overcoming these barriers and to achieve efficient process interconnections (R. G. Richey, Jr., Chen, Upreti, Fawcett, & Adams, 2009).

An organization with a hierarchic culture may struggle to achieve integration as such a structure has a main functional focus, which may therefore create "functional silo" thinking (Braunscheidel et al., 2010; Pagell, 2004; Turkulainen, 2008; Van Hoek & Mitchell, 2006). Braunscheidel et al. (2010) advertise the need for future studies on the effect that subcultures have on integration, and refer to Palthe and Ernst Kossek (2003) study of subcultures. This study reveals that

subcultures and associated practices may support, alter, or reduce the application of an organization's HR strategies.

To achieve collaboration, it is important to have a collaborative culture. Trust, mutuality, information exchange, openness and communication are essential elements in achieving such culture (Barratt, 2004). Wilding et al. (2012) use the constructs of "*internal relational behavior*" (IR) or "*intra-organizational connectedness*" to describe the formal and informal direct contacts between personnel across units. The alignment of this contact is essential in achieving jointly accepted outcomes, according to (O'Leary-Kelly & Flores, 2002; Pagell & LePine, 2002)).

Several elements are considered to affect culture and therefore also integration, including the following:
- *Sets of values, guiding beliefs, understandings and ways of thinking*
- *Connecting links, informal communication and tacit knowledge*
- *Job rotation*
- *Transfer of managers*
- *Co-location*
- *Cross-functional teams*
- *Functional silos*

Each of these elements are described more in detail below.

Sets of values, guiding beliefs, understandings and ways of thinking:
Employees fulfilling different functions are often considered to have very different backgrounds and hence, different world views. These differences may cause a distance to occur between functions. A research including 167 marketing and R&D managers at high-technology firms found that the managers' traits were quite similar, independently of whether the departments were well integrated or not. As the cultural barriers were of the most frequently cited kind, there is reason to believe, according to Griffin and Hauser (1996), that the difference was caused by a perception of barriers caused by differences in personality or stereotypes. They further claim that if one of the groups believes in certain stereotypes, those stereotypes may become a barrier for the departments' alignment, even though they are not based on facts. In the literature, this is one of the most commonly cited barriers for integration, as in the research of Ellinger et al. (2006), in which a considerable perceptual incongruence between two departments of study was experienced. To reduce this barrier, the focus should be placed on mechanisms that can create confidence between units (Griffin & Hauser, 1996).

Connecting links, informal communication and tacit knowledge: Establishing common arenas for information sharing and interaction, such as **team-board meetings**, may be useful in achieving a better connection between two different sections. But to succeed in doing so, it is far more important to focus on improving the quality of interaction, rather than increasing the quantity, according to Ayers et

al. (2011). An exploratory study was performed by Pagell and LePine (2002), with a focus on identifying factors that affect team performance. Their data suggests that **informal communication** is largely reliant on physical layout, working structure and rules or the philosophy of management. Informal communication is defined as team members easily being able to communicate outside of formal meeting arenas. To increase informal communication, **informal meeting points** may be arranged at several places in the building, with for instance free coffee and available resources for short informal meetings. Having these areas may enable a more informal atmosphere, and further relieve both useful and unutilized information (Griffin & Hauser, 1996). Although informal communication is often perceived as a competitive advantage for SMEs, compared to larger firms, and though it can also be considered as a positive element in achieving integration, Vinten (1999) argues that such organizations nevertheless have a similar need for formal communication. According to Kenneth B. Kahn and Mentzer (1996), **meetings** are arenas for verbal information flow and therefore for elements that may stimulate integration. However, it is important to keep meetings brief in to achieve an organization's objectives (Lindlof & Soderberg, 2011). Additionally, Wiengarten, Humphreys, Cao, Fynes, and McKittrick (2010) emphasize the importance of the quality of exchanged information.

Studies of integration performed from the perspective of Social Capital Theory found a positive relation between internal communication and employee satisfaction, and this relation was further positively connected to supply-chain integration (Jacobs, Yu, & Chavez, 2016).

The term **tacit knowledge** has its roots in action, commitment and participation (M. Polanyi, 1967), and has been characterized as having an individual quality that is difficult to communicate and describe (Nonaka, 1994). The concept is closely related to the phenomenological tradition, as exemplified by Michael Polanyi (1958), who states that we know far more than we know we know and thereby refers to a type of knowledge that language or mathematics cannot capture. As tacit knowledge has an indefinable character, it can only be identified by its action. To be able to share tacit knowledge, it is important to achieve transparency in a value chain (Nonaka & Takeuchi, 1995). Based on a study into the visualization of knowledge in project-based work, Whyte et al. (2008) suggest that "visual representation disrupts the tacit-codified dichotomy", which entails that visualization can be said to strongly support the transfer of tacit knowledge.

Job rotation: Job rotation is mentioned by several authors as an important tool by which to achieve integration among professionals (Allen, 1984; Basnet & Wisner, 2012; Carroad & Carroad, 1982; Gronstedt, 1996; Moenaert, Souder, Meyer, & Deschoolmeester, 1994; Pagell, 2004; Roussel, 1991). It is found to be mildly connected to integration in small companies and strongly connected to integration in make-to-order companies. Furthermore, job rotation can contribute to an increased understanding of the problems that may occur at other stations and further contribute to a more holistic view of a company (Basnet & Wisner, 2012).

Theoretical framework

Galbraith (1994) claims that using job rotation between key interfaces can contribute to establishing good relationships and positively affect cycle time. For a project with little formal documentation, for instance, this is especially important. Employees transfer cultural elements, as well as contacts and new relationships, as suggested by Griffin and Hauser (1996):

> *"Moving personnel across functions increases marketplace success and decreases time to market by decreasing thought world, language, and physical barriers between the functions, increasing information utilization and cross-functional coordination, and decreasing technical uncertainty."*

Griffin and Hauser (1996) further state that temporary transfers of employees are shown to be most effective, as functional expertise is thereby preserved at the same time as integration is improved.

Through a survey studying integrated approaches to design in manufacturing, Ettlie (1995) found that companies that used job rotation as a design-manufacturing personnel-integration mechanism had higher sales per employee. Furthermore, in studying job rotation in a global context by comparing organizations from the U.S. and Sweden, they found that both countries rarely used job rotation, with the U.S using it even less than Sweden.

Transfer of managers: The transfer of managers can, according to Turkulainen (2008) cause managers who are being rotated to achieve a broader contact network, which further enables them to communicate more easily and informally with other departments, as a result of which more effective information-processing is achieved. However, one possible disadvantage is the time and effort that are required to learn new tasks, and the time that is needed to develop job rotation. through a study of four European MNCs, Edström and Galbraith (1977) found that sustained international transfer throughout an employee's career forms an important administrative tool by which to socialize employees, and that designing the information system for large MNCs was a powerful resource as it dealt with verbal information. The authors hypothesized that the extensive transfer of managers and fostering multiple contacts among them may be a useful technique for making a verbal network of which expatriate's form part. Hence, the transfer of managers was used as a coordination mechanism.

Co-location: In lean management, co-location is often used to enhance relationships and supply-chain integration for large manufacturing companies, for instance through the co-location of supplier representatives and customers. This model can also be applied to an internal supply chain. Locating the internal supply-chain functions together is found to be positive, as it allows problems to be taken care of easily and employees to have better opportunities to interrelate with other functions (Basnet & Wisner, 2012). However, Galbraith (1994) cautions that while co-locating two groups may render better communication between them, the communication with other groups that are not affected by the co-location may

decrease. Hence, the use of other mechanisms by which to connect with the other groups may be useful. A survey performed by Kenneth B Kahn and McDonough (1997a) with 514 respondents consisting of department managers within the electronic industry generally supported the claim that co-location has a positive effect on the integration of departments. However, the authors indicate that this effect was department-specific, based on the survey. Co-location was found to facilitate collaboration between marketing and R&D, but this was not found to be the case for manufacturing and other departments. No direct relationship was found between co-location and performance, though collaboration was found to contribute positively to both performance and satisfaction.

Cross-functional teams: There is a difference between the degree of integration that companies need and the type of mechanisms that they use to achieve it. When it is important to achieve integration in the value chain, there should be a greater focus on mechanisms of integration as cross-functional groups, according to Turkulainen (2008). The use of cross-functional coordination and cooperation stimulates and fosters skills across functional borders, and contributes to an understanding of common challenges. In addition, it can contribute to revealing tacit knowledge and increases cross-functional knowledge (Lee, 1992). Based on Turkulainen (2008), Daft and Lengel (1986), Galbraith (1970, 1973, 1994) and McCann and Galbraith (1981) present the following advantages of cross-functional teams: decrease of hierarchical overload, generation of possibilities for creativity when different employees with different professional background are in the team, greater ease in recognizing and contacting cross-functional peers, more information sharing across functional borders and decreased equivocality. Furthermore, the following disadvantages are mentioned: time and effort are required to develop the organization of a team and the selection of team members, members need time to adapt to working as a team and time is needed to maintain such a team. This can easily overload team members, as mutual problem-solving occurs on a more daily base.

It is important that cross-functional cooperation is optimal in to achieve good integration. The research of Kathleen M Eisenhardt and Tabrizi (1995) suggests that cross-functional teams can contribute to an earlier detection of problems and consequently shorten development time. X. M. Song et al. (1997) studied an NPD with the R&D interface and manufacturing, and determined which antecedents affected the cross-functional cooperation. From the survey results of all three groups, they found that a firm's evaluation criteria, reward structures and management expectations were perceived to have the most direct effects on cross-functional cooperation and NPD performance.

From a study in the health-care industry, Pinto, Pinto, and Prescott (1993) investigated both the antecedents and the consequences of cross-functional cooperation in projects. Due to their influence on cross-functional cooperation, the antecedents' superordinate goals, physical proximity and project-team standards were found to directly or indirectly affect the outcome of the projects.

Theoretical framework

Griffin and Hauser (1996) note the need for a reassessment of prior research on the integration of R&D and marketing departments due to the change in companies' organizational structures towards a flatter structure and team organization. As guidance for future research in the field, earlier research was reviewed and hypotheses for methods by which to integrate these types of departments were developed. Their review, together with their hypotheses, was presented within the framework of a causal map that was developed for studying functional integration. However, they claim that, instead of a separate examination of the hypotheses, researchers should consider situational, structural and process dimensions in the future. Furthermore, the situational dimension is referred to as "the amount and types of integration needed in a project, which depend on such factors as the project phase and the level of project uncertainty." Through the structural and process dimensions, an emphasis is placed on actions that are taken to achieve functional integration, such as "relocation and physical facilities design, personnel movement, informal social systems, organizational structures, incentives and rewards, and formal integrative management processes."

In previous empirical research within OM, much attention has been dedicated to the effects that cross-functional integration have on performance (Turkulainen & Ketokivi, 2012). Turkulainen and Ketokivi (2012) argue that the majority of research on the topic describes the effect of integration on performance to be similarly independent of the influence of different conditions. However, recent research has adopted a more conditional view, and uncertainty, for instance, has been considered as a possible influencing factor.

Functional silos: Organizations are typically organized in functions and responsibilities are related to separate functions, as illustrated in figure 2-10.
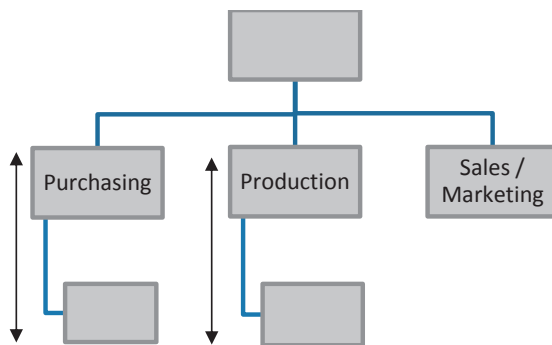
Figure 2-10: Illustration of functional silos

"Working in silos" has for many years been considered to be a typical hinder in achieving integration and even though the topic is well known, it continues to be important for organizations today (Beth et al., 2003; Pagell, 2004; Van Hoek & Mitchell, 2006).

It is often observed that functional boundaries obstruct good process management when an organization's focus is to improve single functions rather than a process as a whole. To exemplifies this, Christopher (2011) illustrates it with an oil refinery, in which the production process is controlled as an united stream and not as single elements.

Organizations that contain functional silos can often create managers who act like "barons" and want to defend their territory. Because of their "jealousy" towards other functional managers, they are reluctant to cooperate with other functions (Christopher, 2011). As a contribution to increasing cross-functional work and further enabling operational integration when organizations struggle with functional myopia, the use of different types of collaboration is suggested by several authors (Kenneth B. Kahn & Mentzer, 1996; Stank et al., 2001; Stevens, 1990). Furthermore, existing research on integration has found that moving departments closer to each other contributes to integration in (Leenders and Wierenga, 2002; Basnet and Wisner, 2012).

2.2.2 Management support / vertical integration

Much of the literature focusing on integration claims that management plays an important role in achieving integration (Basnet & Wisner, 2012; I. J. Chen & Paulraj, 2004; Lawrence et al., 1967). Organizational behavior is influenced by management and there is therefore reason to believe that if top management stresses the importance of integration towards functional departments, those departments will comply.

For an organization to achieve integration in their value chains, its management should participate, focus on the importance of integration, and set the course and culture of the organization, according to for instance (Barki & Pinsonneault, 2005; Basnet & Wisner, 2012; Braunscheidel et al., 2010; Daugherty, Ellinger, & Gustin, 1996; Drupsteen et al., 2016; Griffin & Hauser, 1996; Morash & Clinton, 1998; Nabavizadeh et al., 2013; Pagell, 2004; Wheelwright, 1992).

D. Mollenkopf et al. (2000) claim that integrated organizations include integration into their strategies. Nabavizadeh et al. (2013), Gupta et. al. (1985-1987) and Child (1972) claim that management should act as a tool to affect integration between functional groups. Management should aim for creating an organizational atmosphere that enables integration, in which each function has an understanding of the other functions' needs, and bonus and rewards systems are mutual. Management should have a facilitating role and secure that the organizational strategy is communicated downwards in the organization, while simultaneously inspiring cross-functional work to give employees an understanding and positive perception of the given guiding principles (Slater & Narver, 1994).

Also found to be of importance for the collaboration between functions to succeed is the kind of attitude that department managers have towards other functions

(Ellinger et al., 2006) and that which management has towards collaboration (Le Meunier-FitzHugh & Piercy, 2007).

Through a study of R&D-marketing integration versus innovation success, Gupta et al. (1986) suggest five variables that can be influenced by senior management to develop an environment with a greater degree of integration between departments:

(1) Management promoting the need for integration
(2) The establishment of joint reward systems
(3) A balancing of the long- and short-term objectives of a company
(4) Management encouraging risk-taking
(5) Providing occasions for R&D and marketing managers to know and comprehend each other

A low degree of hierarchy can positively contribute to integration (Braunscheidel et al., 2010). To achieve this, the commitment and participation of management is important (Basnet & Wisner, 2012; Morash & Clinton, 1998). If management tries to reduce the barriers between two functions by changing existing structures and measures, it should be aware that this process may also create new barriers for integration if middle managers who reached their position by following "old rules" are resistant to changing the course due to the fear of losing authority (Griffin & Hauser, 1996).

As previously mentioned, what management focuses on is of importance for the degree of supply-chain integration. H. Chen, Daugherty, and Landry (2009) found that the existing literature showed little consensus of the meaning of supply-chain process integration. To examine what affects integration and find further support for which integration is useful, they interviewed supply-chain managers from both China and the U.S. In answering questions about the key drivers for supply-chain process integration, customer and cost orientation were distinguished as the two most influential antecedents.

Customer orientation: The literature refers to an organization's orientation towards the customer as a factor that influences integration (H. Chen, Daugherty, & Landry, 2009). Customer orientation is defined by Deshpandé, Farley, and Webster Jr (1993) as "*the set of beliefs that puts the customer's interest first, while not excluding those of all other stakeholders such as owners managers, and employees, in order to develop a long-term profitable enterprise.*"

Cost orientation: An organization has a cost orientation when the main focus lies on trying to find and exploit all types of cost benefits (Parthasarthy & Sethi, 1993).

Even though there exist some studies on the effect that management support has on integration, there continues to be a need to further investigate the topic, according to Basnet and Wisner (2012).

2.2.3 Consensus integration

It is often observed that functional goals and attitudes are in conflict in organizations (Ellinger et al., 2006), which could negatively influence the possibility to attain integration of the supply chain (Stevens, 1990). It is important that a collaborative supply chain is a mutual objective, in which common initiatives are made to secure that each value-chain participant benefits from success (Simatupang & Sridharan, 2002).

A key component in the integration process may be to achieve consensus, as consensus is by Pagell (2004) defined as having an agreement and knowledge of that an agreement exists, on the strategic priorities. Furthermore, to achieve consensus it is important that all of the members of an organization frequently communicate the main goals and priorities for the value chain (Pagell, 2004). The overall company goal and strategy should be decomposed into "subtasks" that are relevant for employees (Malone & Crowston, 1994).

A study performed by Lawrence et al. (1967) found a direct link between functional consensus and achieved performance. The organizations in this study had achieved consensus by using mechanisms for coordination. The same was experienced in a study by Ellinger et al. (2006), in which the use of planning techniques was found to contribute to a higher level of interdepartmental consensus. The research of Basnet and Wisner (2012) indicates that it is possible to achieve increased integration if functions are made mutually responsible for accomplishing company goals.

Pagell (2004) describes consensus as follows:

"*High levels of consensus would be indicated in a plant where all managers agreed on the business strategy, where all functions were supporting the business strategy and each other, and finally where all managers knew this was going on.*"

The data of Pagell (2004) suggest that strategic consensus is a key indicator of integration, rather than its predecessor.

2.2.4 Formalization & standardization

To achieve integration, it is essential to comply to established and standardized systems, according to Bowersox et al. (1999). The interdependencies between two process-steps are characterized by a producer/consumer relationship. Hence, what is produced in a preceding process step must be usable in the following process step. Standardization of work may be necessary to ensure that the output fits the expectations of a user (Malone & Crowston, 1994). Standards prescribe how employees should act and consequently secure coordination of the work, according to Mintzberg, Quinn, and Ghoshal (1995). Hence, standardization may enable coordination and is thereby a mechanism that has the potential to drive

47

integration. Standardization of work is further found to be appropriate in dealing with complex and less structured work and activities. As products and processes become more complex, a higher degree of formalization is required (Rondeau et al., 2000). If this is difficult to achieve, the standardization of output is considered to be an effective mechanism for integration. Finally, if it is not possible to standardize the processes nor the output, the establishment of standards for norms, skills and knowledge is considered to be the most suitable approach (Glouberman & Mintzberg, 2001).

D. Mollenkopf et al. (2000) define formalization as rules by which to direct behavior and the degree to which those rules control employees' actions. They found formalization to be negatively related to integration, but also to the integration-related coordination of activities. Hence, they suggest that, to the extent that rules negatively affect flexibility or unique solutions, formalization may be a hinder to integration. A study of the perceived integration between marketing and R&D in Japanese firms also suggests that formalization is negatively related to integration. The author's explanation is related to the lack of description of activities between the two departments, as appeared in their written communication (Song, 1993). Moenaert and Souder (1990), and H. Chen, Daugherty, and Roath (2009), on the other hand, argue that having clear roles and responsibilities can improve the information flow between R&D and marketing.

Ayers et al. (2011) suggest that management can take the following actions to formalize integration:

- Arranging obligatory weekly meetings
- Creating cross-functional constellations
- Establishing information-exchange programs such as e-mail, Group Ware, etc.
- Physically relocating employees

They further claim that it is important not to consider changing relational norms as a "quick-fix", as doing so may take years to achieve and rushing the process will at best result in limited success.

Establishing formal arenas or standards for interaction may contribute to increased interaction (Ayers et al., 2011) and improved integration. However, it is important to focus on the quality of interaction rather than only aim to increase interaction frequency, as this can only cause inefficient interaction between the involved parties(Ayers et al., 2011). According to Pagell (2004), the existing literature shows evidence that real-time/informal communication is preferable over formal/scheduled communication. However, formal communication can be necessary if real-time communication is difficult, for instance due to large distances. According to Rondeau et al. (2000), the competitive gains are higher for companies that have a high degree of standardization.

2.2.5 Information systems

In the book "*Shared minds: the new technologies of collaboration*", Schrage (1991) stresses that it is important to bear in mind that, even though we use technology to shape our environments, technology is shaping us. He further claims that new technology readjusts and redefines our perceptual world, as well as our relationship with our environment.

Many managers think that investing in new technology will solve their information-sharing challenges. However, installing new systems for information sharing is seldom the only solution (Drupsteen et al., 2016; Pagell, 2004). It is equally important to ensure a willingness among personnel to share information (Fawcett et al., 2009). It is also important to ensure that there is sufficient information infrastructure, as a poor strategy may lead to reduced value-chain integration given that the abilities to obtain, accumulate, control and transfer data can become less efficient (Muckstadt et al., 2001). Furthermore, the implementation of new technology requires a greater use of cross-functional work (Turkulainen, 2008).

According to Gattiker (2007), OM literature concentrates on the marketing – manufacturing interface and focuses to a minor degree on information technology as a mechanism for integration. On the other hand, literature published by IT vendors positions the use of IT as a way by which to achieve good interdepartmental integration. In contrast, Galbraith (1994) finds that the use of information systems does not necessarily affect integration in a positive way, as how and whether information is processed is also of importance. An organization with information systems and databases that are not fully integrated and consistent across organizational functions may experience major hinders for integration, and dysfunctional conflicts and discussions may arise regarding the question of who has the right data. Within companies that have common databases for all members, a higher degree of honesty and less "data games" are experienced (Galbraith, 1994). Studies exist (Boone & Ganeshan, 2002) that examine in which way common technology platforms can assist value chains in having a more unified technology platform and hence becoming more integrated.

Gattiker (2007) claims that few studies focus on the use of information systems to manage the interface between marketing and manufacturing. His study of these two functions suggests that it was experienced that the more dependent functions there are, the greater the benefit of investing in information systems such as ERP (enterprise resource planning) to control interfaces. Leenders and Wierenga (2002) found a positive relation between the use of ICT, and the integration between marketing and R&D. They experienced ICT to improve day-to-day communication, and additionally enable knowledge creation among functions. The research of Basnet and Wisner (2012), however, did not find any support for this and they call for more research to be pursued on the topic.

2.2.6 Facility and layout

The literature also emphasizes the importance of locating functions within close distance to each other and without barriers in achieving integration (Allen, 1984). The probability that two employees communicate once per week is claimed to be proportional to the distance between them: the more distance there is between two people, the smaller the probability that they communicate at least once per week. This decreases rapidly with the physical distance between them. If offices are separated by 10 meters, the probability of communication occurring is found to be less than 10%. To avoid the drop-in communication between employees, companies can relocate the affected parties. This does not necessarily solve the problem, as there may be other factors that influence communication in a negative way (Griffin & Hauser, 1996). While it may be necessary to break the plant into subunits that relate to separate departments, Hayes and Wheelwright (1984) claim that this often leads to the creation of a "plant within a plant".

The proximity between teams or functions has been found to have an impact on integration ((Leenders & Wierenga, 2002; Pagell & LePine, 2002; Pinto et al., 1993). The more distance there is between units, the easier it is for each subunit to organize itself to meet its responsibilities. However, achieving open communication among employees who work in separate sub-units can become difficult because of the separation. A focus should be placed on developing relational norms between departments.

Team-related literature such as that of Pagell and LePine (2002); Pinto et al. (1993); Van den Bulte and Moenaert (1998) suggests that the layout of facilities, the design of work and proximity influence how teams can achieve real-time communication in to contribute to an improved team performance. According to Pagell (2004), departments that work together can be characterized as teams if they are integrated. Through a qualitative study of a series of cases aimed at identifying factors that influence teams' effectiveness, Pagell and LePine (2002) claim that there is a high degree of informal communication if team members can communicate easily outside of formally arranged meetings. Moreover, they found informal communication to be fundamentally related to the three following parameters: the layout of the facility, the organization of the work, and the philosophy and guidelines of management. If employees were allowed to leave the workplace to communicate with each other, informal communication occurred. However, when this kind of movement was discouraged, it had a negative effect on informal communication. Physical nearness, possible danger, the philosophy of the manager, the price of leaving the work space and the union's work rules are recognized as factors that discourage informal communication. However, the research of Pagell (2004) reveals no relation between the size of a plant and the degree of integration.

2.2.7 Measurements and rewards

According to Galbraith (2002), the purpose of a reward system is to align an employee's goal according to an organization's orientation. It provides motivation and incentive for the completion of a strategic direction.

The way in which rewards are allocated across different unites is probably the most important factor contributing to organization-wide integration, according to (Coombs & Gomez-Mejia, 1991). Leenders and Wierenga (2002) call attention to the lack of attention that has been dedicated to measurements and rewards as mechanisms of integration, despite the fact that these mechanisms are found to stimulate certain behaviors. An adequately composed system of compensation may contribute to making employees more focused towards organizational goals. A value chain that has aligned bonuses may create an aligned focus and collaboration between functions, contribute to the reduction of conflicts and have a positive influence on integration (Moberg et al., 2003; Nabavizadeh et al., 2013). On the other hand, if goals are occasional and not functionally coordinated, the willingness to cooperate can decrease (Ellinger et al., 2000; Good & Schultz, 1997; Griffin & Hauser, 1996; Sabath & Whipple, 2004). Claiming that many organizations use individual-based performance evaluation, Coombs and Gomez-Mejia (1991) present the following instructions for how to attain cross-functional collaboration in high-technology companies:

- The reward systems should be based on customer-service performance, and acknowledgement and compensation should be linked to cross-functional collaboration to improve the degree of cooperation and mutual problem solving. This inspires information sharing and a culture that supports mutual activities.
- Cross-functional collaboration should be clearly integrated as a key factor in the performance assessment of all employees, to illustrate that individualistic behavior is undesirable and that collaborative behavior is desired.
- Performance indicators should reflect that both functional areas are involved. I.e., the use of customer-service surveys and feedback from visits by senior management can be used as a foundation to decide on the bonus compensation, instead of function-specific performance measures.

In a comprehensive study of three hospitals, Drupsteen et al. (2016) experienced that a silo-mentality was caused by the fact the hospitals' main focus lay on departmental measures rather than on overall value-chain performance. Measures that should cover the overall value chain were suggested to improve value-chain integration.

Ellinger et al. (2000) claim that it is important that departments think in processes rather than functional units, to achieve optimal collaboration between departments. They suggest that evaluation and reward that acknowledges

teamwork and cooperation can have a positive impact on integration and accordingly on performance. Furthermore, research of Leenders and Wierenga (2002) shows that having two different functions with the same rewards and career opportunities positively influences integration.

D. Mollenkopf et al. (2000) assert that rewards can be used to nurture coordination in the integration process, but may not function as a bribe to develop integration. They further claim that rewards cannot replace an established culture if they come from strategic decisions.

2.3 Chapter summary

Through a presentation of the theoretical background, this chapter discusses some of the main topics related to integration, as well as the antecedents or mechanisms that affect integration. The concept of integration has been studied from various perspectives, and with different terms and definitions, which makes the research on the topic complicated. Despite the extensive amount of research that has been done in the field, several authors call for a clarification of the concept. According to Turkulainen and Ketokivi (2012), the literature often describes how companies have attempted to achieve integration, however small the outcome of their efforts. Although much focus has been placed on the topic of integration, few empirical studies have been performed on the antecedents of integration and the research that exists is mostly focused on why organizations should aim for integration, rather than on how to achieve integration. Studies on the antecedents of integration have been performed from different perspectives. This thesis therefore groups them into seven different categories in to form a basis on which to categorize the empirical findings for the ensuing research. In this chapter, each of these categories has been discussed and related to the relevant literature.

The following chapter presents the research questions and the rationale for each of them. Thereafter, the research methodology that was applied in answering the research questions is presented.

Chapter 3

3   Methodology and research design

Karlsson (2008) characterizes the objective of research as the "*creation and development of knowledge, and the value of research as the contribution it makes to academia and practice."* Moreover, good research is often considered to be relevant for practice, contributes to the academic field and presents a significant contribution to knowledge.

Methodology is by Arbnor and Bjerke (2009) defined as an understanding of how methods are created, which implies how an operative paradigm is established. The aim of this chapter is to provide a methodological review and discussion by which to demonstrate the origin of the formulation of the research questions and how they are answered through this thesis.

Firstly, this chapter presents the main perspective, purpose and objectives of the research. Thereafter, a chronology of the research and publications are presented. A presentation of different research paradigms and an introduction to different research approaches is subsequently discussed, followed by a presentation of the different methods used for data collection. The last section discusses the reliability, validity and generalizability of the research. Figure 3-1 illustrates the chapter structure.
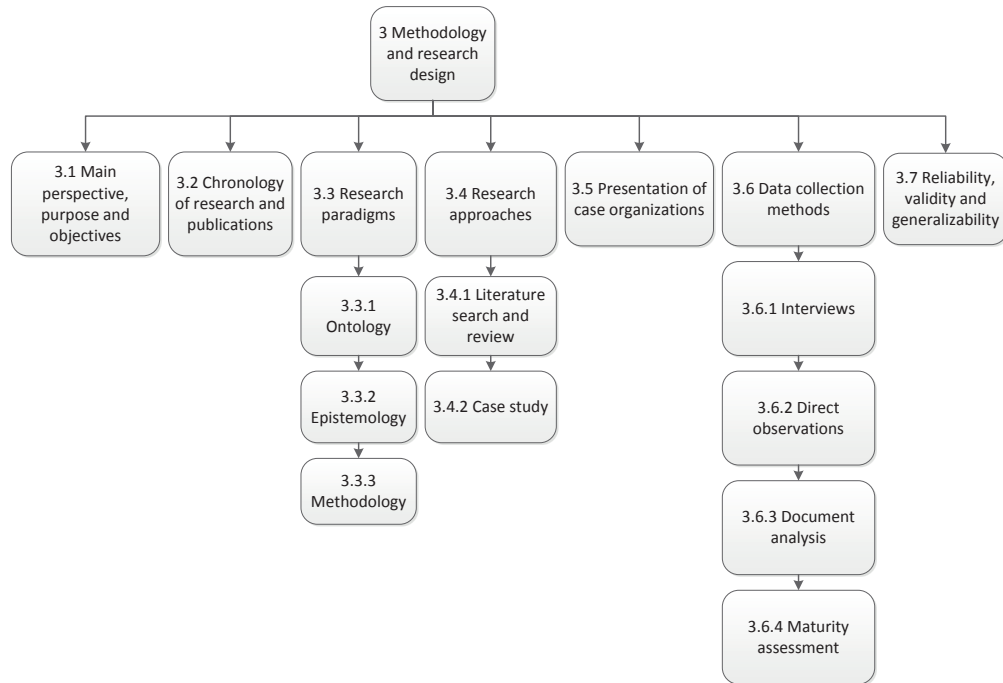
Figure 3-1: Structure of chapter 3

As introduced in the first chapter, the motivation for studying this topic was multilateral, which entails that both the personal and professional experiences, as well as the academic background influenced the choice for the topic of study. An extensive review of existing research in the field (presented in chapter 2) shows that, despite the vast amount of research that has been done on the topic there continue to be several unanswered questions. The first section of this chapter presents the main perspective, purpose and objective of this thesis. The motivation for the choice of research questions is described together with an introduction to how they are resolved in this thesis.

3.1 Main perspective, purpose and objectives

According to Yin (2009), the purpose of research can be either exploratory, descriptive, explanatory or policy-oriented. This is obviously related to the type of research that is performed and may also change during the research period.

The use of case studies is considered to be valuable for diverse kinds of research purposes, such as exploration, and theory-building, -testing and -extension. Table 3-1 illustrates the typical structure that is used for case-studies in relation to research purpose (C. Voss, Tsikriktsis, & Frohlich, 2002).

Table 3-1: A match of research purpose with methodology (Voss et al. 2002a)

Purpose	Research question	Research structure
Exploration Reveal areas for research and theory development	Is there something sufficiently interesting to justify research?	In-depth case studies. Unfocused, longitudinal field study
Theory building Identify / describe key variables Identify linkages between variables Identify why these relationships exist	What are the key variables? What are the patterns or linkages between variables? Why should there be a relationship?	Few but focused case studies In-depth field studies Multi-site case studies Best-in-class case studies
Theory testing Test the theories developed in the previous stages Predict future outcomes	Can the generated theories survive the test of empirical data? Do the data render the behavior that was predicted by the theory or is an unanticipated behavior observed?	Experiment Quasi-experiment Multiple case studies Large-scale sample of population
Theory extension /refinement To better structure the theories considering the observed results	How generalizable is the theory? Where does the theory apply?	Experiment Quasi-experiment Case studies Large-scale sample of population

The main purpose of this thesis is to build theory and explore the existent field of study. This is described more thoroughly in the next sections.

This PhD thesis raises five main research questions (RQ1-RQ5). The research questions and their corresponding objectives are presented in table 3-2.

Table 3-2: Research questions

RQ no.	Question	Objective
RQ1	How are the topics of integration covered in the existing literature?	Describe current research on the topic of integration
RQ2	Which enablers and disablers affect the integration of the main value chain in the different sectors?	Create a better understanding, based on both theoretical and empirical findings, of which enablers and disablers affect the integration of the main value chain in different sectors.
RQ3	What are the significant differences in integration in different sectors?	Through a comparison of empirical and theoretical findings, map the differences and similarities between the integration processes in different sectors.
RQ4	Which facilitators for integration are used within the different sectors?	Based on theoretical and empirical findings, map the use of different approaches by which to facilitate operational integration within different sectors.
RQ5	How can an integration maturity assessing model be developed to be a valuable tool for value chains that aim towards increasing the degree of integration of the value chain?	Establish a tool that can assist practitioners in assessing the integration maturity of their value chain.

What follows is a brief description of the five research questions and why they were chosen, as well as an introduction to how they are answered.

RQ1: How are the topics of integration covered in the existing literature?

In the literature, a great deal of attention has been given to the topic of integration, but this has occurred in many ways and from different perspectives, so that the literature can be both inconclusive and contradictory, according to authors such as Autry et al. (2014); Leuschner et al. (2013); Mackelprang et al. (2014); Turkulainen and Ketokivi (2012), and Frankel and Mollenkopf (2015). To better understand and attain an overview of the existing research and the gaps that exist on the topic of integration, it was essential to lay a foundation based on the existing literature. This contributes to a better knowledge of possible limitations and weaknesses. In this study, both exploratory and descriptive approaches are reviewed. The answer to the research question is given in the theory section (chapter 2).

RQ2: Which enablers and disablers affect the integration of the main value chain in the different sectors?

Authors such as Basnet and Wisner (2012), and Gattiker (2007) call attention to the fact that existing research on the antecedents of integration is mainly survey-

based and mostly focuses on a few mechanisms. Hence, they call for more empirical studies into the antecedents of integration, as well as studies that connect them. The purpose of RQ2 is to contribute to reducing this gap by providing further knowledge, based on both theoretical and empirical findings, of which enablers and disablers affect the integration of the main value chain in different sectors. The answer to this question is formulated based on the theoretical findings presented in chapter 2 and the empirical findings presented in chapters 4 and 5.

RQ3: What are the significant differences in integration in different sectors?

The literature expresses a need for more studies into different types of value chains to study integration within different organizations and sectors to create more generalizable data (Schoenherr & Swink, 2012; Turkulainen & Ketokivi, 2012; Vallet-Bellmunt & Rivera-Torres, 2013). The third research question was formulated as a response to this request. As there is little research that covers different sectors, this study is both explorative and contributes to building theory. By comparing what affects integration within different value chains that belong to different sectors, an increased foundation for generalization can be established. The answer to the third question is formulated on the basis of the empirical data that are presented in chapters 4 and 5.

RQ4: Which facilitators for integration are used within the different sectors?

Various value chains have different degrees of integration, and their use of various initiatives by which to achieve integration varies. Within this thesis, these initiatives are named "facilitators". The literature refers to diverse initiatives with varying outcomes. This research question focuses on which types of approaches have been adopted within the different sectors. As with RQ3, an explorative process took place in addition to building theory. This answer to this research question is also formulated on the basis of the empirical data presented in chapters 4 and 5.

RQ5: How can an integration maturity assessing model be developed to be a valuable tool for value chains that aim towards increasing the degree of integration of the value chain?

Based on the summary of the literature and earlier findings, the aim of this question is to propose a framework for the maturity mapping of integration that can assist practitioners who aim to improve the degree of integration of their value chain. This tool is expected to be relevant for value chains from different sectors. The answer to this research question is formulated in chapter 5 by presenting an integration-maturity assessment model and demonstrating its use with empirical data from the five different case companies. By presenting the maturity model, the answer to this research question can be viewed as normative.

The nature of the research for this thesis changed during the research period. It began with the first research question, for which the answer is based on existing integration-related theory. Thereafter, the answer to RQ2 originated in both theory and empirical results. The answer to RQ3 has its main roots in empirical data, while the answer to RQ4 is rooted in both empirical data and theory. The answer to the last research question was established as a sum of both empirical and theoretical data. The progress between the research questions is illustrated by the following figure (3-2):
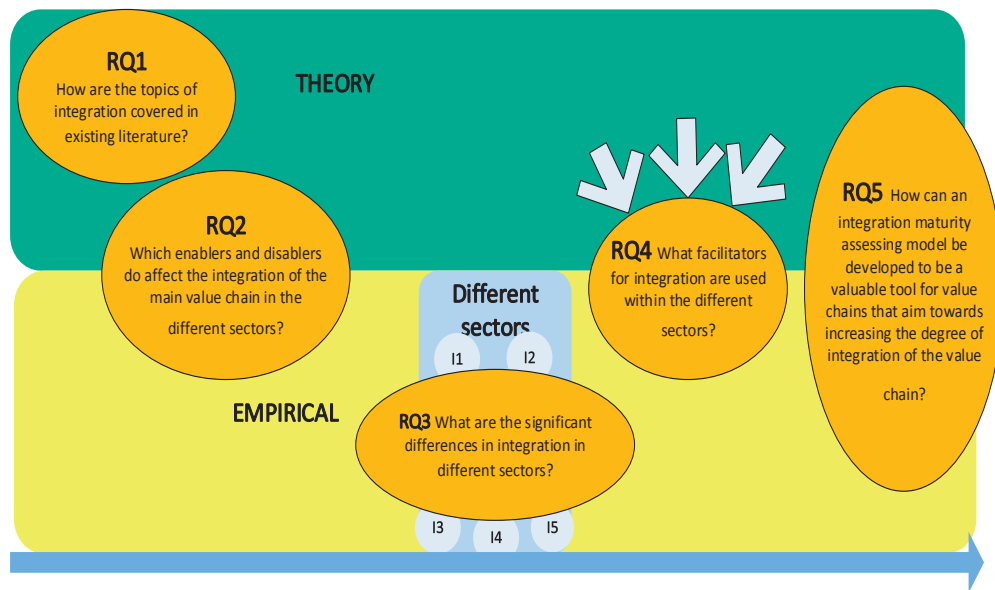
Figure 3-2: Progression of research questions

The following section describes the progression of the research in relation to the articles that were published for this thesis.

3.2 Chronology of research and publications

During the PhD period, four publications were developed (see figure 3-3).

Publication I
Enablers and Disablers for
Operational Integration in a
Craft-oriented Small
Enterprise

Publication II
Enablers and Disablers for
Operational Integration in a
Craft Oriented-versus a Mass
Production Enterprise

Publication III
Operational Integration in
Health Care versus Mass
Production

Publication IV
Assessing Leans' Impact on
Operational Integration

Figure 3-3: Publication overview

The logical sequence of research and publications is presented in figure 3-4 (also presented in chapter 1). C1-C5 represent the case studies. C1 is the craft company, C2 is the MP I, C3 is the H, C4 is the MP II and C5 is the SP. P1-P4 represent the publications.
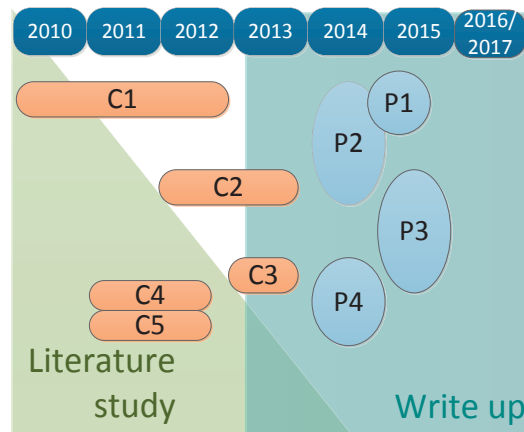
Figure 3-4: Chronology of research and publications

Methodology and research design

Figure 3-5 presents an overview of the relationship between the publications and the research questions. Three papers, namely P1, P3 and P4, were sent to a journal and have been published. Paper P2 was presented at a conference and published in the proceedings. The answer to RQ1 is formulated in the theoretical chapter and based on the theory presented in the papers. The answers to RQ2 and RQ3 are covered by the empirical studies presented in P1-P4. Finally, RQ4 and RQ5 are a synthesis of the empirical work, and are planned for publication in the future (P5 and P6).
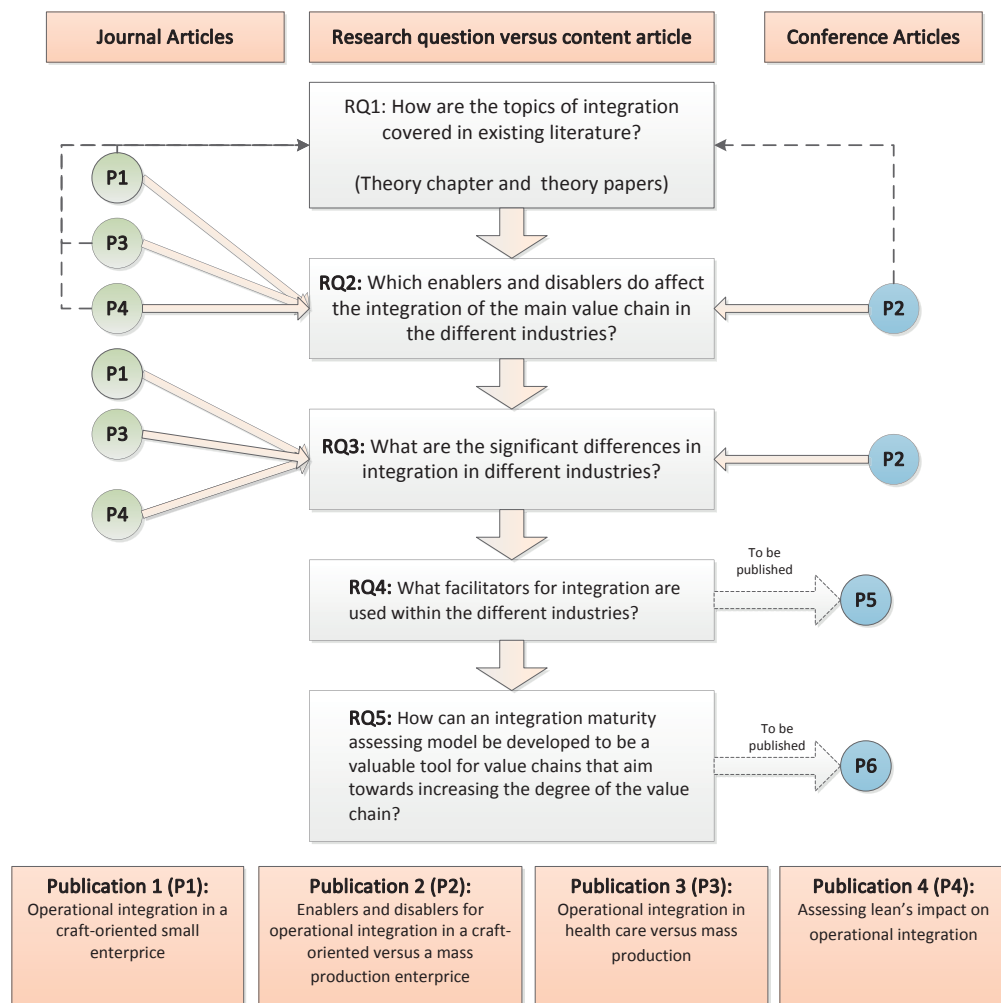
Figure 3-5: Relationship between publications and research questions

The following table presents which case studies that are presented in the different papers.

