Exploring Designs for a Process Prioritisation Method

Jens Ohlsson

©Jens Ohlsson, Stockholm University 2016

ISBN print: 978-91-7649-563-6
ISBN PDF: 978-91-7649-564-3

Printed in Sweden by Holmbergs, Malmö 2016
Distributor: Department of Computer and Systems Sciences

Abstract

Problem/Purpose: Process prioritisation is an ill-structured and complex problem that remains a mystery phase in business process management (BPM) research. More explorative approaches are called upon to tackle process management problems, to facilitate process innovation and to design new processes in dynamic environments. This dissertation aims (i) to design and evaluate a Prioritisation and Categorisation Method (PCM) for addressing process prioritisation problems; and (ii) to explore process innovation by disruptive technologies.
Research methods: This research follows the design science research (DSR) paradigm. The design exploration and the engaged scholarship approaches are also adapted. The demonstration and evaluation of the Prioritisation and Categorisation Method have been conducted with case studies in large Swedish companies, i.e. Seco Tools and Ericsson. An empirical study of the impacts of disruptive technologies on process innovation was conducted at a large insurance company in Sweden.
Results: This research has led to the design and evaluation of the PCM: a new context-aware, effective and holistic method for BPM. In addition, the lessons learnt from the insurance case deepened the understanding of the challenges that are faced by a company when exploring new capabilities (e.g. processes and IT) for future business. Such lessons also emphasise the necessity of configuring PCM based upon business contingencies and industry factors in process prioritisation.
Contributions: This dissertation contributes a novel method to explore BPM in a holistic, yet flexible and effective way. The challenges identified in process innovations improve the configuration capabilities of the PCM through a deeper understanding of the dynamic capabilities within organisations (Capability Layer Model-CLM). This research contributes design knowledge to DSR in the forms of the PCM as an invention, and the three design principles for the PCM: design by holistics, design by commitments and design by explorations. The research is evaluated as good BPM and good design science research.

Keywords: Process prioritisation, exploration, process innovation, design science research, business process management, disruptive technology, capability layer model, systems thinking

Sammanfattning

Syfte/Problem Processprioritering är komplext och problematiken kring att prioritera processförbättringsarbete är mångfacetterad. Inom *Business Process Management* (BPM)-forskning anses detta område vara outforskat och det efterfrågas mer forskning och utforskande metoder inom området. De två målen med denna avhandling är att (i) designa och utvärdera en prioriterings- och kategoriseringsmetod (PCM) som bidrar till att lösa prioriteringsproblem; och (ii) att utforska hur processinnovation genom *disruptiva* teknologier kan åstadkommas.
Forskningsmetod Denna forskning tillämpar *Design Science Research* (DSR). *Engaged Scholarship* och *Explorativ Design* är också tillämpat i denna forskning. Demonstration och utvärdering av prioriterings- och kategoriseringsmetoden (PCM) genomförs med hjälp av fallstudier i börsnoterade svenska företag såsom Seco Tools och Ericsson. Den empiriska fallstudien med avseende på disruptiva teknologier och processinnovation är utförd i ett stort svenskt sakförsäkringsbolag.
Resultat Denna forskning har designat och utvärderat PCM, som är en kontext-känslig, holistisk och effektiv metod för BPM. Parallellt med detta arbete har en fallstudie inom processinnovation bidragit med fördjupad kunskap gällande de utmaningar som företag står inför när de ska utforska nya förmågor (såsom nya processer, och digitala förmågor) för innovativa affärer. Lärdomarna från fallstudien artikulerar också behovet av att konfigurera PCM baserat på på företagskontext och behov av olika ledningsförmågor.
Forskningsbidrag Denna avhandling bidrar med en innovativ metod genom vilken organisationer och företag kan utforska sin processledning och sitt processförbättringsarbete på ett flexibelt, holistiskt och effektivt sätt. De utmaningar som identifierats i arbetet med process- innovation genom disruptiva teknologier har bidragit med kunskap i form av en förmågemodell -- *Capability Layer Model* (CLM) vilken används för att förbättra PCMs konfigurerabarhet.
Forskningen bidrar också med kunskap avseende tre designprinciper för hantering av komplexa problem: design genom helhet (*holistics*), design genom engagemang (*commitments*), och design genom utforskning (*explorations*).

Nyckelord: Process prioritering, utforskning, process innovation, design science research, business process management, management, systemvetenskap

List of Publications

This thesis consists of the following original publications:

Paper 1: **Ohlsson, J.**, Han, S., Johannesson, P., Carpenhall, F., and Rusu, L. (2014a). "Prioritising business processes improvement initiatives: The Seco tools case," In Jarke, M. et al. (eds.) *Proceedings of 26th International Conference on Advanced Information Systems Engineering* (CAiSE), *Lectures Notes in Computer Science*, LNCS 8484, pp. 256-270, Springer International Publishing Switzerland.

Paper 2: **Ohlsson, J.**, Han, S., Johannesson, P., and Rusu, L. (2014b). "Developing a method for prioritising business process improvement initiatives," In *Proceedings of Pacific Asian Conference on Information Systems* (PACIS), Paper 342, Association of Information Systems (AIS).

Paper 3: Händel, P., **Ohlsson, J.**, Ohlsson, M., Skog, I. and Nygren E. (2014). "Smartphone-based measurement systems for road vehicle traffic monitoring and usage-based insurance," *IEEE Systems Journal*, (8:4), pp. 1238-1248.

Paper 4: **Ohlsson, J.**, Händel, P., Han, S., and Welch, R. (2015). "Process innovation with disruptive technology in auto insurance: Lessons learned from a smartphone based insurance telematics initiative,". In vom Brocke, J. and Schmiedel, T. (eds.) *Business Process Management: Driving Innovation in a Digital World*, pp. 85-101, Springer International Publishing Switzerland.

Paper 5: **Ohlsson, J.**, Han, S., and Bouwman, H. (accepted). "The prioritization and categorization method (PCM): an evaluation at Ericsson," *Business Process Management Journal*.

To my children: Lowa, Mika and Otto,
to Malin and to
my parents.

Thanks for everything!

Table of Contents

Abstract v

Sammanfattning vii

List of Publications ix

Table of Contents xiii

List of Tables xv

List of Figures xvi

Abbreviations xvii

Preface xxi

1 Introduction 1

1.1 Research problems and purposes 2

1.2 Design exploration process of the PCM 4

1.3 Contributions and publications 6

1.4 Disposition 7

2 Knowledge Base 9

2.1 Business process management: exploitative and explorative approaches 10

2.1.1 Exploitative BPM: the methods for process improvement and prioritisation 10

2.1.2 Explorative BPM: a new direction for research 12

2.1.3 Six core elements of strategic BPM 13

2.1.4 Ten principles of good BPM research 14

2.2 Systems thinking 15

2.2.1 Organisations as social systems 16

2.2.2 Organisations as networks of commitments 18

2.2.3 Bounded rationality in management decision-making 20

2.3 Implications of the knowledge base for designing the PCM 21

2.4 Summary and reflections 23

3 Design Science Research 25

3.1 Design Science Research Methodology - DSRM 26

3.2 Design exploration: the co-evolution of problem-solution 28
3.3 Engaged scholarship 30
3.4 Design Science Research: knowledge contribution 31
3.4.1 Theorising design knowledge 31
3.4.2 Design relevance and contribution to practice 32
3.4.3 The research guidelines for Design Science Research 34
3.5 Application of the research methods 34
3.6 Research ethics 37
3.7 Concluding remarks 38

4 The Prioritisation and Categorisation Method - PCM 41
4.1 Process Assessment Heat Map (PAHM) 42
4.2 Process Categorisation Map 44
4.3 The PCM way of working: activities and the web-based tool 47

5 Demonstration and Evaluation: Empirical Case Studies 51
5.1 The demonstration of the PCM at Seco Tools 52
5.2 Process innovation with disruptive technologies: the If Insurance 52
5.3 Evaluation of the Configured PCM at Ericsson 54

6 Discussions 59
6.1 The knowledge contributions to BPM research 60
6.1.1 The PCM as a novel method for process prioritisation 60
6.1.2 Exploring process innovation with disruptive technology 62
6.2 The contributions to DSR knowledge 63
6.2.1 The PCM as a DSR invention 63
6.2.2 The design principles for the PCM 64
6.3 The contributions to research relevance 69
6.4 Generalisability of the PCM 71
6.5 Evaluating the research 72
6.5.1 Good BPM research 72
6.5.2 Good Design Science Research 74

7 Conclusions 75
7.1 The main results revisited 76
7.2 The research contributions 76
7.3 Limitations and future research 78

References 81

Appendix 1- The web-based tool for the PCM 91

Part Two: Original Research Papers 99

List of Tables

Table 1. Design exploration process of the PCM 6

Table 2 Exploitative BPM vs Explorative BPM (Rosemann 2011) 14

Table 3. The implications of the theories for designing the PCM 22

Table 4. The DSR research guidelines (Hevner et al. 2004, p.83).....34

Table 5. The PCM design activities and results.....35

Table 6. The interactive activities with distinct perspectives and examples of questions based on the six core elements 43

Table 7. Categorisation Map (CM) dimensions and sample questions 45

Table 8 The questions for the Categorisation Map.....56

Table 9. The three design principles for the PCM 64

Table 10. Evaluating research as good BPM research 73

Table 11 . Evaluating research as good Design Science Research.....74

List of Figures

Figure 1. Design exploration process of the PCM, Modified after (Maher et al. 1996) & (Dorst and Cross, 2001)....4

Figure 2. Organisation as a social system....17

Figure 3. Design Science Research Methodology (modified from Peffers et al. 2008)....26

Figure 4. The co-evolution model (Maher et al. 1996, p.7)....28

Figure 5. Design theorising framework (Lee et al. 2011, p.6)....32

Figure 6. Positioning the PCM in a Conceptual Map of Design Disciplines, modified from (Owen, 1998)....33

Figure 7. Process Assessment Heat Map-PAHM....44

Figure 8. Process Categorisation Map....45

Figure 9. The Prioritisation and Categorisation Method - a web based tool (manipulated screen picture)....48

Figure 10. The Capability Layer Model (CLM)....53

Figure 11. Specification of PCM heath map topics for Ericsson....55

Figure 12. Mapping ESG questions to heath map perspectives....56

Figure 13. The PCM contribution as an Invention....63

Abbreviations

BPM - Business Process Management

CIO - Chief Information Officer

CLM - Capability Layer Model

CM - Categorisation Map

DSR - Design Science Research

DSRM - Design Science Research Methodology

IS - Information Systems

PAHM - Process Assessment Heat Map

PCM - Prioritisation and Categorisation Method

Part One: Research Summary

Preface

This research endeavour goes back to the late 90s when I finalised my master's thesis at the Stockholm University and Royal Institute of Technology. I did my master's thesis at a global software vendor (SAP), where some of the implementation cases of the SAP software suite were investigated. One of the main themes in the thesis was the circumstance that business-change and process improvement projects were delegated to the IT departments. Business process improvement initiatives became IT projects, which resulted in a failure to produce business success while IT costs escalated. After my thesis, I started to work for SAP as a pre-sales consultant focused on improving enterprise processes by implementing Enterprise Resource Planning systems (ERP) and Customer Relationship Management systems (CRM). During my years at SAP, I witnessed many projects that did not live up to their expectations. A major reason for this was attributed to the decision process that supported the investment decisions regarding these business process improvement initiatives. The selection and procurement process of these systems were often done in an old fashion way that was influenced by old behaviour and outdated roles.

I started to work for IDS Scheer later in my career. It was here that I worked with Business Process Management within the domain of Business Process Analytics. The typical companies that I engaged with were large and established companies, as explained above, with the ambition to create a competitive advantage through cost leadership and operational excellence, supported by Business Process Management (BPM). The purpose of the Business Process Analytics approach was to find ways to implement improved processes that were supported by process automation software such as ERP and/or other more workflow oriented software tools. However, it was often the case that the results of working with BPM in the business process analytics area became business process modelling for business process modelling's sake, rather than business process improvements realised by coordinated IT, people, governance, methods and cultures that are well

aligned with the corporate strategy. The Chief Information Officer (CIO) in these companies was a central decision maker engaged in both scenarios described above, thus I was engaged in dialogue with individuals within this role in these large companies.

In parallel with the more traditional, as I call it linear, or an exploitative way of working with business process management and business process efficiency, I also started a research endeavour to explore business model and business process innovations by disruptive technologies; this was initiated in 2009 at the Department of Signal Processing, KTH Royal Institute of Technology. The researchers at KTH developed the fundamental signal-processing algorithms to secure a reliable sensing system that is based on smartphone capabilities. A legal entity was created outside of academia (Movelo AB, www.movelo.se) for the design and development of a smartphone application and back-end system that could measure safe-driving and eco-driving behaviour. The system that was developed can monitor and transmit risk-related information to, e.g., insurers, and the information sent could include the speeding, cornering, braking and accelerating habits of the driver, the current time and date of each incident and the road conditions. Then an innovative business model, based on an ideal design that was inspired by the Osterwalser's theoretical business model ontology, was designed and implemented. The last step was to identify a suitable campaign sponsor that could gain commercial benefits from the campaign and had the resources required to market and distribute the mobile application to their current and potential customers, as well as make them use the application on a regular basis. The ideal case identified was to make sure that drivers benefited from using the application every time they drove their car, thus creating a clear value proposition to the firm's customers. After some investigation, a company in the insurance industry (If Skadeförsäkring AB) was identified as a suitable campaign sponsor (they are the market leader in the Nordic countries with some 3.6 million customers). In May 2011, a commercial contract was signed between If P & C and Movelo AB. An insurance telematics initiative, If SafeDrive was tested commercially. Later on, the If SafeDrive campaign was run for 2 weeks between March and April 2013. In total, some 1,000 registered users were involved in the test. However, the campaign did not succeed as expected, and the innovated business model and the innovated business processes were not fully explored. The lessons learnt and reflections from them have contributed significantly to my further continuation in the exploration of process innovations in organisations. In particular, the application of general system theory and soft system thinking to the design of a method for making process improvements more pragmatic.

In 2010, I started to establish the research presented in this thesis with the ambition of conducting applied research based on cross-disciplinary

principles in the domain of integrating strategy with operations and business with IT. To make this happen a think-tank was formed, Duqtor (www.duqtor.com). The purpose of the think-tank is to facilitate the dialogue and collaboration between practitioners and researchers. One initiative, that is central to the design process, is to engage CIOs, business practitioners and experts in collaborations to design a method of prioritising business process improvement initiatives, and with the idea to integrate strategy with operations and coordinate business with IT. The managers who were engaged in the research endeavour came from big organisations in Scandinavia, e.g. Atlas Copco, Postnord, Vattenfall, Västerås Stad, Bombardier Nordic, SSAB, Scania, Siemens Industrial Machinery, Seco Tools, Statkraft (Norway), and Sandvik et al. The Prioritisation and Categorisation Method (PCM) has been designed in an iterative Design Science process, demonstrated and evaluated at Seco Tools and Ericsson. The general idea with the PCM is to support organisations and companies when managing both an exploitative BPM and an explorative BPM.

The design of the PCM is built upon existing BPM theories that are combined with general system theories, such as Ackoff's interactive planning principles, organisations as social systems, Winograd and Flores seminal text regarding how to generate networks of commitments, and Simon's theory of bounded rationality in decision-making.

I claim that companies today operate in dynamic environments; this can be argued, discussed and categorised. Maybe an insurance company consider that they do not need to innovate their business model and their business processes by an explorative approach, but it is a fact that an insurance company has already tried it, and that many CIOs and stakeholders in the business community are asking for it. There is a clear trend in the business community, and in the BPM research community, that shows an increasing demand for novel methods that support an explorative BPM and a context-sensitive BPM. The question is how to do it, but also how to design applicable methods for business stakeholders in this applied and multi-disciplinary research area. The Prioritisation and Categorisation Method (PCM) is designed to partially solve the problem and contribute to continuous work in the domain of business development through business process management.

Acknowledgements

I want to take the opportunity to thank the following people:

My advisors: Associate Prof. Shengnan Han and Prof. Paul Johannesson.

My mentor, friend and former colleague: Björn Rosengren.

The Think-Tank, Duqtor, with Stefan Wernmo, Ole Schjødt-Osmo, Nevzat Ertan and Jörgen Clevensjö.

Cecilia Anneroth at Ericsson for her engagement and contribution with the cases at Ericsson.

Fredrik Carpenhall at Seco Tools for his engagement and contribution with the case at Seco Tools.

Prof. Peter Händel at Royal Institute of Technology (KTH) and the Team behind Movelo.

My colleagues at DSV, especially Prof. Lazar Rusu for his support in my Licentiate thesis; Associate Prof. Ilia Bider for his contribution in the pre-doc activities; and Eric-Oluf Svee for his support in English language.

The First Applied Research Workshop series (chaired by Jens Ohlsson, 2011-2012) at the Department of Computer and Systems Sciences (DSV) at Stockholm University, with the following participants: Nevzat Ertan, Chief Enterprise Architect and Manager at the Sandvik Group; Jörgen Hansson, Enterprise Architect at Sandvik Group; Ole Schjodt Osmo, President Process Improvement and IT Strategy at Statkraft Norge; Erik Leppenän, CIO at SSAB; Hans Narvström, Corporate CIO at Scania; Mats Högberg Corporate CIO at Atlas Copco; Joss Delissen, Corporate CIO at Posten; Claes Wallner, Corporate CIO at Vattenfall; Fredrik Strandlund, CIO at Västerås Stad; Tomas Åkerlind, Nordic CIO at Bombardier; Johan Sundberg, CIO at Siemens Industrial Machinery; Fredrik Carpenhall, CIO/COO at SECO Tools; Stefan Wernmo, former V.P. CIO, Business Development Manager at Sandvik Tooling 2001-2011; and Björn Rosengren from Stockholm University, DSV.

The Second Applied Research Workshop series (chaired by Jens Ohlsson, 2012-2013) at the Department of Computer and Systems Sciences (DSV) at Stockholm University, with the following participants: Anders Candel, CIO at Tele2; Daniel Karlsson, CIO at Transportstyrelsen; Johan Wirf, CIO at Swedish Match; Karin Bogen, CIO at Assa Abloy; Mats Hultin, CIO at Saabgroup; Mattias Wessman, CIO at Euromaint; Per Brandt, CIO at Munters; Per Lundqvist, COO at Cramo; and Tomas Wiik, CIO at JM, and the founders of the Think-Tank Stefan Wernmo, Ole Schjødt-Osmo, Nevzat Ertan and Jörgen Hansson and Björn Rosengren.

The Third Applied Research Workshop series (chaired by Jens Ohlsson, 2013) at the Department of Computer and Systems Sciences (DSV) at Stockholm University, with the following participants: Björn Wetterling, CIO at Ifsworld; Cecilia Anneroth, Head of Business Process Support at Ericsson; Johan Bergsten, Chief Architect at SSAB; Leif Höök, Business Area Manager IT at Försäkringskassan; Lena Bornholm, Verksamhetsutvecklare at Försäkringskassan; Mats Lindeberg, CIO at Alfalaval; Michael Åsman, Head of IT Strategy and Portfolio Management at Lantmännen; Rolf Rönnback, Business and IT Architect at Apoteken Service; and Stefan Johansson, Quality, Compliance and Security Lead at Astra Zeneca, and the founders of the Think-Tank Stefan Wernmo, Ole Schjødt-Osmo, Nevzat Ertan and Jörgen Hansson and Björn Rosengren.

All of the participants in the demonstration and evaluation of the PCM at Seco Tools and Ericsson. Everybody involved in the commercial pilot of the user-based insurance solution.

Jens Ohlsson
Stockholm, Sweden
October 20, 2016

1 Introduction

"*The whole is greater than the sum of its parts*." — Aristotle

This chapter presents the research problems. Then, the design exploration process towards the design of the Prioritisation and Categorisation Method is demonstrated. Following that, the contributions of the research are summarised. Finally, the disposition of the thesis is given.

1.1 Research problems and purposes

For more than 20 years, business processes have been a core unit of analysis in information systems research, but most specifically for Business Process Management (BPM). Organisations need to make consistent efforts for process improvements to maintain the alignment of these processes with their strategy, goals, and values, which ultimately generate competitive advantages (Porter 1980; Hammer 1993; Davenport 1993).

A fundamental activity of process improvement is prioritisation. Among the various methods that support business process improvements, especially process prioritisation, maturity models are receiving growing interests (e.g. Rosemann and de Bruin 2005). The applicability and usefulness of maturity models is limited, and maturity models in BPM are limited when it comes to providing more transparency and also a better support for adaptations to practice (Röglinger et al. 2012). There is an applicability problem with existing BPM maturity models. Further, they are difficult to apply at a business management level in an organisation. Existing scientific approaches to prioritise process improvement initiatives have focused on the generation of revenue, regulatory or social responsibilities, or process strategy alignment (e.g. Bandara et al. 2010; Burlton 2010; Hammer 2007). They mainly provide generic descriptive information about the process performance or conditions; and they rarely prescribe how to improve the prioritised process (Burlton 2010). In addition, the users (e.g. managers and process stakeholders) of these methods rarely participate in the design process of these methods and models. More importantly, a way that these models and methods can be adapted to the managerial decision-making process has not yet been fully explored. Moreover, the motivation for strategic decisions and arguments behind the choices (decisions) made are poorly documented, often only visualisations of as-is and to-be are available. Consequently, prioritisation "remains as a 'mystery phase' in BPM research" (Bandara et al. 2010, p.178).

In business practice, companies operate in an age of accelerating change, increasing uncertainty and growing complexity. Innovations and changing business environments create a lot of concern for large companies. There are new threats appearing on their horizon, both from their existing competitors and from new types of competitors, such as entrepreneurs or companies from other industries who are approaching their industry and value-chains with potentially disruptive technologies and innovative business models. In such dynamic environments, or high velocity markets, change becomes nonlinear or explorative (Eisenhardt and Martin 2000; Rosemann 2011, 2014; Tidd

and Bessant 2009). Disruptive technologies and innovations require agile and radical changes/improvements of processes in order to embrace the innovations required to generate new business values. However, companies appear to lack the explorative BPM capabilities to meet the challenges and to address the "non-linear or explorative" problems. In business practice, as experienced by managers, it is difficult to prioritise among process improvement initiatives (Ohlsson et al. 2014a). It is also difficult to justify prioritisation decisions among managers in the organisation. Decisions are mostly politically driven which means that executives of business units, that are more influential, get funding for projects regardless of their contributions to business strategy and values.

Rosemann (2014) has strongly argued that the research community needs to adapt to more explorative approaches to promote the uptake of BPM in business (not only in IT). Rosemann further articulates that an explorative BPM research effort should facilitate process innovation and design new processes that can utilise disruptive technologies and satisfy a digital-savvy customer base. The key capabilities of explorative BPM are to craft process visions by involving relevant stakeholders, customers, and employees to explore how to make a desired future state; and to identify the opportunities that create new business and revenue. Furthermore, contextual factors and business contingencies should be embedded in the development of the BPM methods (vom Brocke et al. 2016) to solve prioritisation problems in specific business settings. Obviously, this explorative approach has significant impacts on how prioritisation as a mystery phase can be tackled, especially for those companies that face the challenges of disruptive technologies and operate in dynamic environments.

Therefore, this research seeks to address the complex or mysterious "process prioritisation problem" by adapting this explorative BPM approach, and contributing knowledge to business process management research. Particularly, this dissertation aims (i) to design and evaluate a Prioritisation and Categorisation Method by involving and motivating stakeholders to carry out process assessments (for prioritisation) and to explore process visions, in which context and industry factors are considered; and (ii) to explore the impacts of disruptive technologies on process innovation to identify the dynamic capabilities that a company needs to succeed in process innovation and process prioritisation within dynamic environments.

1.2 Design exploration process of the PCM

Process prioritisation is considered as a mystery in process management and decision-making (Bandara et al. 2010). Simon (1973) defines an ill-structured problem as "a problem whose structure lacks definition in some respect" (p.181). Ill-structured problems are usually very difficult, or impossible, to solve immediately. Thus, Simon promotes "design as a problem-solving activity" (Simon 1996). In order to address the process prioritisation problem, which is an ill-structured problem, this research follows Design Science Research Methodology (DSRM) (Peffers et al. 2008), which provides the preliminary guidelines for the design and evaluation of *the Prioritisation and Categorisation Method (PCM).*

During the years of designing the PCM, we have recognised that the problem space is changing throughout the design search process, which makes the assimilation of new information and knowledge become necessary, and ultimately results in the co-evolution of problem and solution spaces. An endeavour where the solution to one problem has led to the identification of a new problem that has demanded a new solution, and so forth. Therefore, the explorative design process theorised by Maher et al. (1996) and Dorst and Cross (2001) is further adapted to reveal the design search process towards the explorative design of the Prioritisation and Categorisation Method (See Figure 1).

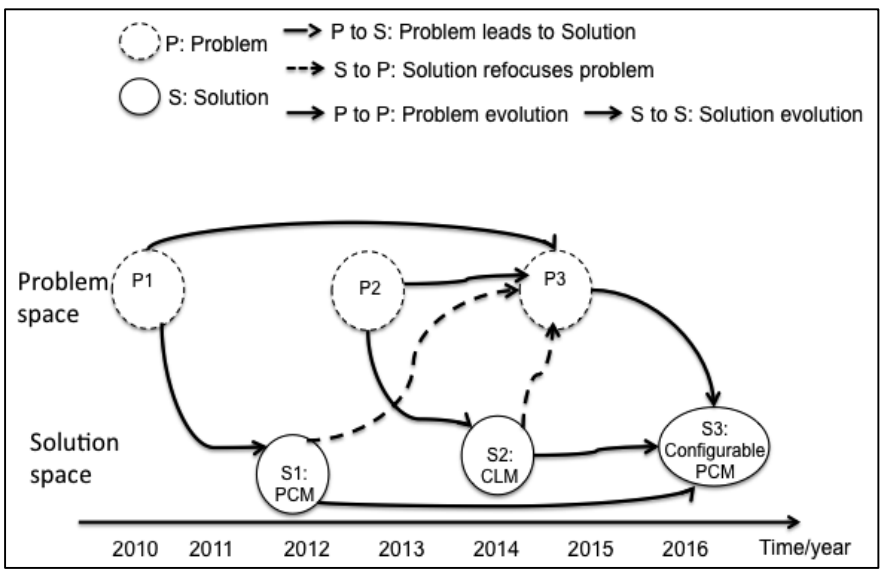

Figure 1. Design exploration process of the PCM, Modified after (Maher et al. 1996) & (Dorst and Cross, 2001)

In the beginning of this research (2010-2012), the problem space P(1) was formulated from "IT-driven" process improvement approaches and the CIO's difficulties in the distribution of IT resources for process improvement and prioritisation purposes. Process improvement methods within the exploitative BPM have supported the initial design of the PCM, i.e. the solution S(1). This design was demonstrated at Seco Tools, focusing on support for the CIO's decision-making with regard to the process prioritisation between IT and business. The demonstration to Seco Tools was successful, and then the PCM was piloted further at Ericsson and included in Ericsson's BPM framework.

From the year 2012-2013, innovation by digitalisation was identified as an emerging challenge for companies. Disruptive technologies and new customer bases posed tremendous pressure for organisations to prioritise and innovate their processes to assure their success in this dynamic environment. Process prioritisation and innovation in dynamic environments, thus is formulated as the problem space 2- P(2). This problem was also articulated by Rosemann (2011) as one of the new directions of explorative BPM research. The problem was investigated by studying a smartphone based insurance telematics solution that was piloted in a large insurance company in Sweden. The results showed that the innovative product/service did not fully succeed in its implementation. The reason is not because of the technology, but the new business processes that were initiated by the new disruptive technologies could not be implemented in the "old" organisation's structure, strategy and industry environment. The solution 2 -S(2) was proposed and presented by the Capability Layer Model (CLM), which is a layered framework for building process capabilities to assure the process prioritisation and innovation that is associated with disruptive technologies in a holistic manner.

From the year 2014, as the new explorative BPM approach (Rosemann 2014) was promoted more strongly to the BPM community, as well as the empirical evidence that we had got from the problem space 2- P(2) (Ohlsson et al. 2015), we acknowledged the importance of new challenges for process innovation and prioritisation in the digital age. Both business contingencies and contextual factors should be embedded into the method development for process prioritisation purposes (e.g. vom Brocke et al. 2016). When the problem space 3-P(3) was formulated, we had received a message from Ericsson's top management that said that they needed to know how their processes could strategically support and identify the opportunities of their "future business", i.e. their vision and strategy within a Networked Society. Thus, the solution space 3- S(3) was developed further by improving the configuration abilities of the PCM to fit into Ericsson's business and its context. The configured PCM was evaluated and was shown to be useful in

this empirical study. The explorative design process of the PCM is further summarised in Table 1.

Table 1. Design exploration process of the PCM

Problem space	**Solution space**	**Original publications**
In Practice: Companies have difficulties when prioritising among process improvement initiatives. **In Theory:** Process prioritisation is a mystery**.** Existing process improvement methods have limited applicability for practitioners.	*Design PCM* *Demonstrate* PCM at SECO Tools *Pilot evaluation* at Ericsson	Paper 1 & 2 Licentiate Thesis (2015)
In Practice: Companies have difficulties when embracing new business processes and business models that are initiated by disruptive technologies. **In Theory:** BPM research needs to address process innovation in the digital age, which is characterised as dynamic and uncertain.	*Propose* a Capability Layer Model-CLM to understand and make a holistic view to generate a common understanding of the process prioritisation and innovation in dynamic environments.	Paper 3 & 4
In Practice: Companies have difficulties when managing processes holistically in dynamic and uncertain environments. **In Theory**: Explorative BPM is demanded in IS research. Business contingencies and contextual factors need to be considered when developing new methods.	*Configure the PCM, make* the PCM fit to Ericsson's business needs/context. *Evaluate* the configured PCM at Ericsson.	Paper 5

1.3 Contributions and publications

This dissertation contributes a novel method to explore BPM and the associated design principles for the PCM to design science research. The method requires the active engagement of stakeholders, it focuses on developing dynamic BPM capabilities and embeds organisational contingencies and contextual factors in the decision-making activities

regarding the business process prioritisation, improvement and management. The PCM contributes to 'good BPM research' (vom Brocke et al. 2014). It helps companies to explore BPM in a holistic, yet easy and flexible way. This contribution is fully elaborated in Paper 1, 2, and paper 5.

The evidence collected in a large insurance company in Sweden further extends the pioneering work of Rosemann (2014) with regards to an explorative BPM in the digital age. Although it is crucial to explore new process capabilities with disruptive digital technologies, without other capabilities and strategic elements available (e.g. people, organisation, business model and strategy) (Rosemann and vom Brocke, 2010), a company cannot succeed in process innovation that caters for future business. This contribution is discussed in paper 3, 4, and paper 5.

The design search process is rarely reported in design science research. The nominal process of DSRM (Design Science Research Methodology) has largely ignored the explorative evolution between a problem space and a solution space. The present research provides empirical evidence that shows the importance of the explorative design process to support while developing a more comprehensive and systematic view between problems and solutions within a specific time frame. In addition, the results from this design science research emphasise the significance of the "engaged scholarship" approach in the design collaboration between researchers and business practitioners. This, to a great extent, increases the relevance of the research, as well as the applicability of the PCM in business. Further, the dissertation contributes the three design principles for the PCM, which are: *design by holistics, design by commitments and design by explorations.* The nascent design principles serve as a guide for other people designing methods within the context of business process management.

1.4 Disposition

This dissertation consists of two parts. Part one is an introduction to my doctoral research process, which I have been engaged in over recent years. Part two is a collection of 5 original articles that are included in this dissertation.

The reminder of this dissertation is organized into the following chapters:

Chapter 2: Knowledge Base
It provides the important knowledge used for the design of the PCM. The previous research regarding exploitative and explorative BPM is reviewed, and special attention is paid to the method of process improvement and

process prioritisation. The theoretical background regarding organisations as social systems, organisations as networks of commitments and the bounded rationality theory in decision-making, are also described and discussed.

Chapter 3: Design Science Research
This chapter describes the design science research strategy, as well as the application of the methods. The explorative design process theorised by (Maher et al. 1996) and (Dorst and Cross 2001) is further elaborated upon. An engaged scholarship approach (Van de Ven 2007) is also introduced.

Chapter 4: The Prioritisation and Categorisation Method
The PCM is presented in detail. The two models of PCM, Process Assessment Heat Map (PAHM) and Categorisation Map (CM) are described. The way of working with the PCM and the supporting web-based tool are also presented.

Chapter 5: Demonstration and Evaluation: Empirical Case Studies
This chapter presents the results from when the PCM was demonstrated to Seco Tools and the evaluation of the configured PCM at Ericsson. The empirical evidence gained from the insurance case has also been described briefly.

Chapter 6: Discussions
This chapter summarises and discusses the contributions of the PCM to both BPM research and design science research. The implications for practice and the generalisability of the PCM are further presented. The research is also finally evaluated using the ten principles of good BPM research, and the seven DSR research guidelines.

Chapter 7: Conclusions
The conclusions provide a summary of the dissertation, highlight the main contributions, and point out the limitations and suggestions for future directions.

Although this research summary draws largely upon a wealth of knowledge from the work of the five original papers, I aim to reflect upon my research as a whole. Therefore, I have discussed more justificatory knowledge (chapter 2 & 3) that has influenced the design and evaluation of the Prioritisation and Categorisation Method (PCM). The knowledge contributions and the design principles for the PCM are articulated and presented in chapter 6.

2 Knowledge Base

This chapter presents a knowledge base to the research. First, the relevant and contemporary Business Process Management theories (both exploitative and explorative BPM) and methods for process improvement and innovation are presented and discussed. Section 2.1 is based on my licentiate thesis (Ohlsson 2015) and paper 5 (Ohlsson et al. accepted). Second, the theoretical understanding of systems thinking and decision-making that influences the design of the Prioritisation and Categorisation Method (PCM) is discussed. It gives a general systemic view and a more specific focus on organisations as social systems supported by the systems thinking. Two other approaches that influence the design of the PCM are also discussed, i.e. organisations as networks of commitments and the theory of bounded rationality in decision-making. The chapter finishes with concluding remarks and reflections by summarising the theoretical background that the research is built upon.

2.1 Business process management: exploitative and explorative approaches

Managing business processes is a necessity for all organisations (Becker et al. 2003). In order to keep the pace with fast changing business environments, organisations must continuously regenerate strategies, goals and objectives (Saint-Onge 1996), and thus there is a continuous demand for changing and improving their business processes. The improvement of business processes involves a series of actions that are taken, to identify, analyse and improve business processes within an organisation with the purpose of meeting new goals and objectives (Harrington 1991).