Table 3-3 Cases presented in the different papers

Paper	Case studies
P1	C1
P2	C1+C2
P3	C2+C3
P4	C4+C5

3.3 Research paradigms

When researchers enter the field of study, they have specific beliefs about what knowledge is, what is possible to know and how it is possible to achieve knowledge. This set of beliefs can be referred to as a paradigm. According to Guba (1990), paradigms can be characterized through three aspects: *ontology*, *epistemology* and *methodology*. The first aspect, *ontology*, entails a supposition of reality: what is real? The second aspect, *epistemology*, regards the nature of the relationship between the inquirer and the known. The third aspect, *methodology,* regards the approach and methods that are adopted in exploring knowledge. These three assumptions can be considered to be consequential for each other, which entails that how a researcher views the ontology of a topic influences his/her epistemological view of it, which further affects how human nature is viewed. As a consequence, researchers choose a methodology based on the assumptions that have already been made (Mazzocato et al., 2012).

The terms *epistemology* and *ontology* are central to theories within philosophy of social science. O'Leary (2013) describes them as follows: *Ontology* is "*the study of what exists, and how things that exist are understood and categorist*" while epistemology is "*how we come to have legitimate knowledge of the world; rules for knowing.*" These two terms are often reason for debate, as rules for knowing and perceptions of what is real can differ. Hence, researchers are forced to develop a clear opinion about their personal orientation to knowledge and reality.

The orientation to knowledge and reality within this thesis: As a researcher, it is important to analyze personal pre-assumptions in seeking to find a philosophical standpoint. My first formal education was graduating as an engineer. Rational topics such as mathematics and physics constituted the main part of this education. Thereafter, I received a master's degree within the topic of process technique. This study placed a greater focus on studying systems and identifying the interrelationships between different elements than my previous education. My professional background is related to many years of working in the production of automobile parts. In this work, the focus is placed on finding the "single right solution", but also on seeing the "whole picture". There is a high degree of using standards for how the work should be done. Nevertheless, through problem solving, for instance, there was a focus on identifying how different process elements interrelated and cross-functional work was used as a tool to assist in gaining a more holistic view. For two years, I was responsible for the development of a company's information system. In this work, it was important to understand

the entire value chain and how all of the process steps were related to each other. In addition, over the past 10 years I worked in different research projects and as an advisor within many different value chains and different parts of value chains, and I have filled different positions and solved different tasks. Within this work, it was important to develop a deeper understanding of the working processes to provide the best assistance for the customer. In working on improvement processes within an organization, for instance, it was important not only to observe what happens, but also to understand the underlying mechanisms and how to influence organizations themselves to establish and maintain solutions. In summary, given my initial background, I appear to be rooted in rationalism. However, later experiences caused me to move towards the social sciences.

In finding the philosophical perspective for this research, it was essential to explore the wide-ranging field of philosophical traditions. The aim was thereby to find the best fit with my personal research motivation. Consequently, the focus was placed on finding a good connection between my personal motivation, the method chosen for this work and the particular research conditions. The intention was thereby to identify which traditions in the philosophy of social science best meet the terms of the research questions, the characteristics of the unit of analysis and my perception of reality. The following sections present a theoretical introduction to the different paradigms, followed by a description of my position as a researcher.

3.3.1 Ontology

Ontology is the first of three paradigm aspects and is derived from "on", which means "being" and "logos" which means "theory". Hence, the meaning of ontology is the *theory of being* (Delanty & Strydom, 2003) and concerns questions regarding the fundamental nature of existence (Kvale & Brinkmann, 2010).

Arbnor and Bjerke (2009) emphasize the importance for researchers to be aware of which *view* is used during the *reflection*, as how researchers experience a problem is strongly dependent on that view. They categorize methodological views into three categories: the analytical view, the systems view and the actors view. These three views are illustrated in figure 3-5 and further discussed below.
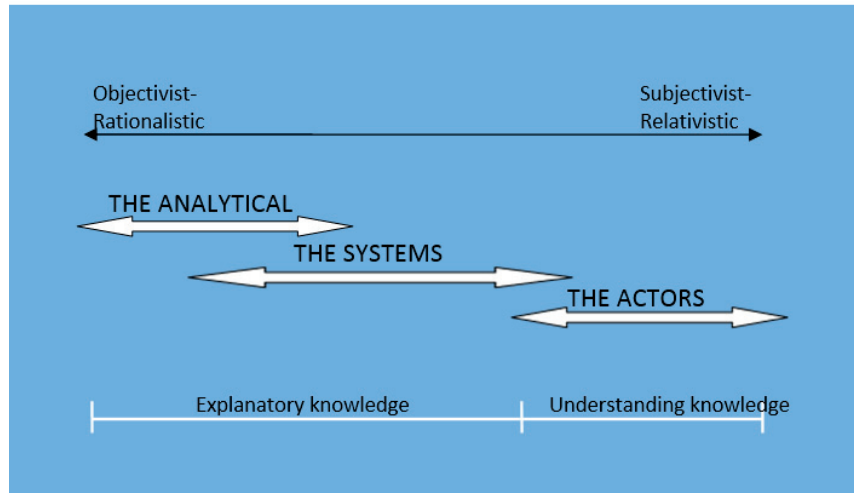
Figure 3-6 Relationship between explanatory knowledge and understanding knowledge (Arbnor and Bjerke, 2009)

The analytical view: In this view, reality is filled with facts that are independent of the perceptions of the researcher. The basis of knowledge is always facts and the aim is to explain reality as objectively as possible. Researchers who adopt this view do not have a special interest in philosophical perspectives. However, they make assumptions about reality, or act as if certain assumptions have been made(Arbnor & Bjerke, 2009).

The systems view: As with the analytical view, this view assumes that there is a factive reality. However, creators of knowledge believe that there is a difference between this view and the analytical view. The systems view is assumed to contain components that are mutually dependent on each other, which entails that it is impossible to sum them up. Hence, not only the content of a single component is important in providing information, but also the combination of components and how they act together. Furthermore, to formulate an appropriate explanation, it is necessary to consider the whole picture. The foundation of the systems view lies in systems theory, holism and structuralism (Arbnor & Bjerke, 2009).

The actors view: In this view, there is an aim to understand how social reality is defined, established and sustained. It differs from the other two views in that models do not only represent reality, but also form it. Through action, the researcher becomes a part of the process and achieves knowledge creation through interchanges with actors in the field of study. In the actors view, objectivity is questioned as it is created by people. This view aims to attain both an external and an internal understanding. An internal understanding entails that performers better understand their situation (Arbnor & Bjerke, 2009).

Methodology and operative paradigm: Arbnor and Bjerke (2009) describe *methodology* as "the understanding of how methods are constructed", and hence "how an operative paradigm is developed." They claim that in discussing a methodology it is important to view the whole picture of study plans, approaches, methods, problem formulations, different methodologies and study areas. The relationships are illustrated by figure 3-7.
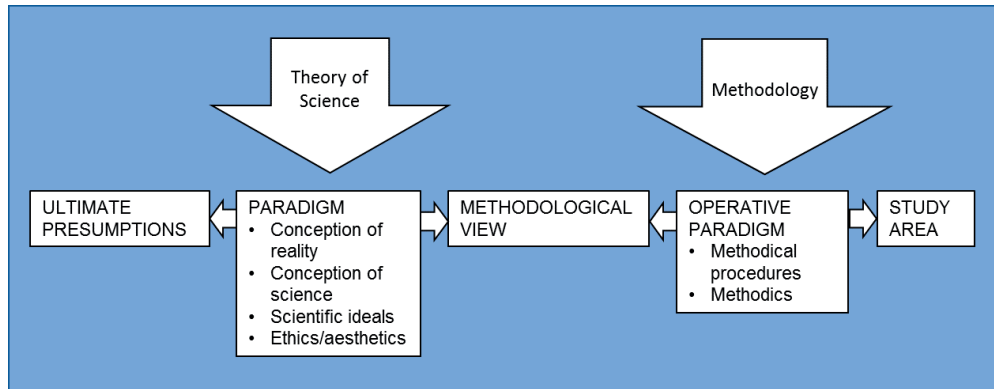
Figure 3-7 Theory of Science and Methodology (Arbnor and Bjerke, 2009)

An outline of the three methodological views that are provided by Arbnor and Bjerke (2009) are summarized and presented in table 3-4, on the following page.

Table 3-4: Characteristics of the three methodological views based on Arbnor and Bjerke (2008)

Objectivists – Rationalistic
Explaining reality

Subjectivist – Relatitivistic
Understanding reality

←—————————————————————————————————————→

	Analytical view	**Systems view**	**Actors view**
Conception of reality	The whole, which is factive, is equal to the sum of its parts.	The whole, which is factive, is not equal to the sum of its parts.	Reality is socially constructed and consists of different levels of meaning structures.
Knowledge	Knowledge is independent of individual observers. Descriptions and explanations of reality are general and absolute.	Knowledge is dependent on systems and reality is described through pictures of systems or parts of systems. Usually, these pictures are not general, but valid for specific classes.	Knowledge is dependent on individuals and the creator of knowledge. Knowledge is based on how actors perceive, understand and act.
Explaining or understanding	Causality / cause-effect. Explanation.	Finality. Explanation or understanding.	Dialectics. Understanding.
Result	Increasingly more verified hypotheses.	An improved explanation or understanding of the behavior of different classes of systems.	Through understanding, the knowledge of those processes that socially construct reality will grow.
Methods for knowledge creation	Representative cases.	Typical cases or partly unique cases.	Interactive action.

Methodological view for this research: The research for this thesis is founded on the systems view. According to Arbnor and Bjerke (2009), this view has strong origins within the philosophies of systems theory, holism and structuralism. Case research is a methodology that is founded on this view and is also chosen for this thesis. The main aim of this research project is to contribute to the increase of knowledge related to the integration of a value chain. The systems view is based on the assumption that the total is different from the sum of each involved element. Additionally, it is important to consider how elements are related (Arbnor & Bjerke, 2009). In studying the integration of a value chain, it is necessary to consider many dynamic elements which could influence each other, though not necessarily. The systems view also assumes that knowledge can be created by trying to develop an understanding of a totality through subsystems and elements. The results that this system renders are typically an improved understanding of a system. In this research, integration has been studied for selected parts of the designated value chains to indicate the state of integration of the value chains.

3.3.2 Epistemology

The second aspect, *epistemology - the theory of knowledge;* is derived from the Greek "episteme", which means "knowledge" and "logos" which means "theory". An epistemological topic within a discipline focuses on what should be viewed as valid knowledge (Bryman, 2012). According to Delanty and Strydom (2003), epistemology covers problems such as how we can know the limits of knowledge, where to draw the line between the knowable and the unknowable, what the limits of achieving knowledge are, what the valid sources of knowledge are and which methods we can use to gain knowledge.

Positivism: An epistemological position known as positivism affirms the importance of reproducing the natural sciences. To describe the positivist principle in a precise manner is extremely difficult, as it is presented in very different ways by different authors (Bryman, 2012). Bryman (2012) defines positivism as "*an epistemological position that advocates the application of the methods of the natural sciences to the study of social reality and beyond.*" The construct is also found to contain the following principles:

- Principle of *phenomenalism:* Only when phenomena (hereafter knowledge) are confirmed by the senses can they be genuinely acknowledged as knowledge.
- Principle of *deductivism*: The purpose of theory is to create hypotheses for tests that allow an assessment of the explanations of laws.
- Principle of *inductivism:* Through the collection of facts that prove to form the basis for laws, knowledge is attained.
- Science must (and most probably can) be directed in a value-free way (i.e., *objectively*)
- There exists a clear difference between scientific statements and normative statements, and the former are the true sphere of the scientist. The first principle implies the last, as the truth or otherwise normative statements cannot be confirmed by the senses.

Realism: Another epistemological position is realism, which has two characteristics in common with positivism: a commitment to the view of a reality that lies out there for scientists to direct their attention to and the use of the same approach to collect and explain data.

Realism can further be divided into two separate directions:

- *Empirical realism*: the understanding of reality can be achieved through a suitably selected method. This direction is often referred to as *naive realism* as realists often think that reality and the terms used to describe it have a perfect or almost perfect conformity.

- *Critical realism*: critical realism holds that identifying the structures that are at work in generating events and discourses is the only way for scientists to understand and further change the social world. According to critical realists, generative mechanisms that are not directly apparent are nevertheless tolerable, as it is possible to observe related effects (Bryman, 2012).

Easton (2010) describes critical realism as a philosophical position that is novel, rigorous and coheren. In addition, it substantiates case research as a method and provides helpful implications for the development of both the theoretical foundation and the research process. Furthermore, the possibility to use causal language to describe the world is an important rule of critical realism (Easton, 2010). It is important to evaluate objects analytically to explain and understand social phenomena (Sayer, 2000).

Interpretivism: This construct is given to distinguish phenomenology from positivism. It summarizes the understanding of authors who criticize the use of positivist models in studying the social environment. These authors are influenced by several intellectual traditions, such as Weber's notion of "verstehen", the hermeneutic-phenomenological tradition and symbolic interactionism.

In comparing *critical realism* with *positivism* and *interpretivism*, it is noteworthy that a relatively wide range of research methods are approved or are compatible with critical realism. This entails that the chosen methods should be dependent on the nature of what is being studied and what the researcher wants to learn about it. The approach of critical realism to case studies is especially appropriate for phenomena that are quite clearly limited, but complex, such as organizations, inter-organizational connections, or nets of connected organizations (Sayer, 2000). According to Bryman (2012), critical realists acknowledge that there is a distance between the object of study and the terms that are used to describe, understand and explain it.

Epistemological position of this research: As the approach of critical realism encourages multidisciplinary research, it is compatible with quite an extensive range of research methods. Compared to interpretivistic and positivist approaches (Sayer, 2000), the critical realist approach has been found to fit with the nature and scope of the research for this thesis. The unit of study, namely the case companies, can be perceived to be of a complex nature, even though the area of focus can be clearly limited (i.e., the main value chains within each case). Furthermore, the research questions focus on a wide range of aspects in which variety is requested for approaches and methods. A more thorough description of how this has been carried through is given in section 3.4. To collect the data for the studies, a qualitative approach was adopted. The characteristics of qualitative and quantitative research, and a more detailed description of how the research is performed in this thesis are given in section 3.3.3.

3.3.3 Methodology

In fields of study that are immature and in which little knowledge exists, the foundation on which to develop theory is minor. Hence, research within such fields is often *explorative* (Karlsson, 2008). However, researchers should be aware of the possible pitfall of assuming that little research has been done in the field if the research issue is defined too specifically. Research projects that are explorative are those that are principally initiated to clarify a problem. Nevertheless, following the analytical view, such studies should begin with a formulation, or at least a preliminary one. If little is known about a topic, it may be difficult to present a good research design. Researcher should find applicable theories and concepts, and if necessary, create new ones, or determine whether existing methodologies can be used (Phillips & Pugh, 2003). When several explorative studies have been performed within a field, and a topic is studied from different viewpoints and with different methods, a foundation of the field emerges. Even more systematic studies of the field can give a better overview of the area and research thereby moves on to a more *descriptive* phase (Karlsson, 2008). Descriptive research results typically focus on components, patterns, structures and systems. Furthermore, a well-performed descriptive research creates a solid basis for analytical studies.

Another kind of research is *explanatory research*, which is intended to explain rather than describe the field of study. This type of research has traditionally been quantitative in nature, but it has recently also been applied for various types of qualitative research (Maxwell & Mittapalli, 2008). Holmström, Ketokivi, and Hameri (2009) describe the fundamental difference between exploratory and explanatory research to be ontological. While phenomena must be created to be evaluated in exploratory research, they already exist in explanatory research and the aim of the researcher is to establish an understanding of them. They illustrate the differences of the two strategies as presented in table 3-5 on the next page.

Table 3-5: Exploratory vs. explanatory research based on Holmström et al. (2009)

	Exploratory Research (Design science)	**Explanatory Research** (Theoretical science)
The phenomenon	"Artificial phenomena" must be created by the researcher	"Out there"
Data	Created, collected and analyzed	Collected and analyzed
Knowledge interest	Pragmatic	Cognitive / theoretical
Disciplinary basis	Engineering, fundamentally multidisciplinary	Natural and social science, primarily uni-disciplinary

Finally, once the underlying mechanisms are known and understood, it is possible to make normative statements.

Methodology for this research: In addition to the research questions and objectives that are presented in table 3-2, table 3-6 presents an overview of the nature of the research questions.

Table 3-6: Nature of the research questions

RQ no.	Question	Objective	Nature
RQ1	How are the topics of integration covered in the existing literature?	Describe current research on the topic of integration.	Descriptive
RQ2	Which enablers and disablers affect the integration of the main value chain in the different sectors?	Develop a better understanding, based on both theoretical and empirical findings, of which enablers and disablers affect integration in different sectors.	Exploratory / Explanatory
RQ3	What are the significant differences in integration in different sectors?	By comparing empirical and theoretical findings, map the differences and similarities in integration processes within different sectors.	Explanatory
RQ4	Which facilitators for integration are used within each sector?	Based on theoretical and empirical findings, map the use of different approaches that facilitate operational integration within different sectors.	Explanatory
RQ5	How can an integration maturity assessing model be developed to be a valuable tool for value chains that aim towards increasing the degree of integration of the value chain?	Establish a tool that can assist practitioners in assessing the integration maturity of their value chain.	Normative

Methodology and research design

The topic of integration has received a great deal of attention in the literature, which has occurred in many ways and from different perspectives, and can be both inconclusive and sometimes contradictory, according to authors such as Autry et al. (2014); Leuschner et al. (2013); Mackelprang et al. (2014); Turkulainen and Ketokivi (2012), and Frankel and Mollenkopf (2015). The first stadium of research therefore took an exploratory approach by addressing RQ1. Authors such as Basnet and Wisner (2012), and Gattiker (2007) state that studies on the antecedents of integration mainly focus on a few mechanisms and call for more empirical studies of the antecedents as well as studies that connect them. Therefore, RQ2, RQ3 and RQ4 were formulated in seeking to contribute to an increased understanding of the mechanisms of integration. Through this research, the field became more known and the study consequently moved towards a more explanatory approach. The data that were captured through RQ1-RQ4 reveal the need for a tool by which to evaluate the mechanisms in relation to each other. Hence, the purpose of RQ5 became to establish a maturity assessment model for the evaluation of value-chain integration. In addressing the fifth research question, a normative approach was adopted to offer recommendations for how to achieve integration through the proposed integration-maturity assessment model.

Qualitative and quantitative research: There have been many discussions about the "right" method for studying social phenomena. The main discussion is related to the use of either a *qualitative method*, which involves an intensive design in which the focus lies on a few units and in which observations are performed and open interviews are conducted; or a *quantitative method*, which involves an extensive design with large samples, and the use of questionnaires and statistical analyses (Jacobsen, 2010; Yin, 2009). Some researchers adopt both methods (Creswell, 2012). According to Marshall (1996), the research question should form the basis for whether a qualitative or a quantitative approach is chosen, rather than the preferences of the researcher.

In pursuing a qualitative study, considering how to approach the research can be confusing and authors have different opinions about what should be the typical structure for performing a qualitative study (Creswell, 2012). A visualization of the central steps within qualitative research is established by Foster (1995) and further presented by Bryman (2012) (see figure 3-8).
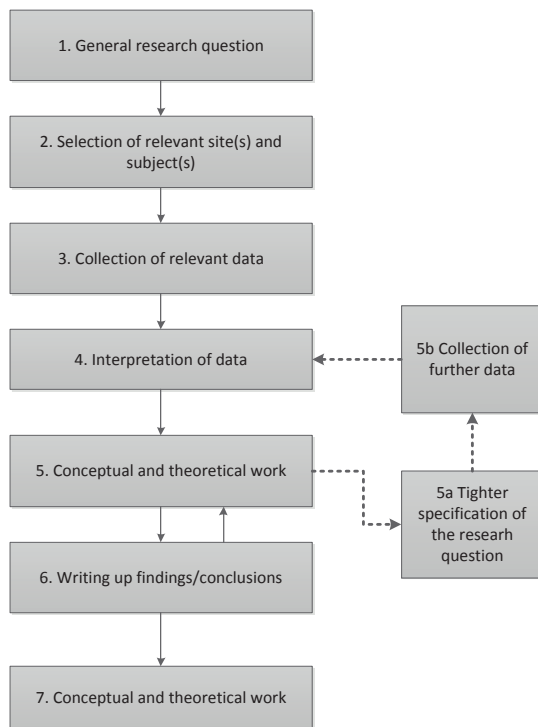
Figure 3-8: Outline of the main steps of qualitative research (Bryman, 2012)

If the researcher decides to perform a qualitative study, the approach of the research design begins with the philosophical presuppositions of the researcher. How a study is conducted and how a report is written are informed by the inquirers' worldviews or beliefs. It is important that researchers are aware of how these assumptions influence the conduction of an inquiry and recognize them during the writing phase. Furthermore, as researchers who perform qualitative studies make use of personal experiences, dialogues and observations, they have to clarify their personal beliefs and suppositions. Moreover, many researchers use theoretical and informative frameworks to form their studies (Creswell, 2012).

Method chosen for this research: Given the multifaceted context of integration and the fact that the primary available units of study were cases (described in more detail in section 3.4.2), which are most appropriately studied through observations and interviews, a generally qualitative approach was chosen for this research. The qualitative approach is useful within this research because qualitative studies aim to shed light on and provide knowledge of complex psychosocial issues (Marshall, 1996), but also due to the need for an in-depth investigation of the research questions.

3.4 Research approaches

From several different research approaches, Creswell (2012) highlights the following five: *narrative research*, *phenomenology*, *grounded theory*, *ethnography* and *case studies*. These are briefly illustrated in table 3-7.

Table 3-7: Five research approaches based on Creswell (2012), and Arbnor and Bjerke (2009)

Research approaches	Definition
Narrative research	- Is rooted in different social disciplines and the humanities - Can be both a method and the phenomenon of study - Focuses on studying one or two individuals - Gathers data through the collection of individuals' stories - Reports individual experiences - Chronologically orders the meaning of those experiences - Reconstructs experiences into a story
Phenomenology	- Describes the meaning for several individuals of their lived experiences of a concept or a phenomenon - Basic purpose: to reduce individual experiences with a phenomenon to a description of the universal essence
Grounded theory	- Aims at developing new theories based on data - Is best suited for open and investigative research - Intends to move beyond description and to create or learn a theory: an abstract analytical map of a process - Based on the idea of systematically collecting and analyzing data by using an iterative process of considering and comparing earlier literature, data and theories emerge as the research process goes on
Ethnography	- Focuses on an entire cultural group - Behavior is studied in an everyday context - Describes the culture or group of study - Gives importance not to imposing any unnatural or experimental circumstances
Case studies	- Involves the study of an issue that is explored through one or more cases within a bounded system - Some researchers claim that a case study is not a methodology, while others present it as a strategy of inquiry, methodology, a type of design in qualitative research, an object of study, or a product of an inquiry - Explores a bounded or multiple system(s) over time through detailed, in-depth data collection involving multiple sources of information

Research approach for this thesis: For this research, a case-study approach has been found to be the most appropriate as it is perceived to be a valuable method for studying complex social phenomena. The aim of this research is to gain knowledge on the topic integration by using several different case studies from different sectors. Through a detailed collection of in-depth data using multiple

sources of information such as semi-structured interviews, observations and document studies, all the cases were studied over a long-time period. To provide information related to the general background and context of the research, a literature review was carried out. The main part of this review took place at the beginning of the research period and additional searches were performed throughout the entire research period.

The following section will cover some theoretical backbone for what characterizes a literature search/review and case studies, and how this has been performed for this thesis.

3.4.1 Literature search and review

A literature review plays a major role in clarifying and identifying the research question (Karlsson, 2008). Robinson and Reed (1998:58) define a literature review as follows:

> "*a systematic search of published work to find out what is already known about the intended research topic.*"

Hence, the review is important in defining the research theme and setting the framework for the research. However, the researcher should be aware of two possible pitfalls:
- Too much time is dedicated to the literature study
- The review is not adequately limited

Therefore, defining a concrete research issue can be difficult (Guthrie, 2010).

Through a literature study, the following questions can be addressed:
- What is the current research on the selected focus area?
- Is this focus area well covered in theory?
- What are the gaps, if any, of this focus area?
- Will the study be an applied or a fundamental study?
- Who will have an interest in this research? (Managers, researchers, policy leaders and funding bodies?)

For a PhD thesis, the literature must span a wide area and assure that relevant literature across different disciplines is accounted for. The research topic and related philosophical traditions should be presented with a high level of analytical and conceptual discussion (Karlsson, 2008).

Literature review for this research: To provide information related to the general background and context of the current research, a main literature review was carried out at the beginning of the PhD. During the research period, supporting-literature searches were performed. The aim of the literature review is to provide sufficient theoretical foundation for the background and framework of the research. As existing research on the topic has been discussed in many ways,

by different authors and with different framings, a wide-ranging literature search had to be performed. To cover the focus area while building a theoretical foundation for the research questions, over 300 theoretical sources were reviewed during this study. Several different sources of information were used and spanned a large range of contexts and research methods. However, the review is nevertheless mainly rooted within the area of OM and organizations theory. Included in the review were journal papers, conference papers, public documents and books.

3.4.2 Case study

There are several ways of doing science, and the case-study approach is one of them. Traditionally, case studies have been criticized for lacking objectivity compared to other research methods within the social sciences. On the other hand, they have often been perceived as valuable tools for the initial, exploratory stage of a research project, and as creating a foundation on which to develop the even more structured tools that are required in surveys and experiments (Rowley, 2002). Important aspects to consider when doing a case study are whether there is relevance to the research questions, whether the phenomenon to be studied may occur and whether the research is feasible and ethical (Karlsson, 2008; Yin, 2009). Case-study research is perceived as one of the most challenging of all efforts in the social sciences and is often used to gain knowledge of individuals, groups, and organizational, social, or political occurrences within a real-life context. The aim is to obtain a rich comprehension of the social scene to describe the context in which events occur and further to determine the extent to which existing theories help to understand the case or whether they require modification (Kathleen M. Eisenhardt & Graebner, 2007). Case-study research can contain one or several case(s) and be explanatory, exploratory, or descriptive (Yin, 2009). With this method, it is possible to have a more detailed development and testing of one approach. It can also often be combined with action research, in which the researcher participates in the development and implementation of the changes that are objects for validation (Greenwood & Levin, 2006). In doing case research, researchers also must take certain obstacles or challenges into consideration. The researcher must be aware of the time it takes to perform a study, as case research can be time consuming. In addition, in performing interviews, it is also required that the interviewers have sufficient skills for the task. Moreover, if the conclusions are to be drawn based on only a limited amount of cases, it is important to be cautious (C. Voss et al., 2002).

The main reason for choosing a case-study approach, according to Yin (2009), is its distinct advantage in situations wherein "how" and "why" questions are posed in to understand a complex phenomenon. Yin (2009) highlights five important components in doing case studies: 1) the questions of the study, 2) the propositions of the study, if there are any, 3) the unit(s) of analysis, 4) the linkage of the data towards the propositions and 5) the criteria for interpreting the findings. Firstly, a topic for the case study should be selected. Thereafter, a set of

research questions or propositions should be identified to set the boundaries for the case study, regarding time, relevant social group, organization or geographic area, type of evidence to be collected, and priorities for data collection and analysis. Using different analytical techniques such as pattern matching, explanation building, time series analysis and so forth, the researcher can link the data to the propositions. As most case analyses do not have the possibility to rely on statistical criteria for interpretation of the findings, an important alternative strategy is to identify and address competing explanations for them.

An important choice in case research is the selection of either *single* or *multiple* cases (C. A. Voss, Frohlich, & Tsikriktsis, 2002; Yin, 2009). The use of a single case can, according to Yin (2009) *"offer a significant contribution to knowledge and theory building."* Even though a single case only gives limited generalizability, there is a possibility to obtain a rich comprehension of the social scene. The researcher should be able to describe the context in which events occur and further determine the extent to which existing theories can assist in understanding the case or require modification (Kathleen M. Eisenhardt & Graebner, 2007).

In case research, it is important to select an appropriate *sample*. The relevance of the research questions, whether the phenomenon that is to be studied appears, and whether the research is feasible and ethical are all important criteria to consider (Karlsson, 2008; Yin, 2009). In doing research with a focus on testing theory, many advocate making a random selection of population samples (Cook & Campbell, 1979). On the other hand, the sample that is selected for qualitative research should be focused and based on the theoretical foundations of the research (Kathleen M Eisenhardt, 1989; Miles & Huberman, 1994)).

In selecting a sample for the qualitative approach, several criteria exist, such as accessibility of the data, different kinds of cases and contexts, suitability for testing the chosen method. The following three main sampling strategies for performing a qualitative study are presented by Marshall (1996):

- *Sample of convenience* is the least rigorous and costly technique in terms of time, effort and money, and implicates the selection of the most available subjects.
- *Judgment sample* is traditionally the most oft-used sampling technique, in which the most productive sample is selected to fulfill the research objectives. This technique is perceived to be a more intellectual approach than the simple demographic stratification of epidemiological research, though it may be important to include variables such as age, gender and social class.
- *Theoretical sample* is explained as "*building interpretive theories from the emerging data and selecting a new sample to examine and elaborate on this theory*."

These three approaches have substantial overlaps, and the research question and choice of type of data analysis are of importance in determining which approach is relevant.

Performing case studies for this thesis: As the topic of integration has been described in different ways by several authors, the next step is naturally to try to understand and organize the topic. Many researchers claim that the empirical evidence in the field is scarce, hence the next phase is necessarily to find additional empirical data that can enhance the existing research base. As mentioned in section 3.3.1, the systems view perceives reality to consist of relations that are mutually dependent on each other, but at times can be partly unique (Arbnor & Bjerke, 2009). As the critical realism approach to case research is found to be especially appropriate for studying complex social occurrences, as well as organizations and phenomena that are quite clearly limited but complex, such as organizations, inter-organizational connections, or nets of connected organizations (Kathleen M. Eisenhardt & Graebner, 2007; Sayer, 2000), different case studies were chosen to form part of the main methodology for this thesis.

In addition to the fact that it appears to be an appropriate method by which to shed light on the problems that are addressed in this thesis (as mentioned above), this research method has traditionally been used within the environment of my professional background. The case-study approach is a suitable choice for this type of research, as it provides a better understanding through an empirical approach in which data are collected through interviews, observations and document studies (Yin, 2009). The case-study methodology that was used for this research is based on empirical material such as semi-structured interviews, observations and document reviews. The method was especially experienced as useful in mapping the informants' perception of the studied phenomena. In addition, it gave an understanding of the underlying processes within the organization and helped to cross check previous observations from the document analysis and personal observations.

This research was conducted as a holistic study (Yin, 2009), which comprises multiple cases with the same unit of analysis. The units of analysis are related to the main value chain, which is that part of a value chain that has a value-adding character. The rationale behind the choice for each case study is described in more detail in section 3.5.

For the choice of research samples, it was necessary to select certain types of industry and a specific type of sample within those sectors. The choice was made to study the phenomena within different sectors to have the possibility to illustrate the topic from different perspectives and to build a foundation for the research to be generalizable for different sectors. The strategy in choosing the different cases studies was that of sample of convenience. In choosing samples for this study, two different issues had to be considered: the choice of industry and the choice of specific case studies within those sectors. In making this decision, emphasis was placed on the possibility to generalize the data to a larger amount of cases within different sectors. In addition, the cases should represent both the public and private sectors.

All the cases were studied over a long-time period and a detailed collection of in-depth data was performed by using multiple sources of information, such as semi-structured interviews, observations and document studies. The data for case 4 and 5 were collected by other researchers, but it was possible to gain insight into the research methods by discussing with the researchers who conducted the investigations. The data analysis was performed in the same way for all cases. Through the case analysis, a focus was placed on identifying mechanisms that inhibit or enable integration in the value-adding element of a value chain. For this analysis, the data were coded according to table 2-7. For instance, evidence of partitions in one of the case organizations was placed within the category "facility and layout". After all case studies were completed, categorization was primarily used to reduce the amount of data and to present it in a meaningful way (Miles & Huberman, 1994; Yin, 2009). For each case, a table was established with the mechanisms that were found to matter in influencing integration. To develop a cross-case analysis, it was necessary to observe the individual mechanisms across each case organization. Hence, "cutting and pasting" was done, by which the specific case-study items were cut from the original data sheet and pasted into the overall data sheet. The data were subsequently reorganized according to the categories that were found to be relevant. The analysis between the cases was then performed by reorganizing the data from single-case data to common constructs and categories.

The studied organizations are two mass producers, a craft producer, a hospital and a service organization, each of which are presented in more detail in section 3.5. The units of analysis in these different organizations are the value-adding elements of their value chains. And stated by Pagell (2004), "*the only way to truly assess the level of integration is by collecting data from respondents responsible for different value creating processes.*" Consequently, this research focuses on ensuring that at least two employees were interviewed within each process step of the value-adding element of the value chain.

Table 3-8 on the next page, presents an overview of the different case studies and how they are related to the articles.

Methodology and research design

Table 3-8: Case overview in relation to articles

Case	Pseudonym	"Products"	Methods used for data collection	Materials used in article
Case 1 (C1)	Craft (CP)	Leisure boats	Individual interviews (semi-structured) Observations Document analysis	1 and 2
Case 2 (C2)	Mass producer (MPI)	Components for utility vehicles	Individual interviews (semi-structured) Observations Document analysis	2 and 3
Case 3 (C3)	Hospital (H)	Health services	Individual interviews (semi-structured) Observations Document analysis	3
Case 4 (C4)	Mass producer (MPII)	Car components	Individual interviews (semi-structured) Observation of meetings Document analysis	4
Case 5 (C5)	Insurance company (IC)	Insurance services	Individual interviews (semi-structured) Observation of meetings Document analysis	4

Table 3-9 offers an overview of the research questions and which case studies were performed in approaching each of them. C1-C5 represent cases 1-5.

Table 3-9 Relation between research question and cases

RQ	Question	Objective	Case
RQ1	How are the topics of integration covered in the existing literature?	Describe the current research front.	Literature study
RQ2	Which enablers and disablers affect the integration of the main value chain in the different sectors?	Create a better understanding, based on theoretical and empirical findings, of which enablers and disablers affect integration in different sectors.	C1, C2, C3, C4, C5
RQ3	What are the significant differences in integration in different sectors?	By a comparison of empirical and theoretical findings, determine the differences and similarities in integration processes within different sectors.	C1, C2, C3, C4, C5
RQ4	Which facilitators for integration are used within the different sectors?	Based on empirical findings, describe which facilitators are used to achieve integration within the different sectors.	C1, C2, C3, C4, C5
RQ5	How can an integration maturity assessing model be developed to be a valuable tool for value chains that aim towards increasing the degree of integration of the value chain?	Establish a possible framework for integration.	C1, C2, C3, C4, C5

3.5 Presentation of case organizations

Five case companies were the objects of study for this thesis: a craft producer (CP), two mass producers (MP I and MP II), a hospital (H) and a service provider (SP). Table 3-10 provides a brief overview of each company's characteristics and corresponding year(s) of study.

Table 3-10: Characteristics of the case companies / organizations

No	Type of company	Domain	Sector	Year(s)
1	Leisure boat producer	Craft production	Private	2008-2012
2	Mass producer of car components for utility vehicles	Mass production	Private	2012-2013
3	Hospital	Health care	Public	2013-2014
4	Mass producer of car components	Mass production	Private	2011
5	Insurance company	Service sector	Private	2011

Case 1 - The craft producer

This first case study formed part of a larger research project that had the overall objective to develop an effective, competitive and profitable production within a leisure boat- and craft-oriented industry in Norway. The overall project period was from 2008 until 2012 and the interviews for this study were performed in 2011. The main project had a focus on modularization and standardization of work processes, and additionally emphasized the preservation of the craft tradition while working towards industrialization to improve the industry's competitive ability. The main project was funded by the Norwegian Research Council. The case company was a craft-oriented leisure-boat producer with approximately 20 employees and had a turnover of about €4 million (2011). Table 3-11 shows the main research characteristics of the case.

Table 3-11: Case-company characteristics of craft producer

Characteristics	Craft producer
Years of study	2008-2012
Main product	Leisure boats
Number of employees	20

The craft company produced 18 to 27-foot boats, the quality of which was perceived to be very high by the market. The production line consisted of three main departments: molding, pre-assembly and assembly. Even though the organization had taken steps towards integration of its internal supply chain, it had a quite functionally oriented structure, with several potentially built-in delays and inventories. There were very few formal reporting structures and systems, and those that existed were process-oriented only to a small extent. However, there was a lot of contact and communication between the foremen and the management

in the manufacturing process. The manufacturing processes were mainly manual and adjustments were made along the entire production line. Little focus was placed on performance measurements in the production line, despite a few figures. The main figures were measured during the daily routines, namely "number of produced boats per week" and "time of flow".

This type of industry was chosen because SMEs are presumed to be the main driving force of future economic growth in industrialized world economies and because the main share of such SMEs are craft-oriented small enterprises.

Case 2 - The mass producer

The second case study is an independent research initiative that was initiated by myself and a PhD colleague. Both of our projects were funded by the Norwegian Research Council. The company that was chosen for this study is a mass producer that produced car components for commercial vehicles. This company was also located in Norway, but formed part of a larger group with operations in four continents.

The case company was chosen because its production paradigm appeared to be quite different than that of the craft sector. The production line had 37 employees and the key value chain consisted of two main process steps.

Table 3-12: Case-company characteristics of mass producer

Characteristics	MP I
Years of study	2012-2013
Main product	Commercial vehicle components
Number of employees	37

Case 3 - The hospital

The hospital was a middle-sized general hospital located in the south-east of Norway. It formed part of a network hospital organization. Each hospital in the network has an independent and autonomous role, and responsibilities in certain defined areas, such as professional and economic issues. On the other hand, the hospital was committed to follow decisions made by the network-hospital board.

Practitioners have for a long time argued that it can be useful for health-care institutions to focus on the automobile industry to learn how to achieve more efficient work processes. The hospital began an improvement program based on the lean philosophy and with supervision from the automobile industry. As the hospital was also trying to move towards a greater "industrialization" of the value chain, it was interesting to determine the extent to which the value chains really differed with respect to integration. Table 3-13 summarizes the characteristics of the hospital.

Table 3-13: Case-company characteristics of hospital

Characteristics	Hospital
Years of study	2013-2014
Main product / service	Patient flow for thrombolysis treatment
Number of employees	265

Case 4 – The mass producer II

The fourth case organization is one of six large Norwegian companies from different industry segments that participated in a larger Norwegian research project. The overall project was built on international research and aimed to create new insights on lean in the Norwegian context specifically. The project began in 2006 and was completed in 2015. Four of the selected companies were traditional manufacturing companies, one was in the telecom industry and one in the insurance/banking industry.

The mass producer mainly produced components for the automobile industry. The company was bought by a large German concern in 2009. The value chain of study was located in Norway.

This case company was chosen because of its history of implementing lean and hence its focus on achieving a streamlined value chain. The case companies for the main research project were chosen because they all have a history of implementing lean in their organizations and continue to work actively with lean. Norwegian companies were selected to examine lean in a Norwegian context. Finally, all of the selected companies were large in terms of revenue and employees, and are situated within the same socio-cultural context, thereby making it feasible to compare the degree of operational integration in the companies' processes. The case company that was studied for this thesis produces components for the automobile industry. Table 3-14 gives a brief overview of its characteristics.

Table 3-14: Case-company characteristics of mass producer II

Characteristics	MP II
Year of study	November 2011
Main product	Billet production, extruded and welded aluminum products for automotive industry
Number of employees	513
Revenue 2011	1.3 billion NOK

Case 5 - Service provider

The case company for the fifth case study, the service provider formed part of the same research project as MP II, as previously mentioned. The SP's main product is insurance of life, and pension, assets and banking. The company is located in Norway and has 1200 employees. In 2011, its revenue was 48 billion NOK. In 2005/2006, the administrative cost became more visible due to official regulations. Hence, a need to reduce the administrative costs arose. Another challenge was that of an

increased individualization, caused by larger responsibility and increased flexibility among employees. The competition in this business was tough. The lean work focused on increasing the customer focus, teamwork and execution capability. The case company's characteristics are presented in table 3-15.

Table 3-15: Case company characteristics of service provider

Characteristics	SP
Year of study	November 2011
Main product	Insurance life and pension, insurance assets, banking
Number of employees	1200
Revenue 2011	48 billion NOK

3.6 Data collection methods

There are several methods for collecting data in research. Watkins (2012) mentions the following methods as the most commonly used for data collection in qualitative research:

- Group interviews/focus groups: Six-eight people discussing a phenomenon.
- Individual interviews: Meetings with individuals to speak about a phenomenon, which can be open-ended, unstructured, semi-structured or structured.
- Participant observation: An observation of individuals in a setting to study a specific phenomenon.
- Document review: A systematic analysis of documents, which provides insight into the background history / information on a study group.

In doing research, there is a risk that the way in which the research is performed has an influence on "creating" the results. Everything that is investigated is affected to a certain degree by the investigation. Knowledge about different methodologies assists the researcher to reflect critically on the collected findings and can contribute to a good discussion on whether the findings have been caused by the methods or whether they render an accurate picture of reality (Jacobsen, 2010).

Triangulation: To increase the robustness of the research, the researcher can use triangulation (Patton, 1990), which entails collecting the same information from multiple sources such as documents and direct observations in the field (Yin, 2009). Triangulation is defined by Bryman (2012) as follows:

"The use of more than one method or source of data in the study of a social phenomenon so that findings may be cross-checked."

Jacobsen (2010) stresses the importance of explaining as thoroughly as possible which methods were used, even if different types of triangulation were used. In

this way, it is possible for readers to judge whether they trust the data or not and for there to be an open dialog about the results.

Based on Miles and Huberman (1994,), Denzin (1978) distinguishes five kinds of triangulation in qualitative research:

- Triangulation by data source (data collected from different persons, or at different times, or from different places)
- Triangulation by method (observation, interviews, documents, etc.)
- Triangulation by researcher (researcher A, B, etc.)
- Triangulation by theory (using different theories, for instance, to explain results)
- Triangulation by data type (qualitative text, recordings, quantitative results)

Triangulation during this research: A qualitative approach was adopted in this research and multiple sources of data were chosen to perform a triangulation of the data. The triangulation was solved in the following way: Data were collected from various organizations within different sectors, through semi-structured interviews with key personnel, direct observations in the value chain, and observations made at informal/formal meetings and workshops. Content analyses of internal procedures, annual reports, process charts, and so forth were carefully performed to confirm or disconfirm the information that the informants provided. In addition, different persons in different situations were asked he same questions with the aim of finding rival explanations. To attain triangulation by researcher, other researchers were involved in both the collection and analysis of the data. Furthermore, different theoretical perspectives such as OM and organizations theory were used to explain the results.