Business Process Management (BPM) has rapidly evolved as a management philosophy and discipline with a specific focus on business processes (Kokkonen and Bandara 2010). BPM "combines knowledge from information technology and knowledge from management sciences and applies this to operational business processes" (van de Aalst 2013, p. 1). BPM is also understood as a managerial philosophy for creating a process view of management in order to maintain a corporate competitive advantage (Hammer 2010). BPM considers the continuous improvement and the fundamental innovation of business processes to ensure that the strategic goals and objectives of an organisation can be achieved (Burlton 2010). Hammer defines BPM as a comprehensive system for managing and transforming organisational operations. However, Hammer also criticises BPM by saying that it has become a topic with too much focus on software (Hammer 2010).

Harmon (2010) positions BPM as a combination of three traditions, the quality control tradition, the management tradition and the IT tradition. He also stresses that the main challenge of BPM is its position as a holistic approach that embraces all three traditions, and that there is an alignment problem between the traditions. Individuals who come from one tradition do not appreciate the other approaches, feeling that their approach is sufficient or superior (Harmon 2010). However, BPM researchers have recognised the problem and set up a research direction from exploitation to exploration (e.g. Rosemann 2014; vom Brocke et al. 2016).

2.1.1 Exploitative BPM: the methods for process improvement and prioritisation

In a literature review on the business process, Solaimani and Bouwman (2012) provide an overview of the research areas that are, generally speaking, related to Business Process Modelling (e.g. Giaglis 2001; Yu and

Wright 1997; Lin et al. 2002; Recker and Rosemann 2009), Business Process Re-engineering (e.g., O'Neill and Sohal 1999; Yu and Wright 1997; Lin et al. 2002), Business Process Management (e.g. Lee and Dale 1998; Van der Aalst et al. 2003; Duffy 1994) or Business Process Automation (Kirchmer and Pantaleo 2005; Watson and Holmes 2009). Some other, less extensive, BP areas are discussed by O'Neill and Sohal (1999), including Business Process Improvement, Core Process redesign, Process Innovation, Business Process Transformation, Breakpoint Business Process Design and Business Scope Redefinition. In this thesis, we focus on Business Process Management. In the last two decades, Business Process Management (BPM) research has advanced knowledge on process innovations and process improvements (Van der Aalst 2013).

The BPM community has produced mature knowledge regarding process modelling and information technologies that support process efficiency and performance. Methods for continuous process improvements and prioritisation have traditionally been designed based on exploitative BPM (Rosemann 2014; Kohlborn et al. 2014). Porter (1980) defines an organisation as a combination of primary and supporting processes. The primary processes consist of the processes of inbound logistics, operations, outbound logistics, marketing and sales, and services; and the supporting processes include firm infrastructure, human resource management, technology development, and procurement. Hammer and Champy (1993), and Devenport (1993), argue the important role that information technology plays in re-engineering work and processes in order to increase value creation and achieve a competitive advantage. These classical research studies claim that organisations need to make consistent efforts for process improvement in order to maintain the alignment of the processes with the business strategy, goal and value, which ultimately generate competitive advantages (e.g. Harrington 1991; Davenport 1993; Trkman 2010; Dumas et al., 2013). The fundamental activity of process improvement is prioritisation (which process to be improved first) (Burlton 2010). The maturity level of the processes and BPM is often considered as an indicator for improvement. However, the models lack applicability and configurability to practitioners (Röglinger et al. 2012), and most of the maturity models lack the validation of empirical evidence (Tarhan et al. 2016). Previous research has introduced a few methods specifically for the purpose of prioritising process improvement initiatives, for example, the business value scoring method (Bandara et al. 2010), the process performance scoring method (Huxley 2003) and the value matrix of process and strategy alignment (Burlton 2010). Although there is no standardised methodology regarding process prioritisation yet, the literature shows that the prioritisation criteria focus on: i) the strategic importance of the process; ii) the performance of the process; and iii) organisational readiness for process improvement, i.e. culture,

people, and governance for the implementation of a new redesigned or improved process. Previous research shares certain agreements with regards to how a process can be analysed and understood (e.g. Harrington 1991; Davenport 1993; Dumas et al. 2013). Quantitative and formal methods are recommended. So the measurements for assessing the process performance in terms of time, quality, flexibility and cost, are mostly adopted in the research (e.g. Dijkman et al. 2016). However, these methods only describe the process performance and indicate what to prioritise; the information on how to improve is mostly lacking. Bandara et al. (2010) conclude that the prioritisation "remains as a 'mystery phase' in most available guidelines" (ibid, p. 178).

2.1.2 Explorative BPM: a new direction for research

Exploitative BPM tools, methods and IT-related software have become a commodity, which means that companies cannot depend on them to create competitive advantages. Rosemann (2011 and 2014) further points out that the weaknesses of exploitative BPM have negative impacts on industries exposed to disruptive technologies and an emerging new class of competitors. As a result, *explorative* BPM has been put on the research agenda as a new direction for BPM development and application in organisations (Rosemann 2011; Rosemann 2014; Kohlborn et al. 2014). Explorative BPM research goes back to the core of the BPM concept and it is proposed by the classical strategic management approaches to promote the uptake of BPM within business (not only in IT), for example Hammer (1990) and Devenport (1993). Explorative BPM research and practice should facilitate process innovation and design new processes "*capitalizing on emerging technical solutions and satisfying a consumer base with increased digital literacy*" (Rosemann 2014, p.7). Rosemann (2014) defines the two key capabilities of explorative BPM. The first is to craft process visions "*that are compelling and transformational that they motivate staff, and customers, involved to explore how to make a desired future state…*" (ibid, p.7). And the second is to identify the opportunity points in processes that can create new business and revenue opportunities. Organisations need new explorative BPM capabilities for value creation to better meet the demands of their customers in new business environments (e.g. Lindman et al. 2016). vom Brocke, Zelt and Schmiedel (2016) challenge the one-size-fits-all methods used in BPM, and instead propose a framework for a context-sensitive BPM. The BPM body of knowledge is enriched by examining and assessing a broader variety of business contexts that helps practitioners to better understand the specific business context in which the BPM initiatives are applied (Niehaves et al. 2014). Niehaves and his co-authors explicitly comment further on the negative effects of the BPM maturity models on business practice, and they argue that dynamic capabilities related to

embedding contingencies in a developing BPM are needed. Obviously, this new explorative approach and thinking has an impact on how prioritisation as a mystery phase can be tackled in BPM research.

2.1.3 Six core elements of strategic BPM

To ensure the correct scope of BPM and to foster a common understanding of the research area, Rosemann and vom Brocke (2010) have defined the six core elements of strategic BPM: strategic alignment, governance, method, information technology, people and culture. They claim that these six elements, and the corresponding capabilities, increase our understanding of BPM as a holistic management discipline. The six elements "make the holistic view on BPM more tangible" (ibid, p.120). This framework "has the potential to become an essential tool for such strategy and road-mapping exercises as it facilitates the task of *allocating priorities and timeframes* to the progression of the various BPM elements" (ibid, p.119). The elements are further defined as the following:

Strategic Alignment: Strategic alignment is defined "*as the tight linkage of organisational priorities and enterprise processes enabling continual and effective action to improve business performance*" (Rosemann and vom Brocke 2010, p. 112).

Governance: BPM governance is described "*as appropriate and transparent accountability in terms of roles and responsibilities for different levels of BPM (portfolio, programme, project, and operations). Governance also focuses on the design of decision-making and reward processes to guide process-related actions*" (Rosemann and vom Brocke 2010, p. 113).

Methods: Methods are defined as "*the set of tools and techniques that support and enable activities along the process lifecycle and within enterprise-wide BPM initiatives*" (Rosemann and vom Brocke 2010, p. 113).

Information Technology: Rosemann and vom Brocke (2010) have mentioned that IT-based solutions are very important for BPM initiatives.

People: People are defined as "*individuals and groups who continually enhance and apply their process and process management skills and knowledge in order to improve business performance*" (Rosemann and vom Brocke 2010, p. 113).

Culture: BPM culture is described as "*the collective values and beliefs with regard to a process-centred organisation*" (Rosemann and vom Brocke 2010, p.113).

In an interview regarding business transformation through processes, vom Brocke (in Van den Bergh et al. 2014, p. 17) further emphasises that "*these six factors are not a cookbook-they're a stimulant for embracing an all-inclusive approach towards BPM. Context sensitivity with regard to the company's current state of affairs is crucial. Each company should adjust its*

approach and balance the various factors in order to optimise value creation from BPM efforts."

2.1.4 Ten principles of good BPM research

vom Brocke et al. (2014) propose the ten principles of good BPM and further articulate the importance of BPM research for an organisation to become more explorative and holistic in nature. The ten principles (vom Brocke et al. 2014) are principles of organisational context-awareness; of continuity: BPM should be a continuous and permanent practice; of enablement: BPM should build new capabilities; of holism: BPM should be inclusive in scope; of institutionalisation: BPM should be embedded in the organisational structure; of involvement of all stakeholder groups; of joint understanding; of purpose, i.e. contributing to strategic value creation; of simplicity: BPM should be economical; and of technology appropriation: BPM should make opportune use of technology.

In conclusion, BPM research has developed mature knowledge regarding how to model, analyse, automate and streamline processes, which is labelled as exploitative BPM. This approach has supported companies to overcome identified problems within a process. However, the capabilities related to the exploitation have become a commodity. Therefore, more and more BPM researchers and practitioners promote an explorative approach in conducting BPM research, which is coined as "explorative BPM". Rosemann has argued the importance of this explorative approach for BPM research (e.g. Rosemann 2011 and 2014; Kohlborn et al. 2014; Van de Bergh et al. 2014). Rosemann (2014) asserts that "*Explorative BPM is a significant future opportunity, and challenge, for the BPM community*" (p. 7). The explorative approach is still in its infancy. But it will generate more ambidextrous capabilities to companies (See Kohlborn et al. 2014; O'Reilly and Tushman 2013). The following table contrasts the differences between exploitative BPM and explorative BPM.

Table 2. Exploitative BPM vs Explorative BPM (Rosemann 2011)

Exploitative BPM	**Explorative BPM**
Reactive	Proactive
Today's efficiency (Process model)	Tomorrow's revenue (process vision)
Problem-focused	Opportunity-focused
Exclusive (only processes)	Inclusive (business models, products, services, etc.)
Transactional innovation	Transformational innovation

In addition to the knowledge base from the BPM research, systems thinking has influenced the design of PCM, which are, organisations as social systems (Ackoff 1994), organisations as networks of commitments (Winograd and Flores 1986), and bounded rationality in decision-making (Simon 1957 and 1997).

2.2 Systems thinking

System and management sciences have been heavily influenced by the goal-seeking paradigm, so called "hard system thinking". However, most of the criticism to this paradigm has been put forward regarding its limitations for management use. The reality facing today's managers is complex and dynamic and subject to change, reducing problem situations to a form that would make them amenable to a hard system modelling that was already considered to be a difficult and unfeasible task in the early 1980s (Checkland 1981). Checkland argues that a "hard" paradigm is unable to handle complexity and to cope with a plurality of different beliefs and values, and is not of much help when it comes to politics and power games in an organisation. He has pointed out that intervening in ill-structured problem situations requires relationship maintenance that is at least as important as goal-seeking, and answering questions about what we should do is as significant as determining how to do it.

Another limitation is that hard systems thinking is unable to deal satisfactory with multiple perceptions of reality (Jackson 2003). Stakeholders normally have diverse opinions about the nature of the system that they are involved with and about its proper purpose, or as Beer puts it *system is a very subjective thing* (Beer 1979). Therefore, in the 1970s a general understanding was established that hard system thinking was not useful for more complex situations and in problem contexts that were deemed to be more pluralist and coercive in character (Jackson 2003). Soft systems methodologies related to problem contexts were created to focus on system models expressing different viewpoints so that alternative perspectives could be systematically explored, compared and contrasted. Soft system thinkers abandoned the notion that it was possible to assume easily identifiable, agreed-on goals that could be used to provide an objective account of the system and its purpose.

The "soft systems" approach suggests that complex real world problems should be discussed and analysed within the context of the problem. The participants and the complexity of the system in focus are the two primary sources in analysing the situated problem.

2.2.1 Organisations as social systems

Ackoff (1981) discusses the changing concept of the corporation as an organisation and how it has evolved since the industrial revolution. He defines an organisation as (1) a purposeful system that is (2) part of one or more purposeful systems, and (3) parts of which, people, have purposes of their own**.** The social systems view of an organisation has evolved from a mechanistic view to an organismic view and now to a social systems model.

Mechanistic models of reality conceptualise an organisation as a machine that works with regularity directed by its internal structure and processes together with the causal laws of nature. A mechanical view is inflexible. Therefore, it can only operate effectively if its environment is static or has little effect on it. That is where it can operate as a closed system. A rapidly changing environment requires continuous adaptation and learning by organisations if they are to stay effective. Adaptation and learning require a readiness, willingness and ability to change. Mechanistically managed and structured organisations lack such abilities (Ackoff 1994).

A social system conceived as an organism has a purpose of its own. The environment for many organisations are characterised by accelerating change, increasing uncertainty and growing complexity that diminish the possibility of accurate and reliable forecasts at an increasing rate. In such an environment, the best hope for a social system lies in its ability to bring more and more of its future under its own control. Such an approach requires a model of a social system different from the mechanistic and organismic models. The social model conceptualises a social system as a part of a larger purposeful system as well as a system with purposeful parts. It focuses on both the functions of the parts in the whole, and of the whole in the larger containing system of which it is a part. Therefore, it can yield an understanding of both the behaviour of the parts and the whole.

The social system model can help to get a better understanding of an organisation. The social system model points out that the system should be viewed as a whole and cannot be divided into independent parts because the behaviour of each part and its effect on the whole depend on the behaviour of other parts. This model can reveal why it is what it is, and why it behaves the way it does.

From a systemic point of view, an organisation consists of several components inherent with certain capabilities. In the business context of today the evolution of some of these components is so fast that there is a challenge for other systems to keep up with the pace, e.g. the technological capabilities are evolving at such a pace that the organisations and individual capabilities cannot change accordingly. These components can also be defined as sub-systems. In Figure 2, the sub-systems are described as Individuals, Technologies, Information, Processes, Products and Services, Organisational structures, Strategies and Business Models. These sub-systems need to be coordinated and integrated to achieve business value (Ackoff, 1981 and 1989). Since companies today act in an age of accelerating change, increasing uncertainty and growing complexity, the demand for coordinating and integrating the sub-systems is higher than ever, and the task of coordinating and integrating the sub-systems is also more difficult than ever.

Figure 2. Organisation as a social system

Viewing the organisation as a holistic system can also be found when Keen (1991) argues that competitive, technical, organisational, economic, and management choices and their consequences are so interdependent that they cannot be handled in isolation from one another. To be effective, business design through IT must balance the interplay among these capabilities. If you want to lead the business initiative that depends on IT, you must manage the decision process for IT, otherwise you can end up in a situation where you have delegated the important business issues to IT people.

In order to study organisations holistically, according to Ackoff (1994), it is critically important to engage with as many of the companies' stakeholders as possible in the planning process. He stresses that if you do not plan, you will be planned for by someone else, internally or externally.

Ackoff (1994) proposes interactivism as a methodology to coordinate and engage individuals' participation in planning and decision-making. This approach is based on the three operating principles: the participative principle, the principle of continuity and the holistic principle.

The *participation* principle provides the members of an organisation with the possibility to develop and acquire an understanding of the organisation. The most important reason for *continuous* planning is the fact that its principal benefit derives from engaging in it. The *holistic* principle has two parts: the principle of coordination and the principle of integration. The principle of coordination states that no part of an organisation can be planned effectively if it is planned independently of other units at the same level. The principle of integration states that planning done independently at any level of an organisation cannot be as effective as planning carried out interdependently at all levels. When the principles of coordination and integration are combined, we obtain the holistic principle, which states that the more parts of a system and levels of it that are planned for simultaneously and interdependently, the better.

2.2.2 Organisations as networks of commitments

Organisations as networks of commitments are presented in the seminal work of Winograd and Flores (1986). This approach stresses the fundamental role of language that is played in creating social actions, communications, conversations and commitments among individuals in an organisation. One important underlying theory of this approach is the speech act theory. This theory emphasises that language is a form of human social action, and speech acts create commitments. Winograd and Flores (ibid, p.76) argue that:

"*To be human is to be the kind of being that generates commitments, through speaking and listening. Without our ability to create and accept (or decline) commitments we are acting in a less than fully human way, and we are not fully using language".*

Therefore, the authors suggest that this approach can guide organisation design centred around what they named as a "conversation-for-action" model that would be developed through certain speech acts. They describe a manager as a person in a position to direct actions that affect the economic, political or physical conditions of others in the organisation. That means that an essential part of all of the management work is dealing with coordination based on conversations and communication, which builds the network of commitments. The authors argue that management decision-making should focus on the problems of communication. "*that the key elements are the conversations among the affected parties and the commitment to action… **Success cannot be attributed to a decision made by a particular actor, but only to the collective performance*** "(p.151, emphasis added). The authors further articulate that management should create, take care of, and initiate

new commitments with an organisation for assuring effective cooperative action, as well as generating a context in which an effective action can be consistently realised.

Winograd and Flores (1986) stress the importance of pre-understanding, tradition and background for the understanding of conversations.

"*An individual's pre-understanding is a result of experience within a tradition. Everything we say is said against a background of that tradition, and makes sense only with respect to it*." (Winograd and Flores 1986, p.74)

The authors also point out that (ibid, p. 78):

"*Knowledge and understanding… arise from the individual's committed participation in mutually oriented patterns of behaviour that are embedded in a socially shared background of concerns, actions, and beliefs*".

This approach emphasises the socially situated knowledge and understanding that are vital for management to create a network of commitments, and in their decision-making.

The seminal text of Winograd and Flores (1986) is largely considered as a basis for understanding language, communication, conversation, and designing new computer-based tools for training and improving an individual's participation in organisational life, e.g. planning, or decision-making (Suchman 1993). Winograd and Flores explain that:

"New tools can be designed to operate in the domain of speech acts and conversation – the one in which terms like 'reminding', 'requesting', and 'agreeing' are relevant. We will argue that this is the most fruitful domain for understanding and facilitating management." (Winograd and Flores 1986, p.144)

In their summaries of the key thoughts regarding the influence of speech acts on organisations and management, the authors argue the key ontological design principles for a system design, among others, should focus on:
(1) In creating tools, new conversations and connections are designed;
(2) Design includes the generation of new possibilities;
(3) Tools are designed to conduct the network of conversations (commitments).

2.2.3 Bounded rationality in management decision-making

Peter Drucker, as a management philosopher and communicator has defined the manager by saying "*the manager is the dynamic, life-giving element in every business*" (Drucker 2007, p.3). The manager has two specific tasks in his work, which are: (1) "to create a true whole that is larger than the sum of its parts, a productive entity that turns out more than the sum of the resources put into it" (ibid, p.295), and (2) "to harmonize in every decision and action the requirements of immediate and long range future" (ibid, p.296). Langefors (1970) also emphasises that business management has two main tasks, which are: (1) to achieve suitable efficiency for units, and (2) to achieve cooperation between the units in accordance to the strategies and goals for the company. The main activity of the manager's work is management, which is always a decision-making process. Decision-making usually involves two elements, fact and value (Simon 1997). These two elements lead to the two kinds of decision-making processes, structured and judgemental (Keen and Scott Morton 1978).

Structured decision-making has been shaped by rationalistic tradition as a source of understanding. Rationalistic tradition and its orientation can be depicted in a series of steps in decision-making: (1) characterise the situation in terms of identifiable objects with well-defined properties; (2) find general rules that apply to situations in terms of those objects and properties; and (3) apply the rules logically to the situation of concern, drawing conclusions about what should be done. The rationalistic tradition is supported by the mathematical analyses of decision-making and with the behavioural analyses of human conduct. In this discipline, decision-making is regarded as the central task of management and the task is characterised as a process of information gathering and processing. Then, rational behaviour is seen as a consequence of choosing among alternatives according to an evaluation of the outcomes (Simon 1957 and 1997).

Decision-making, in practice, roughly approximates this ideal as Simon points out. However, it is impossible for the behaviour of a single, isolated individual to reach any high degree of rationality. Rationality requires a complete knowledge and anticipation of consequences. Since an individual cannot obtain comprehensive knowledge, and consequences lie in the future, they can only be imperfectly anticipated, so merely "bounded rationality" can be achieved (Simon 1957).

Simon's original view of bounded rationality has three features: search for alternatives, satisficing and aspiration adaptation. This theory defines that a person makes a "good enough/satisfactory" decision among the alternatives

if this decision reaches above his/her aspiration level. Simon recognises the role of intuition and judgement played in decision-making in administration and management (Simon 1997). The unstructured or judgemental decision-making has been considered as the art of management, which is dependent largely on a manger's intuitive skills, the feeling of the phenomena, tacit knowing and reflection-in-action (Schön 1983). Although the decision support systems, designed by the rationalistic tradition, cannot replace a manager's judgements and reflections in decision-making, especially in a situation characterised by uniqueness, uncertainty and complexity (Schön 1983). Accordingly, Schön argues that the design, which is aimed to create a new solution or improve a situation, should be considered as "a reflective conversation with the situation", and consider a manager's "reflection-in-action", the artistry elements in decision-making. The process is aimed for satisficing, instead of optimising. Simon (1997, p.139) emphasises that:

"*Every manager needs to be able to analyse problems systematically… Every manager needs also to be able to respond to situations* ***rapidly****,* ***a skill that requires the cultivation of intuition and judgement*** *over many years of experiences and training".*

Process management and process prioritisation in organisations are characterised as complex, unique and uncertain problems, thus, the design of the Prioritisation and Categorisation Method should follow the "bounded rationality" theory and be complemented by a manager's reflection-in-action in the decision-making processes.

2.3 Implications of the knowledge base for designing the PCM

The design of the Prioritisation and Categorisation Method (PCM) is influenced by the knowledge base that is presented in section 2.1 and 2.2. The knowledge from both an exploitative BPM and a new explorative approach serve as the departure points of the design. While the systems thinking, which are: organisations as social systems, organisations as network of commitments and bounded rationality in decision-making, influences the design choices. The implications of the theories for designing the PCM are summarised in Table 3.

Table 3. The implications of the theories for designing the PCM

Theories/knowledge	**Implications for designing the PCM**
Exploitative BPM	
Model, analyse, automate and streamline processes for achieving operational excellency.	PCM should identify problems of processes that hinder their alignments with operational goals.
Explorative BPM	
Being inclusive and holistic (e.g. the six factors of BPM & ten principles of good BPM research).	PCM should support companies to investigate the interrelationships among different dynamic capabilities, business contingencies, contextual factors, business models, products, services, etc.
Being proactive and exploring process opportunity and new revenue streams.	PCM should support companies to become more explorative and ambidextrous.
Organisations as social systems	
The social system model points out that the system should be viewed as a whole that cannot be divided into independent parts because the behaviour of each part and its effect on the whole depend on the behaviour of other parts.	PCM should be theoretically built upon the holistic approach. PCM should not focus only on IT, process modelling or methods. Strategy, governance, people and culture, together with IT and models should be considered.
Organisations are non-mechanistic they should not be conceptualised as machines that work by internal structures and processes together with the causal laws of nature.	PCM should be designed as a novel "social" method for prioritising purposes.
It is critically important to engage as many stakeholders as possible in interactive decision-making processes: The three operating principles: - the participative principle - the principle of continuity - the holistic principle.	PCM should support interactive evaluations and common understandings. PCM should facilitate continuous process evaluations based the needs of an organisation. PCM should facilitate holistic principles.
Organisations as networks of commitments	
Management is centred on the "problem of communication" and "conversation for action".	PCM should facilitate the communication and conversation among the stakeholders.

Pre-understanding and background is very important in making the relevant decisions. Knowledge and understanding arise from a shared background of actions.	PCM should support the efficient collection of information and consider any pre-understanding of contexts and units of analysis from stakeholders of the organisation. PCM should facilitate shared understanding between stakeholders.
Success cannot be attributed to a decision made by a particular actor, but only to the *collective performance*.	PCM should improve all of the stakeholders' participation and contribution to decision-making.
Bounded Rationality in decision-making	
Bounded rationality is a satisficing process to search for a satisfactory decision. A manager's reflection-in-action plays an important role in the decision-making process.	PCM should support a decision/ planning process by involving the key stakeholders in collective reflection-in-action. The decision generated by the PCM should be satisfactory.

2.4 Summary and reflections

Although the research studies by Rosemann (2014), vom Brocke and others (2016) provide some directions for explorative BPM research and suggest an extension to our understanding of BPM in a more holistic and context-sensitive way, no enabling and implementable method has yet been developed. Such a method should demonstrate that an explorative approach is feasible, while at the same time providing the empirical evidence, based on real business settings, and that such a method creates more values for BPM practice and research. In this thesis, the Prioritisation and Categorisation Method (PCM) is designed and evaluated to solve the problem of process prioritisation. As we discussed, this problem is complex, ill-structured and dynamic. Both researchers and practitioners are aware of the difficulties in solving this problem.

In dynamic environments, or high velocity markets, change becomes nonlinear or explorative. In order to maintain competitive advantages, organisations need to make consistent efforts for process improvement, and this is a management responsibility. Business Process Management is multi-facetted and complex. It has different elements and capabilities that must be coordinated and integrated, elements such as strategic alignment, governance, methods, information technologies, people and culture.

Business processes have different characteristics. They can be understood as a strictly formal process where the operation and the behaviour of the process can be automated by formal BPM methodologies and BPM systems. They can also be understood as adaptive, where human activities and knowledge are crucial in a process, as in high-level management work and knowledge work.

The task of prioritising and deciding on improvement initiatives is difficult. Because of this complexity, managers are limited by bounded rationality in making these type of decisions. In other words, it is hard for managers to make purely fact-based or mechanistic decisions since many of the "truths" and facts are embedded as tacit knowledge and reflections in the minds of key stakeholders in the organisation. Process selection criteria for improvement work have to consider all of the aspects of BPM, but at the same time, being relevant for managers. This makes analysing business processes both an art and a science, thus both qualitative and quantitative methods should be applied in process analysis. The majority of the existing methods and models approach BPM with quantitative methods, or methods, such as maturity models, that aim to quantify qualitative information by, for example, staging in maturity levels. These models are also limited when it comes to applicability.

In conclusion, knowledge about BPM and BPM capabilities in an organisation can be subjective. Thus, approaches, both for doing research in the area and designing novel methods applicable for practitioners, should aim to be complementary to mechanistic methods, and capture the subjective interpretations of the "topic in scope" or "unit of analysis". In practice, the unit of analysis could be a certain business process or another part or subset of the organisation that is being analysed. In this specific research the question is how a Prioritisation and Categorisation Method can be designed in order to support managers in deciding on their process improvement initiatives and how to engage the managers, and make them participate in the process by sharing their subjective and objective interpretations in an efficient way. It is also important that such a method also engages stakeholders, and generates networks of commitments (anchoring) in the company, and at the same time collects relevant holistic information based on the stakeholders understanding regarding the unit of analysis and it's contextual (external context and internal context) capabilities.

3 Design Science Research

This chapter presents the research methods that have been adapted to this research. Process prioritisation and process improvements are ill-structured problems. Simon (1996) promotes design as the problem-solving activity. Therefore, this research adapts Design Science Research (DSR) as the research strategy to design a method for addressing the process prioritisation problem.

This research follows the Design Science Research Methodology (DSRM) proposed by Peffers et al. (2008). The explorative design process theorised by Maher et al. (1996) and Dorst and Cross (2001) is further adapted to reveal the design search process of the Prioritisation and Categorisation Method. The engaged scholarship approach (Van de Ven 2007) supports the design by facilitating the collaboration and knowledge co-creation processes between researchers and practitioners. The use of case studies has been chosen as the method for collecting empirical data regarding the use of the designed artefact -the Prioritisation and Categorisation Method (PCM) in business. To be exact, the demonstration and evaluation of PCM has been conducted through case studies in large Swedish companies, i.e Seco Tools and Ericsson. The empirical study regarding disruptive technologies and process innovation was conducted at a large insurance company in Sweden.

This chapter draws some text on my Licentiate thesis (Ohlsson 2015). The applications of the research methods are summarised by the text of the "research methods" from the original papers (paper 1-5).

3.1 Design Science Research Methodology - DSRM

In information systems research, scholars have developed several approaches to conduct Design Science Research (e.g., Hevner et al. 2004; Gregor and Hevner 2013). In this research, Design Science Research Methodology (DSRM) promoted by Peffers et al. (2008) is adapted (see Figure 3). DSRM includes the following six activities:

1. Problem Identification and Motivation
2. Objectives of a Solution
3. Design and Development (Artefact)
4. Demonstration
5. Evaluation
6. Communication

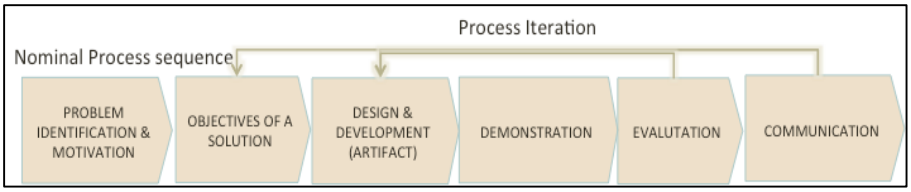

Figure 3. Design Science Research Methodology (modified from Peffers et al. 2008)

Activity 1: Problem Identification and Explanation

The first activity in DSRM is to identify a problem that explains why the artefact (i.e. the PCM) is beneficial and should be designed, developed, demonstrated, evaluated and finally communicated.

Activity 2: Definition of the Objectives of a Solution

Activity two defines the objectives of the artefact, which illustrates the appropriate requirements of the artefact. These requirements should be based on the first activity, problem identification. The output of the activity should specify in which way the artefact solves the problem. Requirements are mainly defined for the functionality of the artefact. The requirements should also be related to the context in which it is used and practised (Johannesson and Perjons 2014).

Activity 3: Design and Development

The output of activity three is the designed artefact. The design process of the artefact should be described. Johannesson and Perjons (2014) emphasise that, in this activity, the artefact's objectives, requirements, its functionality and architecture should be considered in the design and development process.

Activity 4: Demonstration
The purpose of the fourth activity is to demonstrate how the artefact can be used in a real situation with the aim of demonstrating the utility of the artefact. The knowledge of developing the artefact used in the third activity should also be used for the demonstration of the artefact. This activity is the first step to investigate whether the artefact fulfils the design requirements, and can be used for solving the identified problem (Johannesson and Perjons 2014).
Activity 5: Evaluation
In Design Science Research, the evaluation may be conducted by different research methods (Peffers et al. 2008; Hevner et al. 2004). According to Hevner et al. (2004) these include observational methods, analytical methods, experimental methods and descriptive methods.
Activity 6: Communication
The purpose of this activity is to communicate the research both to an audience in academic research and business practitioners. The research contribution should be explicitly discussed to meet the needs of both research and business. The research results can be reported in different outlines, i.e. publishing papers in journals and conferences. The results can also be published as manuals, slides, software tools or demos for communication to different stakeholders. The knowledge generated in DSRM activities is used in communication activities. The experts recommend that the knowledge produced by this activity can guide us to iterate back to any of the prior activities in order to improve the artefact (Peffers et al. 2008; Hevner et al. 2004; Johannesson and Perjons 2014).

As has been discussed in section 1.2, DSRM has provided the preliminary guidelines for the design and evaluation of the PCM during the last few years of the design process. The reason DSRM was chosen was because it is easy to apply to research conduct. The design process of the PCM basically matches the iterative sequences of the DSRM activities. The design activities of the PCM is further described in section 3.5 (summarised in Table 5).

In the process of designing the PCM, exploration activities were performed intensively to ensure the design quality and to enforce the research relevance to real business practice. Accordingly, the design exploration and engaged scholarship are adapted to complement the DSRM activities. These two approaches are presented in the following two sections, section 3.2 and section 3.3.

3.2 Design exploration: the co-evolution of problem-solution

Design Science Research Methodology assumes that in the phase of problem formulation, designers can define the problem well as the starting point to search for possible solutions. Thus, the nominal process that is proposed with this methodology can be implemented in research. However, process management and process prioritisation are ill-structured problems, which means that the "search" process for plausible solutions is different than that of well-defined problems. The design process for ill-structured problems is conceptualised as "design exploration" by Maher et al. (1996). The authors elaborate that (p.3-4):

"*Design is an iterative interplay to "fix" a problem from the problem space and to "search" plausible solutions from the corresponding solution space. The features and constrains in the current solution can become new criteria that lead to a redefined space, which in turn helps to generate a new design space. We call this phenomenon exploration*".

Maher et al. (1996) propose and discuss a formal model of exploration (See Figure 4). The model shows the interaction and co-evolution of a problem space and solution space. The problem space is illustrated by ***P***, and the solution space is depicted by ***S***. Exploration (horizontal movement) is conceptualised as a phenomenon in design where P interplays and evolves with S over time. The diagonal movement is a search process where the goals lead to a solution. This could be that the problem leads to or "fits" into the solution (downward arrow), or the solution refocuses the problem (upward arrow).

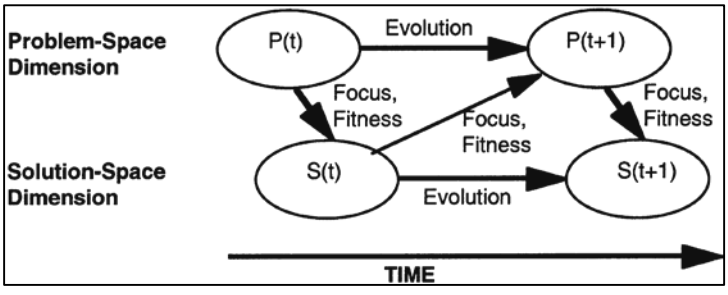

Figure 4. The co-evolution model (Maher et al. 1996, p.7)

Dorst and Cross (2001) adapt and refine the co-evolution model, and suggest relevant new concepts of 'default' and 'surprise' problem/solution spaces. The authors acknowledge the significance regarding the knowledge gained in the design search process that influences the understanding of the problem

space, which in turn, expands the solution space. The authors focus their study on creativity in a design process. Creativity is often characterised by the occurrence of certain significant events. If the problem is not strictly defined (ill-structured), creativity and innovation is an important element in the design exploration process. New problems arise when solutions to other problems have been made. These events can occur as sudden insights or in retrospect when thoroughly analysing results and solutions to problems identified earlier.

Sometimes such an event occurs as a sudden insight in which the designer immediately recognises as a significant "eureka" situation. Most often it is only in retrospect that the designers, or someone else engaged in the process, identifies a certain point or a certain result during the design process at which important key concepts emerged.

The sudden insights that designers may have in the exploration process are also considered as "reflecting-in-action" (Schön 1983). Schön explains that (ibid, p.56):

"*When intuitive performance leads to surprises, pleasing and promising or unwanted, we may respond by reflecting-in-action…. In such processes, reflection tends to focus interactively on the outcomes of action, the action itself, and the intuitive knowing implicit in the action*".

Simon's design theory, which respects bounded rationality, also acknowledges the contribution of our intuitive faculties (Simon 1996). Dorst and Cross (2001) propose that a creative event in design is like building a bridge between a problem space and a solution space by the identification of a key concept. Gregor and Hevner (2015) also point out the role of creativity in the process of designing an innovation.