The following sections present the theoretical background for the data-collection methods and a description of how the data were collected for this research.

3.6.1 Interviews

An interview can be either structured or unstructured (Jacobsen, 2010; Karlsson, 2008) and is a common method within the qualitative-research tradition (Ryen, 2002). Even though it may appear easy to conduct an interview, it is difficult to do so properly (Kvale & Brinkmann, 2010). Considering it literarily, one can split the word up into two words: "inter" and "view", from which it can be drawn that an interview is "*an exchange of views between two persons in a dialogue on a topic that is of common interest*" (Kvale & Brinkmann, 2010). The main focus of an interview should be to reveal as much as possible of an "everyday dialogue" (Holme & Solvang, 1998). On the other hand, the interview should be a professional conversation with a focus on attaining a picture of the informant's experiences and worldview to find interpretations of the phenomena that the researchers would like to investigate (Kvale & Brinkmann, 2010). It is important that the researcher

pays attention to what is being said in the interview to make the interviewee feel like an informant rather than a respondent (Yin, 2009).

There exist different ways to categorize interviews, though Berg, Lune, and Lune (2004) suggest the following main categories (Gill, Stewart, Treasure, & Chadwick, 2008):

- *Standardized interviews* are interviews that are formally structured and do not allow the communication to go beyond the predefined questions.
- *Unstandardized interviews* are interviews that are completely unstructured and in which the researcher assumes that none of the relevant questions are known in advance.
- *Semi-structured interviews* are prearranged interactions with certain predefined rules, but informants are able to provide additional important insights into facts, regarding their opinions on a desired topic (Yin, 2009).

Semi-structured interviews are usually used to gain an understanding of the informant's experiences and reflections on the subject. The interviewer makes a list of questions and topics in advance, but there is also a possibility to follow up on topics that may arise during the interview and which are not prepared in advance(Kvale & Brinkmann, 2010).

The number of interviews that are involved in studies is often dependent on the size of the project, economic factors or time availability. However, minor projects have an unwritten rule that about 10-15 informants is natural (Kristoffersen, Tufte, & Johannessen, 2005).

The interview process for this research: As interviews enable the collection of information targeted directly to the chosen topic and have further advantages in providing perceived causal explanations (Yin, 2009), using interviews as a method was found to be well suited to this research. Table 3-16 shows the number of interviews that were conducted per value chain, the process steps that were involved and the types of informants.

Table 3-16 Number of interviews per value chain and types of informants

Characteristics	CP	MPI	H	MPII	SP
Formal interviews	12	11	15	16	8
Informant population	Operators, foremen, managers, production manager	Operators, production manager, foremen, planners, tool manager, quality technicians	Nurses, radiographers, paramedics radiographers, paramedics, attending physicians, clinical nurses, specialist nurses	CEOs, lean managers, production managers, operators, union represent-tatives	CFOs/COOs, customer managers, lean managers, staff members, union representatives

Collecting data directly from informants is perceived to be a good method because informants' possible reflections and articulations, as well as their expertise and closeness to the topic can enrich the impressions of what is being studied. Prior to the research, a research protocol was developed that describes the data-collection methods and includes an interview guide. The interview guide includes open-ended questions on the following topics: information sharing, collaboration, culture, and horizontal and vertical integration. However, the interview guide contains a few slight differences for MP II and SP compared to the other three organizations. The interview guide has main topics and questions such as lean company philosophy, lean implementation and history, lean organization, and lean training and history. However, the research data were coded and analyzed according to the same characteristics. Even though several pre-defined questions were formulated, the interviews could proceed at their own pace, thereby giving the informants the possibility to add important information and data. This is aimed to ensure that the same questions and characteristics are covered through all the interviews, and to ensure consistency among the elements of the research questions.

Semi-structured interviews were chosen as the interview method for all case studies, to identify the enablers and disablers for achieving integration of the value chain. The interviews took the form of semi-structured conversations in which the informants were asked pre-written questions but could answer freely. Moreover, multiple people were asked the same questions, as recommended by Karlsson (2008). Each interview lasted approximately one hour. According to Yin (2009) recommendations, the researchers focused on asking questions in an unbiased manner to serve the needs of the line of investigation, while also aiming to create an informal setting so that informants would open up and provide valuable data. This entails that the process was open-ended and the interviews were conducted in a conversational manner, while nevertheless following a specific set of questions from the interview guide. Understanding the interviewees' experiences and how they reflect on the topic is paramount, and this kind of interview can be useful in uncovering these elements (Kvale & Brinkmann, 2010). The interviewees' response can to some extent reflect that with which the employees were concerned at the moment. For example, in the case of the craft producer, the interviews were carried out at a time in which the company was experiencing certain challenges in connection to component supply. This led to frustration among many of the operators, which may have affected how they comprehended other issues.

At least two informants per process step were chosen for the interviews. The sampling was performed in accordance with the recommendations for qualitative research, which state that it is proper to rely on the broad insights of a few significant informants to achieve a wide-ranging comprehension of a specific phenomenon (Lincoln & Guba, 1985). The interviews at all the organizations were conducted with personnel who are directly involved with the main value chain, but

also with employees who are connected to the value chain to support the findings or collect supplemental information regarding integration.

All interviews were recorded and transcribed (Tjora, 2011; Yin, 2009) according to the categories that were derived from the theory (see chapter 2). They were subsequently analyzed to identify the enablers, disablers and facilitators for integration between the internal suppliers and customers in the value chain. A tabular data analysis was performed with the objective of identifying issues and themes that were relevant for interaction processes.

The process of analyzing the interviews is described in section 3.6.3, together with the document analysis.

3.6.2   Direct observations

Another possible source of evidence in case studies is direct observation. As a case study should be performed in the regular environment of the "case", there is an opportunity to directly observe certain relevant behaviors or environmental conditions of the phenomena. The observations can be of formal or less formal character and allow for the collection of casual data (Yin, 2009).

Observation studies for this research: As the strength of observations lies in the fact that they cover the events and context of cases in real time (Yin, 2009), and make it possible to reflect upon the data collected during the interviews, observation was chosen as an additional method. The observational studies were also connected to the value-adding element of the value streams. At the four manufacturing plants, these observations took place on the shop floor and through participation in meetings. Observations at the hospital were connected to the main section of the patient flow, which is that in which there is direct contact with the patient. In addition, observations were made during several meetings and during the value-mapping process.

3.6.3   Document analysis

With qualitative methods, the focus lies on collecting data such as words, sentences and stories. Additionally, qualitative methods can collect records that are written by other persons. Biographies, letters, official documents, annual reports and so forth can be used as sources. According to Jacobsen (2010), there are three situations in which document analysis is especially recommended:

- Main data are impossible to access (the sources may be dead, do not exist, etc.).
- The researcher would like to investigate how situations have been interpreted by others; written sources are less spontaneous and more thought through.

- The researcher would like to determine what exactly has been said and done; documents refer verbatim to what has been done and can often be quite objective.

According to Yin (2009), archival records have the following characteristics:

- *Stable*: can be reviewed several times
- *Unobtrusive*: not created because of the case study
- *Exact*: contains exact names, references and details of events, etc.
- *Broad coverage*: spans a long period of time, several events and many settings

Document review for this research: Document reviews were found to be an important assisting source of information to support and confirm the information derived from the interviews and observations. Several documents were studied in all the organizations to become better acquainted with the processes and to verify the information derived from the observations and interviews. These include work descriptions, minutes of meetings, shift logs, internal procedures, annual reports, tools and process charts, and strategy documents. In addition, plant tours and walk-throughs were done to visually observe the effects of lean in the organization.

A qualitative approach was adopted to analyze the obtained data. All of the captured data were coded (Tjora, 2011) according to the categories derived from the literature (described in chapter 2). The manual coding process was performed as follows: Differently colored marking pens were used to represent different categories; while reviewing the text, the relevant information for each given category was marked with the corresponding color; the texts were sorted into their relevant categories to create an organized overview based on the category headings.

After analyzing the data, the need arose to perform an evaluation of the degree of integration. The literature refers to maturity assessments as a valuable methodical approach by which to evaluate and establish a comparative foundation for improvement (De Bruin, Freeze, Kaulkarni, & Rosemann, 2005; Fisher, 2004). Hence, it was found valuable to develop a model that suited this kind of analysis. The following section offers an introduction to the characteristics of maturity-assessment models and subsequently presents how this is performed within this thesis.

3.6.4 Maturity assessment

During recent years, numerous maturity models have been developed within several areas to assist organizations in their continual efforts to improve their business so that it can meet the ever-increasing demand from the market (De Bruin et al., 2005; Mettler, 2011). Founded on a selection of criteria, such maturity models are designed to assess maturity within a specific field. In the assessment, a

5-point Likert scale is often used, in which 5 is the highest level and 1 is the lowest level. According to De Bruin et al. (2005), few guidelines exist regarding how to develop good and qualified maturity models.

A maturity model can be descriptive, prescriptive or comparative in nature. To gain a deeper understanding of the current situation, an initial model is descriptive. Thereafter, a prescriptive model can evolve through repeatable improvements, based on an increased understanding of the current situation. To achieve a comparative model, the model should be used within several organizations to collect a solid amount of data and thereby ensure a valid comparison. De Bruin et al. (2005) propose to use a generic methodology in developing maturity models within different areas. Such a methodology contains the following phases: determine the scope of the model, define the design that will be the foundation for further development, identify what is necessary to measure and how, and test the model for significance and thoroughness. The model should then be made available for use and verify the degree to which it is generalizable. The final phase is maintenance. To ensure that the model remains relevant over time, it is important to consider which sources are necessary to maintain the model over time.

Assessment of the case study data: Based on the review of existing theory, the relevant categories on the topic were established. The interviews were subsequently coded and the findings were sorted according to the categories.

In defining the categories by which to sort the case-study findings, a review of existing literature focusing on the integration of two or more functions served as a foundation. The literature includes research by Basnet and Wisner (2012); Leenders and Wierenga (2002); Pagell (2004); Singh (2011); Turkulainen and Ketokivi (2012).

The main categories are as follows:

- Culture, social mechanisms and creation of lateral relations
- Management support/vertical integration
- Information systems
- Formalization and standardization
- Consensus integration
- Facility and layout
- Measurement and rewards

The case studies provided a series of data which were sorted under the categories that were found to have the best fit. It is noteworthy that some data could be sorted within more than one category. For this research, a qualitative tool was developed to assess the integration maturity of the collected data. To give an indication of the degree to which each of the findings was considered to be relevant, a ranking system similar to the typical Likert scale (Cohen, Manion, &

Morrison, 2013) was developed. The intention of the development and use of such a scale is to give an indication of the degree to which support for the existence of an enabler or disabler was found within the case studies. Even though a numeric scale was used, it is important to bear in mind that the rating is only intended to provide guidance, based on the researcher's subjective perception of the value chain's integration maturity.

The following structure was established to perform a rating of the case-study data for this thesis:

5 - Definitely
4 - Very probably
3 - Somewhat
2 - Very little
1 - Definitely not

Based on the issues on which the existing literature was found to focus and on the experiences, that were gathered throughout the research for this thesis, questions and statements were developed to form a system by which to assess the degree of integration. This framework for maturity mapping is presented in table 5-14. It is noteworthy that this is an initial framework which should be further developed with results from future research. In addition, a framework is proposed based on the theory and experiences from this PhD research to indicate how the mechanisms for integration are interrelated (see chapter 5). Finally, this framework for maturity mapping was exemplified and used as a tool to assess the degree of integration.

3.7 Reliability, validity and generalizability

To evaluate the quality of research designs, specific logical tests can be used. According to Yin (2009), four tests are usually used to determine the quality of empirical social studies. These tests are common to all methods of social science and are mentioned in many textbooks as a means by which to test construct validity, internal validity, external validity and reliability. The tests are further discussed in the following (see table 3-17).

Methodology and research design

Table 3-17: Case-study tactics based on Yin (2009)

TESTS	Explanation	Case Study Tactic	Phase of research in which tactic occurs
Construct validity	Identify correct operational measures for the studied objects	• Multiple sources of evidence • Create a chain of evidence • Key informants review a draft of the case-study report	• Data gathering • Data gathering • Data composition
Internal validity	Attempt to find a causal connection, whereby certain conditions are believed to lead to other conditions, as distinguished from false relations	• Pattern matching • Explanation building • Address rival explanations • Use logic models	• Analysis of the data • Analysis of the data • Analysis of the data • Analysis of the data
External validity (generaliz ability)	The degree to which the results reflect reality and can be demonstrated elsewhere	• Use theory in single case studies • Use replication logic in multiple case studies	• Research design • Research design
Reliability	Demonstrate that the processes of a study can be repeated with the same results	• Use a case-study protocol • Develop a case-study database	• Data gathering • Data gathering

Construct validity: As illustrated in table 3-17, ensuring construct validity entails identifying whether there are appropriate and necessary measures for the concept of study. Hence, to increase the construct validity, three strategies can be adopted: using multiple sources, establishing a chain of evidence and using key informants to review a draft of the case-study report.

Using multiple sources of evidence is the first tactic that is mentioned and was applied to the cases during the research for this thesis to achieve the highest possible quality of information. The methods used for this research are literature review, interviews with key personnel within the value chain, observations, participation in meetings, and document and systems review. To prepare the necessary theoretical background for the rest of the research, the literature review was performed first. Thereafter, the studies that formed the basis for publication I-IV adopted interviews as their main method. Additionally, some of the interviewees were interviewed several times. At all the locations, an observation study was performed to evaluate the findings and achieve a deeper understanding than that which resulted from the interviews. Finally, the document reviews were performed to better understand the processes. The cases were selected from different sectors to cover a broader range of aspects that are relevant to the topic and to have the possibility to generalize the findings.

The second principle in assessing the construct validity is to create a chain of evidence. This can be done by making it possible for readers to follow the research path, from the initial research questions to how the conclusions are drawn (Yin, 2009). Throughout all publications for this thesis, this element has been realized by describing the purpose of the research and what formed the basis for its suppositions. The aim was thereby to maintain a "storyline", as emphasized by Phillips and Pugh (2003), by which to enable readers to trace the different steps, leading from the conclusions back to the initial research questions, or from the research questions to the conclusions.

The last method by which to maintain the construct validity is to invite informants to review reports. The findings for publication I were discussed with several persons involved in the project. The results presented in publication II were discussed with some of the informants. The input for publication III was discussed with one of the researchers at the hospital, who also participated in writing the article. The fourth publication was written after the main project was completed. Hence, it was difficult to discuss the findings with informants. However, the findings were discussed with practitioners who had formed part of the main project and some of whom had even been employees at one of the organizations.

Internal validity: This test has received most attention in experimental and quasi-experimental studies, and is mainly relevant for explanatory case studies in which the researcher aims to explain _how_ and _why_ occurrence _x_ led to occurrence _y_ (Yin, 2009). In shifting from a descriptive to an explanatory approach, there is a need to distinguish causal relations between phenomena or occasions (Jacobsen, 2010). Hence, internal validity entails an attempt to establish a causal relationship, in which it is believed that certain conditions lead to others. Internal validity reflects the degree to which the explanatory or causal conclusion of a study is acceptable. Such a warrant is founded by how the study minimized systematic error. The tactics by which to ensure internal validity include addressing rival explanations, conducting explanation building, and using logical models and pattern-matching exercises. This issue was addressed during the analysis phase of each case, in trying to find explanations for the findings. This was obviously challenging, both as a single researcher and collectively, as the preliminary conclusions were always discussed with the supervisor and colleagues. In addition, the fact that several papers were presented at international conferences created the possibility to discuss the conclusions with other researchers who had experience in the field (Yin, 2009).

External validity: According to Yin (2009), external validity concerns the degree to which the results reflect reality and can be demonstrated beyond the object of study, i.e. whether the study's findings are generalizable or not. Jacobsen (2010) emphasizes that, rather than generalizing from a selection of units to a larger group of units, the aim of qualitative methods is to understand and elaborate constructs and phenomena. Generalization from a single case has often been criticized. This critique is often rooted in contrasting the conditions to those of

survey studies, the intentions of which include that one sample is generalized within a larger context. In case studies, this analogy is incorrect. While the generalization of surveys relies on statistics, case studies rely on generalization based on analytical assumptions (Yin, 2009).

This study adopts a multiple-case design. To address the main topic, the research was designed around five case studies in Norway, using replication logics, which are the logic for selecting two or more cases within a multiple case study (Yin, 2009). Even though all of the case companies are located in Norway, the results cannot directly be generalized. Nevertheless, due to the organizations' common characteristics, the findings can be used moderately as a basis for research on the same topic for cases within different contexts. The cases were chosen from four different sectors: craft production, mass production, health care and service. However, many sectors have not been covered due to limitations in time and scope.

Reliability: Reliability entails that if another researcher performs the studies following the same procedure, the same results will be obtained. To ensure this, Yin (2009) recommends establishing a case-study database and research protocol describing which documents, procedures and steps have been taken during the research. During this research, notes were taken during the research period, the data were coded, and the coding and analysis process were carefully documented, after which all evidence was documented in the case-study database. Hence, it should be possible to replicate the case studies. As mentioned above, one strategy by which to improve the reliability of research findings is triangulation (Golafshani, 2003). Throughout the work for this thesis, a combination of several approaches was used to achieve triangulation of the results.

According to the Norwegian Research Council (2000), three main elements can be connected high-quality research:

- Originality: the degree to which the research is original and whether there it makes novel use of theory and methods.
- Solidity: whether the statements and conclusions are well supported?
- Relevance: whether the research is linked to professional development, or applied and useful to society.

During the research period, the articles that were written in relation to this thesis were published in journals and conference proceedings. All articles were peer reviewed anonymously, so that there was a process through which to test whether the research approach fulfils the originality, solidity and relevance requirements. In addition, presenting an article at a conference and thereby reaching a larger community of participants from different sectors and research areas can contribute to receiving valuable feedback and further confirmation that the research fulfils the abovementioned requirements.

Finally, the aim of this research is to identify possible enablers, disabler and facilitators for achieving integration of the value chain. Moreover, the integration-maturity assessment model was drawn up to possibly assist organizations in working towards achieving an integrated value chain. Hence, this research aims to contribute to adding value for both individual organizations and, more gradually, for society.

Methodology and research design

Chapter 4

4   Summary of the results of case studies presented in the published articles

This chapter presents an overview of the individual publications and the red thread of the PhD work. The structure of this chapter is presented in Figure 4-1, below.
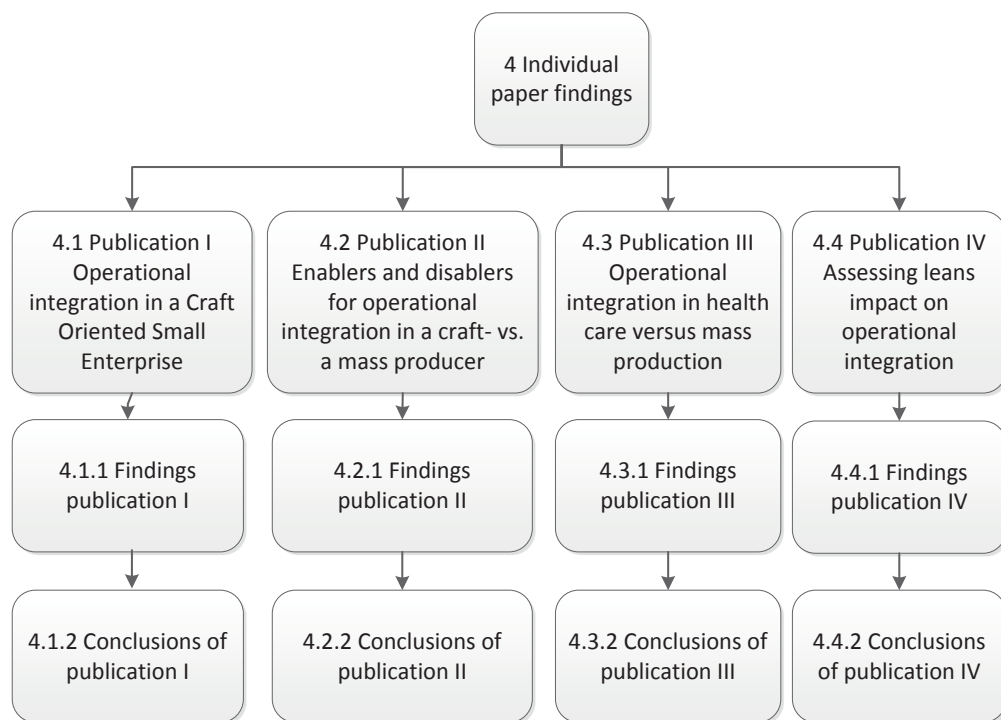
Figure 4-1: Structure of Chapter 4

Three of the studies considered in this thesis focus on the factors that enable or disable integration in a value chain. Three cases from three different sectors (the craft industry, mass production and healthcare) are presented. The fourth article presents a study of a mass producer and a service provider and focuses on how the lean implementation process is perceived in terms of affecting value chain integration.

Summary of the results of case studies presented in the published articles

The relationships between these publications, the case studies and the key issues addressed in each publication are presented in Table 4-1, below.

Table 4-1: Connections between published works and the research questions

Publ.	Title	Relevant research objective	Key issues covered
I.	"Operational integration in a craft–oriented small enterprise"	Which enablers and disablers affect integration in different sectors? What are the significant differences in integration in terms of the interfaces used in the work processes of different sectors?	Enablers and disablers of operational integration in the production line of a craft-oriented small enterprise
II.	"Enablers and disablers for operational integration in a craft- vs. a mass producer"		Enablers and disablers of operational integration in a craft production line versus that of a mass producer
III.	"Operational integration in health care versus mass production"		The enablers and disablers of operational integration in a hospital compared to those of a mass producer
IV.	"Assessing lean's impact on operational integration"	How can different approaches facilitate operational integration? (Also related to publications I, II and III)	In what way(s) does lean contribute to/hinder enhanced operational integration? A study of case companies

4.1 Publication I – "Operational integration in a craft-oriented small enterprise"

The first article considered was published in a journal; the full text of the article can be found in Section II. The article presents a study of a craft-oriented producer of leisure boats. The main objective of the study was to contribute to the understanding of the factors that enable or prevent operational integration within the main value chain of this enterprise.

Summary of the results of case studies presented in the published articles

In this publication, the following research questions were identified:

- To what degree does operational integration occur on the production line?
- Which factors influence operational integration, and what are the success criteria?

A case study approach was chosen for this study. During a half-year period, 12 semi-structured interviews were conducted among the key personnel at the value-adding section of the value chain. During several visits to the plant, the researchers made observations on the shop-floor, participated in meetings and reviewed relevant documents. The information thus obtained formed the basis for answering the research questions.

4.1.1 Findings of Publication I

A literature review led to the identification of several mechanisms that affect the integration of the value chain. To structure the findings of this case study, categories identified from the existing literature in the field were used. An overview of the main findings of this study, related to the categories, is presented in Table 4-2, on the next page.

Summary of the results of case studies presented in the published articles

Table 4-2: Overview of the findings presented in publication I

Enablers	Disablers
Culture, social mechanisms and the creation of lateral relationships	
• Informal culture: It is easy to contact colleagues and management	• Little information-sharing mentality • Little teamwork experience • Ad hoc culture, fire-fighting mentality • Tacit knowledge • Little focus on the interrelations between process steps
Management support/Vertical integration	
• Informal culture exists between management and operators • Small organization, little hierarchy	• Management is not a driving force in achieving integration
Formalization and standardization	
• Little bureaucracy • A visual system is used for logistics • In terms of the visual system, a shopping basket and Kanban are used for component supply • Team boards	• Has autonomy in terms of relating to standards • Few standards; operators develop their own approaches • Few formal meeting areas • No reliance on written information • Mainly single-sourced flow of information; Information mainly linked via the foremen • Little standardized information sharing
Facility and Layout	
• Limited physical distances	• Functional silos
Information systems	
	• Few information systems, which are mainly used by management
Consensus integration	
• Overall strategy is well known	• Little transfer of overall strategy into individual measures. • Operators have different focus on overall strategy • Operators have main focus on own process step.
Measurement, rewards	
• Bonuses paid when a target number of boats is produced • An overall common focus	• Employees have different motivations in terms of achieving bonuses. • Operators are satisfied when a goal is achieved, despite the possibilities in terms of enhancing the results.

The results of this study indicate that this organization had an informal culture, as the employees perceived it to be easy to relate to both colleagues and management. However, little evidence of an information-sharing mentality was found. The operators had little experience with working in teams and stated that their main focus during the workday was on their own workstations. Many of them also referred to the foreman as the main source of information, and therefore they

saw little need for the sharing of information between workers. Additionally, several examples of tacit sharing of knowledge among the operators were revealed.

This CP was a small organization with little in the way of hierarchy. While the culture that existed between the employees and the management was perceived as informal, management did not play an active part in achieving integration. The organization had little bureaucracy and few standards with regard to the sharing of information. There were few written descriptions and limited use of electronic information systems. However, in the months prior to the study, a number of visual information systems had been implemented. Few formal meeting areas existed, but, each morning, a meeting was held in one of the departments at a whiteboard used for planning. In addition, daily meetings were held between the foremen and management, while monthly meetings dedicated to the sharing of information were held with all of the employees. The facility was small, which made it easy to obtain an overview of the company's value chain. However, subcultures were created as a result of the fact the employees associated with each process step were separated by physical boundaries. The overall strategy was well known among the workers, but their levels of focus on it differed. The strategy was, to a minor degree, transferred into the individual measures of the operators. A bonus related to achieving the overall production target contributed to a shared focus on achieving the main goal. However, according to a number of the operators, there still seemed to be different motivations for achieving this goal.

4.1.2 Conclusions regarding the findings of publication I

The findings presented in this publication indicate the importance of management's promotion of and support for integration; in addition, they indicate that, when there are strong relationships between a company's foremen and the operators, the use of mechanisms intended to encourage greater horizontal integration and avoid employees working in functional silos could be useful. The size of a company and the existence of an informal culture make integration easier. However, it could be necessary to further establish a common, standardized platform for interactions and collaboration. Finally, this study reveals that even small physical barriers in the layout of the value chain can negatively affect integration.

4.2 Publication II – "Enablers and Disablers for Operational Integration in a Craft Oriented-versus a Mass Production Enterprise"

Publication II was presented at a conference; it was also published in that conference's proceedings. The case organizations were the CP addressed in publication I and a mass producer of car components (MP I). A case study approach was adopted, with semi-structured interviews, observations and document studies being conducted regarding the main value chains at both

locations. The author collected, transcribed and coded the data regarding MP I in collaboration with a colleague, who also assisted in writing the paper.

The aim of the study was expressed by the following two research questions:

- What are enablers and disablers of operational integration?
- Is there a difference between these two sectors?

The full text of this study can be found in Section II.

4.2.1 Findings of publication II

The case findings were coded and sorted according to the same categories used in publication I; they are presented in Table 4-3, below.

Table 4-3. Summary of the similarities and differences in the findings of the study of MP I and a CP.

Similarities	Differences
Culture, social mechanisms, and the creation of lateral relations	
Distrust in systems, preference for verbal comm., little information-sharing mentality	Experience with standardized work
Management support/vertical integration	
Foremen the main source of information	Foremen connected team meetings
Formalization and standardization	
Informal culture, little hierarchy	MP I was more standardized than the CP
Facilities and layouts	
Short distances, physical barriers, functional silos	
Information systems	
Lack of trust in IT systems	Use of IT systems differed
Consensus integration	
Operators' main focus on own process	Company strategy: well-known in the CP, less in MP I
	Departmental strategy: well-known in MP I, less in the CP
Measurement and rewards	
Rewards distributed among more than one dept.	

The findings suggest that MP I was, unsurprisingly, more accustomed to standardized work than the CP. However, both companies provided examples of employees lacking confidence in systems. The operators at both the MP I and the CP seemed to have little interest in the rest of the value chain, as their main focus was on their own stages of the process. Additionally, they seemed to have little

information-sharing mentality. The findings also indicated that operators at both organizations preferred verbal communication.

The data indicated that the operators at the CP strongly relied on the foremen as the main link in terms of sharing information. The operators at the MP I noted more interaction and sharing of information with colleagues than those at the CP, but the foreman at the MP I played an active role in linking the departments by participating in team board meetings in both departments.

Both organizations had informal cultures and little hierarchy. However, a greater use of standards was noted at MP I when compared to the CP.

Both value chains had limited distances between process steps. However, physical barriers in the value chains, although minor, contributed to the perception of the existence of functional silos in both.

Greater use of IT systems was observed at MP I than at the CP, but, according to several operators from both organizations, there was, in general, a lack of trust in such systems.

The overall strategy was well known to all workers at the CP; however, little of this strategy was translated into functional measures. At MP I, many overall goals were transformed into functional tasks at the production level and visualized on the team boards. Despite this, it did not seem that the overall strategy was sufficiently clear to all of the operators.

Both companies frequently provided shared rewards to the departments in their value chains. The operators at the CP were given bonuses when they had reached a target number of boats produced, while the operators at MP I received verbal commendations for a number of improvement proposals.

4.2.2   Conclusions regarding the findings of publication II

This article demonstrates that, although these companies featured different production paradigms, several common enablers of integration were found: little hierarchy, informal cultures, limited distance between process steps and the use of rewards. Differences were found in the degrees of standardization and formalization, the role of foremen in functioning as connecting links between team boards and the facts that, while overall strategy was well known among the employees of the CP, departmental strategy was better known by the operators of the MP I. The common barriers to integration were found to be related to cultural characteristics and physical obstacles in terms of layout.

4.3 Publication III – "Operational integration in health care versus mass production"

The content of this publication was originally presented at a conference and was thereafter submitted to the associated journal. It consisted of two case studies of two different types of organizations: MP I (which was also the subject of publication II) and a hospital. The research questions for this study were as follows:

- What are the enablers or obstacles to operational integration in the value chains of these two organizations?
- In which way(s) are they similar or different in these two sectors?

A case study approach was also used for the hospital. Semi-structured interviews were conducted, using the same questions used for the interviews of the craft and mass producers in publication II. Additionally, many observations and document reviews were conducted.

4.3.1 Findings of publication III

The empirical findings of this study were categorized according to the same categories used in the other case studies. Table 4-4, presented on the following page, provides an overview of the similarities and differences in terms of the enablers and disablers of integration of both the hospital and MP I. A more thorough version can be found in the complete text of the published paper, which is provided in Section II.

Summary of the results of case studies presented in the published articles

Table 4-4: Similarities and differences between MP I and the hospital

Similarities	Differences
Culture, social mechanisms, and the creation of lateral relations	
Accustomed to standardized work Tacit knowledge A lack of overall focus on the value chain Job rotation perceived as positive	More loyal to the systems at the hospital than at MP I.
Management support /Vertical integration facility & layout	
	Culture at the hospital was more hierarchic than at the MP I
Formalization and standardization	
High degree of formalization	Training for acute situations is provided at the hospital Degree of use of visualization tools at MPI
Facilities and Layout	
Layout a challenge to integration	
Information system	
Some distrust of systems	Greater use of information systems at the hospital than at MP I
Consensus integration	
	Insufficient connections between overall strategies and functional tasks
Measurement, rewards	
Verbal acknowledgment	

The employees of the hospital seemed more **accustomed to relating to systems and more faithful to structures** than the operators at MP I, and the employees at the hospital often referred to procedures when describing how they cooperate. Their main focus was on the wellbeing of their patients, and they intended to provide the best treatment possible throughout the process of caring for the patients. However, several interviews indicated that a strong functional focus existed, especially in particular departments. Several of the informants referred to professional secrecy as a reason why they were unable to provide information concerning patients further down the value chain.

At MP I, it was noted that the operators had **little focus on process steps other than their own** and that the sharing or receiving of information relating to the rest of the value chain was often seen as unimportant. As one of the interviewees stated, "*I have too much to do with my own work.*"

Despite that fact that the hospital uses many information-sharing systems, several examples of **tacit knowledge** were identified. For example, when the interviewees were asked if they could predict the number of incoming patients over the course of a day, they stated that doing so was impossible. However, several interviewees had clear opinions regarding specific fluctuations in the rates of patient arrival.

Summary of the results of case studies presented in the published articles

According to two of the hospital's employees, the sharing of information and the relationships between the different functions were perceived as good when employees acknowledged each other's competence. Furthermore, it was perceived as important that they knew the individuals that they were required to work with to achieve good levels of collaboration.

The hospital used **job rotation** to various extents. While several employees expressed positive opinions regarding the use of job rotation, others were concerned about the possibility of added workload because of having to adjust to working in different locations. The MP I occasionally rotated workers between its departments; this was considered among the employees to be positive, as it was perceived as providing greater knowledge of the rest of the value chain.

C**ultures and structures** were noted to vary among the different departments of the hospital. The researchers perceived the hierarchy of the hospital as being more complex than that of MP I. However, according to some of the informants at the hospital, most of its departments were less hierarchical than they had been previously, which could be the result of considerable changes that had occurred in the relationships between management and employees over recent years. Additionally, **management was frequently a part of the value chain**, meaning that a number of leaders participated in clinical work. Management influenced the value chain in several ways, including through budget planning, strategic choices and directing daily operations.

At both organizations, it was noted that management actively participated in the value chain. However, it seemed that management played a more active role in **linking departments** at MP I than at the hospital; in addition, the operators seemed to be more dependent on the foreman in terms of sharing information when compared to the employees of the hospital, as the two study departments at MP I were managed by the same foreman. In both departments, team boards were used for the planning of daily work; the foreman participated in both meetings, with the objective of acting as a link that ensured the flow of information between these two team boards, thereby achieving greater integration. However, the cultures of these two departments were perceived to be different. While the intention of the foreman being part of both team meetings was to link the departments together, the workers in each department seemed to relate more to the foreman than their counterparts in the other section.

Several **standardized procedures** for controlling the processes of both organizations existed; e.g., MP I used process descriptions, shift logs, shift overlap meetings, team board meetings, weekly team meetings and an ERP system. However, while many systems had been implemented, some inconsistencies were noted in workers' perceptions of how information should be shared. The hospital had used an electronic system for several years. Routines and procedures related to patient treatment had been developed over the years, influenced by research, experience, legislation and professional trends. Information regarding important

104

procedures was stored electronic. During the two years prior to this study, management had focused on increasing the understanding of patient flows through the implementation of a lean process.

The hospital provided training for acute situations. This training emphasized that very certain procedures and standards should be followed extremely closely, discipline should be exercised in the use of systems and that communication should be very clear. In contrast, other departments focused on aspects of care that are important to patients, such as waiting time and continuity of care. Where acute situations did not exist, the scenario was quite different. Some informants stated that, in less acute and life-threatening situations, they chose to perform procedures in their own ways.

Both organizations had high degrees of standardization, but their systems were designed differently: While MP I utilized visualization systems to a significant degree, the hospital used written procedures and provided training for acute situations.

For both organizations, it was noted that localization and the shapes of **facilities** affected collaboration. At MP I, the process steps were separated by walls that had large openings. Despite the limited degree of separation, the two departments functioned more or less as functional silos, with separate cultures and limited understanding of each other's daily challenges. At the hospital, it was more obvious that employees experienced different cultures in their sections of the value chain, as some departments were separated by up to eight floors.

The hospital had several different **information-sharing systems**. According to some informants, a lack of time and a *"cumbersome system for dealing with difficult patients,"* made it difficult to document everything that should have been documented. Additionally, the various departments used different systems, which could not always communicate with each other. For example, the system used in the X-ray department was not able to receive electronic referrals; thus, physicians were required to print them out and deliver them physically. It was also noted that several of the informants often needed to use verbal communication in addition to the electronic systems. The operators at MP I used simple tools such as e-mail to communicate with the rest of the organization to some extent, and production data were registered in an ERP system. However, according to a number of the operators, approximately 90 percent of communication was verbal. It was also observed that some of the operators perceived a need to double-check the systems used: e.g., one informant stated that he often checked by telephone if the emails he had sent had been received. However, there was greater use of electronic information systems at higher levels of the organization.

The employees of the hospital were perceived as having an overall focus on those aspects of the flow related to the "customer," meaning, in this case, the patient. However, according to some of the informants, **overall thinking** was lacking at the

management level, as they asserted that *"management does not understand the clinical problems, and they focus excessively on economic and rational issues."* At MP I, a number of the organization's overall goals were broken down into functional tasks at the production level and were further visualized on the team boards. The overall strategy, however, was not completely clear to all of the employees. At both organizations, the translation of overall strategic goals into to functional tasks could be improved.

According to some informants from the hospital, management's focus was largely on matters related to the economy, while the overall focus of the members of the value chain was on quality of care. However, since governmental measures of the time were mainly related to economic issues, this also affected what management focused on. One of the informants stated that "*I think top management has their main focus on quality, but I have never heard them talking about anything other than the economy.*" Through the recent improvement work at the hospital there has been put a focus on having common goals for the value chains, but this work had not yet reached the value chain of study.

Until recently, the management of MP I gave verbal commendations in response to a number of improvement proposals; they were intended to encourage such improvements. In addition, efforts to identify common motivating factors for the employees involved in the value chain have recently been made. Both value chains have focused on developing common reward systems, but they still face a number of challenges.

4.3.2 Conclusions of publication III

Even though this study considered different types of organizations, common enablers of integration were still identified: Both organizations had many routines and standards, and the employees of both were accustomed to standardized work. Furthermore, the informants from both organizations referred to job rotation as a factor that contributed to increased integration, and both companies used verbal commendations as rewards.

The common obstacles to integration were found to be related to culture and physical barriers in terms of location. At both locations, it was noted that the structures of the organizations had an influence on integration between departments. While both organizations demonstrated a high degree of standardization, a shared disabler of integration was found to be tacit knowledge. In addition, both organizations struggled to translate overall strategies into functional tasks.

The differences in enablers were found at the high degree of training for acute situations at the hospital, greater of use of visualization tools at the MP and greater direct use of information tools in the hospital's value chain.

A disabler of integration that differed was the degree of hierarchy; it was found that the hospital had a more complex hierarchy than the MP.

In addition to providing new insights into the enablers and disablers of operational integration based on an empirical study of two different types of value chains, the findings of this study could also contribute to the identification of operational guidelines for similar types of organizations when they wish to enhance their levels of operational integration.

4.4 Publication IV – "Assessing lean's impact on operational integration"

The fourth publication was also published in a journal. The subjects of this study were an insurance company (a service provider [SP]) and a mass producer (MP II), both of which were discussed in Chapter 3.4. This study focused on identifying the enablers and disablers of integration related to the lean implementation processes at these two companies. The overall objectives of this article were as follows:

- To explore the theoretical background of lean in the context of operational integration; and
- To explore and identify both the positive and negative effects that lean implementation has on operational integration. More specifically, the article sought to determine both the way(s) in which lean contributes to and hinders greater operational integration.

For these case studies, a research protocol that described the data collection methods, including an interview guide, was developed. The interview guide included questions for each company on the following topics: lean philosophy, implementation, organization, training and history. Semi-structured interviews were conducted and data triangulation was achieved by collecting the same information from multiple sources, such as documents and direct observations in the fields. Internal procedures, annual reports, tools, process charts, etc., were carefully reviewed to confirm or refute the information provided by the informants. In addition, plant tours and walk-throughs were conducted for both companies to visually observe the effects of lean on each organization. The following subchapter presents the findings of this paper.

4.4.1 Findings of publication IV

The findings of the study presented in publication IV related to the insurance company, are briefly presented in Table 4-6, on the following page. This overview identifies the perceived enablers and disablers of integration that were found for the insurance company after the lean implementation process.

Summary of the results of case studies presented in the published articles

Table 4-5: Enablers or disablers of operational integration for the insurance company

Lean contributions to operational integration	Lean obstacles to operational
Culture, social mechanisms and creation of lateral relations	
• Greater openness	• Difficulty in involving and informing all of the employees affected by process improvements due to lack of availability
• Self-evaluation led to the possibility of improvement	
• Lower barriers to asking colleagues for help	
• Implementation of team boards led to greater visibility and increased sense of belonging and ownership on the part of employees	
• Increased sharing of knowledge and competence	
• Increased cross-functional collaboration when attending to customer needs	
• Increased use of inter-departmental exchange programs to improve work flow	
• Increased employee participation in departmental meetings	
Management support/Vertical integration	
• Managing director chose to attend each team board meeting	
Formalization and standardization	
• Increased use of team boards for information sharing	
Facility and layout	
	• Collaboration and interaction in cross-functional projects became more difficult since scope of operations grew larger.
Information systems	
• Increased exchange of information	
Consensus integration	
• Increased customer focus, interaction and accomplishment of work	• Insufficient customer focus in cross-functional teams
• Increased use of cross-functional workshops	
Measurement/rewards	
	• Some sub-optimization was required, as employees protected their own departments at the cost of serving the customer

Summary of the results of case studies presented in the published articles

Findings related to the SP's case

The lean implementation process started at the bottom of the organization and later percolated upwards in the system. Prior to the implementation of this process, the employees noted that departments often operated as functional silos when serving customers. Cross-functional customer challenges were difficult to address as a result of employees seeking to protect their own departments at the cost of serving customers. As one of the main elements in a lean process is "adding value to the customer," the company focused on tools intended to encourage cross-functional integration. For example, cross-functional workshops and exchange programs were used to improve the processes that existed both within and between operations. The SP's work environment today features greater sharing of knowledge and competence and fewer barriers to employees contacting each other.

The implementation of team boards was considered to be the most important new element; it was found that this is the area in which lean had the strongest foundation. Today, there are a total of between 250 and 270 team boards in the company, and the structures of meetings differ in accordance with the tasks they address. Some teams have daily meetings, while others have meetings more infrequently. The lean department continuously follows up on how well the department managers lead these team board meetings. This has provided management with valuable feedback that could be used for making improvements.

One of the informants stated that she primarily associated lean with daily improvements and that departments had begun to increasingly focus on this concept: "*Everyone wants to contribute, and they have opened up and shared their knowledge. Nevertheless, not all improvements are well communicated to everyone who should have been involved and some information stops on its way*." She further stated that *"it is difficult to maintain focus."*

The use of team boards represented a new approach to work, and, in the beginning, it was difficult to interest employees in participating. However, after the managing director chose to attend each meeting, there was an increased focus on the importance of these meetings, which affected participation.

Findings related to the case of MP II

In Table 4-6, on the next page, the findings related to MP II are presented. These findings are categorized according to how the mechanisms associated with lean contributed to or hindered integration.