In the design exploration process of ill-structured problems, designers may not able to formulate "well-defined" goals. As Simon argues the discovery processes of problem solving without a goal or designing without final goals.

Simon (1996, pp. 105-106) argues that:

"*Making discoveries belongs to the class of ill-structured problem-solving tasks that have relatively ill-defined goals. ... the test that something has been discovered is that something new has emerged that could not have been predicted with certainty and that the new thing has value or interest of some kind*" (ibid, p. 106).

This design process leads to the openness of various design solutions, which is generally concerned with finding a satisfactory design, rather than an optimum design. Simon points out that (ibid, p 130) "*variety, within the limits of satisfactory constraints, may be a desirable end in itself, among other reasons, because it permits us to attach value to the search as well as its outcome-to regard the design process as itself a valued activity for those who participate in it*".

In conclusion, the explorative design process is useful for solving ill-structured problems. In this process, both rationality and creativity are required in finding a satisfactory solution to the problem at hand. However, this process is open ended. The complexity of the ill-structured problem needs continuous discovery processes that design new solutions at the same time as new problems emerge.

3.3 Engaged scholarship

In order to understand the real world better, as well as respect the "reflection" of business practitioners in the design exploration of the PCM, engaged scholarship is further justified and adapted in this research.

Van de Ven (2007) stresses that a well-supported idea for improving the exchange of knowledge between practitioners and researchers is to create clear cooperation between researchers and practitioners when designing, conducting and implementing research in real world settings.

Van de Ven (2007) addresses what he refers to as a knowledge production problem that occurs in the gap between theory and practice, he further proposes a method of engaged scholarship for addressing the knowledge production problem and argues that engaged scholarship not only enhances the relevance of research for practice but also contributes significantly to advancing research knowledge in a given domain.

The engaged scholarship emphasises the importance of a highly iterative research process, where practitioners and researchers iterate problem formulations, problem solving, research design and theory building. The complementary aspect of Engaged Scholarship to DRSM is the idea that process prioritisation is an ill structured problem that is largely embedded in real organisational settings characterised by various contextual factors, politics and power struggles. To fully understand, the process prioritisation problem cannot be solely approached by researchers, and the exploration process for designing solutions becomes impossible without considering the "reflections" of business practitioners. In this research the problems have been continuously iterated in a co-evolution of problem spaces and solution spaces, where practitioners have been engaged in all of the research activities of the DSRM: in the designing and the development of the artefacts, in the demonstrations of the artefacts, in the evaluations of them as well as in the problem formulations etcetera.

3.4 Design Science Research: knowledge contribution

3.4.1 Theorising design knowledge

Design Science Research (DSR) is required to contribute important and significant knowledge that can be generalised or projected and entrenched to a broader range of contexts and environments (Baskerville and Pries-Heje 2014; Gregor and Hevner 2013). Usually, the design artefact (the output of DSR) is considered as types of knowledge, namely, constructs, models, methods, instantiations (March and Smith 1995), or better theories (Rossi and Sein 2003; Gregor 2006; Gregor and Jones 2007), or information systems artefacts by combining technology, information and social artefacts (Lee, Thomas and Baskerville 2015). Furthermore, the knowledge contribution framework proposed by Gregor and Hevner (2013) is widely accepted as the instrument to articulate the knowledge contribution of Design Science Research. Based on the maturity level of the problem domain and the level of the solution domain, the authors present four types of knowledge contributions, which are: (1) routine design (apply known solutions to known problems), (2) exaptation (extend known solutions to new problems), (3) improvement (develop new solutions for known problems), and (4) invention (invent new solutions for new problems). Furthermore, Design Science Research aims to contribute to design theory through reflection and abstraction during the design process by instantiations of the design artefact (level 1), elucidation of general design/operational principles (level 2), or the development of mid-range or grand theories (level 3) (Gregor and Hevner 2013).

Lee et al (2011) discuss the challenges of theorising in DSR and propose a theorising framework that defines the key activities in a DSR theorising process (Figure 5). This framework shows that theorising occurs in two distinct domains: the abstract domain and the instance domain. In the abstract domain, a solution search process occurs in which an abstract solution is found for an abstract problem. In contrast, the instance domain refers to where an instance solution is designed to address an instance problem. The two theorising domains operate on their own independent ground. However, the theorising occurs through de-abstraction from an abstract domain to an instance domain, as well as by abstraction from an instance domain to an abstract domain. In the de-abstraction process, the abstract design principles or theories can be applied or projected to different settings. In the abstraction process, a more generalised solution to a broader set of problems can be derived through a process that involves reflective judgement. The theorising framework is used as an overarching guide for reflecting and abstracting design principles from this research project, i.e. the

design of the Prioritisation and Categorisation Method. The contribution of the PCM to and the implications for DSR research are further articulated in chapter 6 and chapter 7.

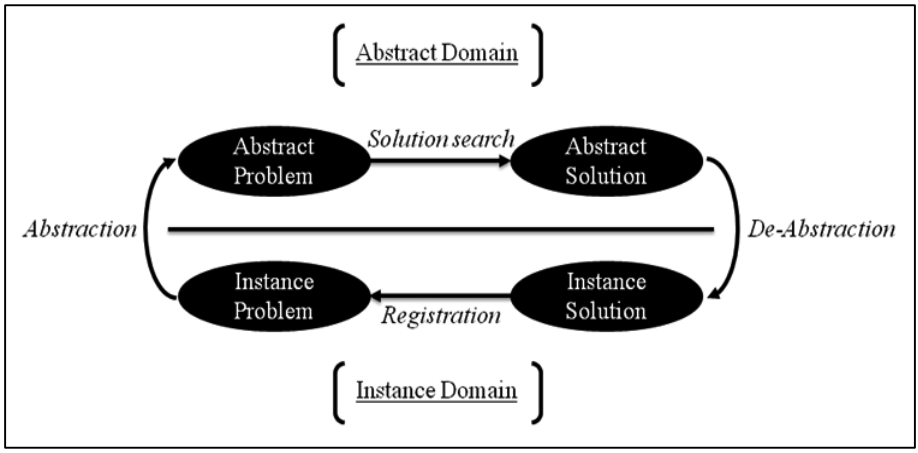

Figure 5. Design theorising framework (Lee et al. 2011, p.6)

3.4.2 Design relevance and contribution to practice

In addition to the scholarly knowledge contributions, Information Systems (IS) research generally requires the results to be relevant to practice (e.g. Benbasat and Zmud 1999; Robey and Markus 1998; Klein et al. 2006). DSR, as a distinct research paradigm, is called for its contribution to practice, to the real problems that are embedded in businesses, public organisations and societies (Rosemann and Vessey 2008; Österle et al. 2011). The relevance of DSR research to applications in businesses, governmental organisations and alike, is acknowledged "*as a key distinguishing feature of DSR in IS research communities"* (Gregor and Hevner 2013, p.342).

The research problems within BPM are usually complex and ill-structured, which need multidisciplinary and holistic approaches so that they can be studied and understood. Moreover, the evolution of abilities affecting BPM and the contexts of BPM, both in academia and in practice, are changing at a fast pace. Additionally, IS practitioners and academics work on different time frames and hold different values concerning the contribution of research. Kuechler and Vaishnavi (2011) refer to this as the relevance gap between practice and academia:

"The common sense view of the issue concludes that academic research frequently fails to address the 'street level' problems that business

information technology wrestles with, and so isn't interesting to practice. This is primarily a content issue, one that Informing Science characterizes as the academic fascination with easily decomposable problems which leads to the tendency to over-research models that are obvious or trivial to practice." (Kuechler and Vaishnavi 2011, p 125).

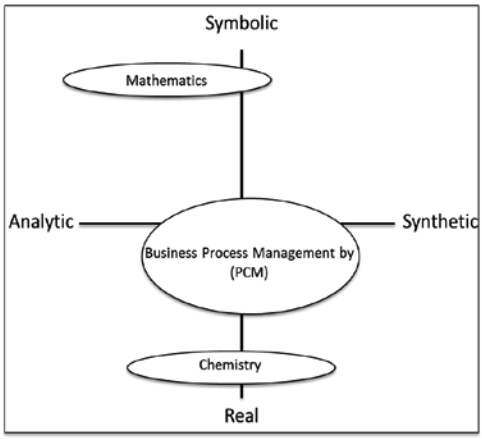

Figure 6. Positioning the PCM in a Conceptual Map of Design Disciplines, modified from (Owen, 1998)

Owen (1998) proposes a conceptual map of design disciplines to describe the relation of design to research, in which the author implicitly implies the positioning of the rigor and relevance in design or design orientated research. Figure 6 is modified from Owen (1998). In the figure the PCM is positioned according to two axes: Analytic/Synthetic and Symbolic/Real. On the left side of the map, disciplines are more concerned with exploration and discovery. On the right side of the map disciplines are characterised more by exploitation and making solutions. The vertical, symbolic/real axis, represents the degree of abstraction where, e.g., mathematics symbolises high abstractions. The figure is illustrated by a continuous scale. As shown in the figure 6, Owen (1998) positions mathematics research as more symbolic and analytic; in contrast, chemistry research is positioned as closer to the "real" nature world. Inspired by Owen's categorisation, I have put the PCM in the middle-lower right of the map to show its closeness to real world problem, i.e. its relevance to business. Designing a method that solves practical problems in a complex, uncertain, and unique environment requires a design method that is highly iterative, where emphasis should be on the exploration between problem spaces and solution spaces (Maher et al. 1996). This research iterates intensively between problem and solution spaces in a non-linear explorative way (section 3.2).

In this thesis, the rigor and relevance dilemma in Design Science Research will not be debated, although giving the readers some context and background regarding my point of departure and the ambition of this research should support the rational for research design choices, as well as the perspectives for reviewing this work. First, the ambition of this study has been to initiate research by a novel design with an innovative and applicable method that supports how the contemporary BPM challenges, like

explorative BPM and process prioritisation, can be solved practically. Second, to provide the foundation to reflect upon the designed artefact in regards to its contribution both to knowledge and to practice.

3.4.3 The research guidelines for Design Science Research

Hevner et al. (2004) recommend the seven research guidelines for DSR. The guidelines can be used for evaluating a DSR project and conclude if the researchers have conducted a significant DSR. The guidelines are summarised in Table 4 (Adopted from Hevner et al. 2004, p.83).

Table 4. The DSR research guidelines (Hevner et al. 2004, p.83)

DSR research guidelines	**Description**
1. Design as an Artefact	DSR must produce a viable artefact in the form of a construct, a model, a method, or an instantiation. Or a better theory, or an IS artefact.
2. Problem Relevance	The objective of DSR is to develop "solutions" to important and relevant business problems.
3. Design Evaluation	The utility, quality, and efficacy of a design artefact must be rigorously demonstrated via well-executed evaluation methods.
4. Research Contributions	Effective Design Science Research must provide clear and verifiable contributions in the areas of the design artefact, design foundations, and/or design methodologies.
5. Research Rigor	DSR relies upon the application of rigorous methods in both the construction and evaluation of the design artefact.
6. Design as a Search Process	The search for an effective artefact requires utilising available means to reach desired ends while satisfying laws in the problem environment.
7. Communication of Research	DSR must be presented effectively both to technology-oriented as well as management-oriented audiences.

3.5 Application of the research methods

We describe the research activities by using the Peffers et al. (2008) framework for DSRM because it is a useful exposition of the processes of DSR, and it mostly matches the thesis research process. Table 5 shows the

research activities during the last 5 years. Note that these activities did not follow in a well-defined linear process as recognised in the design exploration process. Reflection and abstraction occurred throughout the design exploration process (e.g. Lee et al. 2011, see Figure 5).

The data source for designing the method is both from the theoretical input from the research and from the managers' knowledge, experience and reflections gained throughout a series of collaborative workshops. In order to create a trustworthy environment for the collaboration, we agreed with the managers that no video or audio recordings would be made. The workshop agenda, memos and learning notes are used for documenting the design process.

Case study research is a common method for evaluating designed artefacts (Hevner et al. 2004). The case study, as discussed in this thesis, adopts a qualitative, interpretive approach (Yin 2013; Eisenhardt 1989). This qualitative approach is also recommended by the BPM community to develop adaptable knowledge for practitioners (Roeser and Kern 2015). Core elements in the case studies are the complexities and insights that are gained when analysing the BPM practice, and specifically the use of the Prioritisation and Categorisation Method in a process assessment and improvement project.

The mode of data analysis is guided by the "hermeneutics" framework proposed by Cole and Avison (2007). Through the hermeneutics process, from understanding via explanation to interpretation, both the managers and the researchers are able to share the meaning and knowledge of prioritising processes in the design process. The final interpretation of our joint understanding is the PCM.

Table 5. The PCM design activities and results

Timelines: Research Problem & Solution	**Main Research Activities and Results**
2010-2012 **Problem 1** CIOs' difficulties when distributing IT resources for process prioritisation purposes.	**Problem identification and motivation & defining the objectives for PCM** A collaborative research team was formed. The team included a senior researcher at the university, a senior business consultant and former CIO of a big Swedish company, a chief business architect from the same Swedish company and a vice president of process improvement and IT strategy from a Norwegian company.

Solution 1 A design of the PCM that supports the CIO's decision-making process regarding process prioritisation between IT and business.	**Design and development** The research team organised a total of five workshops, a one-day (eight hours) workshop each month, with the CIOs and senior IT/process managers from big Scandinavian companies, e.g. Atlas Copco, Postnord, Vattenfall, Västerås Stad, Bombardier Nordic, SSAB, Scania, Siemens Industrial Machinery, SECO Tools, Statkraft and Sandvik. **Demonstration, evaluation and communication** The PCM was demonstrated at Seco Tools and piloted at Ericsson as case studies. A web-based application of the PCM was designed. The team consistently communicated the research to the practitioners through the workshops as well as through personal communications with other CIOs at social events throughout the three years. Other researchers at the university joined the communication activity in February 2013.
2012-2013 **Problem 2** Innovation by digitalisation was identified as an emerging challenge for companies in several industries. Process prioritisation and innovation in dynamic environments was formulated as a problem. **Solution 2** Proposed and presented by a Capability Layer Model (CLM).	**Problem identification and motivation & defining the objectives for a solution** The problem was identified by members in the collaborative research team and conceptual ideas of how to innovate business processes by disruptive technologies were discussed with companies in several industries. **Design and development** An artefact, a smartphone based insurance telematics solution, was designed and developed together with the Royal Institute of Technology. **Demonstration, evaluation and communication** The solution was piloted in a large insurance company in Sweden (If Insurance). The results showed that the innovative product/service did not fully succeed in its implementation. The reason was not because of the technology, but the new business processes that were initiated by the new disruptive technologies could not be implemented in the "old" organisation structure, organisation strategy & industry environment. A Capability Layer Model (CLM) was introduced, which is a layered framework for understanding process capabilities to assure process prioritisation and innovation associated by disruptive technologies.

2014 – 2016 **Problem 3** Companies have difficulties in managing processes holistically in dynamic and uncertain environments. An explorative BPM is demanded in the IS research. Business contingencies and contextual factors need to be considered in developing a new method. **Solution 3** Make the PCM more configurable to fit different business contexts.	**Problem identification and motivation & defining the objectives for a solution** The problem was identified by the research team and the managers from Ericsson. They wanted the processes to contribute to the success of their future business. **Design and development** Negotiating the process and configuring the PCM to 'fit' with Ericsson's context. The results: a heat map and categorising map were configured. **Demonstration, evaluation and communication** The evaluation of the eight processes using the configured PCM. Fifty-five stakeholders were interviewed and one hundred and nine process evaluations were collected. Some people were involved in the evaluation of multiple processes. The core results were presented to the management board, which, within Ericsson, was called the Ericsson Steering Group (ESG) in January 2015, with a result PCM they decided to train more stakeholders at Ericsson. Fifteen meetings with process stakeholders to calibrate the evaluation results as well as gain more insights. Materials for training more stakeholders in the use of the PCM were developed. Training on how to use the PCM was organised. Ten seminars were held involving more stakeholders/employees. Comments on the PCM delivered during seminars were documented. And two additional evaluations of the PCM were carried out independently by trained Ericsson employees. The results of these evaluations were included in the case data.

3.6 Research ethics

In this research the ambition has been to follow the five principles of research ethics by Smith (2003), these are: 1) discussing intellectual property frankly; 2) to be conscious of multiple roles; 3) to follow informed-consent rules; 4) to respect confidentiality and privacy; and 5) tapping into ethics resources.

Many individuals, both colleagues and business stakeholders have been engaged in this research. This research has been developed with a pragmatic nature and a novel method that focused on how organisations and companies

can solve the problems of process prioritisation and process innovation. The request has been to protect confidential business data as much as possible. However, there is a balancing act, whereby, I as a researcher also want to bring as much of the content as possible to the readers of, e.g., produced papers so that they get as many relevant facts as possible from the completed cases. Yet on an individual level, I have been very strict and have not linked potentially sensitive content directly to an individual. The PCM can contain a lot of sensitive information in itself, thus the principle of discussing this issue with engaged stakeholders has always been followed. Also from this perspective, there is a dilemma, because there is a lot of value in the PCM in the captured individual qualitative data, and in the decision process facilitated by the PCM. Individual identities have been protected in the instantiations of the PCM. In some cases, engaged stakeholders did not have this requirement.

3.7 Concluding remarks

Knowledge about BPM in an organisation is not only objective, but also partially subjective. The approaches to undertake research in this area should aim to capture the subjective interpretations of the "problem in scope" or unit of analysis, and thus I adopted an interpretive research paradigm (Weber 2004). Design science research has been chosen as the research strategy, because the research problem addresses the design of an artefact. Motivation for a researcher to pursue design science research could be to obtain a better understanding of the impact that designed artefacts have in real world contexts, or to understand the world better by building artefacts (McKay and Marshall 2005). The ambition of using design science research or design research could also be to change the world, as expressed by Johannesson and Perjons (2014, p.1): "*design research is not content to just describe, explain, and predict. It also wants to change the world, to improve it, and to create new worlds.*"

I started this research initiative with my practical experience in the BPM field, having worked more than 10 years in the domain, witnessing how many things can go wrong because of a lack of methods for supporting managers in deciding on the process improvement initiatives (See Preface). Thus, the short-term intention of this research is to address this problem. From a long-term perspective, the idea of this practitioner oriented, or pragmatic approach is the following: if you manage to design a method that supports management in a pragmatic way, the method will be used in practice, then spread to more organisations, with the effect that large amounts of data are collected (thanks to a supporting software tool). So from a long-term perspective, the method can also be used to understand the world

better, thus also gain the fundaments for the further improvement of the artefact. Also, from a long-term perspective, eventually explaining it to the world, thus generating prescriptive knowledge by identifying patterns, principles or regularities identified with the help of the designed artefact (Gregor and Hevner 2013).

4 The Prioritisation and Categorisation Method - PCM

This chapter presents the designed artefact - the Prioritisation and Categorisation Method (PCM). The Prioritisation and Categorisation Method (PCM) consists of two models, a Process Assessment Heat Map (PAHM) and a process Categorisation Map (CM). The design rationale of the PCM is to embrace a BPM life cycle view, which implies that a continuous assessment of process characteristics is made at different stages of the process life cycle. Next, the six core elements of the BPM, as discussed in chapter 2, are used in the assessment. In this way, the method is grounded in theory. In addition to the theoretical grounding, the method is empirically and practically grounded, eliciting the tactical knowledge and practical experience from the BPM managers and stakeholders involved by using the business concepts the managers use in everyday practice.

The text in this chapter heavily draws upon the original publications, e.g. Paper 1, Paper 2 and Paper 5.

4.1 Process Assessment Heat Map (PAHM)

A Process Assessment Heat Map (PAHM) has five distinct perspectives (see Table 6): positioning, relating, preparing, implementing and proving perspectives. The positioning perspective is aimed at assessing the alignment of the process with the business strategy, objectives and values. Strategic positioning and value configuration are approaches (e.g. Porter 1996; Treacy and Wiersema 1995; Stabell and Fjeldstad 1998) that are functional for analysing process activities and value creation. With proper positioning, companies are able to identify the degree to which the process is aligned with their business strategy, objectives and values (Hammer 2010; Versteeg and Bouwman 2006). We argue that a positioning perspective, with the help of a PAHM, helps companies to open their employees' minds to generate critical thinking about process prioritisation and to create a shared understanding of business processes and potential improvements. The relating perspective reflects the elements of culture, people and governance, and is focussed on examining opinions and roles of as well as rewards and risks for the stakeholders exposed to or involved in the process. Literature recognises the importance of people and culture within the context of BPM (Schimiedel, vom Brocke, and Recker 2013). A focus on the involvement and interests of stakeholders leads to longer-lasting and stronger process improvements and improved management (Rosemann and vom Brocke 2010). The preparing perspective implies elements of method, IT, people and culture, and it is aimed at analysing the availability and quality of key resources and the capabilities necessary for process improvements, as well as the commitment of stakeholders. The implementing perspective embodies elements of governance, methods and IT, and is focused on analysing the performance of the process (interfaces within the process) that is subject to analysis and change. The proving perspective mirrors the elements of method and governance, and concentrates on the degree to which processes are appropriately monitored and measured. Therefore, it is necessary to define the proper metrics and the right KPI levels.

Table 6 shows the working definitions of the five perspectives and sample questions that are adapted from previous frameworks (e.g. Hammer 2007; Rosemann and vom Brocke 2010). The perspectives follow a process life cycle view, from the process identification (positioning), process redesign (relating and preparing) and process implementation (implementing), to the process monitoring (proving).

Table 6. The interactive activities with distinct perspectives and examples of questions based on the six core elements

PAHM perspectives	Sample questions
Positioning assesses the alignment of the process with the business strategy, objectives and values.	How clearly has the management positioned the process role, mandate and importance in relation to the business strategy and operational business logic? Is the process well described in the management system? Are priorities and the need for improvements shared?
Relating assesses the attitudes, roles, risks and rewards of the stakeholders exposed to the process.	Do stakeholders share risks and rewards among units/departments? Do stakeholders have a clear understanding of their role in the process? Are all of the key stakeholders in agreement with the process interfaces and improvement roadmap?
Preparing assesses the availability and quality of the key capabilities for improving the process.	Do people have the right skills and competence? Are the necessary resources secured? Is the process change dependent on a key person? Do people commit to the process?
Implementing assesses the performance of the process that is subject to analysis.	What are the stakeholders' (internal and external) perceptions about the performance? How well do the interfaces work around supporting processes? How effective is the process?
Proving assesses the degree to which the process is appropriately monitored and measured.	Is the business impact of the process measured in a reliable and valid way? What is the right level for process evaluation? What are the relevant KPIs? Is there a closed feedback loop?

Because each organisation has its own strategy and business processes, the model allows managers to define and refine crucial aspects and questions in each perspective that are relevant to the heat map (PAHM). The motivation for this design choice is twofold. Firstly, the questions involved should motivate and engage the managers and stakeholders to provide tactical knowledge and sample experiences, which means that the questions should be directly related to their work life, experience and context. Secondly, the information included in the heat map should be focused on each relevant process and perspective, so that the prioritisation and decision-making match the organisation in question. Relevant information to complete the heat map is collected based on interviews with managers and key process stakeholders.

We adopted Hammer's (2007) colour regimes and quantitative measurement method in the heat map. If a process according to the chosen perspective is

considered by the process owners and stakeholders to be eligible for improvement, red is used to indicate that the improvement potential is more than 50%. If it is considered to have an improvement potential between 20% and 50%, amber is used, and green is used if the process is considered to have less than 20% improvement potential. The heat map offers room for comments and motivations for the assessment based on the current performance and expected improvements. The colours and comments are documented. All of the assessments based on interviews are consolidated in one table (see Figure 7, which shows a PAHM to analyse the processes based on the answers of 7 respondents to the Positioning perspective). The process with the highest number of red assessments will be given special attention in the decision-making process facilitated by the PCM. Important complementary information for the actual decision is the qualitative data collected in conjunction with the PAHM. While, the Process Assessment Heat Map clearly shows where the priorities are. In the next step, the focus is placed on the Process Categorisation Map.

Figure 7. Process Assessment Heat Map-PAHM

4.2 Process Categorisation Map

The Process Categorisation Map makes it possible to position processes in a space that is defined by three dimensions: differentiation, formality and governance positioning (see Table 7). The results are presented in what is called the Categorisation Map (CM) (see Figure 8). Differentiation is the dimension to the right of the figure, formality to the left, while governance

positioning is placed horizontally, A represents the current As-Is position and T the To-Be position. The map is constructed as a six-cell grid in two dimensions, rather than a cube in three dimensions, for the following reasons: 1) the results are easy to communicate using two dimensional visualisations and 2) although it is assumed that a common, informal process should not ideally exist, we realise that such a process may occur in reality and an A* is used to indicate this specific instantiation.

Table 7. Categorisation Map (CM) dimensions and sample questions

CM dimensions	Sample questions
Differentiation assesses the degree to which a process is superior to similar processes of competitors, thereby differentiating the value proposition of the organisation (scale: differentiating to common).	Does the process in scope differentiate your company from your competitors? Does the process in scope help your company to perform better or worse than your competitors?
Formality assesses the degree to which a process is repeatable, predictable and automatable, and involves applications rather than people (scale: formal to informal) and is therefore easier to manage.	Does the process in scope reside on tactical knowledge? How strictly is the process formalised? How much of the process is based on routine tasks? How much of the process in scope is conducted in an (un-) structured way?
Governance positioning makes it clear whether process governance is positioned at the front-end or at the back–end.	Does the process under governance concern suppliers, consumers or others internal or external actors? Where is the governance of the process positioned?

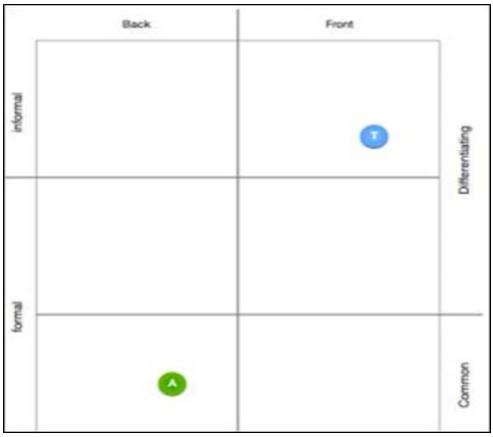

Figure 8. Process Categorisation Map

Figure 8 shows an example of a CM generated by only one answer from one respondent.

The map is intended to obtain indicative information on how the prioritised processes resulting from the heat map can be improved, e.g. the type of process support system that should be used, the degree of change desired, i.e. incremental *improvement or fundamental re-*engineering, and how to build a governance mechanism that is

designed to create and sustain value. The dimensions for selection are based on three criteria. Firstly, the fundamental criterion for prioritising a process is the degree to which it contributes to the business strategy. Because it is important for the process to allow the company to differentiate itself from its competitors by creating added value, we define differentiation as the degree to which a process is superior to similar processes of competitors and supports the value proposition of the organisation. A continuous scale is used with processes that are core for strategic differentiation, vis-à-vis common processes.

Secondly, BPM systems have become the inseparable mirror of process management. Information technology capabilities have to support process management capabilities (Van de Aalst 2013; Mithas et al. 2011). If a process is fully aligned and supported by information technology, it can become formalised and contribute to a cost-effective execution. By contrast, if a process is unpredictable and knowledge-intensive, the operational costs will increase considerably (Swenson 2010), which means that assessing the degree of formalisation is crucial for the analysis. Formality refers to the degree to which a process is repeatable, predictable and automatable, and it involves applications rather than people, making it easier to manage. Formality is scored on a continuous scale, with formal and informal as the extremes.

The third criterion relates to a collaboration within an internal or external organisational value configuration to co-create value for consumers, as well as for organisational units, departments or external suppliers. Revenues have to be created for every actor involved (e.g. Franz et al. 2012; Kothandaraman and Wilson 2001; Rai et al. 2012). The positioning and the role of a specific governance mechanism within the larger value creation network context helps companies to allocate limited resources, and to understand the interdependencies between internal and/ or external partners (Franz et al. 2012). Understanding interdependencies leads to serious (re)consideration of where and how to structure and use governance mechanisms. Governance Positioning can be at the back-end (cost centre) or at the front-end (profit centre), which means that back-end and front-end are opposites. This distinction clearly shows where process governance mechanisms need to be positioned. For instance, if process ownership was moved from the back–end (production) to the front-end (the marketing service), the governance structure and mechanism should be transferred accordingly. The marketing manager is assigned the key accountability and responsibility related to the new process. In order to ensure the fit between business process and business environment, organisations must explicitly address the need for cross-functional collaboration, internal and external supply and demand relations,

and management accountability for end-to-end business processes (Markus and Jacobson 2010).

The Categorisation Map dimensions propose the most fundamental factors for creating a process vision: business process strategy (differentiation), BPMS/IT strategy (formality) and BPM governance strategy (value network governance positioning). The operationalisation of the dimensions helps firms to incorporate these strategies into the future vision of a process. Now that we have explained the core tools for visualisation, the Process Assessment Heat Map (PAHM) and a process Categorisation Map (CM), we discuss the way they are used in practice.

4.3 The PCM way of working: activities and the web-based tool

When companies use the PCM to evaluate their processes, they need to: (i) create and establish a core team that will lead the evaluation and serve as interviewers, by using the Process Assessment Heat Map (PAHM) and configuring the process Categorisation Map (CM). They will fine-tune and adjust the sample questions proposed in Tables 6 and 7 in consideration of their company's business contingencies. The team will be made up of CIOs, C-level managers and senior process managers; and (ii) the team will determine the high level unit of analysis, which processes, within which business context, need to be analysed. The questions associated with the PCM need to be specified towards the business context under analysis. Next, the team selects a group of interviewees (participants) for the evaluation, the aim being (1) to involve more managers and process stakeholders (both formal and informal leaders) at different organisational levels and with different functions, in order to gather a broader array of opinions, increase visibility, transparency and the trustworthiness of the assessment, as well as to create a social and learning environment for prioritising, innovating and managing processes; (2) to ensure the quality of the data, e.g. to get reliable and valid results from the assessment.

The interview procedure is as follows. First, the interviewees are asked to decide on a colour (green, amber or red), based on their knowledge and experience of the processes in question, by interactively discussing the key questions from each perspective with the interviewers. Interviewees are expected to provide concrete arguments for choosing a specific colour. They are also asked to provide advice on how to improve the process. Next, the interviews focus on process categorisation. The interviewees perform an as-is analysis of the process by reflecting on the three dimensions and

answering questions based on the current situation, after which they consider the same questions again, but with a to-be focus. The time horizon is two to three years into the future. Interviewees are asked to position the as-is dot and the to-be dot on the Categorisation Map. The interactions during the Process Assessment Heat Map help the interviewees familiarise themselves with the assessment. Their learning and reflections serve as a basis for projecting the dots onto the CM and ultimately generating the final map.

The entire process of implementing the PCM is supported by a cloud-based web tool (See Figure 9, showing a summary of a specific configuration of an assessment, including selected perspectives, questions, processes (unit of analysis) and participants). The tool helps to initiate and create an assessment, select the processes to be assessed, prepare for the interviews adhering to the five PAHM perspectives and the three CM dimensions, select the participants, and document and analyse the interviews and evaluations, as well as visualise them in the PAHM (See Figure 7) and CM (See Figure 8).

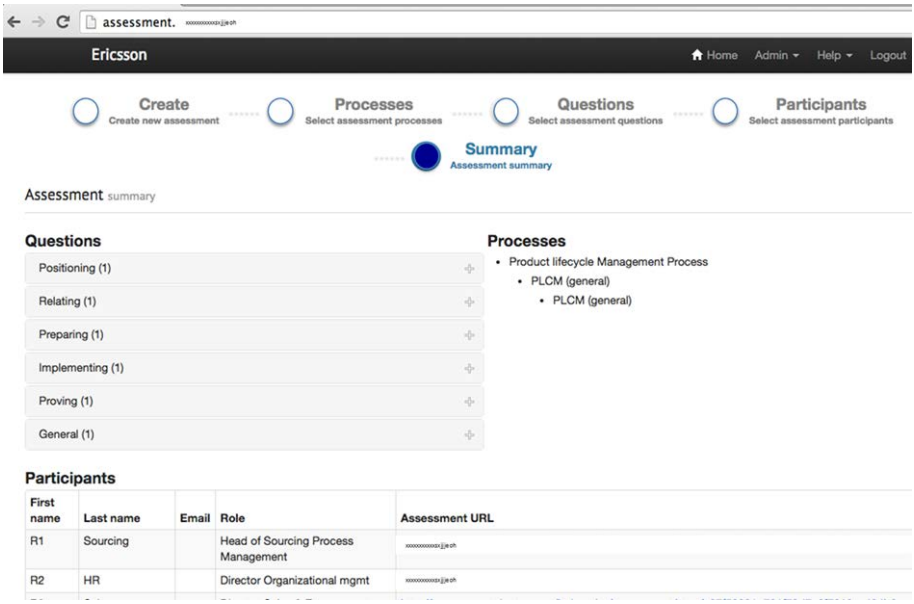

Figure 9. The Prioritisation and Categorisation Method - a web based tool (manipulated screen picture)

Finally, top management can make a decision based on the aggregated results generated by the web-based tool. The PAHM supports the prioritisation of the 'red' process for improvement. The CM can help to identify the gap in the performance of the processes by comparing the different projections of the as-is dots and the to-be dots. The results generate

‘coarse-grained’ improvement heuristics for the to-be processes. Management can also consider aligning the core BPM elements with associated organisational capabilities in preparing the implementation of the prioritised processes, in order to realise the required changes.

The step by step description of the web-based tool for the PCM is shown in Appendix 1.

5 Demonstration and Evaluation: Empirical Case Studies

This chapter summarises the key results gained from the empirical case studies that have been conducted. These include: the demonstration of the PCM to Seco Tools (Paper 1), a small scale pilot at Ericsson (Paper 2), the investigation of the impact of the smartphone based insurance telematics solution on process innovation (Paper 3 & 4), and the evaluation of the configured PCM at Ericsson (Paper 5).

5.1 The demonstration of the PCM at Seco Tools

Seco Tools' CIO initiated the usage of the PCM because he had a prioritisation problem, the CIO had to say no to more than 66% of demanded IT related process improvements due to limitations on abilities and capacities, in other words capabilities. He wanted a method of supporting him and the executive team to make relevant prioritisations. At the same time, he wanted to have a consensus within the organisation regarding these prioritisations. He also wanted an appropriate input regarding how to improve the prioritised processes, and which capabilities to use or acquire for the purpose of improving the prioritised business processes. In this case, the CIO and his team selected 12 processes for assessment, and 20 stakeholders, both customers and owners of the processes, participated in the assessment.