Summary of the results of case studies presented in the published articles

Table 4-6: Enablers or disablers of operational integration for MP2

Lean contributions to operational	Lean obstacles to operational
Culture, social mechanisms and creation of lateral relations • Increased competence utilization through teamwork • Increased alternation between work tasks	
Management support/Vertical integration • Implementation of weekly meetings between management and employees to encourage communication and problem-solving (through WOC [walk, observe, communicate]) • Management uses alternates in terms of attending various team meetings • Management spends more time among operators	• More pronounced top-down culture • System implementation without employee involvement results in distrust and lack of commitment
Formalization and standardization • Meetings for information exchange held more frequently • Increased use of visual communication systems such as team boards and A3	
Facility and layout	• Lack of co-location of operations makes collaboration more difficult
Consensus integration	• System implementation without employee involvement results in distrust and lack of commitment • Focus on up-time and number of parts produced makes involving operators in improvements difficult • Increased focus on key performance indicators (KPIs) causes sub-optimization, as departments focus on their own KPIs rather than working towards overall goals

Mass producer II has made extensive use of lean elements over the years. In 2009, the company was sold to a German firm that had adopted a self-developed lean-based system. This system was implemented in the Norwegian company with few

employees being involved and minimal possibilities for adjusting the system. The old and the new systems emphasized different aspects of lean: The previous system predominately focused on TPM, 5S and SMED, while the new system attached importance to productivity, improvement activities, visual planning and KPIs and their links to strategies.

The team leaders emphasized the use of job rotation to achieve operational integration. As one of them claimed, "alternation of work tasks contributes to integration in this way: The more you understand, the more you are able to affect the process. Then you start thinking of ways to improve the process and learn how to cooperate. You begin to think: When the worker in the process step prior to mine delivers services of poor quality, then I will not do the same to the next process step. I will make sure that I deliver what's best for the next worker…in this way, the operators are both an internal customer and supplier." The team's management also stressed the importance of utilizing workers' competences and claimed that through the alternation of employees, the employees "gain experience from other areas, get used to handling new challenges and their qualifications become more visible." They further stated that the focus on flow had increased, which had contributed to greater dialogue between operators. However, it was found that the need to leave an operation to retrieve components could occasionally serve as an excuse to take a break and talk to other operators.

Because of the implementation of the new lean process, more standardized and, to some extent, more frequent meetings were held. Once a week a shift manager meeting is held. On the shop floor, there are daily morning meetings and shift overlap meetings. However, according to one of the interviewees, the morning meetings could be more focused, and they tend to last too long.

The employees perceived it as easier to achieve operational integration in the value chain within the borders of the company than when there were distances between operations, especially when these operations were separated by national borders.

Since the implementation of the new lean process, changes occurred with regard to the use of visual communication systems such as team boards and A3. The company previously used team boards, but they were framed differently and featured different content. Today, several team boards exist, the contents and design of which have been standardized by the parent company. The new versions feature different content and symbols when compared to the meetings held previously, and colors are used to indicate if processes are progressing adequately. Every day, a morning meeting is held, which features the following participants: the team leader, the process leader, the shift leader, the individuals responsible for maintenance, quality, the toolmaker and, on occasion, an operator. The team leaders are responsible for leading the meetings; according to one of them, the "*focus on up-time and number of products produced makes it difficult to involve the operators in continuous improvements.*"

Summary of the results of case studies presented in the published articles

The majority of the KPIS were derived from the company's strategy, and reports based on these figures are sent to management on a weekly basis, while the parent company receives reports monthly.

The implementation of lean contributed to an increased focus on the use of a new tool for visual management: the WOC routine. This refers to a process in which a manager, together with a representative from the production team, walks about the production area, making observations based on a checklist and communicating his or her findings to those affected by them. The participants in this routine vary, involving both individuals from management and the operators' side. The checklists focus primarily on issues related to quality, but they also consider HES (Health-Environment & security) elements. Since several of the managers seemed to consider this routine as being of only minor importance, follow-up was inconsistent.

4.4.2 Conclusions of publication IV

This article presents the empirical findings of an initial mapping of two companies' experiences with operational integration by means of a lean implementation process, including both success factors and obstacles. While this exploratory study considered only two cases, its findings illustrate the importance of the commitment and involvement of management. Furthermore, the use of visualization tools for information exchange and designating formal meeting areas, in addition to cross-functional work, were also found to be factors that contributed to achieving operational integration. When comparing these two companies, a difference was noted in the manner in which lean was implemented, as the insurance company particularly focused on employee involvement and the participation of management. As many of the decisions at MP II were controlled by its parent company, there were only limited possibilities in terms of controlling the processes. However, the systems did, to some extent, contribute to ensuring integration. Both companies expanded their use of visualization tools, and both reported that this contributed to enhanced integration, an observation that is also supported by the literature (Bititci et al., 2015; Liker, 2006; Lindlof & Soderberg, 2011). However, the way these tools are implemented seems to be of crucial importance, as this study indicates that the degree of involvement and empowerment of employees affects the success of such implementations, and furthermore, the degree of operational integration. In both companies, it was observed that the involvement of management was a driving force.

This study provides knowledge concerning how lean implementation processes influenced operational integration in two Norwegian companies that operate within two different sectors. The contribution of this article to the existing literature is that it provides new insights into how a lean implementation process could contribute to or hinder operational integration in a specific Norwegian context. This knowledge may also provide operational guidance to companies who are in the process of implementing lean practices.

4.5 Summary of the publications and their practical and academic contributions

A summary of the practical and academic contributions of the four publications considered in this thesis are presented in Table 4-7, below.

Table 4-7: Summary of publications' practical and academic contributions

Publication	Academic contribution	Practical contribution
Publication I	Provides new insight into how mechanisms for integration can influence integration in the value chain of a craft-oriented enterprise, in a specific Norwegian context.	The knowledge provided by this publication may provide operational guidance for similar companies that wish to improve integration in their value chains.
Publication II	Provides new insights into how mechanisms for integration can influence integration in the value chain of a craft-oriented enterprise, compared to that of an MP, in a specific Norwegian context.	The knowledge provided by this study could also contribute to providing operational guidance for similar types of companies that wish to improve integration in their value chains.
Publication III	Provides new insights into how mechanisms for integration can influence integration in the value chain of an MP, compared to that of a hospital, in a specific Norwegian context.	The insights provided by this study could contribute to providing operational guidance to similar types of organizations that wish to improve integration in their value chains.
Publication IV	Provides new insights into how a lean implementation process can contribute to or hinder operational integration in a specific Norwegian context.	The insights provided by this study may also provide operational guidance to companies that are in the process of implementing lean practices with regard to how they can influence integration.

Based on these five studies, a more holistic analysis and synthesis is presented in Chapter 5.

Summary of the results of case studies presented in the published articles

Chapter 5

5 Analysis and discussion

Chapter 4 provided a brief overview of the findings of each publication. In this chapter, the aim is to present a holistic analysis and synthesis of these empirical findings. First, the enablers and disablers of integration for each organization are presented; they are related to the categories introduced in Chapter 2. Thereafter, the following section explores which mechanisms are used within each organization to facilitate integration. Finally, based on the theory and empirical data, a framework for mapping the maturity of integration is proposed. An example of how this framework could be used to provide an impression of integration maturity within a value chain, using case study data, is presented. This chapter's structure is depicted in Figure 5-1, below.
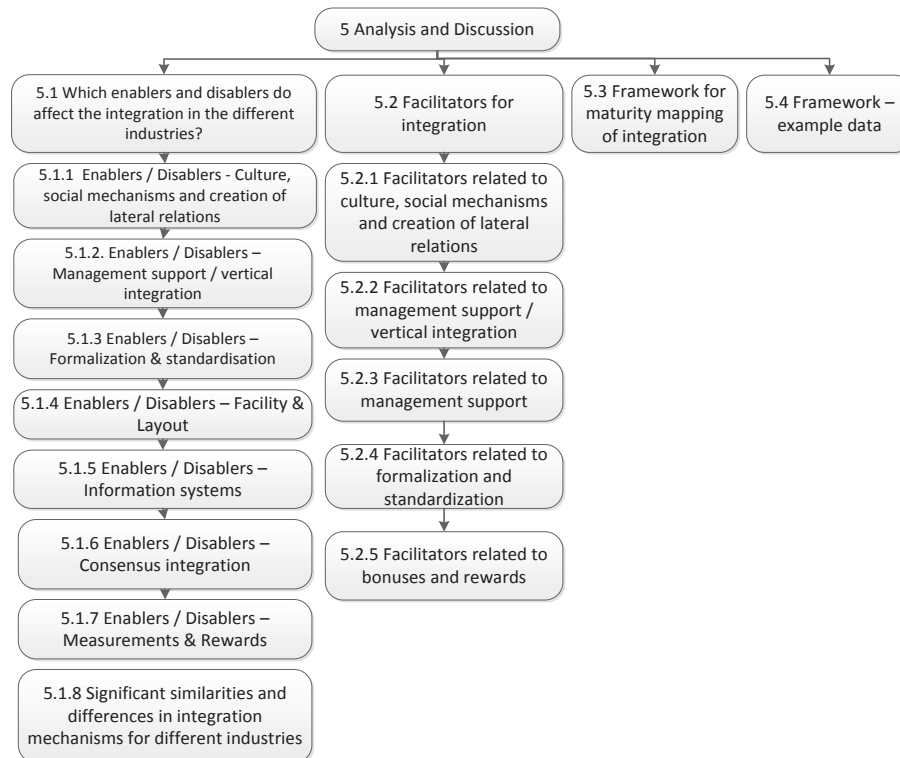
Figure 5-1: Structure of Chapter 5

The overview provided in Figure 5-2, on the next page, illustrates the relationships between the various antecedents/mechanisms and how they relate to

organizational functions and value chains. This figure is based on what the literature identifies as the mechanisms that influence integration (previously presented in Chapter 2 and Table 2-7), combined with the empirical data of this research. Figure 5-2 also provides a focused overview of the main categories.
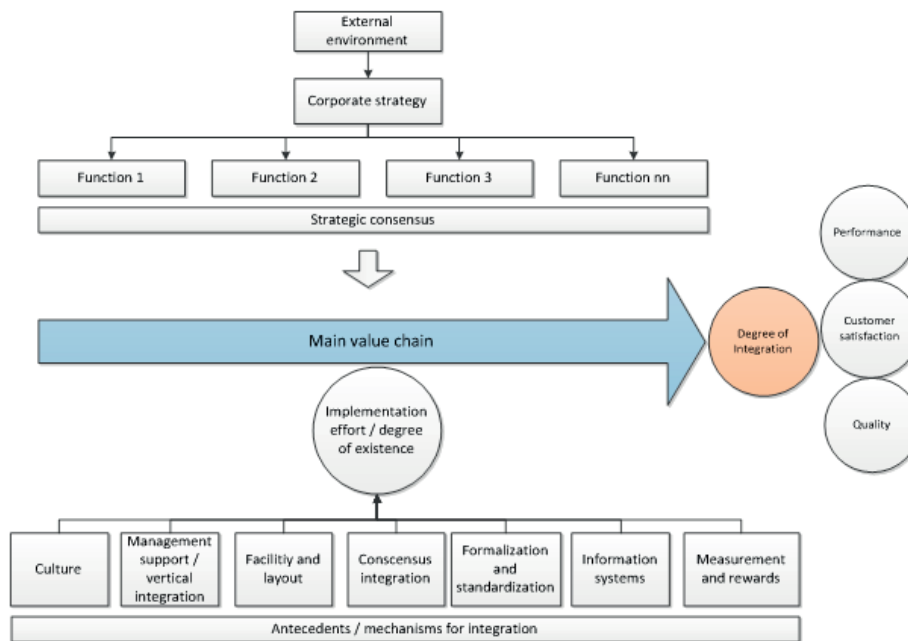
Figure 5-2: Overview of the various elements that may affect the integration of value chains, based on the existing literature (as presented in Chapter 2) and empirical findings.

In Figure 5-3, which follows, Figure 5-2 is supplemented with the addition of the mechanisms that, during the analysis of the theory and empirical study, were identified as relevant to each category. It should be noted that some mechanisms could be placed under several categories.

At the top of the figure is the external environment. The external environment is often considered to influence the development of corporate strategy. The manner in which strategy is framed affects all of the functions of such an organization. The figure indicates that it is of crucial importance that the main strategy is translated into the functions to achieve a strategic consensus (Malone & Crowston, 1994); this strategic consensus will have an influence on the value chain. Thereafter, all of the different mechanism categories presented in Chapter 2 and Table 2-7, such as culture, managerial support/vertical integration, facility layout, consensus integration, formalization, use of information systems and approaches to measurements and rewards (Basnet & Wisner, 2012; Leenders & Wierenga, 2002; Pagell, 2004; Singh, 2011; Turkulainen, 2008) could influence the degree of integration of a value chain. The degree to which these mechanisms or antecedents

exist and whether the efforts made to implement them were successful affect the degree of integration achieved. Finally, the degree of integration can affect elements such as organizational performance, quality or customer performance (Turkulainen and Ketokivi (2012). More detailed descriptions of the content of each mechanism/antecedent are provided in Figure 5-3, below.

External environment

Corporate strategy

| Function 1 | Function 2 | Function 3 | Function 3 |

Strategic consensus

Main value chain

Integration impact

Implementation effort

Culture, social mechanisms and creation of lateral relations	Management support/Vertical integration	Facility and Layout	Consensus integration	Formalization and standardization	Information systems	Measure-ment, rewards
Temporary or permanent • set of values, guiding beliefs, understandings, way of thinking • Connecting links • Informal communication • tacit knowledge • liaison roles • task forces and teams • integrative departments or integrators • informal communication • conferences • Job rotation • transfer of managers • adjusting top management's attitude • Increasing knowledge of one another => Increases the capacity to process information => reduces equivocality without overloading the vertical organization, creates potential for more creative ideas.	• Level of decision making • Vertical transfer of strategy => Simplifies information processing when decision maker gathers, controls and processes information • Horizontal communication between managers • Management plays an active role in achieving integration • Management spends time in value chain • Management connects functions • Little hierarchy • Informal culture between management and employees	• Plant size/ physical distances • Partitions impact integration => the ability to communicate	• Knowledge of and focus on overall strategy • Transfer of overall strategy down to individual measures • Building an organization culture of known and shared strategic objectives and values. • Correlation between managment focus and employee focus	• Written policies • Rules • Job descriptions • Standard procedures • Charts • Information processing practices • Meetings, team board meetings • Visual systems • Standards • Strategic planning • Functional plans, scheduling • Financial performance control • Technical reports • KPI's established => Eliminates the need for further communication with clear standards for informationprocessing. => Provides a formal platform for information processing.	• Information Technology =>Increasing scope of database and degree of formalization of information flows => Enhances the capacity of Information processing => Rapid information exchange without overloading the hierarchy	• Bonuses, re-muneration, promotion, incentives • Formal Measure-ment systems => People tend to perform the activities for which they are rewarded.
Antecedents / mechanisms for integration						

Figure 5-3: Detailed overview of the various elements that might affect the integration of a value chain, based on the existing literature (as presented in Chapter 2) and empirical findings.

5.1 Which enablers and disablers affect integration of the main value chain in the different sectors?

Using the empirical data as a basis, the following sections present and discuss the enablers and disablers related to the chosen categories identified at all the organizations discussed previously.

5.1.1 Enablers and disablers - Culture, social mechanisms and creation of lateral relationships

Organizational culture is found to influence the achievement of internal integration. Thus, if a company struggles to achieve integration, efforts to change its culture may prove necessary (Braunscheidel et al., 2010). The culture-related enablers are described and organized under the following categories:

- *Values, guiding beliefs, understanding, and ways of thinking*
- *Connecting links, degree of informality in communication, tacit knowledge*
- *Job rotation*
- *Co-location*
- *Cross-functional teams*
- *Functional silos*

All the enablers and disablers related to each case company are summarized in Table 5-1, on the next page; they are further discussed below the table.

Table 5-1 Enablers and disablers in terms of culture, social ... per organization

Culture, social mechanisms and the creation of lateral relations.				
CP	MP I	H	MP II	SP
- Little information-s +/- ad hoc culture - Lack of confidence i systems -Standards rarely use +Informal culture exi between manageme and employees -Foremen the main s of information -Cross-functional tea not standard -Job rotation not standard procedure +/- Tacit knowledge	+ Accustomed to standardized work - Some lack of confidence in systems - Main focus on own work stations, less focus on overall value chain - Operators prefer verbal communication +/- Informal culture exists between management and employees + Foreman connects team boards + Cross-functional teams at higher levels - Use of job rotation inconsistent -Tacit knowledge	+ Accustomed to standardized work + Discipline in terms of the use of systems + Overall focus on patients - Strong functional focus +/- Acknowledgement of competence results in greater flow of information +/- Information flows better when employees know each other +/- Tacit knowledge + Cross-functional when discussing patients - Job rotation: Largely used at the level of attending physicians	+ Accustomed to standardize d work + Available at the value chain + Informal culture exists between management and employees + Information- sharing mentality + Cross- functional teams	+ Confidenc e in systems + Focus on customer + Team- work experience +Use of cross- functional teams + Accustome d to standardiz ed work - Functional silos

Values, guiding beliefs, understanding, and ways of thinking: Communication in the production areas of the CP and both MPs, both between colleagues and between employees and management, was noted as being of an informal character. This informality facilitated the discussion of challenges and tended to result in short response times when an incident occurred. The CP had a lack of formal structures, which may have encouraged the workers to communicate more often. However, since there were few standards regarding what should be communicated, there was some haphazardness with respect to the types of subjects that were addressed. According to some of the informants at the hospital who had worked in or with more than one department, the cultures and structures among the different departments varied; the fact that the departments had different managers could account for these different cultures. The observations regarding the value chains indicated that the hospital's hierarchy was, to some extent, more complex than that of the CP and the two MPs. However, according to a number of the informants at the hospital, the complexity of the hierarchies in the majority of departments had decreased over recent years. An informant at the SP claimed that the organization had previously had an extremely hierarchic structure, noting that there had been up to eight levels between the top manager and the lowest employees. He also claimed that the employees did not talk with each other very much during the working day. A possible cause for this was indicated to be the open landscape solution.

Analysis and discussion

According to Pagell (2004), cultures that stimulate good communication encourage integration. A specialist nurse at the hospital was asked the following question: "When is the information flow perceived to be good?" Her answer was as follows: "*I think the information flow is good when the person I am talking to acknowledges my competence and I acknowledge that person's competence.*" Another interviewee perceived that information seemed to flow better "*when you know the people you are collaborating with.*" However, the level of informal communication at the hospital was found to be largely dependent on physical layout, working structures and management's rules or philosophy (Pagell, 2004).

Ad hoc problem-solving culture: The research data indicated that an ad hoc problem-solving culture existed at the CP. This culture could be considered to be both positive and negative, with the positive aspects including the short response times when something occurred and a greater acceptance of the use of creativity in the problem-solving process. On the other hand, if creativity went beyond what was specified in job descriptions and decision-making procedures were ignored, further problems may arise. How to decide who should be involved in problem-solving was also somewhat unclear since there were few formal structures in place.

Confidence in systems: The personnel at the hospital seemed to be more accustomed to the use of systems and more obedient in terms of following regulations than the operators at the CP and the two MPs. Informants often referred to procedures when describing the manner in which they cooperated. The culture at the hospital was characterized by a strong reliance on systems, and the workers were accustomed to the use of, and had confidence in, standardized systems, such as the principles and methods adapted from total quality management (TQM). Training for acute situations required a very particular structure and standards to be followed; in addition, a greater degree of discipline regarding the use of systems when compared to the other organizations was noted. Bowersox et al. (1999) emphasized the importance of employees complying with established and standardized systems in achieving integration. Since standards prescribe how employees should work, they ensure the coordination of work tasks; thus, they can be particularly useful when dealing with complex situations (Glouberman & Mintzberg, 2001). The data also suggest that the employees of the two MPs were accustomed to relating to systems and had an information-sharing mentality; these characteristics were the results of several years of experience with high-quality systems and lean practice. As described previously, standardization has been referred to in the literature as a possible enabler of integration (Mintzberg et al., 1995). Through their many years of experience with systems and standards, and the team board meetings in particular, the employees of the two MPs attained both increased openness in their communication and an information-sharing mentality. According to a number of the employees interviewed, team board meetings contributed to their understanding of the entire value chain and the interrelations between process steps. The use of cross-functional teams was found to stimulate and nurture skills across functional

borders, enhance understanding of mutual challenges, reveal tacit knowledge and increase cross-functional knowledge (Lee, 1992; Turkulainen, 2008). Despite the fact that the employees of MP I had long experience with standards, a lack of confidence in systems, as found among the operators at the CP, was noted among them. For example, when one of the employees of MP I sent emails, he also felt the need to double-check if they had been received via telephone.

Connecting links and formal meeting areas: At both the CP and MP I, the foremen played a major role in the sharing of information, but this was more pronounced at the CP than at the MP. This could result in the foremen becoming a bottleneck in the information-sharing process; however, it could also facilitate such sharing. The two departments at MP I were managed by the same foreman; each department used a team board for the planning of the day's work, and the foreman participated in both meetings. By doing so, the foreman was intended to as a link through which information could flow between the two team boards, thus achieving greater integration. Nevertheless, these two departments were found to have different cultures. Although the intention behind having the foreman participate in both team meetings was to link these departments, it was perceived that the workers tended to interact with the foreman, rather than with the employees from the other department. At MP I, both the efforts made by the foreman to link the two departments by participating in both team board meetings and the existence of an informal culture that had little in the way of hierarchy were found to be enablers that were associated with the support of management.

The two MPs, the hospital and the SP all demonstrated a broad use of formal channels for information sharing, such as regular departmental meetings, team board meetings, etc. For example, MP II has made extensive use of lean elements over several years. In 2009, the company was sold to a German firm that had a self-developed lean-based system. This system was implemented in the Norwegian company without the involvement of many employees and with minimal possibilities for making adjustments to it. The old and the new systems emphasized different aspects of lean: The main focus of the previous system was on TPM, 5S and SMED, while the new system attached importance to productivity, improvement activities, visual planning and KPIs and their links to strategies. As a result of the new implementation process, more standardized and, to some extent, more frequent meetings were held: Shift manager meetings were held once a week, while, on the shop floor, daily morning and shift overlap meetings were held. According to Kenneth B. Kahn and Mentzer (1996), meetings are arenas for the verbal flow of information and can therefore contribute to the stimulation of integration; however, it is important to keep meetings short to achieve their objectives (Lindlof & Soderberg, 2011).

Informal communication: Relatively informal cultures with respect to interactions between employees and management were found to exist at the CP and the two MPs. The CP, in contrast, mainly relied on the verbal sharing of information. Hence, the information shared could be, to some extent, situation-

dependent and inconsistent, and the author's overall impression of the culture was that it was not conducive to the formal sharing of information. However, the degree of informality made it easy for employees to discuss challenges and tended to result in short responses time when something occurred. In addition, the lack of formal structures may have influenced the workers to communicate more frequently; on the other hand, since there were few standards regarding what should be communicated, there was some haphazardness with respect to the types of subjects that were addressed. The data also indicated that few of the employees saw a need for the sharing or receiving of information beyond the process steps that they were responsible for. One operator at the CP, when asked if he perceived a need for the sharing of information across process boundaries, claimed that "I have too much to do with my own work." Several similar statements were made at both the CP and MP I.

Several studies of small and medium-sized enterprises have provided evidence that informal communication is very often seen as preferable to more formal structures; in the literature, such informal communication is often referred to as a strength for smaller businesses. Informality could provide a competitive advantage, as it is associated with reduced bureaucracy and more efficient communication, but, as argued by Vinten (1999), it also could prove beneficial to aim for a balance between formal and informal communication. In addition, as emphasized by Ayers et al. (2011), the quality of interactions is more important than their frequency.

Several studies have suggested that cultural walls may arise if employees perceive barriers between each other due to differences in personalities or stereotypes. According to (Griffin & Hauser, 1996), if one of the groups believes in these stereotypes, even though they are not based in facts, it could become a barrier for the alignment of the departments. Mechanisms that could create confidence between the units could assist in reducing such barriers. As stated by one of the nurses at the hospital, "*I think the information flow is good when the person I am talking to acknowledges my competence and I acknowledge that person's competence.*"

Tacit knowledge: Indications of tacit knowledge were found at both the CP and the hospital. While the CP had made efforts toward capturing processes in work descriptions, a great deal of information remained tacit knowledge. Information captured during the workday was often written down in a notebook, which was then placed in the employee's hip pocket. Furthermore, it seemed difficult to achieve consistency in terms of the recording of information when using forms. The hospital had a large number of information-sharing systems in place; however, there were still examples of the tacit sharing of knowledge among its employees. In one example, the interviewees stated that it was impossible to predict the incoming number of patients during the course of a day; however, several informants had clear opinions with regard to specific fluctuations in the rate of

patient arrivals. Having a transparent value chain could prove valuable when attempting to address such types of tacit knowledge (Nonaka & Takeuchi, 1995).

Cross-functional teams: Both the employees of the hospital and the two MPs had experience with working in cross-functional teams. Mass producer I primarily made use of cross-functional teams at higher levels, while the hospital largely used such teams for discussing patients. The SP had previously found that its departments operated as functional silos when serving customers, and cross-functional customer challenges were difficult to address as a result of employees seeking to protect their own departments at the cost of serving customers. To reduce the functional focus and to improve the focus on customer demands and on improving the processes that exist within and between operations, the company emphasized the use of tools that encouraged cross-functional integration, such as cross-functional workshops, exchange programs and team boards. This is in line with Turkulainen (2008), who suggested that, when organizations wish to achieve greater integration, they should focus on mechanisms that enable integration, such as cross-functional groups. To provide the best value for the customer, it is important that all value-creating activities work in unison to achieve a well-managed value chain, i.e., an integrated value chain (G. N. Stock et al., 1999). The SP's work environment today features greater sharing of knowledge and competence, and its employees have fewer barriers to communicating with each other. There is reason to believe that, since working in silos is a typical barrier to achieving integration (Pagell, 2004), this cross-functional exchange program contributed to achieving greater operational integration.

Job rotation: In the literature, job rotation is considered to be a practice that has a positive influence on integration. Basnet and Wisner (2012); Galbraith (1994); Pagell (2004) indicate that job rotation enhances integration, particularly with respect to coordination and consensus. Job rotation can contribute to improving employees' holistic understanding of the value chain. A limited degree of job rotation occurred within sections of the CP's production line, but operators seldom switched to departments on the other sides of the separating walls. At MP II, the use of job rotation as a tool to increase integration was emphasized. According to one of the team leaders, *"alternation of work tasks contributes to integration in this way: The more you understand, the more you are able to affect the process. Then, you start thinking of ways to improve the process and learn how to cooperate. You begin to think: When the worker in the process-step prior to mine delivers services of poor quality, then I will not do the same to the next process-step. I will make sure that I deliver what's best for the next worker...in this way the operators are both an internal customer and supplier."* This is in line with work of (Basnet & Wisner, 2012; Galbraith, 1994), who found that job rotation contributes to increasing employees' understanding of the problems that could occur at other stations and further assists them to gain a more holistic view of the company. The organization had a focus on utilizing the workers' competence; through rotating employees, they *"gain experience from other areas, get used to handling new challenges, and their qualifications becomes more visual."* Furthermore, according to the team

management, an increased focus on flow contributed to better dialogue between the operators.

Job rotation was, to varying degrees, used at the hospital; however, it was primarily a practice engaged in by the attending physicians. According to one nurse, "*it could have been an advantage to have the possibility to walk in each other's shoes, since we know very little about other departments' work when we have never been in their place*." Another informant stated that "*job rotation is instructive, but, then again, it is more that has to be learnt*." At MP I, there was occasionally rotation of workers between departments, and one of the operators perceived this as providing them with better knowledge of the rest of the value chain.

The insurance company used job rotation to varying degrees, often dependent on who the department manager was. According to one of the informants, the employees perceived little need for job rotation, since they had very similar job responsibilities, with the only differences being related to customer segments.

Functional silos: At the CP and MP I, it was noted that the informants had little overall focus on the value chain and did not exhibit a great deal of interest in knowing what the other process steps focused on. They indicated that their main focus was on their own steps in the process, to the point that sharing or receiving information beyond that which was relevant to their own process steps was perceived as unnecessary. According to one of the employees at the CP, "I have too much to do with my own work." Another worker at MP I said "to be honest, I do not care. This is my workplace, and I get the necessary information from the foreman." The main impression at both value chains was that the operators did not find it necessary to know anything about the other process steps, as they expected their foremen to provide them with the necessary information.

The physicians and the nurses at the hospital predominately focused on the wellbeing of patients and aimed to provide the best possible treatment throughout the process of caring for the patient. However, several interviews still indicated a strong functional focus, especially in certain departments. Several of the informants referred to professional secrecy to account for why they were not able to follow information concerning a patient further down the value chain. The same view was also experienced at the SP: e.g., a customer service representative who provides a customer with banking products is not allowed to view the insurance products purchased by the same customer. This could represent a possible pitfall for integration, as a transparency value chain is essential in achieving effective interdepartmental collaboration (Bauch, 2004; Ellinger et al., 2006; Økland et al., 2010).

The service company had previously noted that its departments were operating as functional silos when serving customers, which caused by functional related rewards; in addition, it was noted that cross-functional customer challenges were difficult to address when employees sought to protect their own departments at

the cost of serving the customer. To reduce the functional focus and improve focus on the customers' demands, the company emphasized the use of tools intended to encourage cross-functional integration, e.g. cross-functional workshops, exchange programs and team boards, all of which can improve the processes that exist within and between operations. Tools as cross-functional groups and visual planning systems are considered to be useful when attempting to improve communication within teams (Hines et al., 2006). Today, the work environment at the SP features greater sharing of knowledge and competence, and its employees have fewer barriers to contacting each other.

5.1.2 Enablers and disablers – Managerial support/Vertical integration

Many authors refer to the support provided by management as important to achieving integration (Basnet & Wisner, 2012; I. J. Chen & Paulraj, 2004; Lawrence et al., 1967). Table 5-2, on the following page, presents an overview of the enablers and disablers related to the support provided by management for each of the case organizations.

Table 5-2: Enablers and disablers related to managerial support of each organization

Managerial support / Vertical integration				
CP	MP I	H	MP II	SP
+ Informal culture exists between mgmt./ employees + Horizontal communication occurs between managers + Little hierarchy + Management attends team board meetings + Management connects functions + Management spends time in the value chain	+ Informal culture exists between mgmt. and employees + Horizontal communication occurs between managers + Implementation of structures for securing appearance of mgmt. in value chain + Little hierarchy + Mgmt. attends team board meetings + Mgmt. connects functions + Mgmt. is a driving force in achieving integration + Mgmt. spends time in the value chain + Vertical transfer of strategy	+ Culture dependent on the persons and departments involved + Horizontal communication occurs between managers +Mgmt. attends team board meetings + Mgmt. is a driving force in achieving integration + Mgmt. spends time in the value chain + Vertical transfer of strategy	+ Informal culture exists between mgmt. and employees + Horizontal communication occurs between managers +Implementation of structures for securing the appearance of mgmt. in value chain + Mgmt. attends team board meetings +Mgmt. connects functions +Mgmt. is a driving force in achieving integration + Mgmt. spends time in the value chain + Vertical transfer of strategy	+ Informal culture exists between mgmt. and employees +Horizontal communication occurs between managers + Implementation of structures for securing the appearance of mgmt. in value chain. + Little hierarchy + Mgmt. attends team board meetings + Mgmt. connects functions + Mgmt. is a driving force in achieving integration + Mgmt. spends time in the value chain

During the analysis, both similarities and differences in terms of enablers and disablers were identified among the five organizations; these are discussed in the following section.

Management spends time in the value chain: Employees of the CP and the two MPs perceived that little hierarchy existed, management was easy to communicate with in an informal manner and managers were often present on the production

line. However, according to one of the informants, after MP II was sold to a German company in 2009, the culture had become more top-down than it was previously. Top management was perceived as more detail-oriented than it was previously, and, according to the informant, managers would typically comment on issues, e.g. if robots should have smarter pathing. An informal tone was observed among the operators at the CP and both MPs.

It was particularly noted that, at the CP, there seemed to be a strong connection among the operators and the foremen. This this approach to dealing with employers is described by Glouberman and Mintzberg (2001) as *direct supervision* (see Figure 5-4, below). In this approach, the foreman acts as a supervisor of the operators' daily work tasks and coordinates, but does not perform, work.
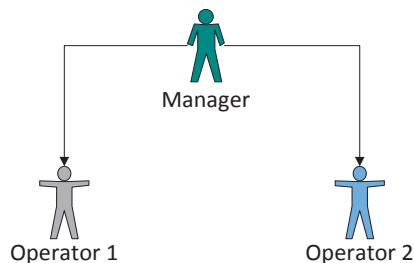

Figure 5-4: Illustration of direct supervision at the CP

An indication of the fact that a direct supervision approach existed was the fact that several of the **workers relied on the foremen** to plan their daily work. As one of the workers stated, "*the foreman takes all the responsibility and makes the total plan for the daily work*." The daily presence of one of the foremen at the team board meeting also contributed to increased vertical integration. However, despite the foremen's appearances at the value chains, calls for management to provide more information were noted at both the CP and MP I. It is reasonable to conclude that a lack of standards regarding the formal sharing of information could cause the operators to become more dependent on managers to control their work.

What distinguished the value chain of the hospital from the others was that **management participated directly in the value chain**, meaning that a number of leaders participated in clinical work. Furthermore, management influenced the value chain in several ways, such as through budget planning, strategic choices and establishing the direction of daily operations. There was a core impression that an informal culture existed between management and employees, but culture seemed to be dependent on department. As mentioned previously, the participation of management is important in achieving integration (Barki & Pinsonneault, 2005; Basnet & Wisner, 2012; Braunscheidel et al., 2010; Daugherty et al., 1996; Drupsteen et al., 2016; Griffin & Hauser, 1996; Morash & Clinton, 1998; Nabavizadeh et al., 2013; Pagell, 2004; Wheelwright, 1992), and a low degree of hierarchy positively contributes to integration.

Implementation of structures intended to ensure management's appearance in value chain: Mass producer II established several systems intended to ensure that management should appear in the value chain, e.g. the WOC routine. Using this approach, management had a facilitating role and, while its focus was, e.g., translating overall strategy into functional measures, spending time in the value chain and attending board meetings, it could be argued that management also played a facilitating role by establishing systems intended to ensure its appearance in the value chain, as described by Slater and Narver (1994).

Management connects functions: At all of the organizations discussed, horizontal communication between management employees was ensured through regular meetings. Management contributed to connecting functions by, amongst other activities, participating in team board meetings. For example, the operators at MP I felt that their two departments had different cultures. Consequently, a foreman participated in the meetings of both teams in an attempt to share information between them. This is in line with Child (1972), who suggested that management should act to improve the levels of integration between functional groups. However, while the intention behind the foreman participating in both team meetings was to link the departments, it was noted that the workers interacted with the foreman, rather than with the workers from the other department.

Vertical transfer of strategy: Both the MPs, the hospital and the SP had made efforts to translate their broad strategies into functional measures; however, they did so to very different degrees. Mass producer I translated a number of overall goals into functional tasks at the production level and visualized them on the team boards. However, despite these efforts, it did not seem as though the overall strategy was sufficiently clear to all.

At MP II, several of the managers identified their own, individual KPIs, which were disconnected from the rest of the system. The new measurement system, which was established after the company was sold, was referred to as more focused on "*hard data*," such as that concerning down-time, efficiency and scrap, rather than on people, competences, communication, etc.

Over the two years prior to the study, the hospital's management had attempted to increase its personnel's understanding of patient flows by implementing a lean process that included elements such as value stream mapping and introducing team board meetings. During this process, there was also a focus on translating management's strategy into functional measures. However, according to some employees, while efforts were made toward achieving management's goals, a great deal of work still remained to be done, as they noted differences in the focus of top management when compared to the main focus of the employees. As claimed by some of the employees, top management primarily focused on financial concerns, while the employees focused on quality. If goals and attitudes are not aligned, problems could arise in terms of achieving integration (Pagell, 2004; Simatupang & Sridharan, 2002; Stevens, 1990).

The SP focused on the use of tools intended to encourage cross-functional integration, such as cross-functional workshops, exchange programs and team boards, to improve the processes that existed within and between its operations. Through the use of team boards, the SP's management translated its overall strategy into functional measures; this was perceived as having improved the correlation between what management and operations focused on. In the beginning, to emphasize the importance of the meetings, the managing director chose to attend them. This is in line with Slater and Narver (1994), who state that management should play a facilitating role and ensure that strategy is communicated downwards in organization. Ongoing feedback from the lean department regarding how departmental managers conduct the team board meetings and review reports are sent to top management. This provides management with valuable feedback that can be used to make improvements, and, according to one manager *"well-conducted board meetings contribute to improved and faster responses if something occurs."* This is in accordance with what was stated by Whyte et al. (2008): It is important that managers understand the potential of visual representations as powerful tools that can assist them in making superior choices and, furthermore, allow better control over the outcomes of processes.

5.1.3 Enablers and disablers – Formalization and standardisation

To ensure that the outcome of a process meets users' expectations, standardization of work is crucial (Malone & Crowston, 1994). Table 5-3, on the following page, presents the empirical data relevant to this topic.

Table 5-3: Enablers and disablers related to formalization and standardisation of all organizations

CP	MP I	H	MP II	SP
+/- ISO 9001 - not maintained. +/- Job descriptions are not adequately maintained + Team board meetings, foremen/management meetings + Self-developed system for production planning - Few KPIs, not translated into functional measures + Some visual systems established	+ ISO/TS 16949, ISO 14001, lean + Standardized work descriptions + Shift logs, mail, verbal communication, etc. + Departmental, team board meetings and shift overlap meetings +/- ERP, Excel sheets + KPIs established, a number translated into functional measures +Kanban, visual logistics planning, visual tool status	+ TQM, elements of lean established recently + Procedures + Overlap meetings at change of shift, verbal communication, telephone, mail + Some team board and departmental meetings, training in acute situations +/- Knowledge of KPIs differs, a number translated into functional measures + Some visual tools	+ ISO/TS 16949, ISO 14001, lean + Standardized work descriptions + Shift logs, mail, verbal communication etc. + Departmental, team board and shift overlap meetings +/- SAP, Excel sheets + KPIs established, a number translated into functional measures +Kanban, visual logistics planning, visual tool status	+ Lean elements, such as team boards; KPIs established

Standardized information sharing: According to Mintzberg et al. (1995), the use of standards contributes to ensuring the coordination of work and, furthermore, enables integration, while D. Mollenkopf et al. (2000) found formalization to have a negative effect on integration if rules lead to reduced flexibility. The employees of both MPs, the hospital and the SP were perceived as more accustomed to the **formalized sharing of information** than the operators at the CP. The CP had been certified according to ISO 9001 standards, but, in recent years, the system has only been irregularly updated. Today, there is an impression that a high degree of autonomy with respect to standards exists in the organization and that, when standards are not updated or too few standards are in place, it is easier for the operators to "do it their way." For many years, both MPs were certified according to different standards, such as ISO TS 16949 and ISO 14001, and had what could be defined as high degrees of standardization.

The two MPs had several **standardized and formalized procedures** in place for controlling processes, such as process descriptions and shift logs, as well as shift overlap, team board and weekly team meetings. At MP I, each department had a team board, and they also used visual systems, such as Kanban and tags for tool

statuses, on several occasions. Despite the use of these systems, various perceptions regarding how information should flow existed among the workers.

Because of MP II having used systems intended to ensure the quality and the efficiency of lean for several years, a certain degree of **bureaucracy** had been developed. Because of the revitalization of this company's lean system, more standardized and, to some extent, more frequent meetings are held.

For many years, the hospital used principles and methods adapted from total quality management (TQM). Routines and procedures related to patient treatment were developed over the years, influenced by research, experience, legislation and professional trends. Information regarding important procedures was stored in an electronic system called EK. Over the two years prior to the study, management has focused on increasing understanding of patient flows through the lean process. Training for acute situations followed a very specific structure and standards; there was a high degree of discipline in terms of the use of systems, and communication was very clear. In contrast, when the focus was on aspects of the value chain that are important to the patient, such as waiting time and continuity of care in the absence of an acute situation, the scenario was quite different. Some informants stated that, in less acute and life-threatening situations, some employees chose to perform procedures in their own ways.

The SP implemented a lean process in 2006. Previously, the insurance industry was protected by regulations, and the costs were mainly taken up by the customer. However, in 2007, a new law related to insurance was introduced. The industry was already aware of the possibility of this law being enacted in 2004/2005, and, while it was possible to serve a large number of customers with outdated IT systems and complex products, the adoption of tools such as TQM, Six Sigma, etc. was considered. However, a choice was made to implement lean. The main intention during this process was to enhance customer focus, operational integration and capacity for accomplishment.

High degrees of standardization were observed at both MPs, the SP and the hospital; however, the systems used were designed differently. Both MPs and the SP used visualization systems to a significant degree, while the data suggested that the hospital saw greater use of written procedures and training for acute situations. Mentzer (2004) indicates that a high degree of standardization has a positive effect when attempting to improve integration. However, it is also recommended that the use of standards be complemented with activities intended to promote informal interaction (Glouberman and Mintzberg, 2001). Since higher degrees of complexity in products and processes require more formalized and standardized approaches to information sharing (Rondeau et al., 2000), it is not surprising that the two MPs, the hospital and the SP had more formalized systems in place for sharing information than the CP. The formalization of information sharing has been found to contribute to improved integration among functions (Ayers et al., 2011; Mentzer, 2004) when it is combined with informal interactions;

it is reasonable to assume that this could have contributed to higher degrees of information-sharing mentality and openness at the two MPs, the SP and the hospital than at the CP. However, the significant distances between the process steps at the hospital could very likely have led to reduced levels of informal communication and thus reduced levels of integration. The observations at MP I indicated that, as a consequence of reduced confidence in systems, the operators sometimes chose to find their own approaches to performing their tasks, which may have had a negative influence on integration.

Team boards/visualization tools: To develop stronger connection between two different sections, achieve greater transparency, streamline work processes and ensure faster response times, it is useful to establish common arenas for the sharing of information and interaction through the implementation of visual management tools such as team board meetings (Bititci et al., 2015). Visual management systems can assist in the development and implementation of strategy, make the measurement and review of performance easier, improve worker commitment, strengthen both internal and external communication, promote collaboration and integration, and nurture an atmosphere of continuous improvement and innovation (Bateman et al., 2016; Bititci et al., 2015; Lindlof & Soderberg, 2011; Parry & Turner, 2006).

A particularly extensive use of **team boards** was noted at the SP, but they were also used to a large degree at both MPs. Additionally, several visual systems, such as Kanban, were in use at both MPs. The use of team boards was observed to a minor degree at the hospital and the CP. Research has shown that the use of visual tools can contribute to making process expectations clearer; furthermore, they can make it easier to prioritize work tasks (Bititci et al., 2015; Eppler & Burkhard, 2007; Olausson & Berggren, 2010).