The demonstration of the PCM to Seco Tools verified that the PCM was usable, effective and efficient. The PCM delivered the expected results in an efficient manner. A significant benefit of using the PCM is that the practitioners can gain a better, and more common, understanding of the processes, their improvement potential and ways to improve them. This builds up a solid foundation for decision-making in prioritising the process improvement initiatives. Furthermore, the company has created a novel way of making decisions by using the PCM. The prioritisation process was transparent, open and trustworthy. This supported the top management in making the right decisions, and created a good "buy in" of the decisions made. Additionally, the top-down social process in using the PCM has been beneficial for the company in eliciting the "intelligence" from the right people, and creating a culture for process management. Therefore, the PCM can enable the avoidance of politics in decision-making for the prioritisation of process initiatives.

In this case, the PCM was used in the context of existing strategies and business models at the respective organisation. In other words, how to deliver their existing products and services in the existing value proposition according to the existing business strategy respectively, as efficiently and effectively as possible, by operational excellence.

5.2 Process innovation with disruptive technologies: the If Insurance

With the purpose of exploring how business process innovations enabled by disruptive technologies could be realised, a case study, at an insurance

company, was initiated in 2012 to test a smartphone based telematics business solution in a commercial campaign. The campaign examined how a potentially disruptive technology can deliver new information, which, combined with existing information in the company, could innovate the business processes and the products and services of the company, while embedded in a novel business model. Rosemann (2014) claims this activity is crucial for exploring new process opportunities and future revenue streams for companies. This creates capabilities to transform business through process innovation (Van den Bergh et al. 2014).

The If SafeDrive campaign was run full scale for 2 weeks between March and April 2013. In total, some 1,000 registered users were involved in the test. The pilot generated big data containing 4,500 driving hours and 250,000 km of road vehicle traffic data in total (Händel et al. 2014: Paper 3). The campaign was one of the first campaigns worldwide, utilising the processing power of smartphones. The data quality was assured by rigorous soft computing methods.

The case resulted in evidence that the customers embraced the new product and service that was enabled by the innovated business processes and the insurance telematics disruptive technology, inter alia, the abilities of the smartphone. However, these innovations could not succeed without the coordination and integration of the necessary organisational changes, business model redesigns and business strategy transformations. The empirical results showed that disruptive technologies in insurance telematics have advanced a new design of insurance product and service. That new innovative product and service interrelates with the design and implementation of novel and innovative business processes. The old processes could not embrace the advantage and cultivate the success of the disruptive insurance telematics product and service. The company decided to put the trial on hold and delayed the roll-out of the new insurance product to mainstream customers.

Figure 10. The Capability Layer Model (CLM)

One contributing result of this case was a model for understanding and discussing the different interrelating capabilities, the Capability Layer Model (CLM) (Figure 10) within an organisation. The Capability Layer Model (CLM) was inspired by the six elements of Business Processes Management (Rosemann and vom Brocke, 2010) and the systems thinking (the theories

discussed in section 2.2) and business model principles (Osterwalder and Pigneur 2010). The CLM consists of seven layers, from the core inner layer, encompassing technology (innovation/disruptive technology design), information (data generated by the disruptive technology), business process design for the core technology implementation, product/services implementation, individual/organisational readiness for innovation implementation, towards business models and the outer layer of business strategy. Business environment is conceptualised as the macro economic and market environment that a company operates within. The purpose of the CLM is to support the common understanding of the interrelated sub-systems, and the capabilities of the firm, by generating a common view of all of it as a complex social system. The innovation of business processes requires changes to the interrelated systems and their capabilities within the 7 layers of the CLM (see Figure 10). The evidence collected in this case and the proposition of a CLM model have significant impacts on the evolution of the PCM to make it more configurable. The impacts are summarised below:

- Holistic configuration – always iterate between the layers of the CLM when configuring the PCM, involve as many stakeholders as possible in the assessments. This can also create networks of commitments among the stakeholders (symbolised in the CLM by all of the layers for the firm and their interrelation with each other)
- Explorative (Circular) configuration – approaching the PCM with interactive formulations and reconfigurations of questions and stakeholder identification (symbolised in the CLM by its circular design).
- Contextual configuration – being able to move upwards in the CLM when configuring the PCM to consider both the effectiveness and efficiency of achieving a new business vision (see Paper 5, evaluation of the PCM at Ericsson. A summary is shown in section 5.3)

5.3 Evaluation of the Configured PCM at Ericsson

After demonstrating the PCM at Seco Tools, Ericsson wanted to evaluate the PCM with the purpose of identifying whether it was efficient in choosing a process to be prioritised for improvement, as well as to provide input on what capabilities should be improved in different processes. While the purpose of the first evaluation (the pilot) of the PCM at Ericsson, in 2013, was to evaluate whether it could serve as a holistic and efficient method.

A large evaluation that involved 55 stakeholders was conducted in 2014 - 2015. The Ericsson Steering Group (ESG) wanted to understand how their

business processes and their capabilities could strategically support its "future business" in their vision of a Networked Society. They wanted answers regarding how Ericsson, in an efficient and effective way, can continue with their profitable businesses in a society that is "connected". In other words: how should the company innovate its strategy and business model to, e.g., sell novel services and products that are delivered in effective and efficient business processes. In this context, the PCM needed to be more configurable to meet the new requirements. After a long-time negotiation, the researchers and the managers at Ericsson configured the PCM to meet these demands. The PCM was configured to take into account contextual factors and situational factors that are related to Ericsson's strategic-, process-, organisation-, and environmental- dimensions.

The five perspectives of the heat map were configured to the business terms that are used by Ericsson, which are: positioning to 'alignment to strategy', relating to 'relation and interface to other stakeholders', preparing to 'capability to execute', implementing to 'actual/required performance', and proving to 'ability to monitor and measure' (See Figure 11).

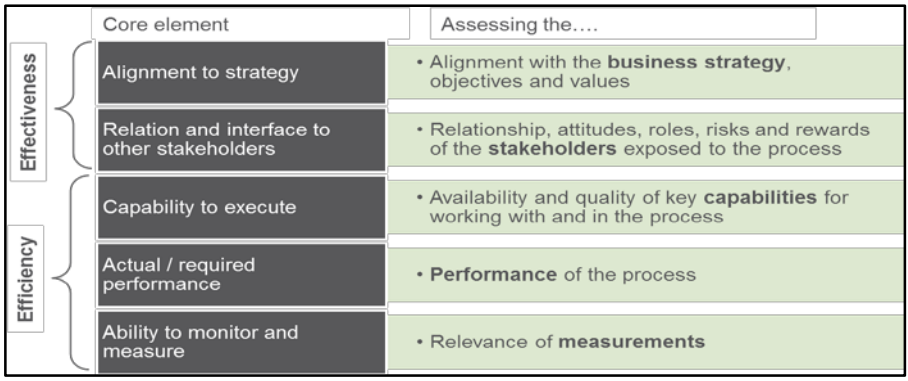

Figure 11. Specification of PCM heath map topics for Ericsson

As a next step, Ericsson's processes were evaluated using the configured Process Categorisation Method (PCM). The evaluation team was formed by four senior employees, one PCM consultant and one of the researchers. The activities involved specifying the requirements from the Ericsson Steering Group (ESG) to questions to be used in the steps to generate the heath map (see Figure 12).

For every perspective, the leading principle was defined, for instance, with regard to the positioning perspective, it was important to emphasise that the process should be future-proof; for the relating perspective, the end-to-end of the process was important; for preparing, simplicity was key; with regard to implementing, the involvement of process owners was important.

Ultimately, it was crucial to prove that the process would lead to an improved performance.

Figure 12. Mapping ESG questions to heath map perspectives

Ericsson further configured the Categorisation Map from the positioning 'dots' (See Figure 8 both of the as-is and to-be "dots") in the map space to a scale of 1-10, since the ESG expects the quantified results. The questions used in the Categorisation Map are shown in Table 8.

Table 8. The questions for the Categorisation Map

Questions per process	
Is the process customer facing or an internal process? 1 - 10	Current
Is the process structured or semi structured? 1 – 10	Current
Is the process differentiating or a commodity process? 1 - 10	Current
Is the process customer facing or an internal process? 1 - 10	Future
Is the process structured or semi-structured? 1 – 10	Future
Is the process differentiating or a commodity process? 1 - 10	Future

Eight business processes (finance, IT, human resources, sales, product management, services, sourcing and supply) were analysed and evaluated at Ericsson by the configured PCM, resulting in new knowledge about which of the processes are most relevant to Ericsson's future business, and which processes and capabilities to build/improve in order to stay successful in future business.

An important insight gained during the implementation of the PCM method within Ericsson was that power struggles became explicit. Power 'politics'

will make it more difficult for a company to implement new ‘process structures. In practice, most problems are related to the ‘governance’ and organisational accountability of processes, which are reinforced by Ericsson’s complex process structure, with regions, markets and product areas.

After the PCM evaluation. Ericsson is initiating changes.

“*A new governance is in design and planning*” (personal communication from an Ericsson top-manager in June 2016)

In conclusion, the Prioritisation and Categorisation Method (PCM) helped Ericsson to evaluate its processes within its business context and industry environments. The results show that, to realise seamless end-to-end processes in the eight assessed processes, Ericsson has to make a greater effort to improve its process structures, governance and culture to fulfil the needs of future business. The Ericsson Steering Group was satisfied with the insights provided and has decided to train more stakeholders to use the PCM.

6 Discussions

The aim of this thesis is (i) to design and evaluate the artefact - the Prioritisation and Categorisation Method (PCM), and (ii) to explore the impacts of disruptive technologies on process innovation. This chapter discusses the PCM's contribution to BPM research in general, and to the process prioritisation and process innovation by disruptive technologies in particular. The contribution to DSR knowledge is further discussed by positioning the PCM into the DSR knowledge contribution framework by Gregor and Hevner (2013). The design principles that we identified as the key factors that influence the positive outcomes of this research are identified by adapting the DSR theorising framework (Lee et al. 2011, Figure 5). The generalisability of the PCM is argued by following the three levels of generalisation of Design Science Research (Sein et al. 2011). The contribution to practice, or the relevance of the DSR results are also described. Finally, the research, as a whole, is evaluated based on the principles of good BPM research (vom Brocke et al. 2014), as well as the research guidelines of DSR (Hevner et al. 2004).

6.1 The knowledge contributions to BPM research

6.1.1 The PCM as a novel method for process prioritisation

The Prioritisation and Categorisation Method (PCM) is not only IT-driven, but it is also business-driven, in contrast to, for instance, Enterprise Architecture (e.g. Lankhorste et al. 2009, Versteeg and Bouwman 2006) and many Business Process modelling approaches (e.g. Ami and Sommer 2007; Andersson and Johannesson 2009; Curtis, Kellner and Over 1992; Kettinger 1997; Recker and Rosemann 2009). The case study at Seco Tools indicated that the PCM helped the CIO to communicate with businesses, involve key stakeholders in different business functions in IT decision-making, and balance the business need for IT resources. The case study at Ericsson clearly showed that processes that match future business opportunities were crucial reasons for using the PCM in process evaluation.

Moreover, the PCM can be viewed as a kind of co-creation effort, in which business plays a more important role than IT. This solves one of the problems in Business IT alignment research, where commitment from business is often poor in practice (e.g. Gerow et al. 2014). In the Ericsson case, fifty-five process managers, process owners or process stakeholders were involved in the evaluation of the processes. As 'future business' was the main concern in driving the evaluation, commitments from the business were high. Process management is a 'business' and 'management' practice, which cannot be exclusively dedicated to IT. This co-creation process was also recognised in the case of Seco Tools, which gave greater support for the CIO's decision in the process prioritisation initiatives.

The PCM also distinguishes itself from the top-down Business Architecture approach proposed by Vertseeg and Bouwman (2006). Where strategy serves as a driver for Business Architecture and is based on information from top-level management, and a blueprint for the business architecture is made. In addition to considering the top-management's requirements, the PCM is able to involve the managers/owners of the processes from different levels within an organisation in defining their process domain as well as the alignment between the processes, business and strategy. The results of the PCM are aggregated by collecting opinions and tactical knowledge from the stakeholders and process owners, in other words, the people who know the operation and performance of a particular process. As a result, decisions are made based on this 'collective intelligence' or 'collective reflection-in-action', which can be called a 'bottom-up' approach to managing processes. This intelligence provides direct indications for the redistribution of

resources and the acquisition of dynamic BPM capabilities for business purposes. As such, the PCM introduces a transparent and democratic procedure for process management decision-making, as it provides evidence of why the decisions were made, and it shows why such decisions have been chosen.

Moreover, the evaluation of business processes using the PCM has raised awareness among managers of what to think, what to do and how to understand the processes in their entirety, and not as 'separate' processes that are owned. As a result, the awareness creates a supportive culture for new business process modelling. People are more prepared for possible changes due to changes in strategy. People are one of the key elements of strategic BPM (Rosemann and vom Brocke 2010), in that 'people' implement and invoke in each other's presence to promote a particular action to achieve a strategic purpose, which means that it is important to fully consider people's role in strategic planning (e.g. Ackoff 1994, MacLean and MacIntosh 2015). The Capability Layer Model (CLM), proposed in the IF insurance case, has further enhanced the understanding of planning/designing holistically. The lessons learnt in the insurance case have confirmed the importance of the wholeness: process innovation cannot be succeeded without changes of other parts of an organisation, or other layers in the CLM. As Drucker emphasises, the management practice is to "create a true whole" (Drucker 2007).

Compared to other holistic approaches, e.g. Archimate (Lankhorst et al. 2009) or Aris (Scheer 1998), and various maturity models (e.g., Röglinger, Pöppelbuß and Becker 2012; Rosemann and de Bruin 2005; Weber, Curtis, and Gardiner 2004), the PCM is easy to use, simple and can yield results within a short period of time. The demonstration at Seco Tools was completed in one month. After configuring the questions and focusing on the most important aspects that interested Ericsson, the evaluation of the eight core processes was completed in three months, which would not be possible by, for example, applying maturity models to determine where to improve process capabilities. Speed and timing of decision-making are becoming increasingly important in a digital world (Bharadwaj et al. 2013). Faster and more effective decisions are needed to survive in the turbulent economic environment that companies face nowadays.

To conclude, the PCM provides a more explorative approach to Business Process Management, taking into account the business processes in business contexts, business cultures, governance and governance mechanisms, related to the availability of resources and capabilities, or the need to make the latter available. Because no comparison has been conducted between the PCM and other possible methods of process improvement in the empirical case studies, we lack the empirical evidences to claim that the PCM is more appropriate

than other BPM methods that serve the same purpose, i.e. prioritising and categorising business processes. The theoretical argumentation of comparing the PCM with other methods, as we discussed earlier, can support the argument that the PCM is a satisfactory solution to address process prioritisation problems in various contexts. More importantly, the collected empirical evidence shows that the PCM helps to solve problems, offers high quality results in a flexible and efficient way, it is appreciated by practitioners and it can be applied in real business practices. The method is configurable, flexible and adaptable.

6.1.2 Exploring process innovation with disruptive technology

The contribution of the empirical study reported in paper 3 and paper 4 is twofold. First, as discussed in section 5.2 and section 6.1.1, the results have extended the reflections and understanding towards the significance of configuring the PCM to better fit into a company's context, contingencies and business visions. Second, the results have contributed a deeper understanding of the challenges faced by companies that conduct an explorative BPM in practice. The new customer acquisition process (See paper 4), created by the user-based insurance solution, has fundamental impacts on the case company's current business model and strategy. Because the company needs to transform its business towards a more customer-centred approach, and to provide insurance services that are based on the "big data" generated by their customers' driving behaviour, the changes are fundamental and the company has not yet built the ambidextrous capabilities to explore them.

In order to fully understand the holistic, political and explorative implications for Business Process Management, the Capability Layer Model (CLM) (see section 5.3, Figure. 10) was proposed with the aim of gaining a better understanding of the fundamental capability layers to manage process innovation with disruptive technologies, as well as creating propositions for critical thinking regarding process innovation. The lessons learnt from the case study at the insurance company strongly indicate that in the exploration for process innovation, the business process layer simply could not be innovated without the stimuli imperatives, high iterations and experimentation with the inner layers of information and technology. In tandem with the intensive iterations within the inner layers (technology, information and processes), the two outer layers, business strategy and business model, which are conceptualised by the CLM, must be connected with the inner layers through the organisational and individual layer. In order to explore process innovation, individuals (who are committed, innovative, and ambidextrous) (e.g. Good and Michel 2013) can coordinate and integrate the interactions between the inner layers and the outer layers. By doing this,

a company can ensure the survival and sustainability of innovated processes. In other words, the innovation space for an explored process will collapse if the relevant individuals do not commit to the explored processes. Individuals, who are responsible or accountable for the capabilities required to implement innovated processes, need to have the necessary motivation, competence and empowerment/mandate. The execution of the PCM may generate such "individual commitments and mandate".

Implementing the Capability Layer Model (CLM) to understand process innovation with disruptive technologies can provoke critical thinking on this topic and generate a general interest. For instance, before we apply established methods in the process analysis and redesign, it is vital to investigate the processes in scope at a macro-level in order to obtain knowledge of any potential process innovation from the technology layer to the business strategy layer. Thus, organisations can craft ambidextrous capabilities (e.g. Raisch et al. 2009) in order to better cope with the resistance of industry structures or radical change in competitive environments. In short, process innovation cannot succeed in an organisation without having all of the necessary elements/layers/capabilities in place.

6.2 The contributions to DSR knowledge

In this section, we discuss the PCM contribution to DSR knowledge. First, the contribution is articulated as "invention" based on the DSR knowledge contribution framework (Gregor and Hevnor 2013). Second, the design principles for the PCM is discussed based on our critical reflections.