To improve transparency, create a learning environment with common arenas for information sharing and to increase operational integration, the possibility of using team boards for each compartment was introduced at the CP. The operators at the CP had little teamwork experience, and some of the employees considered formal information-sharing arenas such as meetings and team boards to be superfluous; there was already a team board in the molding area that displayed detailed data regarding the number of products manufactured per week. This formed the basis for the plans for the rest of the production line. The operators in the molding area held meetings at this team board each morning, and the information provided could be passed on to the rest of the value chain by the foreman; alternatively, the operators went to view the information themselves. Adding additional team boards was considered desirable to address issues encountered in the rest of the production line and to improve the connections between the process steps. Visual planning systems such as team boards have been found to be useful in promoting coordination and efficient communication among teams, as these systems are generally easy to use and foster commitment (Lindlof and Soderberg, 2011). However, through interviews and observations, a general

skepticism regarding the implementation of new and more detailed team boards was discovered. When discussing the possible introduction of further team boards as tools for promoting the sharing of information, one of the operators stated that "*it is not necessary; we just go and talk to each other.*"

Because of its decades of experience with certified quality systems, MP I had several standardized procedures for information sharing in place. Each department used a team board and several visual systems. However, during the interview sessions, differences in the perceptions of some employees regarding how information should flow were noted, since they referred to different individuals as the recipients of specific information. At both the CP and MP I, it was noted that the operators lacked trust in systems and found it necessary to double-check information: Some made phone calls to check if emails had been received, while others verbally verified the content of operation formulas if they perceived them as being insufficiently trustworthy. This lack of trust may have led to decreased levels of integration had employees chosen to "do it their own way," as, to achieve integration, it is essential that the employees comply with established and standardized systems (Bowersox et al., 1999).

Mass producer II was sold to a German company in 2009. As a result, its employees experienced a change in the use of visual communication systems such as team boards and A3. Team boards had been used for several years at the company, but they previously had different framing and content. Today, there are several team boards, the contents and design of which have been standardized by the parent company. The new versions feature different content and symbols when compared to those that they replaced. The majority of the KPIs were derived from the parent company's strategy. Each day, there was a morning meeting that involved the following participants: the team leader, the process leader, the shift leader, and the individuals responsible for maintenance, quality, and the toolmaker and on occasion, an operator. Ayers et al. (2011) argue for the importance of having common arenas for information sharing and interaction to achieve greater integration and that it is the quality, rather than quantity, of interaction that should be emphasized.

The use of team boards represented a novel approach to work at the SP, and, in the beginning, it was difficult to interest all employees in participating. However, after the managing director chose to attend each meeting, there was an increased focus on the importance of the meeting, which affected participation. Today, the SP has between approximately 250 and 270 team boards. The structure of the meetings differs in accordance with the tasks they address: Some teams have daily meetings, while others have them more infrequently. The lean department continuously follows up on how well the department managers conduct these team board meetings; green, yellow or red scores are used to visually depict how well they are conducted. All reviews are summarized in an Excel spreadsheet and reported to management. This has provided management with valuable feedback that could be used for making improvements, and, according to one of the managers, *"well-*

conducted board meetings contribute to improved and faster responses if something occurs." This is also in accordance with research by Eppler and Burkhard (2007) that suggested that visual planning increases the speed and quality of knowledge transfer. The manager further stated "*there is always a question as to whether the level of ambition is high enough. There are also some communities that haven't adopted team boards, and, as they say, 'we're so special' – so implementation is not at 100 percent."* In many cases, visual planning is a useful tool, but it is important to note that the regular coordination of activities and deliverables is necessary to make such a system function (Lindlof & Soderberg, 2011). One of the informants said that the lean process contributed to increased focus in the departments: "*Everyone wants to contribute, and they have opened up and shared their knowledge. Nevertheless, not all improvements are well communicated to everyone who should have been involved, and some information stops on its way*." Explaining further, she stated that *"it is difficult to maintain the focus."*

5.1.4 Enablers and disablers - Facility and layout

Several authors mention facility structure and layout as important factors that influence integration (Leenders & Wierenga, 2002; Pagell & LePine, 2002; Pinto et al., 1993). This mechanism is divided into the three factors: plant size, physical distances and partitions. The ways in which this mechanism impacts the different organizations are presented in Table 5-4.

Table 5-4: Enablers and disablers related to facilities and layout

Facility & Layout	CP	MP I	H	MP II	SP
· Plant size		+ Large plant, small value chain + Limited physical distances + Intimate environment	Large organization, many process steps	NA	- NA
· Physical distances	+ Limited physical distance	Physical obstacles to verbal communication	Some physical distance between departments	-Lack of co-location of operations makes collaboration more difficult	
· Partitions	- A wall separates functions; this is perceived as creating functional silos	- Minor partition with an opening. Perceived as creating functional silos	- Sometimes localized over two different floors or different buildings.	N/A	

Plant size, physical distances and partitions: Evidence that facility design and layout affected integration was found at the CP, both MPs and the hospital. At both the CP and MP I, the data indicated that the physical separation of departments affected collaboration processes. At MP I, there was an open connection between departments with only a minor adjacent wall (se figure 5-5 on the next page). Despite this small size of this partition, the two different departments functioned more or less as functional silos, with separate cultures and a lack of understanding of each other's daily challenges.
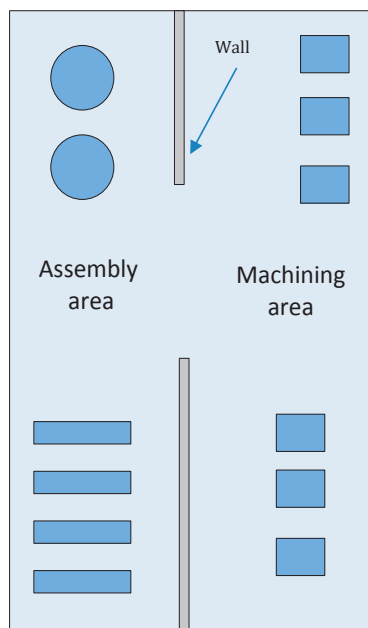
Figure 5-5: Illustration of the layout at MP I

The value chain at the CP was small, with minor distances between the activities (see Figure 5-6, below). This made it easy to understand and obtain an overview of the entire process. Intuitively, it seems reasonable that communication should flow smoothly in an intimate work environment that is familiar to the workers. In addition, according to one of the operators, changes to the line flow have contributed to increased horizontal communication. However, the current layout of the production facilities poses challenges in terms of achieving transparency in the value chain. The boat assembly area and body assembling area are divided into

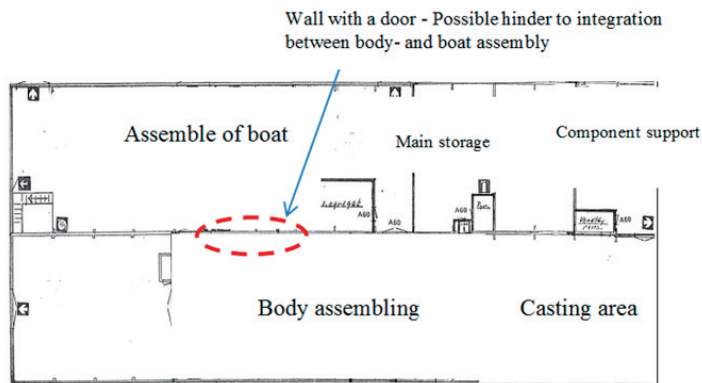two sections, with a physical wall in between (see Figure 5-6, below).

Figure 5-6: Layout of CP's value chain

The data suggested that this physical separation contributed to the development of different cultures on each side of the wall; this situation also made cooperation and the sharing of information more difficult, resulting in the creation of functional silos. This is in accordance with what has been argued by Hayes and Wheelwright (1984), namely that a separation between subunits may reduce the degree of integration. Furthermore, functional silos are typically found to hinder integration (Pagell, 2004). To overcome such functional myopia, it is important that management encourages positive relationships between departments (Basnet and Wisner, 2012) and focuses on the quality, rather than quantity, of interactions (Papadopoulos, Radnor, & Merali, 2011). To bond these two sections, it was proposed that common arenas for information sharing and interaction, such as shared team board meetings, be created.

It may have seemed more obvious that personnel at the hospital experienced different cultures in their respective sections of the value chain, as some departments were separated by as many as eight floors. This was also experienced at the SP, as one of the informants referred to a large distance between departments, both geographically and socio-culturally.

According to Allen (1984), when there is a distance between entities that is greater than 10 meters, the probability of communication between them will likely be less than 10 percent.

5.1.5 Enablers and disablers - Information systems

The literature also refers to information systems as possibly influencing integration. In Table 5-2, below, an overview of the different enablers and

disablers of integration related to such systems identified at each case organization is presented.

Table 5-5: Enablers and disablers related to information systems

Information systems				
CP	MP I	H	MP II	SP
· Few systems for information control; primarily managers who have access to computers	+/- Several systems in use, such as ERP, a document-handling system, a mail system, etc. -Some lack of trust in systems	+ Several systems in use, such as electronic patient journal (DIPS), a mail system, etc. - Some lack of trust in systems	+/- Several systems in use, such as ERP, a document-handling system, a mail system, etc.	- Self-developed and tailored solutions

The CP had a limited number of electronic systems for information control, and those that existed were primarily used by management. Previously, some of the operators were responsible for updating the process descriptions, but, in more recent years, the production manager had assumed responsibility for updating them.

The operators at MP I used tools such as e-mail and recorded production data in an ERP system. However, according to a number of the operators, approximately 90 percent of communication was verbal. Authors report different findings as to whether or not systems such as ERP contribute to increased integration (Basnet & Wisner, 2012; Davenport, Harris, & Cantrell, 2004; Gattiker, 2007). The observations on the shop floor also revealed that some of the operators felt the need to double-check the systems. For example, one informant stated that he often checked by telephone whether the emails he had sent had been received. However, there was greater use of electronic information systems at higher levels of the organization. The use of information systems does not necessarily affect integration positively, since if and how information is processed is also of importance (Galbraith, 1994).

The hospital used several different systems for sharing information. According to some informants, too little time and a "cumbersome system for dealing with difficult patients" made it difficult to document everything that should have been documented. Additionally, the various departments used different systems, which could not always communicate with each other. For example, the X-ray department's system could not receive electronic referrals; the physicians thus had to print them out and deliver them physically. During the course of the study, it was noted that several of the informants frequently required verbal communication in addition to the electronic systems in particular cases. If an organization's information-sharing infrastructure is poor, it could lead to reduced value chain integration, as the abilities to obtain, accumulate, control, and transfer

data could be reduced (Muckstadt et al., 2001). The data suggest that the infrastructure at the SP was perceived as good, since they had an IT manager available to adjust the systems according to the needs of the employees.

Many of the systems in place at the SP were the result of Norwegian legislation that requires organizations to have self-developed and tailored solutions. The organization had a very intelligent and enterprising IT manager who, in 2011, was named the "IT manager of the year" by a well-known IT-magazine; he was also extensively involved in the lean process. Since the implementation of lean in 2006, much of the SP's focus has been on cutting costs, and lean had been used as a method in the IT department.

5.1.6 Enablers and disablers - Consensus integration

Several authors note that having conflicting functional goals and attitudes can have a negative influence on the likelihood of achieving integration (Ellinger et al., 2006; Stevens, 1990). The research of Pagell (2004) suggests that, rather than being a predecessor to integration, strategic consensus is instead a key indicator of its presence. However, for the purposes of this research, consensus integration was chosen as part of the coding. The enablers and disablers that were found to be related to consensus integration are presented in Table 5-6, on the next page.

Table 5-6: Enablers and disablers related to consensus integration - per organization

Consensus integration				
CP	MP I	H	MP II	SP

+/- Operators aware of departmental strategy, less of company strategy
 	
+/- Some measures derived from strategy, visually displayed via team board
 	
- Operators' main focus is on own process step
	+/- Varying levels of knowledge of overall strategy
	  - Operators' main focus is on own work
	
	+/- Overall strategy partly translated into functional measures
		- Management's overall focus on finances, while functional strategies focus on quality	-Different KPIs per manager could create different areas of focus and priorities
			
			+/- Common standard KPIs provided by mother company
			
			+/- Overall strategy partly translated into functional measures
			
			- System implementation without employee involvement leads to distrust and lack of commitment
				+ Ongoing effort toward achieving a more uniform measurement system at the individual level
				
				  - Today, many different target numbers exist

It is important that managers focus on breaking down an organization's strategy into "subtasks" to ensure that the employees can grasp the overall goal; this, in turn, contributes to achieving the organizational goal (Malone & Crowston, 1994).

The overall strategy of the CP seemed to be well known among its operators. However, few direct links between the overall strategy and the tasks of the individual operators were identified. The focus on the overall strategy was inconsistent, and, when asked about their relationships to other process steps or the production line, few operators found it necessary to look beyond their own steps in the process. Only a handful of them considered the steps that preceded and succeeded theirs as being "internal supplier and customer," respectively.

At MP I, an effort had been made toward breaking down a number of the overall goals into functional tasks at the production level. These functional tasks were visualized and followed up on the team boards. The overall strategy, however, did not seem to be very clear to all of the employees. Despite the seemingly thorough systems of measurement used on the plant floor, the links between these tasks/measures and the overall goals seemed to be under-communicated.

Analysis and discussion

According to Pagell (2004), frequent communication of the main priorities of the value chain and company goals to employees is important in achieving consensus. Moreover, to achieve company goals, it is highly recommended that they are translated into functional tasks that are relevant to the employees (Malone & Crowston, 1994).

The research data concerning the hospital also indicated some mismatches between the overall company goal and the main areas if focus in the value chain. Some informants at the hospital reported that the main focus of management was on finances, while the overall focus in the value chain was on quality. The governmental measures focused primarily on matters related to the economy, which is a factor that will also affect what management focuses on. One of the informants stated that "*I think that top management has their main focus on quality, but I have never heard them talking of anything other the economy.*" According to another informant, management did not understand the clinical problems that existed and focused excessively on economic and rational issues.

The new lean system at MP II had much in common with the old, but it had a greater focus on KPIs and their links to the company's vision. Common to all of MP II's plants were the four KPIs: HES, stop time, number of products manufactured and quality. One of the team leaders noted that "*involving the operators in continuous improvements is difficult when there is such a large focus on up-time and number of products manufactured.*" In addition, according to one of the informants, many of the managers had their own KPIs. Hence, some sub-optimization was experienced, as there was more emphasis on each department's KPIs than on a common focus. Moreover, since the implementation of the system had taken place without sufficient involvement of the employees, a lack of commitment to and distrust of the systems were observed.

The SP had made efforts aimed at developing a more uniform system of measurement intended be more focused on the individual level. Today, many different target numbers exist. The focus on the KPIs differs for each team board meeting. According to one of the department managers and the employee representative, some employees were critical of the manner in which the KPIs were developed. However, they had positive attitudes towards the team board meetings in that "*everyone should now have a customer focus; after the start-up of the lean process, it was not clear that all departments know what it means to have a customer focus. Therefore, we must help them understand what is meant by having a customer focus.*"

The dataset indicated that all the organizations had the potential to improve the levels of correspondence between their overall strategic goals and functional tasks. Similar observations were made in the research performed by Van Hoek and Mitchell (2006), in which internal misunderstandings and different perspectives in terms of both the opportunities and priorities of the studied organization where

found. Hence, to improve internal communication an initiative planning process was suggested to achieve a better supply chain alignment.

5.1.7 Enablers and disablers - Measurements and rewards

Measurement and rewards are referred to by several authors as mechanisms that can have a significant influence on the degree of integration (Coombs & Gomez-Mejia, 1991; Drupsteen et al., 2016; Moberg et al., 2003; Nabavizadeh et al., 2013); however, these authors also emphasize the importance of ensuring that the rewards are aligned with and linked to a common strategy. An analysis of the data provides evidence of that two of the organizations made use of some form of bonuses, two used verbal acknowledgments and no evidence of any form of reward system was found for the final company (see Table 5-7, below).

Table 5-7: Measurements and rewards - mechanisms by organization

Measurement and rewards				
CP	MP I	H	MP II	SP
+/- Bonus upon achieving a certain number of produced boats	+/- Verbal commendations for improvement proposals	+/- Verbal acknowledgments	N/A	+/- Bonus and incentive systems at departmental and group levels

The craft company provided bonuses related to the number of boats produced per week. A positive effect of this system was that all the workers were aware of the common goal and, for some, this truly provided motivation. However, this could occasionally lead to frustration among some operators when the levels of motivation to achieve the goal varied among the other operators and when it was observed that some worked slower than others. Another effect of the bonus system was that the operators were satisfied when the goal was achieved, even though it would have been possible to further improve the results over the remaining weekdays. Aligning bonuses for two departments could assist efforts directed toward achieving collaboration (Nabavizadeh et al., 2013); however, the literature notes that setting only occasional goals or goals that are not functionally coordinated may create resistance towards collaboration (Ellinger et al., 2000; Good & Schultz, 1997; Griffin & Hauser, 1996; Sabath & Whipple, 2004).

Until recently, the management of MP I provided verbal commendations in response to improvement proposals; the intention behind doing so was to offer rewards that would encourage further improvements. More recently, work has been done toward identifying common motivating factors for the value chain.

Analysis and discussion

Some informants at the hospital reported that its management had their main focus on the economy, while the overall focus of the employees in the value chain was related to the quality of the service provided. However, as governmental measures focus primarily on the economy, this factor will obviously affect what management chooses to focus on. This is not in accordance with that which is suggested by Coombs and Gomez-Mejia (1991), namely that a reward system should be based on performance in terms of customer service and acknowledgement and that compensation should be linked to cross-functional collaboration. Following such an approach, they argue, will improve the degree of cooperation and mutual problem-solving, which will in turn promote information sharing and a culture that supports mutual cooperation in activities. Through the recent years a focus has been placed on achieving common goals for the value chains, but this work had not yet reached the value chain studied in this case study. The management of the hospital provided verbal acknowledgements as rewards.

In addition to their regular salaries, the employees of the SP previously received bonuses in the range of 75 to 175 NOK" or "75 to 175 kr. All the employees received some form of bonus; however, according to the top manager, this had no positive effect on results. Hence, he intended to do away with this bonus. Today, the employees have negotiated 70 percent of the bonus share as part of their fixed salaries. The sellers had their own incentive schemes, and senior executives receive bonuses. Local salaries were minimal; hence, it is not possible that every employee could receive a bonus.
The employee representative wondered how people should be incentivized to deliver. According to one of the informants at the SP, they had bonus and incentive systems in place at the departmental and group levels that functioned to inhibit further development and innovation.

All the value chains face some challenges with regard to developing common reward systems and encouraging a common focus. As noted by Cao et al. (2008), as different departments tend to have different interests and focuses, it is particularly important to ensure good overall coordination, as differences in focus and reward systems may negatively affect integration (Pagell, 2004).

5.1.8 Significant similarities and differences in the integration of the value chains of different sectors

Having reviewed the enablers and disablers of each organization and summarized the findings, it is now possible to consider the significant similarities and differences overall. In the following sections, summaries of each of the categories are provided.

Culture, social mechanisms and creation of lateral relations: Surprisingly, the cultures of the three production companies (the CP and both the MPs) were, despite their different sizes and structures, considered to be quite similar. In each of the three value chains, there were an informal culture, horizontal

communication between the shop floor workers and vertical communication between the workers and the management. It seems reasonable to assume that the similarities in terms of the formal backgrounds of the workers on the shop floors of all of these organizations and the fact that all of the value chains were relatively co-located could be possible explanations. Some slight differences were found in terms of confidence in systems, as the employees of both the MPs were found to have greater confidence in their respective companies' systems than those of the CP. The CP was found to have a greater degree of ad hoc culture, and its employees were less accustomed to relating to standards and systems than those of the other organizations. In addition, the employees of the CP seemed more dependent on the directions provided by management than the operators at the other organizations. Intuitively, it seems reasonable to assume that, when there are few systems and structures that guide daily work, more directly guidance from management is necessary. Greater discipline in terms of the use of systems was found among the employees of the hospital and the SP than those of the MPs. The higher degree of "on-the-job" training provided by the hospital and the potential consequences of failure in the medical field make serve as explanations for the hospital. Additionally, the employees of both SP and the hospital had closer contact with customers than the employees of the other firms. Overall, these research findings may indicate that the degree of employee confidence in systems may be related to the number of systems established and to how long the organization has operated them for.

Management support/vertical integration: Topics within this category were found to affect the levels of integration at all of the organizations. All of the organizations had systems in place that were intended to ensure effective communication between their managers, such as daily meetings in the mornings or frequent management meetings. The number of systems implemented to ensure managerial involvement varied: Both MPs and the SP implemented various systems and techniques intended to secure the active participation of management, such as the participation of managers in team meetings and WOC routines. All three of these organizations had used elements from, or completely adopted, the lean philosophy for several years, while the craft organization and the hospital were relatively new to the lean concept. This could represent one possible explanation for the differences found in terms of the participation of management, as lean has been found to positively influence vertical integration by promoting more communication between management and operators (Worley & Doolen, 2006).

Facility structure and layout: For the CP, MP I and the hospital, *facility structure and layout* were perceived as being the most significant obstacles to integration. This is an interesting finding, since the sizes and the structures of these three organizations are quite different. Within this category, the view that physical obstacles are perceived as negatively affecting integration is common to all three of these organizations.

Information systems: The CP had few systems for information control in place, and it was primarily management that had access to computers. All of the other four organizations demonstrated high levels of use of electronic information systems, but, at the two MPs, the greatest use was found at higher organizational levels. Evidence of a lack of trust in systems was found at MP I and at the hospital.

Consensus integration: Efforts toward translating overall strategies into functional measures had been made by both MPs and the SP. However, for all of the organizations, consistency was lacking. In addition, a need for greater levels of correspondence between overall strategic goals and functional tasks was noted at all of the organizations. The most significant finding was the mismatch between the hospital's overall goal and the functional focus of its employees, as management's focus was mainly directed towards the economy, while the functional focus was principally on the quality of health care.

Measurements and rewards: Evidence of the use of measurements or rewards was only found at the CP and the SP, despite the use of verbal acknowledgements at MP I and the hospital. It appears the employees at the CP had different motivation regarding achieving the overall goal related to the bonus, and this led to frustration among the employees.

Table 5-8, on the following page, presents a summary of the similarities and differences discussed above.

Table 5-8: Summary of similarities and differences

	Similarities	Differences
Culture	CP, MP I and MP II: - Similar cultures on shop floors - Informal cultures existed between employees and management - Workers had similar formal backgrounds	- Employees of the MPs were more confident in systems than those of the CP, while the hospital employees were most confident - Higher degree of ad hoc culture at CP than the other organizations - Greater discipline in the use of systems at the hospital and the SP than at the other organizations
Management support / vertical integration	- Systems intended to ensure effective communication between the managers had been established	- Both MPs and the SP had established systems to ensure the involvement of management in the value chain
Facility structure and layout		- CP, MP I and hospital: physical obstacles perceived to affect integration
Formalization and standardization	MPI, H, MPII, SP: High degree of formalization and standardization.	CP: Little degree of formalization and standardization, some visual systems
Information systems		- Hospital and SP: Significant use of electronic information systems - Both MPs: Use of electronic information systems mainly seen at higher levels - CP: Little use of electronic information systems
Consensus integration	- A need for improved correspondence between overall strategic goals and functional tasks	- Both MPs and the SP: Efforts made toward translating overall strategies into functional measures - H: Mismatch between overall and functional focus - Overall focus on economy, functional focus on quality
Measurements and rewards		- Use of measurements or rewards only at the CP and the SP

This section focused on the factors that enable or hinder integration. In the following section, the facilitators of integration are discussed.

5.2 Facilitators of integration

Some value chains have high degrees of integration, while others have low levels of integration. Various initiatives have been launched to enhance the degrees of integration at particular organizations. For the purposes of this research, these initiatives are referred to as "facilitators". Facilitators are distinguished from enablers and disablers in this research in that facilitators are considered to be mechanisms or actions that organizations actively introduce to promote value chain integration, while enablers or disablers are mechanisms that do also include elements that could be, or are not apparent in the value chain, for example cultural elements as informality. This chapter presents the mechanisms that are considered to have been directly introduced by the case organizations to facilitate integration.

A basis for mapping the data considered in this research was developed by reviewing the various mechanisms for integration listed in Table 2-7. Thereafter, the items listed in this table were sorted with regard to the mechanisms that were considered to have been intentionally introduced by an organization to promote integration; these are presented in Table 5-9, below.

Table 5-9: Facilitators of integration

Culture, social mechanisms and the creation of lateral relationships
Cross-functional teams
Job rotation
Transfer of managers
Management support/Vertical integration
Vertical translation of strategy into individual measures
Horizontal communication between managers
Managerial focus on connecting functions
Management attends team board meetings
Implementation of structures intended to secure management's appearance in value chain
Formalization, standardization and visualization
Visual systems, e.g. Kanban
Team boards
Formal meeting arenas across functions and departments
Standardized information sharing
KPIs
Bonuses and rewards
Aligned bonuses/rewards

The central purpose of Chapter 5.1 was to explore what type of enablers and disablers the employees and the researcher perceived as existing in the five

different value chains. As some facilitators could be perceived as being more tangible than enablers and disablers, to provide an impression of the degree to which each facilitator was used within each organization and to illustrate the distribution of their use, the author decided to rate the data using the Likert-inspired scale introduced in Chapter 3.
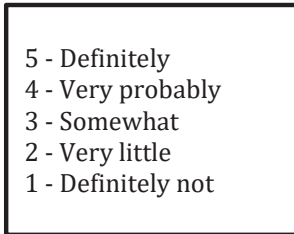
```
5 - Definitely
4 - Very probably
3 - Somewhat
2 - Very little
1 - Definitely not
```

Figure 5-7: Likert-inspired scale for rating research data

A rating of 5 indicates that good support is found for the use of the mechanism. A 4, typically, means that evidence was found that a mechanism had been implemented, e.g., job rotation, but not consistently across the entire value chain. A rating of 3 usually indicates that there is some support that the mechanism had been in use on occasion but that the use was not consistent. A rating of 2 would typically indicate that a particular mechanism was briefly referred to by informants, but that no further evidence of its use was found. A rating of 1 means that no evidence was found for the use of the mechanism considered. Finally, a 0 indicates that the item is not applicable at the current value chain or that there was no evidence for its use.

From the case studies, no evidence of the existence of facilitators was found within the consensus integration, facility structure and layout and information systems categories. The following sections discuss each category in greater detail.

5.2.1 Facilitators related to culture, social mechanisms and the creation of lateral relationships

The facilitators that were identified as being relevant to the culture, social mechanisms and the creation of lateral relationships category are listed and rated according to the previously discussed scale in Table 5-10, below.

Table 5-10: Overview of the use of facilitators within the culture category

Culture, social mechanisms and creation of lateral relations	CP	MP I	H	MP II	SP	
Cross functional teams	2,00	3,00	4,00	4,00	4,00	
Job rotation	2,00	3,00	3,00	5,00	3,00	
Transfer of managers	2,00	2,00	3,00	3,00	3,00	

Analysis and discussion

The data regarding how these facilitators are distributed can be further illustrated by means of the following spider diagram (see Figure 5-8, on the next page).
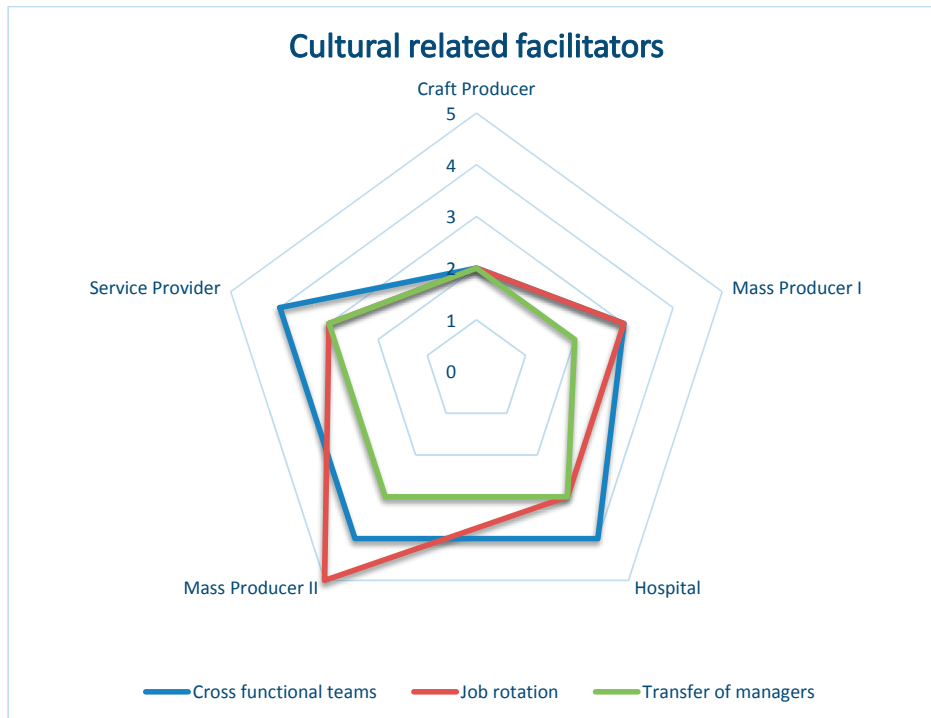
Figure 5-8: Visual presentation of facilitators used within the culture category

The facilitator that achieved the "highest score" with regard to use was **job rotation**. Good support was indicated for the use of this facilitator at MP II, while there were varying levels of support among the other organizations. It may seem surprising that the two MPs differed to such an extent in their use of job rotation, but an explanation may be that MP II had longer-standing traditions and had established more lean-related systems than MP I. In the literature, the use of the job rotation facilitator is considered to provide participants in the value chain with a more holistic understanding of its overall structure and assist them in attaining a greater understanding of the challenges encountered in other process steps (Basnet & Wisner, 2012; Eriksson & Ortega, 2006).

Evidence of the use of **cross-functional teams** was found at the SP, the hospital and MP II, as previously mentioned in Section 5.1.1. While these organizations have established routines regarding the use of cross-functional teams, this practice was not perceived as being applied consistently throughout their entire value chains. At MP I, evidence of the use of cross-functional teams was mainly found at higher levels of the value chain. In the same manner as the transferring of

managers and job rotation, the use of cross-functional teams also contributes to the transfer of skills across functions and provides employees with an understanding of each other's challenges. Another argument for the use of cross-functional teams is the potential doing so offers with regard to identifying tacit knowledge (Lee, 1992).

Varying levels of support were found for the use of **"transfer of managers"** at the hospital, SP and MP II, while little support was found at the CP and MP I. This facilitator is considered to assist managers in developing broader contact networks and promotes communication with other departments. However, organizations should be aware that learn new job tasks and to developing transfer programmes can be time consuming (Turkulainen, 2008).

5.2.2 Facilitators related to managerial support/vertical integration

The managerial support/vertical integration category contains the largest number of facilitators used. As the data in Figure 5-11, below, indicates, MP II was the organization that made the greatest use of these types of facilitators.

Table 5-11: Overview of the use of facilitators related to "managerial support" by organization

Management support/Vertical integration	CP	MP I	H	MP II	SP	
Vertical transfer of strategy into individual measures	3,00	4,00	4,00	5,00	5,00	
Horizontal communication between managers	5,00	5,00	5,00	5,00	5,00	
Management focus on connection of functions	4,00	4,00	3,00	5,00	4,00	
Management attends team board meetings	4,00	5,00	4,00	5,00	5,00	
Implementation of structures for securing management apparer	2,00	4,00	3,00	5,00	5,00	

A further illustration of these facilitators is provided in the spider diagram in Figure 5-9, on the next page.
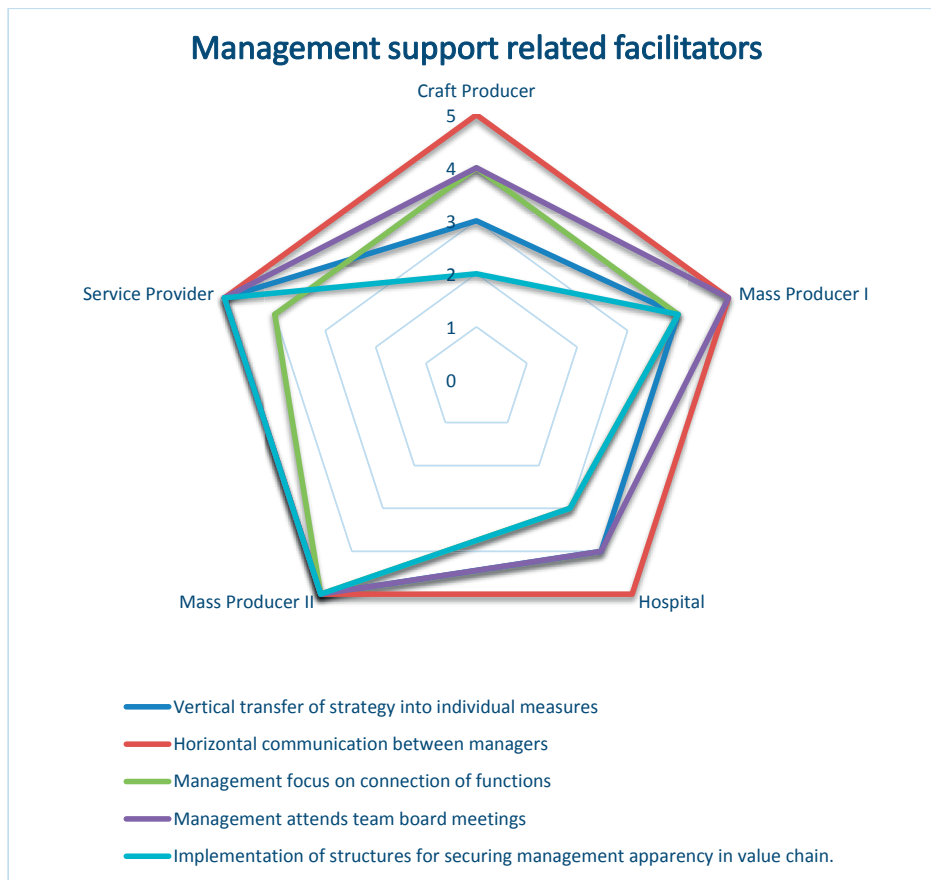
Figure 5-9: Detailed overview of facilitators related to managerial support by organization

From the diagram, it can be seen that the research data provided good support for all of the facilitators at MP II. At this organization, **management's appearance** in the value chain was ensured at using the WOC routine, while **horizontal communication** between the managers was ensured by the establishment of standardized meetings at all of the organizations. This perhaps reflects the finding in the literature that formal structures for the flow of information can possibly function as enablers of integration (Kenneth B. Kahn & Mentzer, 1996). Three of the organizations (MP I, MP II and SP) had established systems for ensuring the **attendance of management at team board meetings,** while some support was found for such measures at the CP and the hospital. In the literature, the participation of management is largely considered to be essential to achieving integration (Barki & Pinsonneault, 2005; Basnet & Wisner, 2012; Braunscheidel et al., 2010; Daugherty et al., 1996; Drupsteen et al., 2016; Griffin & Hauser, 1996; Morash & Clinton, 1998; Nabavizadeh et al., 2013; Pagell, 2004; Wheelwright, 1992). Furthermore, when visualization tools such as team boards are used, it is

crucial that management participate and assist in the process of their use. However, the process itself should be run by the team members (Parry & Turner, 2006).

In summary, the data in terms of management support indicate more such support for MP II and the SP than the other organizations, particularly in terms of the mechanisms associated with lean. One reasonable explanation for this finding could be the high focus on lean within both of these organizations; as noted in the literature, the support of management is essential to succeeding with lean (Saad et al., 2006).
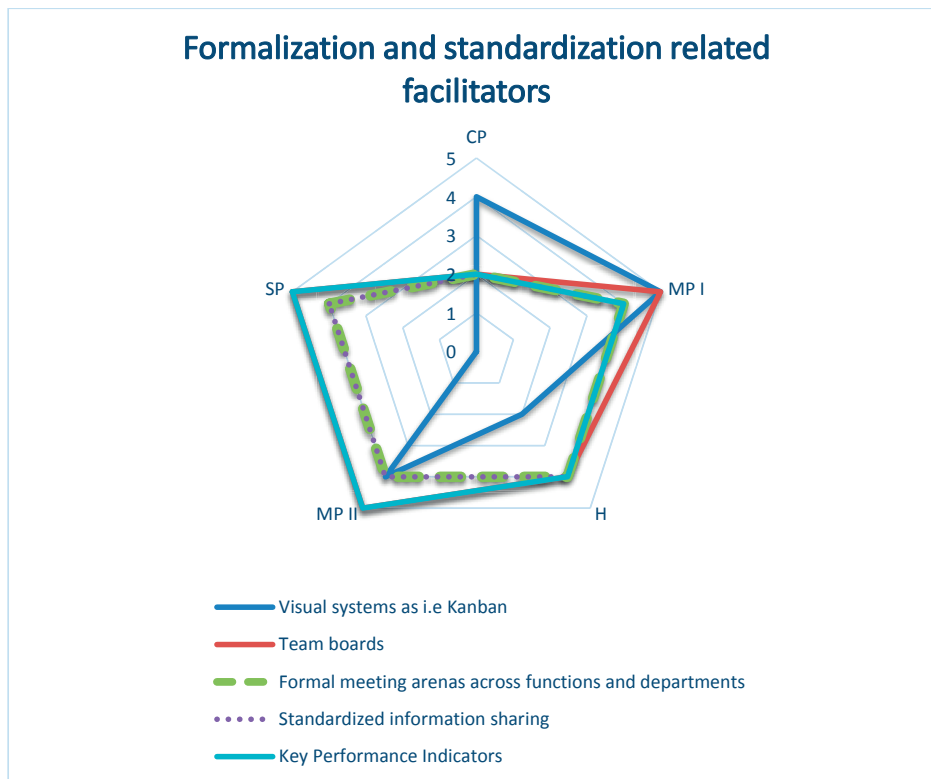
5.2.3 Facilitators related to formalization, standardization and visualization

Within the category formalization and standardization, five different mechanisms were found to be typical facilitators of achieving integration. Table 5-12, below, displays the distribution of the use of the facilitators related to this category for each of the case organizations.

Table 5-12: Overview of the distribution of facilitators related to "formalization and standardization"

Formalization, standardization and visualization	CP	MP I	H	MP II	SP	
Visual systems as i.e Kanban	4,00	5,00	2,00	4,00	0,00	
Team boards	2,00	5,00	4,00	5,00	5,00	
Formal meeting arenas across functions and departments	2,00	4,00	4,00	4,00	4,00	
Standardized information sharing	2,00	5,00	5,00	5,00	5,00	
Key Performance Indicators	2,00	4,00	4,00	5,00	5,00	

Both MPs and the SP made the most extensive use of the facilitators related to formalization and standardization. This could once again be explained by, among other factors, these organizations' extensive use of lean elements. These data can also be visualized in the form of a spider diagram, which is presented in Figure 5-10, on the following page.

Figure 5-10: Detailed overview of the facilitators related to formalization and standardization by organization

Not surprisingly, there were, overall, significant differences between the CP and the other four organizations due to the minimal use of up-to-date standardized systems at the CP and high degrees of the **standardized sharing of information** related to, e.g., ISO and lean within the other organizations.

The research data reveal the use of a significant number of **team boards**, particularly at the SP and also, to a lesser but still significant extent, at both MPs. Evidence of the use of team boards was also found at the hospital, but this was not consistent throughout the entire value chain.

Evidence for the extensive use of tools such as **Kanban** was found at MP I. The research data also revealed a frequent use of such tools at both the CP and MP II, but to a somewhat lesser degree than MP I. The data indicated no use of Kanban at the SP and very little at the hospital. In the literature, the use of such facilitators has been referred to as contributing to process transparency, enabling greater understanding of the value chain and making it easier to determine the status of the different aspects of the process (Bititci et al., 2015; Eppler & Burkhard, 2007; Olausson & Berggren, 2010; Parry & Turner, 2006). Hence, it is reasonable to

assume that these facilitators have supported these three organizations in the process of becoming more integrated.

Well-developed systems associated with **key performance indicators** were established at both MP II and the SP, and, when compared to the other organizations, they had both made efforts toward translating their strategy into measurable functional parameters. In the literature, formalization and standards are referred to as mechanisms that support integration; however, authors seem to have different opinions with regard to their effects, particularly those related to NPD processes (Gonzalez-Zapatero et al., 2016; Leenders & Wierenga, 2002; Mintzberg, 1979; X. M. Song, Neeley, & Zhao, 1996).

The research data revealed that both MPs, the SP and the hospital had established **formal meeting arenas**. Evidence was also found for the existence of such arenas at the CP, but much more sporadically than at the other organizations.
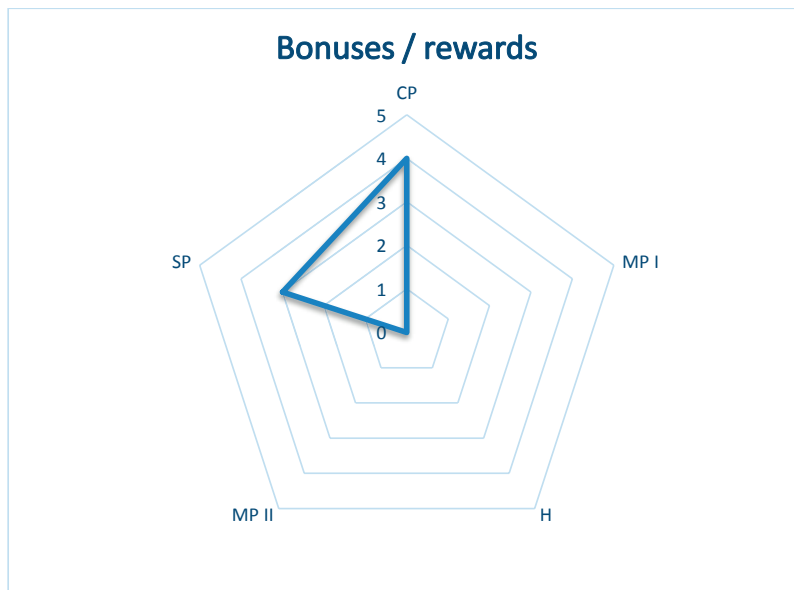
5.2.4   Facilitators related to bonuses and rewards

Facilitators such as bonuses and rewards were only found to be used at the CP and the SP. This is illustrated by the Table 5-13 and the spider diagram in Figure 5-11, on the next page.

Table 5-13: Overview of the distribution of the facilitators related to "bonus and rewards"

Bonuses and rewards	CP	MP I	H	MP II	SP		
Aligned bonuses / rewards	4,00	0,00	0,00	0,00	3,00	■	■

Figure 5-11: An overview of the distribution of the facilitators related to "bonuses and rewards" per organization

While both organizations offered aligned rewards, the rewards offered by the CP were perceived to be more aligned than those of the SP. In the literature, the use of bonuses is considered to possibly influence integration positively if the bonuses are aligned throughout the value chain. The importance of such alignment is emphasized because it contributes to avoiding conflicts and reduced willingness to cooperate among employees (Ellinger et al., 2000; Good & Schultz, 1997; Griffin & Hauser, 1996).

All the facilitators related to this category are summarized in Table 5-14, on the following page.

Table 5-14 Overview of all the facilitators of all the organizations

Culture, social mechanisms and creation of lateral relations	CP	MP I	H	MP II	SP	
Cross functional teams	2,00	3,00	4,00	4,00	4,00	
Job rotation	2,00	3,00	3,00	5,00	3,00	
Transfer of managers	2,00	2,00	3,00	3,00	3,00	
Management support/Vertical integration	**CP**	**MP I**	**H**	**MP II**	**SP**	
Vertical transfer of strategy into individual measures	3,00	4,00	4,00	5,00	5,00	
Horizontal communication between managers	5,00	5,00	5,00	5,00	5,00	
Management focus on connection of functions	4,00	4,00	3,00	5,00	4,00	
Management attends team board meetings	4,00	5,00	4,00	5,00	5,00	
Implementation of structures for securing management apparent	2,00	4,00	3,00	5,00	5,00	
Formalization, standardization and visualization	**CP**	**MP I**	**H**	**MP II**	**SP**	
Visual systems as i.e Kanban	4,00	5,00	2,00	4,00	0,00	
Team boards	2,00	5,00	4,00	5,00	5,00	
Formal meeting arenas across functions and departments	2,00	4,00	4,00	4,00	4,00	
Standardized information sharing	2,00	4,00	4,00	4,00	4,00	
Key Performance Indicators	2,00	4,00	4,00	5,00	5,00	
Bonuses and rewards	**CP**	**MP I**	**H**	**MP II**	**SP**	
Aligned bonuses / rewards	4,00	0,00	0,00	0,00	3,00	

In the preceding sections, the focus has been on discussing the enablers, disablers and facilitators of integration based on theoretical and empirical data. On the basis provided by these data, a framework that can be applied by practitioners to achieve integration is proposed in the following section.

5.3 Framework for mapping the maturity of integration

During the research phase, a review of the existing literature on the topic of integration was conducted (see Chapter 2). This literature review revealed a call for further empirical research into the mechanisms that influence integration (H. Chen, Daugherty, & Roath, 2009; Ellinger et al., 2000; Ellinger et al., 2006; Pagell, 2004) and the relationships among them (Leenders & Wierenga, 2002; Pagell, 2004). On the basis of the research of of Pagell (2004), Leenders and Wierenga (2002), Singh (2011), Basnet and Wisner (2012) and Turkulainen (2008), categories for the enablers and disablers were developed (see Table 2-7). Five different case studies formed the basis of the empirical findings (see Chapters 4 and 5). The existing literature, together with a summary of the findings of the five case studies, provides a foundation on which a framework can be developed that identifies the factors that a practitioner should consider when aiming towards improving the integration of the value chain, the types of mechanisms that influence the integration of a value chain and how these mechanisms are related to each other.

Questions and statements are formulated to reflect what existing literature refers to as influencing the integration of the value chain combined with what was

observed during the research conducted for this thesis. It should be noted that this questionnaire contains questions or statements that can be applied to either the enablers, the disablers and/or the facilitators. If the management of a firm desires to gain an understanding of the degree to which its value chains are integrated, the following questions/statements could prove helpful when evaluating the mechanisms in use. Table 5-15, on the following page, displays the specific questions and statements that are related to the different categories.

Table 5-15 Questions/statements used to indicate level of integration

Consensus integration	Information systems
- The overall strategy is translated into individual measures - Employees are involved in the process of deriving KPIs (to avoid mistrust) - The overall strategy is well known - The employees support the overall strategy - There is a correlation between management's focus and employees' focus - All of the managers agree upon the business strategy	- To what degree are electronic systems used - Information technology systems are perceived as enabling integration in the value chain - Employees have trust in electronic information systems - The electronic systems communicate with each other - The use of IT systems is similar throughout the value chain
Culture, social mechanisms and the creation of lateral relationships	**Managerial support/Vertical integration**
- The personnel involved in the value chain are available - Employees have confidence in systems - A degree of acknowledgement of colleagues' contribution - A degree of focus on customers exists among the employees - A degree of openness exists among the employees - A degree on focus on the entire value chain - Employees focus on the interrelations between the process steps - An informal culture exists - The employees have an information-sharing mentality - When possible, the use of job rotation is consistent throughout the value chain - Employees have knowledge of other departments - Employees have teamwork experience - Transfer of managers is used to increase integration - Cross-functional teams are used - Employees are accustomed to standardized work	- Horizontal communication occurs between managers - Structures for securing management's appearance in value chain are implemented - An informal culture exists between management and employees - Little hierarchy - Does management attend team board meetings? - Do management contribute to connecting functions? - Is management a driving force in achieving integration? - Does management spend time in the value chain? - Has management initiated a vertical transfer of the company's strategy?
Formalization and standardization	**Measurement/Rewards**
- Formal meeting arenas exist to a degree - Quality systems are implemented to a certain degree - A degree of standardized information sharing exists - Visual systems are used to a certain degree - The necessary KPIs are established, and tools such as team boards are used	- Are there any performance measurements? - Are there any bonuses or rewards? - Are the employees motivated by the rewards (if offered)? - Are the rewards aligned?
Facility and layout	
- Employees are co-located - The plant layout is small and transparent - The layout contains no partitions	

By answering these questions, an indication of to the extent to which an organization has fulfilled the requirements of each category is provided. To reflect the entire value chain, it is recommended that representatives from each of the

involved process steps participate. One possible approach to performing this evaluation could be holding workshops in which each question could be evaluated using the following Likert-inspired scale (as presented in Chapter 3 and previously in this chapter):

5 - Definitely
4 - Very probably
3 - Somewhat
2 -Very little
1 - Definitely not

In addition, based on the theory and the observations made during the research conducted for this thesis, a model that provides insight into the status of each of the mechanisms identified as contributing to integration and the interrelations among them is developed; see Figure 5-12, below.
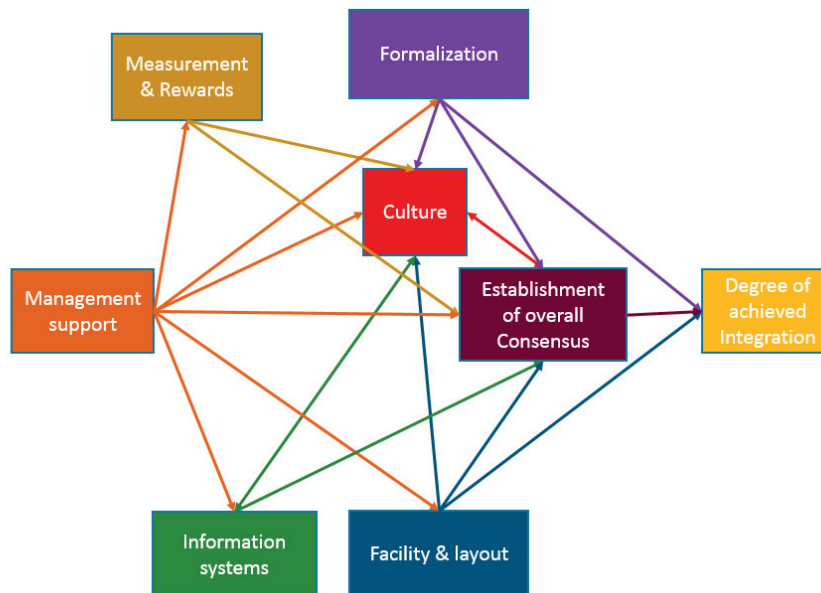
Figure 5-12: Framework developed based on the literature and empirical data obtained from the case studies

Each of the arrows in the above figure illustrates the relations among the connected mechanisms: Some are related in two directions, while others are related in only one. The following section provides an explanation of the above framework and how the mechanisms are related. Even though this framework is context specific, it should be relevant to various sectors.

Both in the literature (Basnet & Wisner, 2012; Pagell, 2004) and in the empirical findings, **managerial support** was found to be important in forming the basis for the integration of a value chain. Management being available to and involved in the value chain provides the foundation necessary to achieve an integrated value chain. Furthermore, having managers who agree upon and have a consensus on the priorities in terms of processes is important in making it possible to communicate the strategies and priorities to the rest of the organization in a consistent manner. The focus that managers agree upon will affect their priorities in their interactions with employees. This is important when attempting to define adequately aligned functional measures and identify suitable rewards.

To achieve integration, it is important that management influences the choice of **information structure**s and ensures that an adequate information-sharing infrastructure is in place (Muckstadt et al., 2001). Furthermore, Fawcett et al. (2009) emphasize that it is important that management should assist in the creation of an information-sharing culture among employees. The research data indicate varying degrees of use of information systems and formalization among the case companies, but, at all of the organizations, it was indicated that management played a central role in establishing the requirements for the information-sharing strategy and the degree of standardisation.

Researchers (Bititci, Mendibil, Nudurupati, Garengo, & Turner, 2006; Coombs & Gomez-Mejia, 1991; Drupsteen et al., 2016; Moberg et al., 2003; Nabavizadeh et al., 2013) have found that the construction of the **performance measurement system** influences consensus and culture. This is visualized in the model by the arrows that point directly towards these boxes. It is important that these measures are aligned with the overall strategy and are directly linked to the **reward** system, since having only measures within individual departments could result in the creation of functional silos. When linking the overall measures to the strategy, it seems reasonable to assume that management would naturally influence the decision-making process. Furthermore, both the literature and the empirical data suggest that measurement and rewards could have an influence on both the consensus and culture. The consensus is affected by what the employees put their focus on, and culture will be affected by whether the measurements and rewards contribute to the creation of functional silos.

The manner in which management influences the degree of **formalization and standardization** has been noted as having an influence on culture (Ayers et al., 2011). Hence, it seems obvious to place an arrow from managerial support, through formalization, in the direction of culture. This is also indicated in the empirical results, in which the data indicated that the use of standards, or the lack thereof, influenced both culture and consensus on integration. The empirical data indicated little use of formalized information sharing at the CP, while many standards and formalized structures related to the sharing of information were noted in the other four value chains. Both culture and consensus integration were perceived to be affected by the number of common arenas for information

exchange. In addition, the degree of formalization and standardization was perceived as being interlinked with managerial support: given the existence of a limited degree of use of formal systems, stronger connections with management seemed to be necessary, while, on the contrary, with a high degree of use of formal descriptions or systems, there seems to be less need for directions from management.

The degree of use of formalized systems (Moenaert & Souder, 1990), information-sharing systems (Fawcett et al., 2009), facility structure and layout (Leenders & Wierenga, 2002; Pagell & LePine, 2002; Pinto et al., 1993) and to what degree an organization makes use of measurements and rewards (Leenders & Wierenga, 2002) are all mechanisms that can affect **culture**, and management plays an important role in controlling these mechanisms. Finally, the type of culture that exists will affect the consensus integration among the employees. This consensus, or lack thereof, will affect the degree of total integration achieved in a value chain. For example, if an organization has a hierarchic structure, it could lead to the creation of "functional silo thinking" (Braunscheidel et al., 2010; Pagell, 2004), which could negatively influence the consensus (Ellinger et al., 2006). The empirical data also supported this; e.g., physical separation of employees or misaligned rewards were noted as contributing to the creation of functional silos. Evidence was found related to that information systems and formalization, and the degree of informal and formal communication among the employees could contribute to the creation of functional silos.

Should practitioners struggle to achieve integration in their value chains, this framework could hopefully support them by providing an understanding of the mechanisms that influence integration and how it might be achieved in a value chain. If, e.g., challenges related to one of the mechanisms are experienced, influencing of one of the connected mechanisms could contribute to addressing such difficulties.

5.4 Framework - Example data

To exemplify how this framework could be applied to improve the integration of a value chain, an example is provided, using data from MP II. It was necessary to make some assumptions when the existing data did not provide information regarding a particular mechanism.

The mechanisms were rated according to the extent to which the researcher found evidence for each mechanism during the case study. It should be noted that this rating would normally be performed by practitioners themselves, who would rate the mechanisms according to their own experiences with them. After the rating procedure, the average rating per category is calculated. Table 5-16, on the next page, presents the distribution of the different mechanisms within the given categories.

Table 5-16: Degree of mechanism use per category for MP II

Use of mechanisms within each category (scale 1-5)	1	2	3	4	5	
Consensus integration						
The overall strategy are transferred down to individual measures				4		4
The employees are involved in the process of deriving KPI's (to avoid mistrust)			3			3
The overall strategy is well known					5	5
The employees support the overall strategy				4		4
There is a correlation between management focus and employee focus				4		4
All the managers agree upon the business strategy			3			3
Summarized	0	0	6	12	5	3,83
Culture, social mechanisms and creation of lateral relations						
The personell are available at the value chain				4		4
The employees have confidence in systems				4		4
Degree of acknowledgement of colleagues				4		4
Degree of focus on customer among the employees				4		4
Degree of openness among the employees				4		4
Degree on focus on entire value chain				4		4
The employees have focus on the interrelation of the process steps				4		4
There exists an informal culture				4		4
The employees have an information sharing mentality				4		4
The use of job rotation is consistent when possible throughout the value chain				4		4
The employees have knowledge of other departments				4		4
The employees have team work experience					5	5
The transfer of managers is used to increase the integration					5	5
There is a use of cross functional teams				4		4
The employees are used to standardized work				4		4
Summarized	0	0	0	52	10	4,13
Facility and layout						
The employees are co-located			3			3
The plant layout are small and transparent				4		4
The layout contain no partitions				4		4
Summarized	0	0	3	8	0	3,67
Formalization and standardization						
Degree of formal meeting arenas				4		4
Degree of quality systems					5	5
Degree of standardized information sharing				4		4
Degree of visual systems					5	5
The necessary KPI's are established					5	5
There is use of tools like team boards					5	5
Summarized	0	0	0	8	20	4,67
Information systems						
The degree of use of electronical systems for information sharing				4		4
The information technology is perceived to enable integration in the value chain				4		4
Employees trust in electronical information systems				4		4
The electronical systems communicate					5	5
The use of IT systems are similar all over the value chain			3			3
Summarized	0	0	3	12	5	4
Management support/Vertical integration						
Horizontal communication between managers					5	5
Implementation of structures for securing management apparency in value chain.					5	5
Informal culture between management and employees				4		4
Little hierarchy			3			3
Do the management attend team board meetings					5	5
Do the management contribute to connect functions					5	5
Are the management a driving force in achieving integration					5	5
Do the management spend time in the value chain					5	5
Have the management initialized a vertical transfer of the strategy					5	5
Summarized	0	0	3	4	35	4,67
Measurement, rewards						
Are there any performance measurements					5	5
Are there any bonuses or rewards				4		4
Are the employees motivated towards rewards (if any)			3			3
Are the rewards aligned			3			3
Summarized	0	0	6	4	5	3,75
Degree of integration maturity					4,1875	

A visualization of the mean value per category is provided in Figure 5-13, below:
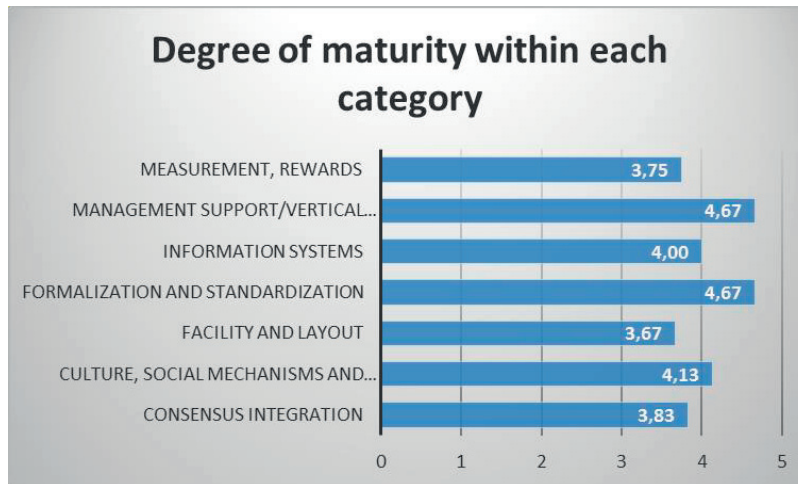
Figure 5-13: Example of the application of the maturity assessment model to MP II

The chart indicates that the organization had the most evidence of the existence of mechanisms for integration within the categories of formalization and standardization, managerial support and culture. Hence, to improve integration maturity, it seems natural to consider the categories with the lowest scores. The facility and layout category received the lowest score and should therefore have the highest potential for improvements. Looking deeper into the results of the evaluation, the greatest use of mechanisms was found to be related to the categories of managerial support, formalization and culture. Hence, to improve the degree of integration of the value chain, it would seem reasonable to consider how the mechanisms in the other categories could be improved.


Figure 5-14: Maturity level

The following scale is suggested for evaluating the maturity of an organization:

Level 5 - Very good
Level 4 - Good
Level 3 - Acceptable
Level 2 - Poor
Level 1- Very poor

Based on the calculation of maturity within each category, the data indicated that MP II had a total score of 4.19. According to the scale presented in Figure 5-14, this indicates that MP II has a degree of integration maturity that is equal to level 5. Looking deeper into the mechanisms that received the highest ratings, it can be seen that culture, managerial support and formalization demonstrated the greatest degree of use of mechanisms. Hence, to improve integration, this organization should focus on the other mechanisms.
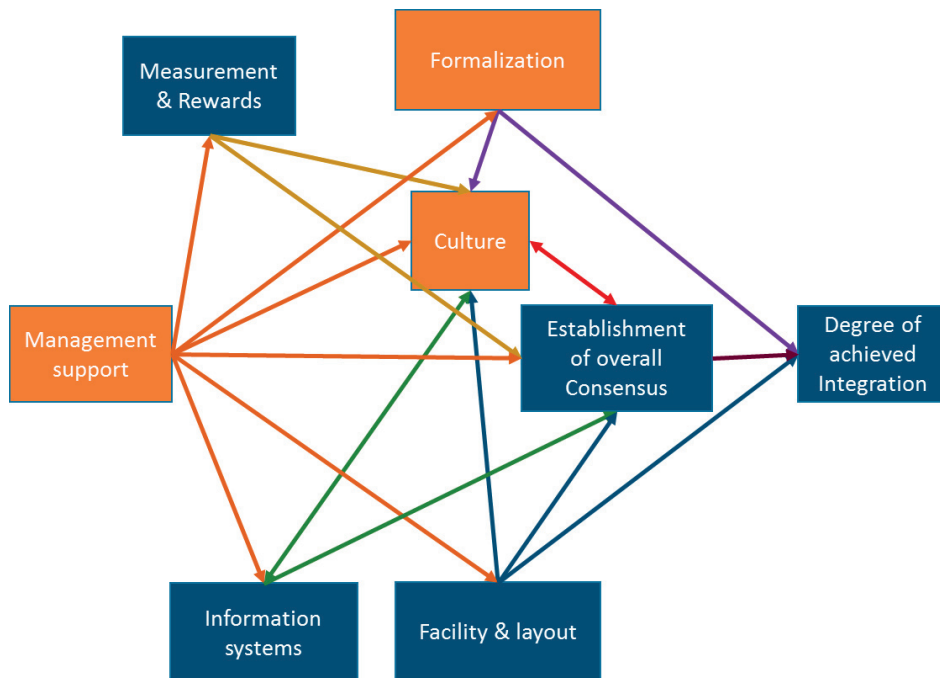

Figure 5-15: Categories with the most frequently used mechanisms - MP II

The facility structure and layout category received the lowest score; within this category, the mechanism with the lowest score was co-location of employees. Hence, to improve the rating of this category, taking actions concerning the co-locating of employees could represent a solution. However, the practitioners should be aware that, as indicated by the framework, changing mechanisms within

the facility structure and layout category may influence culture and/or consensus. The flowchart presented in Figure 5-16, below, outlines the process of applying the assessment questionnaire together with the framework.
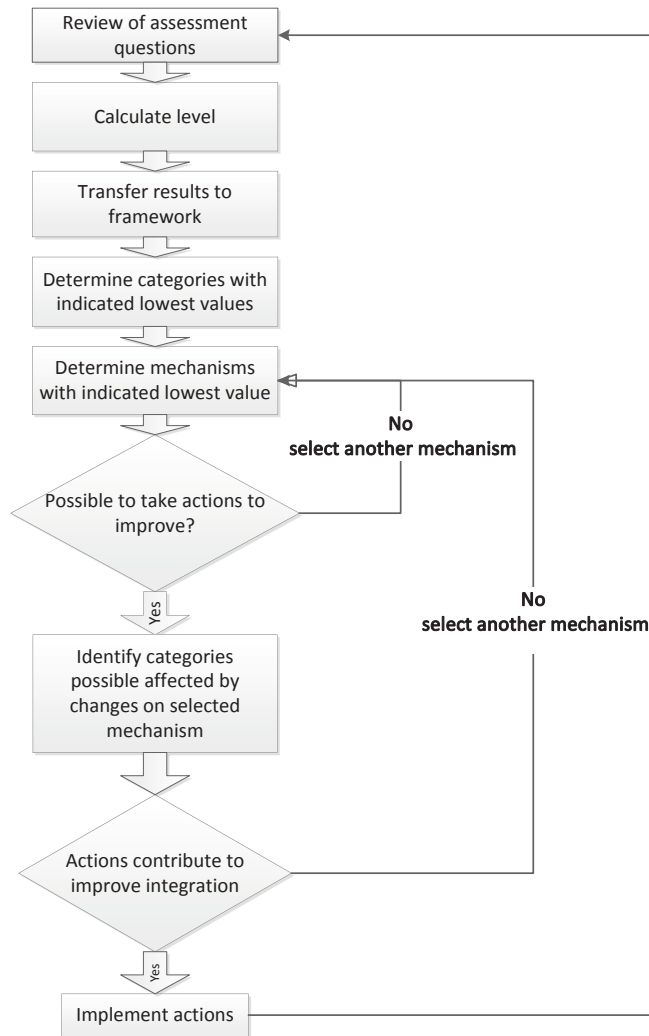
Figure 5-16: Flowchart for following the proposed process for assessing integration maturity

After having gone through this process, a new review should be performed to evaluate the effects of the actions before new actions are taken. Even though this is an initial integration assessment model, it could hopefully assist practitioners in gaining a more holistic view of which mechanisms could influence the integration of a value chain and the complex relationships between them. It is important to

164

note that, since the mechanisms are interrelated, one should consider the effects on the other mechanisms before taking any actions that focus on one item.

Based on the analysis and discussion presented in this chapter, the next chapter presents the overall conclusions of this research, its contributions to the literature, its quality and limitations and suggestions for further research.

Analysis and discussion

Chapter 6

6 Conclusions and further research

This section presents a discussion of the main contributions of this PhD thesis. Furthermore, the quality and limitations of this work are discussed. Finally, suggestions for further research within this field of research are provided. Figure 6-1, below, presents an overview of this chapter.
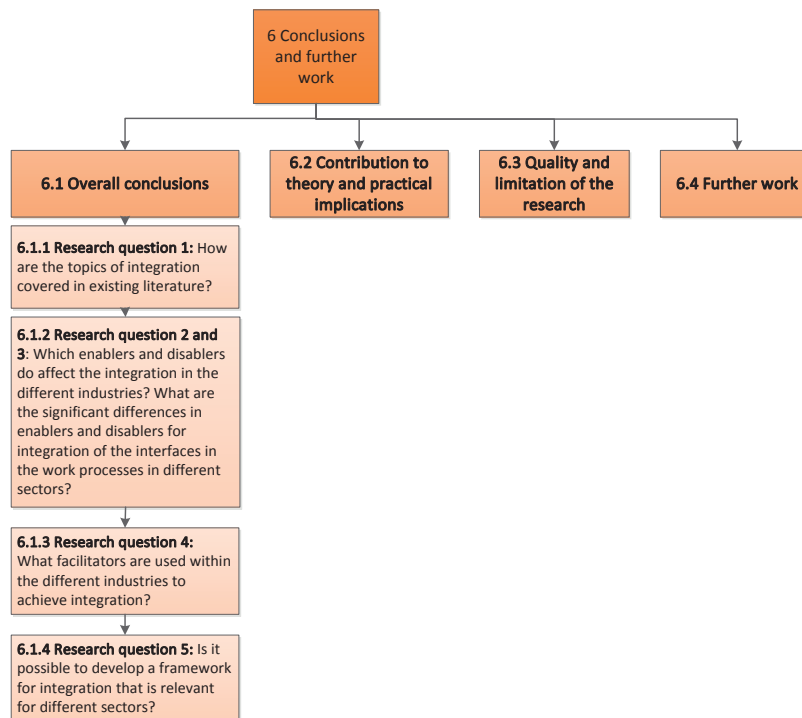

Figure 6-1: Overview of Chapter 6

6.1 Overall conclusions

Despite several years of research on the topic of integration, there remains a need for further research to achieve a greater understanding of this concept (Autry et al., 2014; Frankel & Mollenkopf, 2015). Many different terms and definitions are used within this field, and some authors do not even use any definitions. Given that such inconsistency exists within this area of study, the research conducted in this thesis was intended to address the need for greater clarification and to provide a holistic overview of cross-functional integration in a value chain. Furthermore, this

thesis contributes to providing a greater understanding of which enablers, disablers and facilitators can influence the levels of integration between two or more process steps. As an initial step toward gaining a more generic understanding of the topic, five different value chains within four different sectors were studied. Moreover, to the researcher's knowledge, there exists no integration maturity assessment model applicable to several sectors that both identifies the relationships between the mechanisms in a value chain and that could that support practitioners when attempting to improving the integration of a value chain. Therefore, by suggesting an integration maturity assessment model that could be relevant to different sectors, this thesis has provided an initial version of a tool that could contribute to enhancing practitioners' understanding and the identification of actions that could possibly improve the integration of their value chains. Five main research questions were raised (see Chapter 1.2); based on the research findings and the analysis presented in Chapter 5, these questions are answered in the following sections.

6.1.1 RQ1: How are the topics related to integration covered in the existing literature?

This research question was answered by means of the literature study conducted in Chapter 2 of this thesis. This review was conducted to determine what research on this topic already exists. Obtaining a broad overview of the topic was found to be difficult, particularly since much research within several disciplines has focused on this area and integration is one of the most well-known concepts in the study of management and its practices. The terms, the content and the framing used in the literature vary a great deal. Furthermore, perspectives on the topic also vary by discipline and author, and some authors even referred to the topic without providing any definitions. In recent years, authors have called for clarification regarding the different concepts and have used theoretical bases to perform research to provide a greater understanding of the concepts in this field. Terms such as collaboration, coordination, interdepartmental integration, interaction, operational integration, supply chain integration and cross functional integration have been used in this field.

A broad range of the literature has emphasized the importance of integration. However, several authors have claimed that determining how best to achieve integration is almost impossible and that costs are frequently underestimated.

The literature notes that research into internal integration remains in a nascent phase. In addition, according to some authors, there exists little research related to the testing of theory. Much of the existing literature is based on surveys or literature reviews, and greater use of empirical data is thus called for. Additionally, much of the existing empirical research has been referred to as inadequate and, at times, conflicting, and thus a clear consensus regarding the definition of the term integration is required.

Many different terms for the topic integration have been used in the literature. Some authors refer to the topic mainly as information flow, others have expanded it to include cooperation and collaboration and some do not use any specific terms at all. Thus, it becomes difficult, as a reader, to develop a complete overview. Based on the inconsistencies and confusion in the existing literature, authors have called for research that is deeply grounded in prior research that would make it possible to perform iterations of testing and theory building (Autry et al., 2014; Frankel & Mollenkopf, 2015).

Similar to the many different terms used for the concept of integration, the definitions are also numerous. One of the definitions presented by (Frankel & Mollenkopf, 2015) is related to contingency theory; it was found to be most applicable for the research conducted in this thesis due to its the multidimensional aspect. The definition offered by these authors is related to cross functional integration and is as follows:

"*CFI is a process of interdepartmental interaction and collaboration in which multiple functions work together in a cooperative manner to arrive at mutually acceptable outcomes for their organization.*"

A broad range of the studies published on the subject of integration have discussed the effect that integration has on **performance**, and much of the research has found that performance depends on which dimension is measured. However, it is claimed that the literature has focused more on *how* to achieve integration than methods of determining if integration has actually been achieved. The research on integration in terms of performance has also encountered difficulties because of the inconsistency of recent research, and the use of integration mechanisms or the existence of an optimal level of integration does not automatically lead to good performance. Some authors claim that the term integration stems from the systems perspective and, by optimizing an entire value chain, better performance will be achieved when compared to a chain of optimized systems. More theoretical and empirical research on the topic is required.

Integration has been studied at different levels, including **external and internal**, while other studies have focused on entire value chains. The literature differs in terms of the perceptions of whether it is better to first focus on external or internal integration or whether both should be considered simultaneously. A broad range of studies have found that it essential to study both internal and external integration to view "the whole picture." While some authors have stated that it is important to establish a foundation in terms of internal integration to succeed in terms of external integration, other authors have suggested that the external integration can enable internal integration.

A broad range of studies have focused on integration in the context of **new product development**; based on Turkulainen (2008), such research is often rooted in the

work of Hayes and Wheelwright (1984). Several authors have referred to integration as a key parameter in achieving a successful NPD process.

There is also a great deal of **supply chain management** literature that refers to integration as important to success. Supply chain management encompasses both internal and external integration, and authors have emphasized the importance of having a holistic and systemic overview of the interactions between the factors involved in integration.

The integration concept is also related to the concept of **transparency** in that transparency has been shown to contribute to providing more feedback on activities performed, facilitating coordination by revealing interdependencies, supporting decision-making and enabling improvements.

In the literature, **lean** is also stated to contribute to integration by providing clarity as to internal and external customer-supplier relationships and the roles and responsibilities of the parties involved. Visualization tools have been noted as having the potential to increase the transparency of a value chain, facilitate efficient communication, share understanding, and enhance the ability to prioritize tasks, contribute to achieving a more streamlined work process, clarify process expectations, improve task prioritization and enable well-organized distributions of workloads. However, caution is necessary to ensure that the tool is not being used as a means by which management can control employees. Visualization tools constitute a large proportion of the lean tools, and management is considered to play an important part in ensuring the successful use of such tools. The importance of employee empowerment is emphasized and the use of manual, rather than electronic, team boards is recommended.

Mechanisms for integration: A broad range of the existing studies have focused on the mechanisms that facilitate integration, but, according to some authors, relatively little empirical research, or research in general, has focused on the connections between these mechanisms. A considerable portion of the literature focuses on "*why*" integration should be achieved, but fewer authors have considered "*how*" it may be achieved.

Integration mechanisms have been found to influence the relationships between the required degree of integration and the level of integration achieved. For the purposes of this thesis, the following mechanism categories were derived based on both the existing theory on the topic and the empirical findings: "culture, social mechanisms and lateral relations," managerial support and vertical integration," "consensus integration," "formalization and standardization," "information systems" and "measurements and rewards." A brief overview of what was found in the literature and what was discussed in Chapter 2 is presented below, sorted according to these categories.

Culture, social mechanisms and the creation of lateral relationships: Culture, social mechanisms and the creation of lateral relationships have received much attention in the existing literature related to integration. Several authors have identified the presence of a hierarchic culture, functional silos, cultural barriers, or employee perception of barriers between units in a value chain as barriers to integration. However, in contrast, some authors also consider these factors as having the potential to contribute to integration under certain conditions.

The literature refers to cultural conflicts between functional units as being caused by various factors, including perceptual barriers and differences in backgrounds and worldviews. Many authors refer to functional silos as typical barriers to integration. Authors have identified several mechanisms intended to reduce the impact of these barriers, such as job rotation, cross-functional teams, co-location and the transfer of managers. While a broad range of the existing studies agree upon the advantages of using cross-functional teams, some disadvantages have also been identified, such as the time and effort required to develop the structures of such teams and select team members and the time required for the members to adapt to working as a team, in addition to the time required to maintain such teams. Job rotation is another mechanism that has received much attention in the literature. The use of job rotation has been found to contribute to improving the employees understanding of the other functions in a value chain and to provide them with a more holistic overview of the chain as a whole. However, some authors note that the effects of job rotation vary given the size of companies, with SMEs enjoying better outcomes.

The existence of arenas intended to stimulate informal communication is mentioned in literature as being positively related to achieving integration; however, the effects of such arenas are noted to be largely reliant on their physical layouts and work structures and the rules or the philosophies of management.

Managerial support and vertical integration: A broad range of the integration literature emphasises the importance of managerial support in achieving integration. Important tasks for management are considered to be participation, placing the focus of the employees on the importance of integration and determining the course and culture of the organization. Moreover, management should play a part in ensuring the translation of its strategy into functional measures and demonstrate a positive attitude towards other units.

Formalization and standardization: In the literature, formalization and standardization are referred to as important in ensuring that the outputs of processes fulfil the expectations of the internal and external customer, particularly when complex situations exist. However, different opinions can be found on this subject. As standardization enables coordination, it could drive integration and may be useful when dealing with complex and less structured work. However, if standards hinder flexibility, they could negatively affect integration. Finally, it is important that employees comply with the systems established.

Facility structure and layout: In the literature on integration, there are several examples of distances between functions or teams being considered as possible barriers to integration. Methods of coping with and overcoming this obstacle include developing relational norms and encouraging co-location. Moreover, management's philosophy with regard to whether or not employees are allowed to leave the workplace also has an influence on the development of a culture of informal communication and thus integration.

Information systems: The literature offers different perspectives regarding the use of information technology systems in achieving integration. Studies published by IT vendors have focused more on the positive contribution of IT than, e.g., literature that focuses on the importance of the marketing-manufacturing interface. However, it is clear that the manner in which data are being processed is of importance, and, when attempting to achieve integration, it is crucial that established databases and systems communicate well.

Consensus integration: Several authors have focused on the importance of the existence of a consensus on strategic priorities and avoiding conflicts related to functional goals and attitudes. Furthermore, the importance of the translation of these priorities into to functional measures has been emphasized as important in achieving integration.

Measurements and rewards: According to several authors, offering bonuses that are aligned is associated with the reduction of conflicts between functions and, furthermore, positively influences integration. However, if goals are only identified occasionally and are not functionally coordinated, employees' willingness to cooperate can be reduced. Some authors have called for further research into this topic.

6.1.2 RQ 2 and 3: Which enablers and disablers affect integration in different sectors? What are the significant differences in integration in different sectors?

The objective of the first research question was to gain an impression of how the topic of integration has been addressed within the existing literature. Since this topic has been considered in many ways, with the use of different terms and definitions, it was necessary to devote some effort to sorting the data. The theoretical review provided the basis for the establishment of the categories used to structure the empirical data. During the research period, empirical data were collected from five different case studies. Through considering four articles, these five case studies were presented, and the data provided were further analyzed and discussed in Chapter 5. Research questions 2 and 3 investigate which factors are perceived as enabling or disabling integration within the value chains studied. A further aim was to identify possibly significant differences or similarities within the different sectors.

Culture: Within this category, the research data indicated that the CP and both MPs had in common an informal culture in terms of communication in their production areas. In the literature, informal cultures are considered to stimulate integration, but this is largely dependent on the physical layout and structure of a work environment and the rules or philosophies of management. Differences were found in terms of the degrees to which employees were accustomed to standards. Many years of experience with highly formalized systems had made the employees of the MPs more accustomed to standardized work and information sharing. This was also noted at the hospital and the SP. In contrast, a lack of confidence in the established formalized information-sharing systems was noted at MP I and the CP. It seems reasonable to assume that, despite the existence of a significant degree of formalization and standardization, if the employees do not follow the standards or trust in them, the potential effect that standardization can have on integration may be reduced. (This is also supported by the literature.) The research data indicated the existence of a more ad hoc problem-solving culture at the CP than at the other organizations. This could also have a negative influence if the employees choose to not follow standards and to use their own approaches to tasks.

Openness, an information-sharing mentality and a focus on the entire value chain were noted to exist at the hospital, MP II and the SP. However, at the SP and the hospital, the rules and principles related to professional secrecy occasionally made it difficult for employees to obtain information regarding other functions.

Indication of *tacit knowledge* were found at the CP and the hospital. The literature states that the sharing tacit knowledge is important to achieve a transparent value chain.

The existence of *functional silos* was noted at the CP, MP I, the hospital and the SP. However, different reasons for their existence were found. At the CP and MP I, there the operators primarily focused on their own processes and were not perceived as being interested in the rest of the value chain. At the hospital and the SP, professional secrecy resulted in the creation of functional silos, as the employees were not allowed to obtain information from the other departments.

Managerial support: The findings presented in this thesis indicate the importance of management's promotion of and support for integration, and this is also highly emphasized in the literature. At all of the organizations, relatively informal cultures were perceived as existing among the management and the employees. The two MPs and the CP both demonstrated little hierarchy and management that was frequently available on the production line. What distinguished the hospital from the other organizations was that its management often directly participated in the value chain. Mass producer II had established routines intended to ensure that its management frequently appeared in the value chain. The literature refers to the participation of management as important in achieving integration

At the CP, a close relationship amongst the employees and the manager, taking the form of direct supervision, was noted. At both the CP and MP I, it was seen that the managers contributed to the establishment of link for the sharing of information between functions. Arenas established to ensure horizontal communication between managers, as well as frequent management meetings, were common enablers for all of the organizations.

At four of the organizations, namely the two MPs, the hospital and the SP, the research data indicated a mismatch between overall goals and functional focus. While efforts had been made at these organizations to translate their overall strategies into functional measures, differences, either between the focus of management and that of employees or between various functions, were noted. In the literature, it emphasized that management should play a facilitating role and ensure that organizational strategy is communicated downwards.

Consensus integration: All the organizations seemed to struggle with achieving strong connections between overall strategies and functional tasks. Four of the organizations had made efforts towards translating their overall strategies into functional measures. Functional silo thinking was noted to negatively influence the degree of consensus at all the organizations.

Facility structure and layout: This is perhaps the most surprising finding. Even though the organizations had very different sizes and layouts, it was found that for three of them, namely the CP, MP I and the hospital, partitions presented obstacles to integration. Previous research has suggested that the presence of partitions between units can lead to the creation of functional silos and different cultures. To overcome this obstacle, it is suggested that management should encourage positive attitudes between departments, designate common arenas for information sharing and focus on the quality, rather than quantity, of communication.

Information systems: Except for the CP, it was found that all of the organizations made significant use of information systems. However, at the MPs, the research data indicated a greater use of electronic information-sharing systems at higher levels. Some lack of trust in systems was noted among the employees of MP I and the hospital. A greater number of adapted systems were found at the SP. Hence, the data show mixed results regarding whether the use of information systems contribute to achieving integration. Moreover, the data could also indicate that this category is dependent on other categories, such as culture and managerial support, in the sense that the employees at MP I lacked trust in the systems.

Formalization and standardization: Except for the CP, a significant degree of use of standards was noted for all of the organizations. In the literature, a high level in terms of standards, combined with informal communication, has been found to contribute to integration. However, the research data could indicate that the informal communication at the hospital could be suffering because of long

distances; in addition, a lack of trust in standards was noted at MP I. Both observations may represent factors that could contribute to reducing integration.

Measurements and rewards: The use of bonuses was only found at the CP and the SP. As motivation in terms of achieving the bonus level differed, this was considered to have a negative influence on integration. The bonus structures at the SP were perceived to be constructed in such a fashion that functional silo thinking could arise, thus inhibiting integration. The view that bonuses that are not aligned could have a negative influence on integration is in line with the existing literature.

Summarized: As also noted by Turkulainen (2008), the research conducted in this thesis supports the view that integration is a multidimensional concept. This can account for why, when studying an individual category, it is often seen that it can directly or indirectly influence one or more other categories. It can also be observed that some enablers or disablers might be placed under several categories and that an enabler could be a disabler, or vice versa, depending on circumstances.

6.1.3 **RQ 4:** What facilitators of integration are used within different sectors?

For the purposes of this thesis, facilitators of integration were defined as the mechanisms directly introduced by organizations to improve the integration and are referred to in the literature as can affect integration. These facilitators are related to all the publications considered previously (i.e. publications I-IV).

The basis for mapping the facilitators that were relevant for the different case studies was provided by a review of the mechanisms referred to in Chapter 2; in addition, those that were perceived as actions that could be directly taken by an organization to improve integration were also taken into account. Based on ratings assigned to the facilitators in each category, an overview of which facilitators were used most frequently and how they were distributed within each case study was established. Within the categories facility structure and layout and consensus on integration, there were no indications of the use of any facilitators.

Within the culture category, the data suggested that job rotation was the facilitator used most consistently; it was mainly used at MP II. Thereafter, evidence of the use of cross-functional teams was found at the hospital, MP II and the SP, but this practice was not consistently adopted throughout these organizations' value chains. At MP I, the data suggested that cross-functional teams were used at higher levels. In the literature, both job rotation and cross-functional teams are considered to contribute to obtaining a superior overview of a value chain.

Overall, the "management support" was the category found to contain the most evidence of use of facilitators; this was particularly pronounced at MP II, where good support were found for all the following facilitators within the "managerial support" category:

- Implementation of structures intended to ensure management's appearance in the value chain;
- Management attends team board meetings;
- Management focuses on connecting functions;
- Horizontal communication occurs between managers; and
- Vertical transfer of strategy into individual measures occurs.

Three of the organizations (the MPs and the SP) had established systems for ensuring the appearance of management at team meetings. However, systems established to ensure management's appearance in the value chain were only found at MP II and SP. To a large degree, the literature refers to managerial support as essential in achieving integration.

The most evidence for the existence of facilitators related to "formalization and standardization" was found at the MPs, the hospital and the SP. This can be explained by the high degrees of standardization found in these organizations. The MPs and the SP demonstrated a high degree of use of team board meetings. Evidence of considerable efforts toward translating functional goals into measurable functional parameters was found at MP II and the SP. The research data indicated evidence of the use of several visual system elements at the CP and both MPs.

The use of bonuses as facilitators was only noted at the CP and the SP, and the findings indicated that the rewards offered by the CP were more aligned than those of the SP.

6.1.4 RQ 5: How can an integration maturity assessing model be developed to be a valuable tool for value chains that aim towards increasing the degree of integration of the value chain?

On the basis provided by the theoretical and empirical findings concerning all the organizations, a framework for mapping the maturity of integration was proposed in Chapter 5.3. To develop a tool for rating the degree of integration of a value chain, the mechanisms and relationships that were identified in the theory and the empirical results as functioning to improve the integration of a value chain were listed in a questionnaire that featured questions and statements. In addition, a framework for investigating the interlinks between the mechanisms of integration was proposed. By filling out the questionnaire and thereafter using the framework as a tool to guide them with regard to which mechanisms they should focus on, practitioners can determine if they were working towards improving their value chains.

The framework demonstrates that achieving integration is a multidimensional process in which the mechanisms are interrelated. Managerial support plays a crucial role in this framework, which supports what was emphasized in literature. This could further affect the culture, which also plays an important part in

achieving integration. The use of bonuses and reward systems, formalization, information systems and the structure and layout of a facility can all possibly influence culture. Furthermore, these mechanisms can affect the overall degree of consensus integration and, finally, the degree of integration achieved. Since this proposed framework is based on the theoretical and practical input provided by several sectors, it could prove useful for different types of sectors. However, there are also several limitations to this research, which are discussed in Section 6.3.

6.2 Contributions to the literature and practical implications.

This thesis offers several contributions to the extant literature. The main aim of this research was to develop a better understanding of the factors that enable, disable and facilitate integration within different value chains in a Norwegian context. With a foundation provided by the existing theory regarding the topic, research questions were developed that focused on what employees within the value chains addressed in this study perceived as the enablers or disablers of integration and the facilitators that have been used within these value chains. Furthermore, the responses to these questions were examined. An additional objective of this thesis was, based on the existing literature and empirical findings that should be relevant to different sectors, the proposal of a framework for the mapping of integration maturity.

This thesis provides supplementary theoretical insights into the topic of integration. By using existing literature in combination with empirical findings, this research attempted to provide additional clarity regarding this subject. Through empirical studies of five different types of value chains within four different sectors in a Norwegian context and the research findings that formed the basis of the four articles discussed in this thesis, this work contributes by providing new insights into the possible enablers and disablers of integration in a value chain. With the existing literature on the topic providing a basis for the collection and analysis of the empirical data provided by the case studies, a knowledge experience has been provided as to which factors are perceived as influencing integration. To produce more generalizable results, key informants from different areas of the value chain were consulted. The results provided by this thesis could also contribute to providing further clarity with regard to the inconsistent findings reported in prior studies.

This thesis provides in-depth descriptions of the enablers and disablers of integration. Unlike much of the existing research, which has tended to focus on integration within a single value chain, this dataset provides data from a broader set of sectors, namely a craft producer, two mass producers, a hospital and a financial service provider.

Since earlier research into integration was, for the most part, based on surveys, several authors have called for more empirical data on the topic. By offering the empirical results of five case studies, this thesis responds to this call for more

empirical data. According to Wong et al. (2017), previous research that focused on several sectors tended to mix the findings in a single study; hence, identifying industrial differences might prove difficult. Since the empirical findings for this thesis consist of data obtained from five separate case studies, a comparison of their similarities and differences is possible.

This thesis also makes a number of practical contributions: This study could contribute to an increased understanding of which factors the employees within different value chains perceive as contributing or hindering to integration. Furthermore, the experiences discussed in this study could contribute new knowledge and provide operational guidance to practitioners within similar types of organizations as to which enablers and disablers can influence integration when they attempt to promote value chain integration. Moreover, insights have been provided as to the types of facilitators that are used within different sectors. Finally, the proposed framework, which is based on both theory and the empirical findings, could provide practitioners with useful guidance in terms of what to consider when attempting to improve the integration of their value chains and provide an indication of the degree of a value chain's integration maturity.

6.3 Quality of this research

According to Patton (1990), a researcher who wishes to conduct quality research should pay attention to validity and reliability when designing, analysing and evaluating the quality of a study. The theory and how it was approached to conduct valid and reliable research for this thesis was described in Section 3.7.

Within Chapter 5, the main findings and the theoretical and practical contributions of this thesis were discussed. Within this section, this research's validity and reliability are be reflected upon with regard to the criteria listed in Chapter 3.7. Construct validity refers to evaluating to what extent to which the focus of a study coincides with what it states it will investigate. Three strategies can be used to improve construct validity: the using multiple sources, establishing a chain of evidence and using key informants to review a draft of the case study report (see Figure 3.16) (Yin, 2009).

The first measure intended to ensure construct validity is the use of multiple sources of evidence. At first, a narrative literature review was performed, which formed the basis for conducting the rest of the research and investigating the publications. In publications I-III, interviews with employees within the value-adding sections of value chains, observations and document reviews were conducted. In addition, the author participated in meetings and conducted additional interviews. A post-mortem approach was used in publication IV.

The second measure used to ensure construct validity is establishing a chain of evidence. With the use of this principle, the reader can follow the course of research, proceeding from the start, with the initial questions, to the end, with the

conclusions. This measure was satisfied in all of the publications, as they first identified the purpose of the research in question and the basis for their suppositions. The aim was to maintain a "storyline," as suggested by Phillips and Pugh (2010), to enable the reader to trace the different steps, either from the conclusions back to the initial research questions or from the research questions to the conclusions. Finally, inviting company representatives to verify the reports of the case study is essential to improving construct validity.

Two of the publications, namely II and III, were discussed with company representatives before publication, while the company studied in publication I had gone bankrupt due to a declining market before the paper was finished. The case companies of publication IV were associated with a project that was completed before the work for this thesis started. Hence, it was difficult to discuss the data with the employees at one of the companies, but the findings were discussed with project participants. The other case company, though, was located nearby. The findings from this company were discussed with both project participants and employees at the company.

The case studies related to this study were explanatory, and therefore testing for internal validity should be performed on the results. The tactics used to ensure internal validity include addressing rival explanations, conducting explanation building, the use of logical models and pattern-matching exercises. This issue was addressed during the analysis phases of each case, when attempting to identifying explanations for the findings. Obviously, this section was challenging, as the author occasionally worked alone, but, consequently, preliminary conclusions were always discussed with the researcher's supervisor and colleagues. In addition, since several of the presentations were given at international conferences, opportunities arose to discuss the conclusions with other researchers who were experienced in this field (Yin, 2009) . This study also has its limitations in terms of external validity, which are discussed in the following section.

External validity concerns the degree to which results reflect reality and can be demonstrated beyond the object of study; in other words, it refers to whether or not the findings of a study are generalizable (Yin, 2009). Jacobsen (2010) emphasizes that, rather than generalizing from a selection of units to a larger group of units, the aim of qualitative methods is to understand and elaborate constructs and phenomena. Generalization from a single case has frequently been criticized. Such criticism often has its roots in the opposite type of studies, surveys, whereas the intention is that one sample should be generalized to a larger universe. In case studies, however, this analogy is incorrect. While the generalization of surveys relies on statistics, case studies rely on generalizations based on analytical assumptions (Yin, 2009).

This study adopted a multiple-case design. To address the main topic, research was designed around five case studies in Norway, using replication logics, which is the logic used when selecting two or more cases within a multiple case study (Yin,

2009). Despite the fact that all of the case companies are located in Norway, the results cannot be directly generalized. Nevertheless, due to the common characteristics of these organizations, the findings can to some extent be used as a basis for research on the same topic within cases from different contexts. The cases were chosen from four different sectors, namely craft production, mass production, healthcare and service. However, there exist many sectors that were not covered due to limitations in time and scope.

Reliability means that, if another researcher performs the same study using the same procedure, the same results will be produced. To ensure reliability, as recommended by Yin (2009), a case study database and a research protocol that described the documents and procedures used and the steps taken during this research was established. During the research period, notes were taken. The data were coded, and the coding and the analysis processes were carefully documented. Next, this evidence was documented in the case study database. Thus, it should be possible to replicate the case studies. As mentioned previously, triangulation is a strategy that improves the reliability of research findings (Golafshani, 2003). In the work performed for this thesis, a combination of several approaches was used to achieve a triangulation of the results.

The articles related to this thesis have been published in journals and at a conference. All of the articles have been anonymously peer-reviewed. As such, there has been a process that tested if the research's approach fulfilled requirements with regard to originality, solidity and relevance. In addition, as the researcher presented the article at a conference and participated in a larger forum with participants from different sectors and the field of research it was possible to obtain valuable feedback and further confirmation that this research fulfilled the above requirements.

The case study protocol was also discussed with either company representatives or colleagues, when applicable, in advance of the data collection phase. Triangulation was ensured by using various research methods intended to contribute to improving the reliability of this research's results. This was ensured by conducting a literature review and case studies.

6.4 Research limitations

The interpretation of the research results of this thesis is subject to several limitations. The main limitations, in the author's opinion, are as follows:

1. Many definitions of the terms integration exist, and its content and framing vary;
2. With the use of case studies, the limitations include the lack of generalizability of the results beyond the specific case context. This research project focused on five different organizations, namely a craft producer, two mass producers, a hospital and a service provider. The

challenge with respect to the generalizability of the results was addressed by conducting case studies in different sectors. However, additional case studies within each industry could have been performed;

3. The use of interviews is more appropriate for gaining a thorough knowledge of a phenomenon than for generalizing to larger populations;

4. This research project deals with the concept of integration in the context of Norwegian organizations. Cultural issues that are taken for granted in the Norwegian context could exist, and therefore may represent a blind spot when analyzing and discussing the results. Organizations representing other parts of the world have not been investigated; hence, the overlapping findings from the case organizations cannot automatically be generalized;

5. For this research, it was decided to investigate only the internal sections of the value chains. That raises the question if the findings from this research would have been similar if both the internal and external part of the value chain had been studied; and

6. The scope of study for this research was limited to the core processes. Hence, if the support processes indirectly influence the integration of the core processes, such relationships may not have been revealed.

The framework for integration presented in this thesis was developed within systems theory, which means that the framework must be considered based on the integration elements themselves, as well as well as the organizations in which they were found. The framework is related to integration in the main value chains; these may vary between organizations and the problems considered. Consequently, only the most common process steps were incorporated into the framework. Since the framework is part of an open system in which there is continuously interaction with the environment, it is expected that it will change over time. Therefore, the framework represents today's available integration elements. In the future, other integration elements, which could become more significant than those described in this thesis, may be identified.

6.5 Opportunities for further study

This study provides a more thorough understanding of the enablers and disablers of integration, the facilitators of integration, the differences in integration between different sectors and a framework for integration. However, as there is still little empirical work on this topic, more research is required to contribute more empirical data and further develop the theory related to this subject. This thesis provides a basis for further studies on integration within different sectors.

Based on the findings from the overall study and what was found during the analysis, the suggestions for further research are as follows:

- Future studies should focus on obtaining more empirical results from each sector relevant to this the topic by including a greater number of cases. The

aim of such studies should be to improve knowledge that may further may improve companies' abilities in terms of achieving operational integration;

- Further studies could use action research to consider the mechanisms that affect integration. Through determining a baseline before the implementation of possible mechanisms and measuring it after implementation, it will be possible to obtain more knowledge regarding the effect of each mechanism;
- This research focused on developing a model for evaluating the degree of integration within the value chains of different sectors and countries. This research is built on five case studies, which are clearly too few to provide generalizable results. Hence, this model should be further tested by applying it to different types of organizations;
- As this research focused on several mechanisms in combination and the literature calls for more research into combined mechanisms, further studies should also focus more on research intended to test the validity of these findings;
- The results considered in this research are based on findings relating to Norwegian organizations. Future studies should focus on obtaining data from global organizations. Furthermore, studies of differences in integration for different value chains within different countries should be conducted;
- As some integration mechanisms can both be enablers in one context and disablers in another, further studies should consider enablers and disablers in greater depth to determine in which circumstances a mechanism could be found to be an enabler and in which it could be a disabler; and
- Framework: The categories used in this research were developed based upon the work of a varying group of researchers, in addition to the empirical results of the case studies considered in this thesis. Since integration mechanisms may vary between organizations and by the problems at hand, further research should test this framework for mapping the maturity of integration to provide a more thorough overview of the mechanisms and how they are related.

References

Adler, P. S. (1995). Interdepartmental interdependence and coordination: The case of the design/manufacturing interface. *Organization science, 6*(2), 147-167.

Allen, T. J. (1984). *Managing the flow of technology: Technology transfer and the dissemination of technological information within the R&D organization* (Vol. 1). United States.

Arbnor, I., & Bjerke, B. (2009). *Methodology for creating business knowledge* (2 ed.). Lund, Sweden: Sage.

Autry, C. W., Rose, W. J., & Bell, J. E. (2014). Reconsidering the supply chain integration–performance relationship: in search of theoretical consistency and clarity. *Journal of business logistics, 35*(3), 275-276.

Ayers, D. J., Gordon, G. L., & Schoenbachler, D. D. (2011). Integration And New Product Development Success: The Role Of Formal And Informal Controls. *Journal of applied business research, 17*(2).

Barki, H., & Pinsonneault, A. (2005). A model of organizational integration, implementation effort, and performance. *Organization Science, 16*(2), 165-179.

Barratt, M. (2004). Understanding the meaning of collaboration in the supply chain. *Supply Chain Management, 9*(1), 30-42.

Barratt, M., & Barratt, R. (2011). Exploring internal and external supply chain linkages: Evidence from the field. *Journal of Operations Management, 29*(5), 514-528.

Basnet, C. (2013). The measurement of internal supply chain integration. *Management Research Review, 36*(2), 153-172.

Basnet, C., & Wisner, J. (2012). Nurturing Internal Supply Chain Integration. *Operations and Supply Chain Management, 5*(1), 27-41.

Bateman, N., Philp, L., & Warrender, H. (2016). Visual management and shop floor teams–development, implementation and use. *International Journal of Production Research, 54*(24), 1-14.

Bauch, C. (2004). *Lean Product Development: Making Waste Transparent.* (Diploma Thesis), Massachusetts Institute of Technology and Technical University of Munich., Munich.

Berg, B. L., Lune, H., & Lune, H. (2004). *Qualitative research methods for the social sciences* (Vol. 5). United States of America: Pearson Boston, MA.

Bergen, S., & McLaughlin, C. (1988). The R&D/production interface: A four-country comparison. *International Journal of Operations & Production Management, 8*(7), 5-13.

Beth, S., Burt, D. N., Copacino, W., Gopal, C., Lee, H. L., Lynch, R. P., & Morris, S. (2003). Supply chain challenges. building relationships. *Harvard business review, 81*(7), 64-73, 117.

Bititci, U., Cocca, P., & Ates, A. (2015). Impact of visual performance management systems on the performance management practices of organisations. *International Journal of Production Research, 54*(6), 1-23.

Bititci, U., Mendibil, K., Nudurupati, S., Garengo, P., & Turner, T. (2006). Dynamics of performance measurement and organisational culture. *26*(12), 1325-1350. doi:10.1108/01443570610710579

Boone, T., & Ganeshan, R. (2002). *New Directions in Supply Chain Management: Technology, Strategy, & Implementation*. New York, United States of America: AMACOM, A division of American Management Association, New York.

Bowersox, D. J., Closs, D. J., & Stank, T. P. (1999). *21st century logistics: making supply chain integration a reality*. Ok Brook: IL: Council of Logistics Management.

Braunscheidel, M. J., Suresh, N. C., & Boisnier, A. D. (2010). Investigating the impact of organizational culture on supply chain integration. *Human Resource Management, 49*(5), 883-911.

Brown, S. L., & Eisenhardt, K. M. (1995). Product development: Past research, present findings, and future directions. *Academy of management review, 20*(2), 343-378.

Bryman, A. (2012). *Social research methods*. United States: Oxford university press, New York.

Calantone, R., Dröge, C., & Vickery, S. (2002). Investigating the manufacturing–marketing interface in new product development: does context affect the strength of relationships? *Journal of Operations Management, 20*(3), 273-287.

Cao, N., Zhang, Z., To, K. M., & Ng, K. P. (2008). How are supply chains coordinated?: An empirical observation in textile-apparel businesses. *Journal of fashion marketing and management, 12*(3), 384-397.

Carlsson, M. (1991). Aspects of the integration of technical functions for efficient product development. *R&D Management, 21*(1), 55-66.

Carroad, P. A., & Carroad, C. A. (1982). STRATEGIC INTERFACING OF R-AND-D AND MARKETING. *Research Management, 25*(1), 28-33.

Chang, W., Ellinger, A. E., Kim, K. K., & Franke, G. R. (2016). Supply chain integration and firm financial performance: A meta-analysis of positional advantage mediation and moderating factors. *European Management Journal, 34*(3), 282-295.

184

Chen, H., Daugherty, P. J., & Landry, T. D. (2009). Supply chain process integration: a theoretical framework. *Journal of business logistics, 30*(2), 27-46.

Chen, H., Daugherty, P. J., & Roath, A. S. (2009). Defining and operationalizing supply chain process integration. *Journal of business logistics, 30*(1), 63-84.

Chen, I. J., & Paulraj, A. (2004). Towards a theory of supply chain management: the constructs and measurements. *Journal of Operations Management, 22*(2), 119-150.

Chen, J., Damanpour, F., & Reilly, R. R. (2010). Understanding antecedents of new product development speed: A meta-analysis. *Journal of Operations Management, 28*(1), 17-33.

Child, J. (1972). Organizational structure, environment and performance: The role of strategic choice. *Sociology, 6*(1), 1-22.

Childerhouse, P., & Towill, D. R. (2002). Enabling seamless market-orientated supply chains. *Int. J. Logistics Systems and Management, 2*(4).

Childerhouse, P., & Towill, D. R. (2011). Arcs of supply chain integration. *International Journal of Production Research, 49*(24), 7441-7468.

Christopher, M. (2011). *Logistics and supply chain management* (4 ed.). Edinburgh Gate, Harlow CM20 2JE, Great Britain: Pearson Eucation Limited.

Clark, K. B., & Wheelwright, S. C. (1992). Revolutionizing product development: quantum leaps in speed, efficiency, and quality. *New York: NY*.

Cohen, L., Manion, L., & Morrison, K. (2013). *Research methods in education, Seventh editon*. London, UK: Routledge.

Cook, T. D., & Campbell, D. T. (1979). *Quasi-experimentation: Design and analysis for field settings*. Boston: Houghton Mifflin Co.

Coombs, G., & Gomez-Mejia, L. R. (1991). Cross-functional pay strategies in high-technology firms. *Compensation & Benefits Review, 23*(5), 40-48.

Council, N. R. (2000). Quality in Norwegian Research. A summary of concepts, methods, and means (In Norwegian: Kvalitet i norsk forskning. En oversikt over begreper, metoder og virkemidler). In. Oslo, Norway: Norwegian Research Council.

Creswell, J. W. (2012). *Qualitative inquiry and research design: Choosing among five approaches* (Second ed.). London, UK: Sage publications.

Cusins, P. (1994). Understanding quality through systems thinking. *The TQM Magazine, 6*(5), 19-27.

Daugherty, P. J., Ellinger, A. E., & Gustin, C. M. (1996). Integrated logistics: achieving logistics performance improvements. *Supply Chain Management: An International Journal, 1*(3), 25-33.

Davenport, T. H., Harris, J. G., & Cantrell, S. (2004). Enterprise systems and ongoing process change. *Business Process Management Journal, 10*(1), 16-26.

De Bruin, T., Freeze, R., Kaulkarni, U., & Rosemann, M. (2005). *Understanding the main phases of developing a maturity assessment model*. Paper presented at the 16th Australasian Conference on Information Systems (ACIS), November 30 - December 2, 2005, New South Wales, Sydney, Australia.

de Menezes, L. M., Wood, S., & Gelade, G. (2010). The integration of human resource and operation management practices and its link with performance: A longitudinal latent class study. *Journal of Operations Management, 28*(6), 455-471.

Delanty, G., & Strydom, P. (2003). *Philosophies of social science: The classic and contemporary readings*. Maidenhead, Berkshire, England: Open University Press, McGraw-Hill Education.

Denzin, N. K. (1978). *Sociological methods: A sourcebook* (2 ed.). New York McGraw-Hill.

Deshpandé, R., Farley, J. U., & Webster Jr, F. E. (1993). Corporate culture, customer orientation, and innovativeness in Japanese firms: a quadrad analysis. *The journal of Marketing, 57*(1), 23-37.

Deshpande, R., & Webster Jr, F. E. (1989). Organizational culture and marketing: defining the research agenda. *The Journal of Marketing, 53*(1), 3-15.

Droge, C., Jayaram, J., & Vickery, S. K. (2004). The effects of internal versus external integration practices on time-based performance and overall firm performance. *Journal of Operations Management, 22*(6), 557-573.

Drucker, P. F., & Maciarello, J. A. (2009). Management cases. In. New York: Collins Business.

Drupsteen, J., van der Vaart, T., & Van Donk, D. P. (2016). Operational antecedents of integrated patient planning in hospitals. *International Journal of Operations & Production Management, 36*(8), 879-900.

Easton, G. (2010). Critical realism in case study research. *Industrial Marketing Management, 39*(1), 118-128.

Edström, A., & Galbraith, J. R. (1977). Transfer of managers as a coordination and control strategy in multinational organizations. *Administrative science quarterly, 22*(2), 248-263.

Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of management review, 14*(4), 532-550.

Eisenhardt, K. M., & Graebner, M. E. (2007). Theory Building from Cases: Opportunities and Challenges. *The Academy of Management Journal, 50*(1), 25-32. doi:10.2307/20159839

Eisenhardt, K. M., & Tabrizi, B. N. (1995). Accelerating adaptive processes: Product innovation in the global computer industry. *Administrative science quarterly, 40*(1), 84-110.

Ellinger, A. E., Keller, S. B., & Ellinger, A. D. (2000). Developing interdepartmental integration: An evaluation of three strategic approaches for performance improvement. *Performance Improvement Quarterly, 13*(3), 41-59.

Ellinger, A. E., Keller, S. B., & Hansen, J. D. (2006). Bridging the divide between logistics and marketing: facilitating collaborative behavior. *Journal of business logistics, 27*(2), 1-27.

Eppler, M. J., & Burkhard, R. A. (2007). Visual representations in knowledge management: framework and cases. *Journal of Knowledge Management, 11*(4), 112-122.

Erens, F., & Hegge, H. (1994). Manufacturing and sales co-ordination for product variety. *International Journal of Production Economics, 37*(1), 83-99.

Eriksson, T., & Ortega, J. (2006). The adoption of job rotation: Testing the theories. *ILR Review, 59*(4), 653-666.

Ettlie, J. E. (1995). Product-process development integration in manufacturing. *Management Science, 41*(7), 1224-1237.

Ettlie, J. E. (1997). Integrated design and new product success. *Journal of Operations Management, 15*(1), 33-55.

Ettlie, J. E., & Reza, E. M. (1992). Organizational integration and process innovation. *Academy of Management Journal, 35*(4), 795-827.

Fawcett, S. E., & Magnan, G. M. (2002). The rhetoric and reality of supply chain integration. *International Journal of Physical Distribution & Logistics Management, 32*(5), 339-361.

Fawcett, S. E., Wallin, C., Allred, C., & Magnan, G. (2009). Supply chain information-sharing: benchmarking a proven path. *Benchmarking: An International Journal, 16*(2), 222-246.

Fisher, D. M. (2004). The business process maturity model: a practical approach for identifying opportunities for optimization. *Business Process Trends, 9*(4), 11-15.

Flynn, B. B., Huo, B., & Zhao, X. (2010). The impact of supply chain integration on performance: a contingency and configuration approach. *Journal of Operations Management, 28*(1), 58-71.

Foster, J. (1995). Informal social control and community crime prevention. *British Journal of Criminology, 35*(4), 563-583.

Frankel, R., Bolumole, Y. A., Eltantawy, R. A., Paulraj, A., & Gundlach, G. T. (2008). The domain and scope of SCM's foundational disciplines—insights and issues to advance research. *Journal of business logistics, 29*(1), 1-30.

Frankel, R., & Mollenkopf, D. A. (2015). Cross - Functional Integration Revisited: Exploring the Conceptual Elephant. *Journal of business logistics, 36*(1), 18-24.

Frohlich, M. T., & Westbrook, R. (2001). Arcs of integration: an international study of supply chain strategies. *Journal of Operations Management, 19*(2), 185-200. doi:http://dx.doi.org/10.1016/S0272-6963(00)00055-3

Galbraith, J. R. (1973). *Designing complex organizations.* Boston MA, USA: Addison-Wesley Longman Publishing Co., Inc.

Galbraith, J. R. (1994). *Competing with flexible lateral organizations* (2nd ed.): Addison-Wesley Reading, MA.

Galbraith, J. R. (2002). Designing organizations - An Executive Guide to Strategy, Structure, and Process, New and Revised. In. San Francisco: Jossey-Bass.

Gattiker, T. F. (2007). Enterprise resource planning (ERP) systems and the manufacturing–marketing interface: an information-processing theory view. *International Journal of Production Research, 45*(13), 2895-2917.

Gill, P., Stewart, K., Treasure, E., & Chadwick, B. (2008). Methods of data collection in qualitative research: interviews and focus groups. *British dental journal, 204*(6), 291-295.

Gimenez, C., & Ventura, E. (2003). Supply chain management as a competitive advantage in the Spanish grocery sector. *The International Journal of Logistics Management, 14*(1), 77-88.

Gimenez, C., & Ventura, E. (2005). Logistics-production, logistics-marketing and external integration: their impact on performance. *International journal of operations & Production Management, 25*(1), 20-38.

Glouberman, S., & Mintzberg, H. (2001). Managing the care of health and the cure of disease--Part II: Integration. *Health Care Management Review, 26*(1), 56-69.

Golafshani, N. (2003). Understanding reliability and validity in qualitative research. *The qualitative report, 8*(4), 597-607.

Gonzalez-Zapatero, C., Gonzalez-Benito, J., & Lannelongue, G. (2016). Antecedents of functional integration during new product development: The purchasing–marketing link. *Industrial Marketing Management, 52*, 47-59.

Good, D. J., & Schultz, R. J. (1997). Technological teaming as a marketing strategy. *Industrial marketing management, 26*(5), 413-422.

Greenwood, D. J., & Levin, M. (2006). *Introduction to action research: Social research for social change.* London, UK: SAGE publications.

Griffin, A., & Hauser, J. R. (1992). Patterns of communication among marketing, engineering and manufacturing—A comparison between two new product teams. *Management science, 38*(3), 360-373.

Griffin, A., & Hauser, J. R. (1996). Integrating R&D and marketing: a review and analysis of the literature. *Journal of product innovation management, 13*(3), 191-215.

Gronstedt, A. (1996). Integrated communications at America's leading total quality management corporations. *Public Relations Review, 22*(1), 25-42.

Guba, E. G. (1990). *The paradigm dialog*. London, United Kingdom: Sage Publications.

Gupta, A. K., Raj, S., & Wilemon, D. (1986). A model for studying R&D. Marketing interface in the product innovation process. *The Journal of Marketing*, 7-17.

Guthrie, G. (2010). *Basic research methods: An entry to social science research*: SAGE Publications India.

Harland, C. M. (1996). Supply chain management: relationships, chains and networks. *British Journal of management, 7*(s1), S63-S80.

Hausman, W. H., Montgomery, D. B., & Roth, A. V. (2002). Why should marketing and manufacturing work together?: Some exploratory empirical results. *Journal of Operations Management, 20*(3), 241-257.

Hayes, R. H., & Wheelwright, S. C. (1984). *Restoring our competitive edge: competing through manufacturing* (Vol. 8). New York, NY: John Wiley & Sons.

Hicks, B. (2007). Lean information management: Understanding and eliminating waste. *International Journal of Information Management, 27*(4), 233-249.

Hines, P., Francis, M., & Found, P. (2006). Towards lean product lifecycle management: a framework for new product development. *Journal of Manufacturing Technology Management, 17*(7), 866-887.

Hofstede, G. (1984). *Culture's consequences: International differences in work-related values* (Vol. 5). United Kingdom, UK: SAGE Publications Ltd.

Holme, I. M., & Solvang, B. K. (1998). *Metodevalg og metodebruk*. Otta: Tano/Aschehoug.

Holmström, J., Ketokivi, M., & Hameri, A. P. (2009). Bridging practice and theory: a design science approach. *Decision Sciences, 40*(1), 65-87.

Horvath, L. (2001). Collaboration: The key to value creation in supply chain management. *Supply Chain Management, 6*(5), 205-207.

Houlihan, J. B. (1985). International supply chain management. *International Journal of Physical Distribution & Materials Management, 15*(1), 22-38.

Jacobs, M. A., Yu, W., & Chavez, R. (2016). The effect of internal communication and employee satisfaction on supply chain integration. *International Journal of Production Economics, 171*, 60-70.

Jacobsen, D. I. (2010). *Forståelse, beskrivelse og forklaring: innføring i metode for helse-og sosialfagene*. Kristiansand: Høyskoleforlaget.

Jones, T. C., & Riley, D. W. (1985). Using inventory for competitive advantage through supply chain management. *International Journal of Physical Distribution & Materials Management, 15*(5), 16-26.

Kahn, K. B. (1996). Interdepartmental integration: a definition with implications for product development performance. *Journal of product innovation management, 13*(2), 137-151.

Kahn, K. B., & McDonough, E. F. (1997a). An Empirical Study of the Relationships among Co‐location, Integration, Performance, and Satisfaction. *Journal of product innovation management, 14*(3), 161-178.

Kahn, K. B., & McDonough, E. F. (1997b). Marketing's integration with R&D and manufacturing: a cross-regional analysis. *Journal of International Marketing, 5*(1), 51-76.

Kahn, K. B., & Mentzer, J. T. (1996). Logistics and interdepartmental integration. *International Journal of Physical Distribution & Logistics Management, 26*(8), 6-14.

Kahn, K. B., & Mentzer, J. T. (1998). Marketing's integration with other departments. *Journal of Business Research, 42*(1), 53-62.

Karlsson, C. (2008). *Researching operations management*. New York, NY: Routledge.

Klotz, L., Horman, M., Bi, H. H., & Bechtel, J. (2008). The impact of process mapping on transparency. *International Journal of Productivity and Performance Management, 57*(8), 623-636.

Koufteros, X., & Marcoulides, G. A. (2006). Product development practices and performance: A structural equation modeling-based multi-group analysis. *International Journal of Production Economics, 103*(1), 286-307.

Koufteros, X., Vonderembse, M., & Doll, W. (2001). Concurrent engineering and its consequences. *Journal of Operations Management, 19*(1), 97-115.

Koufteros, X., Vonderembse, M., & Jayaram, J. (2005). Internal and external integration for product development: the contingency effects of uncertainty, equivocality, and platform strategy. *Decision Sciences, 36*(1), 97-133.

Koufteros, X. A., Vonderembse, M. A., & Doll, W. J. (2002). Integrated product development practices and competitive capabilities: the effects of uncertainty, equivocality, and platform strategy. *Journal of Operations Management, 20*(4), 331-355.

Kristoffersen, L., Tufte, P. A., & Johannessen, A. (2005). *Introduksjon til samfunnsvitenskapelig metode*. Oslo: Abstrakt forlag.

Kvale, S., & Brinkmann, S. (2010). Det kvalitative forskningsintervju Oslo: Gyldendal Norsk Forlag. (2), 21.

Lambert, D. M., Cooper, M. C., & Pagh, J. D. (1998). Supply chain management: implementation issues and research opportunities. *The international journal of logistics Management, 9*(2), 1-20.

Lambert, D. M., García ‐ Dastugue, S. J., & Croxton, K. L. (2005). An evaluation of process ‐ oriented supply chain management frameworks. *Journal of business logistics, 26*(1), 25-51.

Larsson, C., & Säfsten, K. (2016). *Visual communication of performance meaures supporting continuous improvement: Challenges and opportunities for manufacturing SMEs.* Paper presented at the Performance measurement and management: New theories for New practices. 10th conference of the Performance Measurement Association, PMA 2016, Edinburgh, Scotland, June 26-29, 2016.

Lawrence, P. R., Lorsch, J. W., & Garrison, J. S. (1967). *Organization and environment: Managing differentiation and integration*: Division of Research, Graduate School of Business Administration, Harvard University Boston, MA.

Le Meunier-FitzHugh, K., & Piercy, N. F. (2007). Exploring collaboration between sales and marketing. *European Journal of Marketing, 41*(7/8), 939-955.

Lee, D. M. (1992). Management of concurrent engineering: organizational concepts and a framework of analysis. *Engineering Management Journal, 4*(2), 15-25.

Leenders, M. A., & Wierenga, B. (2002). The effectiveness of different mechanisms for integrating marketing and R&D. *Journal of product innovation management, 19*(4), 305-317.

Leuschner, R., Rogers, D. S., & Charvet, F. F. (2013). A Meta ‐ Analysis of Supply Chain Integration and Firm Performance. *Journal of Supply Chain Management, 49*(2), 34-57.

Liker, J. K. a. M., J.M. (2006). *The Toyota Way in Services: the Case of Lean Product Development. Academy of Managemnt Perpectives*.

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry* (Vol. 75): Sage.

Lindlof, L., & Soderberg, B. (2011). Pros and cons of lean visual planning: experiences from four product development organisations. *International Journal of Technology Intelligence and Planning, 7*(3), 269-279.

Mackelprang, A. W., Robinson, J. L., Bernardes, E., & Webb, G. S. (2014). The Relationship Between Strategic Supply Chain Integration and Performance: A Meta ‐ Analytic Evaluation and Implications for Supply Chain Management Research. *Journal of business logistics, 35*(1), 71-96.

Malone, T. W., & Crowston, K. (1994). The interdisciplinary study of coordination. *ACM Computing Surveys (CSUR), 26*(1), 87-119.

Marshall, M. N. (1996). Sampling for qualitative research. *Family practice, 13*(6), 522-526.

Maxwell, J., & Mittapalli, K. (2008). Explanatory research. *The SAGE encyclopedia of qualitative research methods*, 324-326.

Mazzocato, P., Holden, R. J., Brommels, M., Aronsson, H., Bäckman, U., Elg, M., & Thor, J. (2012). How does lean work in emergency care? A case study of a lean-inspired intervention at the Astrid Lindgren Children's hospital, Stockholm, Sweden. *BMC Health Services Research, 12*(1), 28-28. doi:10.1186/1472-6963-12-28

Mentzer, J. T. (2004). *Fundamentals of supply chain management: twelve drivers of competitive advantage*: Sage publications.

Mentzer, J. T., Foggin, J. H., & Golicic, S. L. (2000). Collaboration: the enablers, impediments, and benefits. *Supply chain management review, 4*(4), 52-58.

Mettler, T. (2011). Maturity assessment models: a design science research approach. *International Journal of Society Systems Science, 3*(1-2), 81-98.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook*: Sage.

Mintzberg, H. (1979). *The structuring of organization: a synthesis of the research*. Englewood Cliffs: NJ: Prentice-Hall.

Mintzberg, H. (1983). *Structures in fives: Designing effective organizations.* Englewood Cliffs, NJ: Prentice Hall.

Mintzberg, H. (1989). *Mintzberg on management: Inside our strange world of organizations*: Simon and Schuster.

Mintzberg, H., Quinn, J. B., & Ghoshal, S. (1995). *The strategy process: European edition*: Prentice Hall.

Moberg, C. R., Speh, T. W., & Freese, T. L. (2003). SCM: Making the vision a reality. *SUPPLY CHAIN MANAGEMENT REVIEW, V. 7, NO. 5 (SEPT./OCT. 2003), P. 34-39: ILL*.

Moenaert, R. K., & Souder, W. E. (1990). An information transfer model for integrating marketing and R&D personnel in new product development projects. *Journal of product innovation management, 7*(2), 91-107.

Moenaert, R. K., Souder, W. E., Meyer, A. D., & Deschoolmeester, D. (1994). R&D–marketing integration mechanisms, communication flows, and innovation success. *Journal of product innovation management, 11*(1), 31-45.

Moffat, L. K. (1998). Tools and teams: competing models of integrated product development project performance. *Journal of Engineering and Technology Management, 15*(1), 55-85.

Mollenkopf, D., Gibson, A., & Ozanne, L. (2000). The integration of marketing and logistics functions: an empirical examination of New Zealand firms. *Journal of business logistics, 21*(2), 89-112.

Mollenkopf, D. A., Frankel, R., & Russo, I. (2011). Creating value through returns management: Exploring the marketing–operations interface. *Journal of Operations Management, 29*(5), 391-403.

Monczka, R., Handfield, R., Giunipero, L., & Patterson, J. (2008). *Purchasing and supply chain management*. Nondon, United Kingdom: Cengage Learning EMEA.

Montoya-Torres, J. R., & Ortiz-Vargas, D. A. (2014). Collaboration and information sharing in dyadic supply chains: A literature review over the period 2000–2012. *Estudios Gerenciales, 30*(133), 343-354.

Montoya ‐ Weiss, M. M., & Calantone, R. (1994). Determinants of new product performance: a review and meta ‐ analysis. *Journal of product innovation management, 11*(5), 397-417.

Morash, E. A., & Clinton, S. R. (1998). Supply Chain Integration: Customer Value through Collaborative Closeness versus Operational Excellence. *Journal of Marketing Theory and Practice, 6*(4), 104-120.

Morash, E. A., Dröge, C., & Vickery, S. (1996). Boundary spanning interfaces between logistics, production, marketing and new product development. *International Journal of Physical Distribution & Logistics Management, 26*(8), 43-62.

Muckstadt, J. A., Murray, D. H., Rappold, J. A., & Collins, D. E. (2001). Guidelines for Collaborative Supply Chain System Design and Operation. *Information Systems Frontiers, 3*(4), 427-427.

Nabavizadeh, R., Momeni, M., & Saidi, S. S. (2013). The Impact of Aligned Rewards and Senior Manager Attitudes on Conflict and Collaboration between Sales and Marketing in JahanBehbood Pharmaceutical Co. *International Research Journal of Applied and Basic Sciences, 5*(6), 756-761.

Nahm, A. Y., Vonderembse, M. A., & Koufteros, X. A. (2003). The impact of organizational structure on time-based manufacturing and plant performance. *Journal of Operations Management, 21*(3), 281-306.

Nihtilä, J. (1999). R&D–Production integration in the early phases of new product development projects. *Journal of Engineering and Technology Management, 16*(1), 55-81.

Nonaka, I., & Takeuchi, H. (1995). *The knowledge-creating company*: Oxford University Press, New York.

Novack, R. A., & Simco, S. W. (1991). The industrial procurement process: a supply chain perspective. *Journal of business logistics, 12*(1), 145-167.

O'Leary, Z. (2013). *The essential guide to doing your research project*. London, UK: Sage.

O'Leary-Kelly, S. W., & Flores, B. E. (2002). The integration of manufacturing and marketing/sales decisions: impact on organizational performance. *Journal of Operations Management, 20*(3), 221-240.

Olausson, D., & Berggren, C. (2010). Managing uncertain, complex product development in high‐tech firms: in search of controlled flexibility. *R&d Management, 40*(4), 383-399.

Pagell, M. (2004). Understanding the factors that enable and inhibit the integration of operations, purchasing and logistics. *Journal of Operations Management, 22*(5), 459-487. doi:http://dx.doi.org/10.1016/j.jom.2004.05.008

Pagell, M., & LePine, J. A. (2002). Multiple case studies of team effectiveness in manufacturing organizations. *Journal of Operations Management, 20*(5), 619-639.

Palthe, J., & Ernst Kossek, E. (2003). Subcultures and employment modes: Translating HR strategy into practice. *Journal of Organizational Change Management, 16*(3), 287-308.

Papadopoulos, T., Radnor, Z., & Merali, Y. (2011). The role of actor associations in understanding the implementation of Lean thinking in healthcare. *International Journal of Operations & Production Management, 31*(1-2), 167-191. doi:10.1108/01443571111104755

Papazoglou, M. P., Ribbers, P., & Tsalgatidou, A. (2000). Integrated value chains and their implications from a business and technology standpoint. *Decision Support Systems, 29*(4), 323-342.

Parente, D. H. (1998). Across the manufacturing-marketing interface Classification of significant research. *International Journal of Operations & Production Management, 18*(12), 1205-1222.

Parente, D. H., Pegels, C. C., & Suresh, N. (2002). An exploratory study of the sales-production relationship and customer satisfaction. *International Journal of Operations & Production Management, 22*(9), 997-1013.

Parry, G. C., & Turner, C. E. (2006). Application of lean visual process management tools. *Production Planning & Control, 17*(1), 77-86. doi:10.1080/09537280500414991

Parthasarthy, R., & Sethi, S. P. (1993). Relating strategy and structure to flexible automation: a test of fit and performance implications. *Strategic Management Journal, 14*(7), 529-549.

Patton, M. Q. (1990). *Qualitative evaluation and research methods* (2nd ed.). Thousand Oaks, CA: SAGE Publications, inc.

Perks, H., Kahn, K., & Zhang, C. (2009). An empirical evaluation of R&D–marketing NPD integration in Chinese firms: The Guanxi effect. *Journal of product innovation management, 26*(6), 640-651.

Phillips, E., & Pugh, D. (2003). *How to get a PhD: A handbook for students and their supervisors* (Third ed.). Maidenhead, Philadelphia: OPEN UNIVERSITY PRESS.

Pinto, M. B., Pinto, J. K., & Prescott, J. E. (1993). Antecedents and consequences of project team cross-functional cooperation. *Management Science, 39*(10), 1281-1297.

Polanyi, M. (1958). *Personal knowledge*. London: Routledge and Kegan Paul.

Polanyi, M. (1967). *The tacit dimension*. London: Routledge and Kegan Paul.

Porter, M. E. (1985). Competitive advantage: creating and sustaining superior performance, Free Press, New York.

Power, D. (2005). Supply chain management integration and implementation: a literature review. *Supply Chain Management: An International Journal, 10*(4), 252-263.

Richey, R. G., Jr., Chen, H., Upreti, R., Fawcett, S. E., & Adams, F. G. (2009). The moderating role of barriers on the relationship between drivers to supply chain integration and firm performance. *International Journal of Physical Distribution & Logistics Management, 39*(10), 826-840.

Richey, R. G., Roath, A. S., Whipple, J. M., & Fawcett, S. E. (2010). Exploring a governance theory of supply chain management: barriers and facilitators to integration. *Journal of business logistics, 31*(1), 237-256.

Rondeau, P. J., Vonderembse, M. A., & Ragu-Nathan, T. (2000). Exploring work system practices for time-based manufacturers: their impact on competitive capabilities. *Journal of Operations Management, 18*(5), 509-529.

Roussel, P. A. (1991). *Third generation R&D: managing the link to corporate strategy*. Boston, MA: Harvard Business Press.

Rowley, J. (2002). Using case studies in research. *Management research news, 25*(1), 16-27.

Ruekert, R. W., & Walker Jr, O. C. (1987). Marketing's interaction with other functional units: a conceptual framework and empirical evidence. *The Journal of Marketing, 51*(1), 1-19.

Ryen, A. (2002). *Det kvalitative intervjuet: fra vitenskapsteori til feltarbeid*. Bergen: Fagbokforlaget.

Saad, S., Perera, T., Achanga, P., Shehab, E., Roy, R., & Nelder, G. (2006). Critical success factors for lean implementation within SMEs. *Journal of Manufacturing Technology Management, 17*(4), 460-471.

Sabath, R., & Whipple, J. M. (2004). Using the customer/product action matrix to enhance internal collaboration. *Journal of business logistics, 25*(2), 1-19.

Sanders, N. R., & Premus, R. (2005). Modeling the relationship between firm IT capability, collaboration, and performance. *Journal of business logistics, 26*(1), 1-23.

Sayer, A. (2000). *Realism and social science.* Thousand Oaks, CA: Sage.

Schoenherr, T., & Swink, M. (2012). Revisiting the arcs of integration: Cross-validations and extensions. *Journal of Operations Management, 30*(1), 99-115.

Schrage, M. (1991). *Shared minds: The New Technologies of Collaboration*. New York: John Brockman.

Sherman, J. D. (2004). Optimal modes and levels of integration, and the identification of cross-functional coordination deficiencies in concurrent engineering. *Engineering Management, IEEE Transactions on, 51*(3), 268-278.

Sherman, J. D., Souder, W. E., & Jenssen, S. A. (2000). Differential effects of the primary forms of cross functional integration on product development cycle time. *Journal of product innovation management, 17*(4), 257-267.

Shub, A. N., & Stonebraker, P. W. (2009). The human impact on supply chains: evaluating the importance of "soft" areas on integration and performance. *Supply Chain Management: An International Journal, 14*(1), 31-40.

Simatupang, T. M., & Sridharan, R. (2002). The collaborative supply chain. *International Journal of Logistics Management, The, 13*(1), 15-30.

Singh, R. K. (2011). Developing the framework for coordination in supply chain of SMEs. *Business Process Management Journal, 17*(4), 619-638.

Slater, S. F., & Narver, J. C. (1994). Market orientation, customer value, and superior performance. *Business horizons, 37*(2), 22-28.

Song, M., & Montoya-Weiss, M. M. (2001). The effect of perceived technological uncertainty on Japanese new product development. *Academy of Management journal, 44*(1), 61-80.

Song, X. M., Montoya‐Weiss, M. M., & Schmidt, J. B. (1997). Antecedents and consequences of cross‐functional cooperation: a comparison of R&D, manufacturing, and marketing perspectives. *Journal of product innovation management, 14*(1), 35-47.

Song, X. M., Neeley, S. M., & Zhao, Y. (1996). Managing R&D-marketing integration in the new product development process. *Industrial Marketing Management, 25*(6), 545-553.

Song, X. M., Thieme, R. J., & Xie, J. (1998). The impact of cross - functional joint involvement across product development stages: an exploratory study. *Journal of product innovation management, 15*(4), 289-303.

Stank, T. P., Keller, S. B., & Daugherty, P. J. (2001). Supply chain collaboration and logistical service performance. *Journal of business logistics, 22*(1), 29-48.

Stevens, G. C. (1989). Integrating the supply chain. *International Journal of Physical Distribution & Materials Management, 19*(8), 3-8.

Stevens, G. C. (1990). Successful supply-chain management. *Management Decision, 28*(8).

Stevens, G. C., & Johnson, M. (2016). Integrating the Supply Chain… 25 years on. *International Journal of Physical Distribution & Logistics Management, 46*(1), 19-42.

Stock, G. N., Greis, N. P., & Kasarda, J. D. (1999). Logistics, strategy and structure: a conceptual framework. *International Journal of Physical Distribution & Logistics Management, 29*(4), 224-239.

Stock, J. R. (1996). The social sciences and logistics: some suggestions for future exploration. *Journal of Marketing Theory and Practice, 4*(2), 1-25.

Swink, M. (1999). Threats to new product manufacturability and the effects of development team integration processes. *Journal of Operations Management, 17*(6), 691-709.

Swink, M. (2000). Technological innovativeness as a moderator of new product design integration and top management support. *Journal of product innovation management, 17*(3), 208-220.

Swink, M., Narasimhan, R., & Kim, S. W. (2005). Manufacturing practices and strategy integration: effects on cost efficiency, flexibility, and market - based performance. *Decision Sciences, 36*(3), 427-457.

Swink, M., Narasimhan, R., & Wang, C. (2007). Managing beyond the factory walls: effects of four types of strategic integration on manufacturing plant performance. *Journal of Operations Management, 25*(1), 148-164.

Swink, M., & Song, M. (2007). Effects of marketing-manufacturing integration on new product development time and competitive advantage. *Journal of Operations Management, 25*(1), 203-217.

Tatikonda, M. V., & Montoya-Weiss, M. M. (2001). Integrating operations and marketing perspectives of product innovation: The influence of organizational process factors and capabilities on development performance. *Management Science, 47*(1), 151-172.

Thompson, J. D. (1967). *Organizations in Action- Social Science Bases of Administrative Theory*. New Brunswick, NJ: Transaction Publisher.

Tjora, A. (2011). *Kvalitative forskningsmetoder i praksis* (2 ed.). Oslo: Gyldendal Akademisk.

Turkulainen, V. (2008). *Managing cross-functional interdependencies-the contingent value of integration*. Helsinki: Department of Industrial Engineering and

Management, University of Technology.

Turkulainen, V., & Ketokivi, M. (2012). Cross-functional integration and performance: what are the real benefits? *International Journal of Operations & Production Management, 32*(4), 447-467.

Vallet-Bellmunt, T., & Rivera-Torres, P. (2013). Integration: attitudes, patterns and practices. *Supply Chain Management: An International Journal, 18*(3), 308-323.

Van den Bulte, C., & Moenaert, R. K. (1998). The effects of R&D team co-location on communication patterns among R&D, marketing, and manufacturing. *Management Science, 44*(11-part-2), S1-S18.

Van Hoek, R. I., & Mitchell, A. (2006). The challenge of internal misalignment. *International Journal of Logistics, 9*(3), 269-281.

Vinten, G. (1999). Corporate communications in small- and medium-sized enterprises. *Industrial and Commercial Training, 31*(3), 112-119.

Voss, C., Tsikriktsis, N., & Frohlich, M. (2002). Case research in operations management. *International journal of operations & production management, 22*(2), 195-219.

Voss, C. A., Frohlich, M., & Tsikriktsis, N. (2002). Case Research in Operational Management. *International Journal of Operations and Production Management, 22*(2), 195-219.

Watkins, D. C. (2012). Qualitative Research The Importance of Conducting Research That Doesn't "Count". *Health promotion practice, 13*(2), 153-158.

Wheelwright, S. C. (1992). *Revolutionizing product development: quantum leaps in speed, efficiency, and quality*. New York: The Free Press, A Division of Simon and Schuster Inc.

Whyte, J., Ewenstein, B., Hales, M., & Tidd, J. (2008). Visualizing knowledge in project-based work. *Long Range Planning, 41*(1), 74-92.

Wiengarten, F., Humphreys, P., Cao, G., Fynes, B., & McKittrick, A. (2010). Collaborative supply chain practices and performance: exploring the key role of information quality. *Supply Chain Management, 15*(6), 463-463-473. doi:10.1108/13598541011080446

Wilding, R., Wagner, B., Wong, C., Skipworth, H., Godsell, J., & Achimugu, N. (2012). Towards a theory of supply chain alignment enablers: a systematic literature review. *Supply Chain Management: An International Journal, 17*(4), 419-437.

Womack, J. P., & Jones, D. T. (1996b.). *Lean Thinking: Banish Waste and Create Wealth for Your Corporation*. New York: FREE PRESS, A Division of Simon & Schuster, Inc. .

Wong, C. Y., Wong, C. W., & Boon-itt, S. (2017). Do arcs of integration differ across industries? Methodology extension and empirical evidence from Thailand. *International Journal of Production Economics, 183*, 223-234.

Worley, J., & Doolen, T. (2006). The role of communication and management support in a lean manufacturing implementation. *Management Decision, 44*(2), 228-245.

Yin, R. K. (2009). *Case Study Research. Design and Methods* (Fourth edition ed. Vol. 5). Beverly Hills: CA: Sage Publications.

Yu, W., Ramanathan, R., & Nath, P. (2014). The impacts of marketing and operations capabilities on financial performance in the UK retail sector: A resource-based perspective. *Industrial Marketing Management, 43*(1), 25-31. doi:http://dx.doi.org/10.1016/j.indmarman.2013.07.014

Zhao, X., Huo, B., Selen, W., & Yeung, J. H. Y. (2011). The impact of internal integration and relationship commitment on external integration. *Journal of Operations Management, 29*(1), 17-32.

Økland, A., Lillebo, B., Amdahl, E., & Seim, A. (2010). *A Framework for Transparency*. Paper presented at the POMS 21st Annual Confernece http://www.pomsmeetings.org/ConfProceedings/015/FullPapers/015-0839.pdf

PART II: SUPPLEMENTARY INFORMATION

Interview protocol

Preparation interview
Presentation of the researcher (s)
All information will be anonymized and treated confidentially. We would appreciate if you agree upon that we record the interviews. Is this ok for you?

It is optional to participate in the study and you can at any time withdraw your agreement without giving any reason.

Is there anything unclear and do you have any questions before we begin?

Systems for information sharing

1. What comes to your mind when we say, "systems for information sharing"?
2. What kind of systems for information sharing are you using?
3. What other sources for information are you using?
4. Have you been told what kind of sources you should use to gather information?
5. To what degree do you think that you participated in the planning of what sources to use?
6. Does it happen that you must use other sources for information than what is predefined? And if so, what kind of information sources is this?
7. Do you think there is any possibilities among the employees to influence on the given choice of information sources?
8. To what degree do you think you could influence on changes?
9. If there should be any need for changes, what do you do?

Information flow

10. What comes into your mind when we say, "information flow"?
11. In which way do you receive /collect information in your working day?
12. In which way do you share information?
13. Why do you share information?
14. What do you think is important to achieve good information flow?
15. With whom do you communicate the most during the working day, and in which way are you communicating?
16. How is the information flow in your department?
17. How is the information flow between the departments?
18. How do you think the information between the management and the employees are?
19. What kind of information do you need do perform an optimal job?

20. Is there any kind of information that is difficult to achieve or communicate? And if so, what kind of information?
21. To what degree are you dependent of communicating with other colleagues in the other part of the organization?
22. If yes, who? And in which form?
23. Do you miss any information?

Team boards

24. Which of the information on the team boards do you think is important?
25. Is there any information that is perceived as superfluous?
26. To what degree do you trust the information on the team boards?
27. Who has defined the information on the team boards?
28. Are you actively participating in the team board meetings? And if so, to what degree?
29. To what degree are the content of the information on the team boards communicated in between the meetings?
30. To what degree do you think that you can influence on the content on the team boards?
31. How important do you think it is to know the content of other team boards?
32. If you think it is important, what kind of information do you think that should be shared?
33. Do you participate on other team board meetings? If yes, how useful do you think this is?
34. If no, do you think it would be useful to participate on other team boards?
35. Is the information on the team boards linked together in any way?
36. Is there a link between the information on the team boards and overall system?
37. If so, in which way is the information linked to overall system?
38. In which way are the team boards linked to the quality system?
39. Is it possible to trace the history of the team board meetings? If so, how is the information logged?
40. To what degree do the information on the team boards contribute to build knowledge?
41. To what degree do the team boards contribute to understand the entire value chain?
42. To what degree do the team boards contribute to information sharing?

Performance measurement

43. What has the highest priority in your department related to cost, quality, time?

44. In what order would you have put them? If this is different from the overall – please explain.
45. How are the performance measurement evaluated in your department?
46. What are the main key performance characteristics? How do you use this information?
47. In which way, if any, is your work being evaluated?
48. What proportion of your "recognition" depends of your
    a. Individual performance.
    b. Functional performance.
    c. The performance of the entire value chain.
49. To what degree does your unit focus on achieving the overall company goals? Explain.
50. How does your unit perform compared to other units?

Cross functional work

51. Do you use cross functional work/teams?
52. If so, to what degree and which occasions or levels?
53. To what degree do you think that you have good collaboration?
    - Why / or why not?
54. What mechanisms exists to motivate for collaboration
55. To what degree do your unit collaborate with the rest of the value chain?
56. When you make decisions, to what degree do you consider how this will influence on others or other parts of the value chain?
57. When colleagues make decisions, to what degree do believe they consider how this influences your work?

PART III: INDIVIDUAL PUBLICATIONS

Paper I

Article information:

Users who downloaded this article also downloaded:

For Authors

About Emerald www.emeraldinsight.com

Paper II

Paper III

Operational Integration in Health Care versus Mass Production

Inger Gamme, Geir Berg

ABSTRACT

Purpose: Operational integration has been studied by several authors. However, still there are many research questions to be raised.

Methodology/Approach: Two value chains have been studied within two different sectors: the health sector and the car component industry (mass producer). The research methodology is based on semi-structured interviews with selected persons from different levels within the organizations. The data was transcribed, coded and further analyzed to find enablers or disablers to operational integration in both sectors.

Findings: From this study, factors such as management commitment, co-location, and job-rotation can be seen as contributing factors in both organizations. Both experience disablers such as working as functional silos and little alignment of overall goals. Differences are seen in the greater use of job rotation within health care, while the mass producer had more mechanisms to facilitate working in cross functional teams.

Practical implication: This paper presents empirical findings of success factors and pitfalls for operational integration within the value chain of two different types of organizations. Based on this mapping, recommendations on how to achieve better operational integration will be presented.

Originality/Value of paper: The research initiative provides knowledge experiences from operational integration in two different Norwegian organizations representing two different sectors.

Category: Research paper

Keywords: collaboration; health care; integration; inter-functional; mass production

1   INTRODUCTION

Today there is a constant need for improvement in any professional organization, a need driven by increasingly demands for adjustments of products or services. Both internal and external factors contribute to the requirement of more flexible and adaptable value streams. Key criteria for success are inevitably connected to how the organization meets demands from its customers, i.e. its ability to adjust to future needs and control of the process of integration between complex organizations. The automobile and health sectors face different challenges; nevertheless, they both continually strive for an adaptable and efficient value chain, aiming at delivering the best quality of service or products.

This paper will illustrate practices from interdepartmental collaboration processes within a hospital and a mass producer (MP). It focuses on principles and methods used to create a smooth and efficient interface between actors, which pitfalls they may have experienced, and possible aspects of learning for these two different organizations. The following research questions will be addressed:

- What are the enablers or hindrances to operational integration in these two value chains?

- In what ways are there similarities or differences between these two sectors?

2   THEORY

2.1   Operational integration

Working towards an optimization of the value chain, many organizations focus on the optimization of each process step, while forgetting to secure and optimize the interfaces between steps (Figure 1).
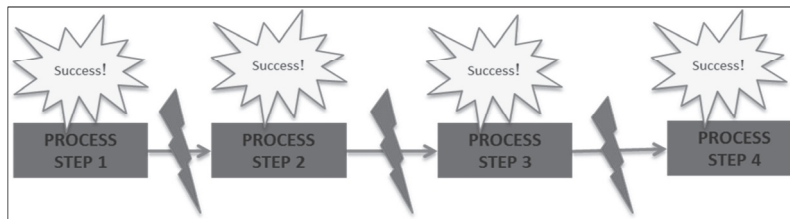
Figure 1 – Optimization of the value chain, requires focus on both process steps and interfaces

One challenge that commonly arises is the "handover of the baton" between two consecutive process steps. Factors such as a lack of documentation or systemization and the existence of functional silos or different cultures are

possible sources of difficulty (Pagell, 2004; Basnet and Wisner, 2012). Achieving a well-managed value chain presupposes that all value creating processes act together (Stank, Keller and Daugherty, 2001) and that intra-organizational customer demand and supply capabilities are aligned and balanced. A well-managed value chain means an integrated value chain that gives the customer optimized value (Stock, Greis and Kasarda, 1999; Morash and Clinton, 1998). This will positively affect an organization's efficiency-capabilities, seen as a quicker response to changes in the customer requirements (Chen, Daugherty and Landry, 2009). Poor integration between the process steps affects the organizational performance in a negative way (Shub and Stonebraker, 2009).

Interdepartmental relations have been studied for decades, but there are still many questions to be answered (Griffin and Hauser, 1996; Childerhouse and Towill, 2011; Barratt and Barratt, 2011; Basnet and Wisner, 2012; Hayes and Wheelwright, 1984; Turkulainen and Ketokivi, 2012). Different perceptions and terms to describe the relevant phenomena are observed between authors and between disciplines. Several authors refer to the topic of integration without presenting a formal definition (Pagell, 2004). Kahn (1996) presents the following definition of integration with the mix of two constructs: information sharing and involvement:

"*A process of interdepartmental interaction and interdepartmental collaboration which brings departments together into a cohesive organization.*"

Basnet and Wisner (2012) present another definition:

"*Working together for the benefit of the company.*"

It can be added that participants in a value chain should share the objective of achieving a collaborative supply chain and search for common initiatives to ensure that each participant benefits from the success (Simatupang and Sridharan, 2002).

2.2   Prerequisites for integration

Many authors agrees that supply chain integration is valuable (Frohlich and Westbrook, 2001; Shub and Stonebraker, 2009; Pagell, 2004), but it has also been pointed out that it is not easy to achieve (Fawcett and Magnan, 2002; Bowersox, Close and Stank, 1999; Childerhouse and Towill, 2011). In the existing research, considerable emphasis is placed on the question of why it is important to attain integration in the value chain, but few studies focus on how to achieve good integration (Basnet and Wisner, 2012; Pagell, 2004). Several contributing factors are described, such as facility and layout, job rotation, cross functional teams, amount of informal/formal communication, organizational culture, consensus on integration, and measurements and rewards (Pagell, 2004; Turkulainen, 2008; Bowersox, Close and Stank, 1999; Basnet and Wisner, 2012).

Culture is one of the elements that affect integration. Despite the difficulty of changing a company's culture, practitioners should try to understand how the culture affects integration (Braunscheidel, Suresh and Boisnier, 2010). Job rotation may be used as a tool to change the culture and enhance integration (Basnet and Wisner, 2012; Pagell, 2004). Another important component to acknowledge is "tacit knowledge" – knowledge which is grounded in action, commitment, and involvement. Tacit knowledge has been characterized as having an individual quality such that it is difficult to communicate and describe (Nonaka, 1994).

Many authors emphasize that management support is an important mechanism to achieve integration (Wheelwright, 1992; Daugherty, Ellinger and Gustin, 1996; Nabavizadeh, Momeni and Saidi, 2013), though there is weak evidence for this claim (Basnet and Wisner, 2012; Morash and Clinton 1998). To achieve consensus on integration it is important that top managers focus on breaking down the organizational strategy into "subtasks" (Malone and Crowston, 1994), and that all the members of an organization have frequent communication about the goals and priorities for the value chain (Pagell, 2004).

To enable better connection between two different sections, it is useful to establish common arenas for information sharing, interaction and implement visual management tools such as team board meetings (Bititci, Cocca and Ates, 2015). But the success criterion most worthy of focus is improving the quality of interaction – not just increasing the quantity – with a concomitant focus on developing relational norms interdepartmentally (Ayers et al., 2001). Standardization facilitates coordination, which is a mechanism for enhancing integration. Use of standards gives the employees a prescription for how to act and coordinates the work (Mentzer, 2004).

Many authors refer to functional silos as disablers for integration (Van Hoek and Mitchell, 2006; Turkulainen and Ketokivi, 2012; Ellinger, Keller and Hansen, 2006; Braunscheidel, Suresh and Boisnier, 2010). Organizations with hierarchic and formal structure are characterized as having vertically driven communication and a functional myopia.

Finally, the use of different reward systems for different units of the organization could have a negative impact on integration, according to (Pagell, 2004; Galbraith, 2011).

2.3   Hospitals

Continuously overloaded and increasing queues are a common challenge for hospitals around the world. In many hospitals, the patient flow is unpredictable, resulting in inefficiency and disorganization (Hoot and Aronsky, 2008). Continuous delays may result in poor use of resources, reduced patient care, employee dissatisfaction and increased patient mortality (Derlet and Richards, 2000). Health care and hospitals all over the world have been organized in terms of health professions and specialist fields such as surgery, internal medicine etc.

The patient's problems are analysed individually. This is an impediment to seeing the "big picture" around the patient's needs and could contribute to problems with achieving "process flow", which again may be a reason for delays and crowded waiting rooms (Preston et al., 1999; Mainz, 1995; Mazzocato et al., 2012).

2.4 Mass Producers

There has been a shift in manufacturing paradigms towards supply chain integration (Muckstadt et al., 2001). Mass production is one of five production paradigms which have been utilized in recent years. In mass production, a large amount of the same product is produced (Jovane, Koren and Boër, 2003). As production volume increases, prices can be reduced and more customers may be able to buy the products. Organizations use technology to support the coordination of the employees' efforts relative to the organizational tasks and objectives. The more effectively the social and the technological systems work together, the better the organization performs (Netland et al., 2008).

For the automobile industry, common quality systems such as ISO/TS 16949:2002, which focuses on quality issues, process flow and lean solutions, have led to a more unified structure for the industry (Kymal, 2004).

2.5 Studying Hospitals versus Mass Production

Both hospitals and mass producers experience a demand for continuous improvements. Seim (2009) has studied similarities and differences between production companies and Operating Rooms. He claims that, among other factors, the operational challenges involve the need for quality improvements, cost reductions, maintenance or improvement in flexibility, secure customer focus and adaptability. These are similarities that make it possible to translate relevant operational management knowledge, principles and techniques between these industries. Porter (1985) claims that looking at work processes as a value chain makes it possible to consider work processes independently from environment and line of business. Even though these two industries are different from each other, they have some similarities. For instance, they both use principles and methods from total quality management (TQM). Useful comparisons can be made between these two sectors (Dahlgaard, Pettersen and Dahlgaard-Park, 2011).

3 METHODOLOGY/APPROACH

Two organizations were studied to find similarities or differences in enablers and disablers for integration. The organizations are quite different from each other with respect to their functions, responsibilities and societal roles. The mass producer, is located in Norway, but is part of a larger international company group. This organization produces high volumes of components for commercial

vehicles on four continents. The second organization is a middle-sized general hospital located in the south east of Norway. The hospital is part of a network hospital organization, in which each hospital has autonomy in some defined areas, such as professional and economic issues, but also follows decisions made by the network hospital board.

Both cases are independent research initiatives made available for a PhD study with the aim of studying enablers of or hindrances to operational integration in value chains. The Norwegian Research Council funded both projects.

A case study is useful to understand both complex social occurrences and organizations (Eisenhardt and Graebner, 2007). A research protocol with an interview guide was prepared in advance of both studies. Semi-structured interviews were conducted to identify the degree of integration for the value chains and enablers and disablers. The same questions were asked in both organizations, and interviews were allowed to proceed at their own pace. This made it possible for the interviewees to volunteer additional information. Understanding the interviewees' experiences and how they reflect on the topic is paramount and this kind of interview can be useful in uncovering these elements (Kvale, 1997). At both organizations, interviews were performed over a period of 6 months. Each interview lasted for approximately one hour. Important aspects to consider are whether there is relevance to the research questions, whether the phenomenon to be studied may occur and whether the research is feasible and ethical (Karlsson, 2009; Yin, 2009). All the interviews were digitally recorded, transcribed verbatim and coded according to the given categories for integration (Tjora, 2011).

Table 1 gives a listing of the essential case company characteristics.

Table 1 – Company characteristics

	Hospital	**MP**
Year of study	2013-2014	2012-2013
Main product/service	Patient flow for thrombolysis treatment	Car components commercial vehicles
Number of employees	265	37
Formal interviews	15	11
Part of value chain included	Ambulance, emergency department, X-ray, ICU, ward, internal medicine, neurology.	Injection molding, assembly
Type of informants	Nurses, radiographer, paramedic's radiographer, paramedics, attending physicians, clinical nurse, specialist nurses.	Operators, production manager, foreman, planner, tool responsible, quality technicians.

4   FINDINGS AND DISCUSSION

With focus on factors that affect integration in the value chain, the research of Pagell (2004), Basnet and Wisner (2012), Bowersox, Close and Stank (1999) and Turkulainen (2008) has been used as a basis to categorize our findings. Factors from these researchers have been grouped to form the categories for our research (see first column of the Table 2).

Table 2 – Enablers and disablers for integration in the hospital and the MP; some may be both enablers and disablers

Main categories and explanation	Hospital (+) enablers, (−) disablers	MP (+) enablers, (−) disablers
Culture		
Values, understandings, ways of thinking Informal communication Connecting links Cross functional teams Job rotation	(+) Used to standardized work (+) Overall patient focus (−) Lacks focus on the whole value chain. (+/−) Competence acknowledgement makes information flow better. (+/−) Information flows better when people know each other (+/−) Tacit knowledge (+) Cross functional work in discussion of patients. (−) Job rotation: mostly used at the level of attending physicians	(+) Used to standardized work (−) Some lack of confidence in systems (−) Main focus own work station, minor overall value chain. (+/−) Prefers verbal communication more than written. (+/−) Informal culture (+/−) Foreman connects team boards, and responsible for both departments (−) Mainly cross functional teams at higher levels (−) Job rotation: no standard procedure
Vertical integration		
	(+/−) The culture is dependent on which persons and departments are involved	(+) Informal culture, little hierarchy (+) Department meetings each week, separate days per dept.
Formalization		
Policies, rules, certification Job descriptions Standard procedures, technical reports Charts, information process practices etc. Strategic planning, functional plans, scheduling Performance control Visual systems	(+) TQM, elements of Lean established recently (+) Procedures (+) Overlap meetings at change of shift, verbal communication, telephone, mail (+) Some have team board meetings, department meetings, training in acute situations (+/−) Knowledge of KPI's differs, some decomposed	(+) ISO/TS 16949, ISO 14001, lean (+) Standardized work descriptions (+) Shift log, mail, verbal communication etc. (+) Department meetings, team board meetings, shift overlap meetings (+/−) SAP, Excel sheets (+) KPI's established, some decomposed to functional measures

Main categories and explanation	Hospital (+) enablers, (−) disablers	MP (+) enablers, (−) disablers
	to functional measures (+) Some visual tools	(+) Kanban, visual logistics planning, visual tool status
Facility & Layout		
Plant size Physical distances Partitions	(−) Large organization, many process steps (−) Some physical distance between departments, and sometimes localized over two different floors or different buildings. (−) Functional silos	(+) Large plant, small value chain (+) Little physical distance. (+) Intimate environment. (−) Physical hindrances to verbal communication (−) Functional silos
Information systems		
Degree of formalization of information flows Enhanced capacity of information processing	(+) Several systems in use such as electronically patient journal DIPS, mail system etc. (−) Some lack of trust in systems	(+/−) Several systems in use, such as ERP, document handling system, mail system etc. (−) Some lack of trust in systems
Consensus integration		
Functional strategies must support the business strategy and each other. All functions support business strategy and each other, and all managers know this is going on.	Overall management focus on economy, while functional strategies focus on quality	Operators know department strategy, less of company strategy (+) Some measures derived from strategy, visual via team board. Operators' main focus: own work
Measurement, rewards		
	(+/−) Verbal acknowledgments	(+/−) Verbal acknowledgment per number improvement proposals

The findings presented under the categories in Table 2 are further discussed under each topic below.

4.1 Culture

In the hospital the personnel seemed to be more used to relating to systems and more faithful to structures than were the operators at the MP, and procedures were often referred to when interviewees were describing how they cooperate.

The physicians and the nurses had as a main focus the wellbeing of the patient and aimed at giving the best treatment throughout the patient flow. Still, several interviews indicated a strong functional focus, especially in certain departments.

Several of the informants referred to professional secrecy as a reason why they were not able to follow the information concerning the patient further down the value chain.

At the MP, the informants had little overall value chain focus, and each focused mainly on his or her own process step, to the point that sharing/receiving information beyond one's own process step was perceived as unnecessary. Some claimed, "I have too much to do with my own work".

Although the hospital has a large number of systems in place for information sharing, there are examples of tacit knowledge. For example, interviewees said it was impossible to predict the number of patients that come in during a day. However, several of them had clear opinions of specific fluctuations in the rates of patient arrival.

Cultures which inspire good communication are linked to integration (Pagell, 2004). In response to the question, "When is the information flow perceived to be good?" a specialist nurse at the hospital said: "I think the information flow is good when the person I am talking with acknowledges my competence, and I acknowledge the person's competence." Another interviewee perceived the information to flow better "when you know the people you are collaborating with."

Job rotation can contribute to improving the holistic understanding of the value chain and can be an effective tool to increase integration (Basnet and Wisner, 2012). Job rotation is used to varying degrees at the hospital, primarily by the attending physicians. According to one nurse: "It could have been an advantage to have the possibility to walk in each other´s shoes, since we know very little about other departments' work, when we have never been in their place." Another informant said: "job rotation is instructive, but then again it is more that has to be learnt." At the MP there had occasionally been a rotation of workers between departments, and one of the operators perceived this as giving them better knowledge of the rest of the value chain.

4.2 Vertical integration

According to some of the hospital interviewees who had been working in or with more than one department, the culture and structure varied in the different departments. The fact that the departments had different managers could explain the different cultures. The researchers perceived the hierarchy as larger at the hospital than at the mass producer. However, according to some of the informants at the hospital, the hierarchy has been decreased during the recent years in most of the departments. Additionally, the management is often part of the value chain, meaning that some leaders participate in clinical work. The management influences the value chain in several ways, e.g. by their budget planning, strategic choices and direction of daily management.

The two departments at the MP were managed by the same foreman. Each department used a team board for the planning of the day's work, and the foreman was a participant in both meetings. By doing this, the foreman hoped to act as a connecting link for information flow between these two team boards and thereby achieve better integration. Nevertheless, these two departments had different cultures. Although the intention of being a part of both team meetings was to link the departments, it was perceived that the workers interacted with the foreman and not with the workers in the other department.

At both organizations it was observed that the management is actively a part of the value chain. According to Braunscheidel, Suresh and Boisnier (2010), a low degree of hierarchy positively contributes to integration, but to achieve this, management must commit and participate (Morash and Clinton, 1998; Basnet and Wisner, 2012).

4.3   Formalization

The MP has several standardized procedures to control processes, such as process descriptions, shift logs, shift overlap meetings, team board meetings, weekly team meetings and ERP systems. Each compartment has a team board and they also use visual systems on several occasions such as Kanban and tags for tool status. Despite all these systems, there are different perceptions of how information should flow among some of the workers.

The hospital has for several years used an electronic system called TQM. Routines and procedures related to patient treatment are developed over years, influenced partly by research, experience, legislation and professional trends. Important procedures are stored in an electronic system called EK. Over the past two years, the management has focused on increasing understanding of patient flows, through the start-up of a lean process.

Training for acute situations involves a very certain structure and a standard to be followed; there is a high degree of loyalty and discipline regarding systems and communication is very clear. This training demands a lot of resources in the hospital. In contrast, when the focus is on aspects that are important to the patient, such as waiting time and continuity of care where there is not an acute situation, the picture is quite different. Some informants state that, in less acute and life threatening situations, some choose to perform procedures in their own way.

Through study of these two organizations, it was found that both had a high degree of standardization, but the systems were designed differently. The MP used visualization systems, while the hospital used written procedures and training for acute situations. According to Mentzer (2004) this high degree of standardization could make a contribution to achieving integration, but it is recommended that it be complemented with informal interaction activities (Glouberman and Mintzberg, 2001).

4.4 Facility & Layout

In both organizations it was reported that the physical location of the departments affects their collaboration. At the MP there was an open connection between the departments, but also a minor wall. Despite this small partition, the two different departments functioned more or less as functional silos, with separate cultures and a lack of understanding of each other's daily challenges. At the hospital it might be more obvious that personnel experienced different cultures in their different parts of the value chain, since some departments were separated by as much as 8 floors.

Hayes and Wheelwright (1984) claim that a separation between subunits may reduce the degree of integration. By contrast, Pagell (2004) found little support for the idea that the size of the organization should affect the degree of integration, even though it was thought that this would be an obvious factor.

4.5 Information systems

The hospital had several different systems for information sharing. According to some informants too little time and "cumbersome system when dealing with difficult patients" made it difficult to document everything that should have been documented. Additionally, different departments used different systems, which did not always communicate with each other. For example, the X-ray department's system could not receive electronic referrals. The physicians had to print referrals out and deliver them physically. It was noticed during the study that several of the informants often needed to use verbal communication in addition to the electronic system in special cases.

The operators at the MP used tools such as e-mail and registration of production data in an ERP system. However, according to some of the operators, approximately 90% of the communication was verbal. It was also observed that some of the operators double-checked the systems. For example, one informant said he often checked by telephone whether the emails he had sent had been received. An explanation of why operators had mistrust of the IT systems at the MP could be, as claimed by one of the informants: "The IT strategy does not correspond with the overall company strategy." At higher levels in the organization there was more use of electronic information systems.

Gattiker (2007) and (Davenport, Harris and Cantrell, 2004) claim that information systems such as ERP systems contribute to integration. However, little support for this claim was found by Basnet and Wisner (2012).

4.6 Consensus integration

The employees at the hospital have an overall focus on the "customer", meaning the patient, and in some ways a focus on the overall patient flow. Despite this, some of the informants refer to an overall lack of thinking on the part of

management. In their view, the management does not understand the clinical problems and focuses too much on economic and rational issues.

The MP had broken some of the overall goals down to functional tasks at the production level and these were visualized on the team boards. The overall strategy, though, was not that clear to all employees.

At both organizations it was seen that the correspondence between the overall strategic goals and functional tasks could be better. This is also in accordance with what Van Hoek and Mitchell (2006) found. Through an internal survey within a large European manufacturing group, they discovered internal misunderstandings and differences in both opportunities and priorities within the organization. They proposed to focus on improving the internal communication and the initiative planning process to achieve better supply chain alignment.

4.7   Measurements rewards

Some informants from the hospital reported that the main focus of the management was on economy, while the overall focus in the value chain was on quality. However, the governmental measures focus primarily on economy, a factor that will also affect what the management focuses on. One of the informants said: "I think the top management has their main focus on quality, but I have never heard them talking of anything else than economy." Through the recent work a focus has been placed on common goals for the value chains, but this work had not yet reached the value chain studied in this case study.

Until recently, the management at the MP has used verbal acknowledgements in accordance with the number of improvement proposals as a reward to encourage further improvements. More recently, work has been done to try to find common motivating factors for the value chain.

Both value chains are aiming towards finding a common reward system and focus, but still they face some challenges. As claimed by Cao et al. (2008), when different departments tend to have different interests and focus, it is especially important to have good overall coordination, and having differences in focus and reward systems may affect the integration negatively (Pagell, 2004).

4.8   Summary of findiungs

A short summary of the similarities and differences of the findings is shown in Table 3.

Table 3 – Summary of the findings

	Similarities	Differences
Culture	• Used to standardized work • Tacit knowledge • Some lack of overall value chain focus • Job rotation perceived as positive	• More true to systems at the hospital than in the MP.
Vertical Integration		• More hierarchy at the hospital than in the MP
Formalization and standardization	• High degree of formalization	• Degree of use of visualization tools in MP • Training for acute situations at hospital
Facility & layout	• Layout challenge to integration	
Information system	• Some mistrust of systems	• More use of information systems at the hospital than in the MP
Consensus integration		• Insufficient connection between overall strategies and functional tasks
Measurement, rewards	• Verbal acknowledgment	

5   CONCLUSION

Through two single case studies of two different organizations, the aim has been to provide a better understanding of enablers and hindrances to operational integration and the similarity or difference in these two types of value chains.

Despite the differences in the types of the two organizations, there were some findings of common enablers: both organizations had a high number of routines and standards and the employees were used to standardized work. Furthermore, in both organizations, job rotation was referred to as a contributing factor to increase integration and both companies used verbal acknowledgment as rewards.

The differences in enablers were found in the high degree of training at the hospital for acute situations, higher degree of use of visualization tools in the MP and more use of information tools directly in the value chain at the hospital.

The common disablers for integration were found to be related to culture and physical hindrances in location, tacit knowledge and difficulties in achieving good integration between overall strategies and functional tasks.

One difference in disablers was found in that the degree of hierarchy was higher at the hospital than in the MP.

The study has focused on creating new insight into enablers and disablers for operational integration in two different types of value chains. The experiences from this study could also contribute to providing operational guidance to similar types of organizations if they want to improve their operational integration.

It is of course difficult to generalize from just two case studies, but these studies could contribute to building theory on the topic. Further research should focus on achieving more information on the enablers and disabler for operational integration, by doing a study of more organizations.

REFERENCES

Ayers, D.J., Gordon, G.L. and Schoenbachler, D.D., 2001. Integration And New Product Development Success: The Role Of Formal And Informal Controls. *Journal of applied business research*, 17(2), pp.133-148.

Barratt, M. and Barratt, R., 2011. Exploring internal and external supply chain linkages: Evidence from the field. *Journal of Operations Management*, 29, pp.514-528.

Basnet, C. & Wisner, J., 2012. Nurturing Internal Supply Chain Integration. *Operations and Supply Chain Management*, 5, pp.27-41.

Bititci, U., Cocca, P. and Ates, A., 2015. Impact of visual performance management systems on the performance management practices of organisations. *International Journal of Production Research*, 54(6), pp.1-23.

Bowersox, D.J., Closs, D.J. and Stank, T.P., 1999. *21st century logistics: making supply chain integration a reality*. Michigan State University, Council of Logistics Management.

Braunscheidel, M. J., Suresh, N. C. and Boisnier, A. D. 2010. Investigating the impact of organizational culture on supply chain integration. *Human Resource Management*, 49(5), pp.883-911.

Cao, N., Zhang, Z., To, K.M. and Ng, K.P., 2008. How are supply chains coordinated?: An empirical observation in textile-apparel businesses. *Journal of fashion marketing and management*, 12(3), pp.384-397.

Chen, H., Daugherty, P.J. and Landry, T.D., 2009. Supply chain process integration: a theoretical framework. *Journal of Business Logistics*, 30(2), pp.27-46.

Childerhouse, P. and Towill, D. R. 2011. Arcs of supply chain integration. *International Journal of Production Research*, 49(24), pp.7441-7468.

Dahlgaard, J.J., Pettersen, J. and Dahlgaard-Park, S.M., 2011. Quality and lean health care: A system for assessing and improving the health of healthcare organisations. *Total Quality Management & Business Excellence*, 22(6), pp.673-689.

Daugherty, P.J., Ellinger, A. E. and Gustin, C.M., 1996. Integrated logistics: achieving logistics performance improvements. *Supply Chain Management*: *An International Journal*, 1(3), pp.25-33.

Davenport, T.H., Harris, J.G. and Cantrell, S., 2004. Enterprise systems and ongoing process change. *Business Process Management Journal*, 10(1), pp.16-26.

Derlet, R. W. and Richards, J. R. 2000. Overcrowding in the nation's emergency departments: complex causes and disturbing effects. *Annals of emergency medicine*, 35(1), pp.63-68.

Eisenhardt, K.M. and Graebner, M.E., 2007. Theory Building from Cases: Opportunities and Challenges. *The Academy of Management Journal*, 50(1), pp.25-32.

Ellinger, A.E., Keller, S.B. and Hansen, J.D., 2006. Bridging the divide between logistics and marketing: facilitating collaborative behavior. *Journal of business logistics*, 27(2), pp.1-27.

Fawcett, S.E. and Magnan, G.M., 2002. The rhetoric and reality of supply chain integration. *International Journal of Physical Distribution & Logistics Management*, 32(5), 339-361.

Frohlich, M.T. and Westbrook, R., 2001. Arcs of integration: an international study of supply chain strategies. *Journal of Operations Management*, 19(2), pp.185-200.

Galbraith, J. R., 2011. The star model. [pdf] Retrieved from http://www. jaygalbraith.com/pdfs/Star Model.pdf.

Gattiker, T.F., 2007. Enterprise resource planning (ERP) systems and the manufacturing–marketing interface: an information-processing theory view. *International Journal of Production Research*, 45(13), pp.2895-2917.

Glouberman, S. and Mintzberg, H., 2001. Managing the care of health and the cure of disease--Part II: Integration. *Health Care Management Review*, 26(1), pp.56-69.

Griffin, A. and Hauser, J.R., 1996. Integrating R&D and marketing: a review and analysis of the literature. *Journal of product innovation management*, 13(3), pp.191-215.

Hayes, R.H. and Wheelwright, S.C., 1984. *Restoring our competitive edge: competing through manufacturing*, New York, NY: John Wiley & Sons.

Hoot, N.R. and Aronsky, D., 2008. Systematic review of emergency department crowding: causes, effects, and solutions. *Annals of emergency medicine*, 52(2), pp.126-136.e1.

Jovane, F., Koren, Y. and Boër, C.R., 2003. Present and Future of Flexible Automation: Towards New Paradigms. *CIRP Annals - Manufacturing Technology*, 52(2), pp.543-560.

Kahn, K.B., 1996. Interdepartmental integration: a definition with implications for product development performance. *Journal of product innovation management*, 13(2), pp.137-151.

Karlsson, C., 2009. *Researching Operations Management*, Taylor & Francis.

Kvale, S., 1997. *Det kvalitative forskningsintervju*. Oslo: Ad Notam Gyldendahl.

Kymal, C., 2004. *The ISO/TS 16949 Implementation Guide: Gaining Value from Your ISO/TS 16949 Implementation*, Paton Professional.

Mainz, J., 1995. *Problem identification and quality assessment in health care. Theory, methods, results*. København: Munksgaard.

Malone, T.W. and Crowston, K., 1994. The interdisciplinary study of coordination. *ACM Computing Surveys*, 26(1), pp.87-119.

Mazzocato, P., Holden, R.J., Brommels, M., Aronsson, H., Bäckman, U., Elg, M. and Thor, J., 2012. How does lean work in emergency care? A case study of a lean-inspired intervention at the Astrid Lindgren Children's hospital, Stockholm, Sweden. BMC *Health Services Research*, 12(28), pp.1-13.

Mentzer, J.T., 2004. *Fundamentals of supply chain management: twelve drivers of competitive advantage*, Sage publications.

Morash, E.A. and Clinton, S.R., 1998. Supply chain integration: customer value through collaborative closeness versus operational excellence. *Journal of Marketing Theory and Practice*, 6(4), pp.104-120.

Muckstadt, J.A., Murray, D.H., Rappold, J.A. and Collins, D.E., 2001. Guidelines for Collaborative Supply Chain System Design and Operation. *Information Systems Frontiers*, 3(4), pp.427-427.

Nabavizadeh, R., Momeni, M. and Saidi, S. S. 2013. The Impact of Aligned Rewards and Senior Manager Attitudes on Conflict and Collaboration between Sales and Marketing in JahanBehbood Pharmaceutical Co. *International Research Journal of Applied and Basic Sciences*, 5(6), pp.756-761.

Netland, T.H., Knutstad, G., Buvik, M. and Skjelstad, L., 2008. The New Importance Of Socio-Technical Systems Research On High-Tech Production Systems. Paper submitted to HOPS, Lausanne, Switzerland.

Nonaka, I., 1994. A dynamic theory of organizational knowledge creation. *Organization science*, 5(1), pp.14-37.

Pagell, M., 2004. Understanding the factors that enable and inhibit the integration of operations, purchasing and logistics. *Journal of Operations Management*, 22(5), pp.459-487.

Porter, M.E., 1985. *Competitive advantage: creating and sustaining superior performance*. New York: Free Press.

Preston, C., Cheater, F., Baker, R. and Hearnshaw, H., 1999. Left in limbo: patients' views on care across the primary/secondary interface. *Quality in Health Care*, 8(1), pp.16-21.

Seim, A.R., 2009. *Process Analysis and Monitoring in Complex Perioperative Environments: Health Operations Management*. Ph. D. Norwegian University of Science and Technology.

Shub, A.N. and Stonebraker, P.W., 2009. The human impact on supply chains: evaluating the importance of "soft" areas on integration and performance. *Supply Chain Management: An International Journal*, 14(1), pp.31-40.

Simatupang, T.M. and Sridharan, R., 2002. The collaborative supply chain. *The International Journal of Logistics Management*, 13(1), pp.15-30.

Stank, T.P., Keller, S.B. and Daugherty, P.J., 2001. Supply chain collaboration and logistical service performance. *Journal of Business Logistics*, 22(1), pp.29-48.

Stock, G.N., Greis, N.P. and Kasarda, J.D., 1999. Logistics, strategy and structure: a conceptual framework. *International Journal of Physical Distribution & Logistics Management*, 29(4), pp.224-239.

Tjora, A. 2011. *Kvalitative forskningsmetoder i praksis*. Gyldendal Akademisk.

Turkulainen, V., 2008. *Managing cross-functional interdependencies-the contingent value of integration*. Ph. D., Teknillinen korkeakoulu.

Turkulainen, V. and Ketokivi, M., 2012. Cross-functional integration and performance: what are the real benefits? *International Journal of Operations & Production Management*, 32(4), pp.447-467.

Van Hoek, R.I. and Mitchell, A., 2006. The challenge of internal misalignment. *International Journal of Logistics*, 9(3), pp.269-281.

Wheelwright, S.C., 1992. *Revolutionizing product development: quantum leaps in speed, efficiency, and quality*. Simon and Schuster.

Yin, R.K., 2009. *Case Study Research, Design and Methods*. Sage Publications Inc.

ABOUT THE AUTHORS

Inger Gamme, Ph.D. Candidate, Gjøvik University College/ NTNU, inger.gamme@hig.no, Teknologiveien 22, 2815 Gjøvik, Norway

Geir Berg, Dr. Public Health, MNSc, RN , Innlandet Hospital Trust Lillehammer, geir.berg@sykehuset-innlandet.no, Postboks 104, 2381 Brumunddal, Norway

Paper IV

Article information:

Users who downloaded this article also downloaded:

For Authors

About Emerald www.emeraldinsight.com