6.2.1 The PCM as a DSR invention

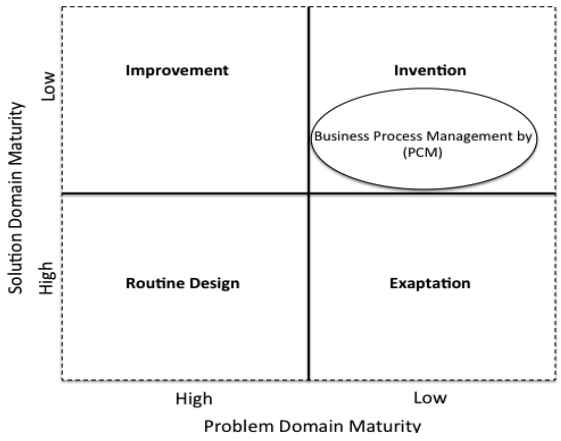

Figure 13. The PCM contribution as an Invention

In Figure 13, the PCM is positioned as an "invention" in the conceptual map of DSR knowledge contribution adapted from Gregor and Hevner (2013).

Gregor and Hevner (2013) define invention as a clear departure from accepted ways of doing and thinking. The process of invention can be described

as an explanatory search over a complex problem space that involves the cognitive skills of creativity, insight, curiosity and knowledge of multiple realms or inquiry to design feasible solutions. The PCM has been designed according to this description, and it has been applied in real-world contexts resulting in prescriptive knowledge based on the instantiations of constructs, models and primarily the method (the PCM). The design of the PCM is also advanced as nascent design theory, in the form of the three design principles that are abstracted in the following section.

6.2.2 The design principles for the PCM

Reflecting on the research results and the entire five years that have encompassed this Design Science Research, we realised that we should abstract the nascent design theory, the design principles for the PCM that can be shared with other designers in solving similar ill-structured problems in the context of process management. Gregor and Hevner (2013) define this kind of design knowledge contribution as fundamental truths or propositions that can serve as a design knowledge base for others. The three design principles have been elucidated based on the total experience and critical reflections of this research endeavour from both theoretical and practical perspectives (see Table 9).

Table 9. The three design principles for the PCM

Principle #1: **Design by holistics**	Organisations as social systems require a holistic design approach, which means that the more parts of the system and levels of it that plan simultaneously and interdependently, the better. The practice of management should create a true whole and harmonise decisions and actions.
Principle #2: **Design by commitments**	Management should be centred on "conversations for action". Success cannot be attributed to a decision made by a particular actor, but only to the collective performance. Knowledge and understanding arise from a shared background of actions. Unstructured or judgemental decision-making is dependent largely on a manger's intuitive skills, the feeling of the phenomena, tacit knowledge and reflection-in-action.
Principle #3: **Design by explorations**	A solution space is co-evolved with a problem space. "Designing without final goals" where design goals are a function that motivates activities that in turn generates new goals. A designed artefact serves as a starting point for new possibilities and actions.

The underlying assumption for the three design principles is the theory that organisations and firms are social systems, and thus should be designed and managed as such. Further, many of the problems that managers handle in organisations are open-ended, circular and ill-structured. The social model conceptualises organisations as social systems that should be viewed as a part of a larger purposeful system as well as a system with purposeful parts. It focuses on both the functions of the parts in the whole and of the whole in the larger containing system of which it is a part. Therefore, it can yield an understanding of both the behaviour of the parts and the whole.

Principle #1: Design by holistics

The principle of design by holistics specifies that design for solving ill-structured problems, e.g. process prioritisation and process innovation, should make as many parts of the organisation interactively involved in the design process as possible in order to create a true whole and to harmonise decisions and actions.

When managing ill-structured problems in the contemporary business environment, managers not only have to manage their own domain or function, but also other domains and functions that contribute to the whole economic performance of the organisation (Drucker 2007). If they focus strictly on their domain or function, there is a high risk of sub-optimisation and "the whole" becomes un-coordinated. This is valid for all sub-systems (parts or functions) in a firm. More and more organisations consist of many knowledge intensive processes, which makes it difficult to delegate any problems with clear instructions to different management levels. Furthermore, the board and the top-management level in an organisation needs the planning input from their different business functions from every level of the organisation. Therefore, the involvement of managers from every level and by every function is vital to achieve a holistic view of the problems at hand, and make decisions that can benefit the organisation as a whole, and not just one business domain or function.

In the design-process of the PCM, practitioners such as CIOs and business process owners from various big companies in Sweden had participated in all of the DSR activities, from the problem formulation to the demonstration and evaluation. They hold positions at different levels of an organisation, as well as being responsible for various business domains. Because these practitioners possess professional knowledge and reflection of their experiences in their daily management practice, their contributions to the design of the PCM are valuable. Through the hermeneutics process of interpreting the divergent professional knowledge, the holistic perspective,

thus it is embodied in the output of the design. This, to a great extent, increases the relevance and applicability of the designed artefacts.

The demonstration and evaluation of the PCM in the empirical case studies further enforced the holistic perspective of the design. The PCM approaches process management using the interactive planning principles proposed by Ackoff (1994). The PCM has proven to be efficient. The selection process of the stakeholders in the PCM is explorative in its nature. Both formal and informal managers and stakeholders at all levels of the organisation and from every functions were involved in the process assessments and the decision-making for the process prioritisation. As expressed by a CIO in an evaluation of the PCM (Seco Tools):

"*It is very important to choose the right interviewees. They should not only be from the management group, but they should also be from a more heterogonous group of key stakeholders, informal leaders in the organisation, such as individuals who have no formal leadership but have a strong position and great knowledge of the business. The number should be manageable, given the size of the business with a decent coverage of the business areas. You have to adopt the method to your own business."*

Or, as mentioned by a manager in another PCM evaluation (Ericsson):
"The evaluation has made every manager involved aware and think more holistically about processes as a whole, and not focusing on only one process that a manager owns. They start to think and understand that the processes should service all kinds of business areas that Ericsson aims for, not only one business area.

The empirical evidence that we collected in the case of the smartphone based telematics implementation has shown negative impacts on the design and implementation of a designed artefact as an activity of a sub-system. Without the principle of design by holistics, the disruptive technology, although it is crucial for the process innovation of car insurance and the organisation's future business, was put on hold until further notices. The partial involvement from a single part of the organisation cannot make progress when implementing the good "design" and utilising it for its full potential.

Principle #2: Design by commitments

The principle of design by commitments specifies that design for solving an ill-structured problem in organisations should create conversations within the situated contexts, and make the design process a collective reflection-in-action for the key stakeholders.

Management decision-making is limited by bounded rationality. For ill-structured problems, the managers' own intuitive and judgemental skills have approved fundamental influences on the decisions made**.** However, success cannot be attributed to a decision made by a particular actor, but only to the collective performance. Knowledge and understanding arise from a shared background of actions. The knowledge cannot be shared via a one-way communication, the knowledge and learning is actually "made by doing" or in actual dialogue between stakeholders with different backgrounds and pre-knowledge of certain domains. Therefore, management should be centred on "conversations for action" and create networks of commitments in the design process when solving ill-structured problems.

In the design-process of the PCM, the practitioners involved had been engaged in continuous negotiations or "conversations for action" to reach a common understanding of the PCM, its two models, and the perspectives and dimensions that are represented in the two models. In this dynamic iterative process, ideas and theories have been presented, debated and interpreted together with the engaged stakeholders until a construct or artefact was designed. Then, the particular artefact was tested in different settings, both in real business settings, cases and in other plenums. The design was iterated several times by further negotiation and debate until it has been considered as "good enough" for its final evaluation. The advantage of this approach is that the committed practitioners easily accept the artefact and also develop a true belief that it can be used in real cases and settings.

When the committed practitioners tested the PCM in their own organisations, this principle design by commitment was further implemented in the process assessments. In the cases, we have seen that business stakeholders and managers become engaged when they are involved with the PCM. They become both the consumer of knowledge from the PCM, and the contributor of knowledge to the problem in the scope (process prioritisation). This engagement is important because it is the fundament for action, e.g. in designing the PCM, in evaluating and using the PCM in real businesses, as well as in decision-making based on this collective manner. As the CIO from Seco Tools reflected:

"The *method is a tremendous help to me, in that it creates, together with the management board, a common picture regarding our as-is state and to-be state. It was a foundation, where we could agree which process works well and which does worse. This consensus was not present at all before we did this demonstration. We know where to assign our resources to the prioritised process. The processes that work fine can wait"*.

He continued with: "*The method helped us to decide what, where in the processes the improvements should take place, but then, the how is the next question that the method can indicate. Should we go for a larger change project or implement an existing process with everyday business operations through a small adjustment?"*

The CIO explains further that: *"By using the method in the decision-making process, I took help from the ones that have spent their entire career in the business; those who know how things really work… I got a sense of what is important at present, and what I should do next."*

In contrast, in the pilot commercialisation of the smartphone based telematics business solution (the insurance case), the research team only got genuine commitments from the marketing people. Other stakeholders were not genuinely interested in the business solution. This, to some extent, also hinders the implementation of the designed solution, and limits its impacts on potential process innovation, as well as the stakeholders' uptake of it as an innovation for improving the organisation's business performance.

Principle #3: Design by explorations

The principle of design by explorations specifies that design for solving ill-structured problems should be explorative rather than exploitative, especially for organisations that operate in dynamic environments. Firms that act in dynamic environments have to learn by continuous interactions, both internally and in dialogues with their environments and contexts, if not, they will not survive (Beer 1979). The design exploration of ill-structured problem posits a continuous, circular and open-ended process (Maher et al. 1996). Simon (1996) defines this as "Designing without final goals". Design goals are a function that motivates activities which in turn generates new goals. A designed artefact serves as a starting point for new possibilities and actions. For the ill-structured problem solving situations, we get satisfactory solutions rather than optimised designs (Simon 1996).

The design activities of the PCM demonstrate the significance of the explorative approach. In the beginning of the design process, the design problem was formulated and limited as IT managers had difficulties in making and executing decisions in regards to supporting business activities and to prioritising processes to improve business values. The design of the PCM was iterated for more than 2 years before the prototype was demonstrated at Seco Tools. Several collaboration workshops were arranged in order to abstract the managers' professional knowledge in the method design. The success story gained at Seco Tools did give the first evidence of the usefulness of the PCM in solving the problem of process prioritisation.

However, when business environments become more dynamic, uncertain and complex, organisations face tremendous challenges from digital technologies, or disruptive technologies. This posed new problems in the problem domain for process improvement and process management in dynamic environments. The lessons learnt in the case of the insurance company extends the problem and solution spaces of the PCM, in which the principle of design by holistics and the principle of design by commitments are enhanced in the design of the PCM. The evaluation of the PCM at Ericsson has brought new evidence that the PCM has to be explored to solve the problems that concern processes for successful future businesses. In these design exploration activities, we argue that the PCM is co-evolved with its problem spaces, to be exact, from an IT driven process prioritisation problem, to process innovation in a dynamic environment, and to process improvement for achieving future business. The empirical studies provide strong evidence of success from this explorative process.

Thus, this research has not been finalised with "the solution to the problem". And this will according to the design by explorations principle continue the explorative process. With the co-evolution of the problem and solution spaces, this explorative process is open-ended. Ill-structured problems cannot be understood completely and solved immediately, thus a solution can only be designed based on the limited scope of problem formulation. In the research for the ill-structured problem solving situations, we get satisfactory solutions rather than optimised designs. Thus, the PCM is a satisfactory solution at this point in time. It is a starting point for continuous exploration to find further satisfactory solutions to the continuous evolution of problems that arise in the business contexts of most firms today.

BPM contains many ill-structured and complex problems. Explorative BPM has emerged as a new research direction to address these problems. In practice, managers and stakeholders should make continuous designs based on their limited understanding of the problem domains. Exploration is the crucial principle for the design process in these contexts.

6.3 The contributions to research relevance

Today, many companies act in a fast changing and turbulent business environment, and should aim to implement changes that are based on faster and more effective decision-making. The PCM can provide a transparent and democratic decision-making procedure, and it can yield high-quality results within a short period of time, generating a shared understanding of process improvements and potential changes. Investment in process improvements or re-design should not only focus on process models or IT, but it should also

look towards cultivating a supportive culture and motivated employees who are keen to change and adapt.

In Sweden the PCM has been demonstrated and evaluated in more than 15 cases. In some of the cases, consultant firms have supported the PCM practice. Two of the empirical cases (e.g. Seco Tools and Ericsson) have been published with the permission of the organisations involved. BPM analytics companies and management consultants are educated and trained to use the method. So far the method has been appreciated for its novelty and its complementary abilities for other more mechanistically and analytically designed methods and models.

The cases discussed in chapter 5, as well as in the original papers, have demonstrated that thPCM supports companies and organisations in the co-creation of an improved understanding of their processes. They have also demonstrated the holistic principles of how processes relate to the business strategies and governance issues. Further, the cases have also demonstrated that companies and organisations, by the PCM, are supported in the decision-making process regarding how to manage resources and capabilities for business process improvements.

The PCM has also demonstrated how evaluation of processes can include organisational factors and environmental variables that organisations are most interested in understanding, especially when improving current business and creating future business. There is no 'one-size-fits all model' that can be applied here. Each company should configure their own PCM to fit its business contingencies and contexts, which means the PCM should not be seen as a method to solve every process improvement problem, but as an inspiration for determining an appropriate evaluation for a company's business needs.

Finally, the PCM leads to potential changes in process governance, both internally and externally, especially if the company operates in a dynamic environment. The PCM may make the internal 'power politics' explicitly, which can help leaders to find where resistance is coming from and help them to deal with change resistance efficiently. Moreover, the PCM can help companies to identify a strong governance position of those processes in their value network in order to create and capture business values.

In conclusion, the PCM embodies a high degree of relevance to business practice. In addition to the research collaboration/co-design in all of the design activities (see section 3.4 and 3.5) with the practitioners through an engaged scholarship approach, my own professional knowledge has also played a significant role in designing and evaluating the PCM (see Preface;

Klein and Rowe 2008). This also increases the relevance of the research to practice.

6.4 Generalisability of the PCM

Researchers have different perspectives towards the generalisability of the outcomes of design science research and design theories (Lee and Baskerville 2003; Gregor and Hevnor 2013). Recently, Baskerville and Pries-Heje (2014) discuss the different nature of descriptive sciences and design science, and propose to use "projectability" as an alternative to articulate the generalisation of design theories. Projectability explains how design theories, being prescriptive, possess a different form of applicability, for example, design theories can be applicable in future contexts or problem spaces that do not yet exist. The debate of how to articulate the generalisability of design outcomes is out of the scope of this thesis. However, generalisation should be discussed in any scientific research. Accordingly, the three principles of generalisation proposed by Sein et al. (2011) are adapted to argue the generalisation/projectability of the PCM. Sein and his co-authors suggest to generalise the outcomes of design science research by analysing: (1) the generalisation of the problem instance, (2) the generalisation of the solution instance, and (3) derivation of design principles from the design research outcomes.

Generalisation of the problem instance

Business process has been a core unit of analysis in IS research for more than 20 years. Process prioritisation remains as a complex and difficult problem to solve from both academic research and management practice. The problem spaces of process prioritisation, thus, have a general nature. Emphasis has to be added that the dynamic nature of the problem spaces that are largely shaped by the complex, uncertain and unique environments. In general, the dynamic exists for every organisation.

Generalisation of the solution instance

The PCM has been demonstrated and evaluated in different companies. The empirical cases (instances) have shown that the PCM works in these different organisations (instances). Although, it has not been evaluated in different cultural contexts, e.g. outside Sweden. Some of the companies involved with the demonstration and evaluation of the PCM are international and global companies. Most of the organisations are complex and social systems, and most of the problems that the managers handle in these settings are open-ended, circular and ill-structured. The PCM has supported management in making coordinated, transparent and well anchored decisions in these contexts. Thus, it is possible to repeat and adopt the method in

different contexts. The purpose of the PCM is to support organisations in making satisfactory decisions in the context of BPM.

Derivation of design principles from the design research outcomes
The three design principles have been derived from the design science research outcomes of the PCM: 1) design by holistics, 2) design by commitments and 3) design by explorations. The underlying assumption for these three design principles is the theory that postures that organisations and firms are social systems, and thus should be designed and managed as such. Further, many of the problems that managers handle in organisations are open-ended, circular and ill-structured. When designing artefacts that are applicable in contexts such as that of the PCM, the three design principles explained in this thesis are applicable and generalisable to similar contexts of complexity.

Through this formalised analysis, it can be said that the PCM has a high generalisability.

6.5 Evaluating the research

In this section, we assess how the research compares to the ten principles of good BPM research (vom Brocke et al. 2014), as well as the seven DSR research guidelines (Hevner et al. 2004). Our evaluation shows that the research satisfies both the criteria of good BPM research and good DSR research.

I claim that this research has also been conducted in a novel way, by heavily engaging practitioners and experts, in a very interactive way, in all of the activities of the DSR, from problem formulation, to design and evaluation. By creating a web-based tool in the cloud for the PCM and combining the research with pragmatic cases such as the insurance telematics case (paper 3,4), I also believe that the new models (such as the CLM) contribute to both academia and real world practice/business. I hope that this approach, in the long run, will generate new relevant theories in the information systems research community in the future.

6.5.1 Good BPM research

In Table 10, we assess the research based on the ten principles of good BPM research (vom Brocke et al. 2014).

Table 10. Evaluating research as good BPM research

Principles of good BPM	**The PCM research**
Principle of context – awareness	The PCM is easy to configure to fit into an organisational context. Thus, business contingencies and environmental factors can be considered in process evaluation and process improvement or redesign.
Principle of continuity	The PCM facilitates a continuous process evaluation based on an organisation's needs.
Principle of enablement	The PCM helps companies to create capabilities to improve processes, and categorise resources and capabilities that they may need to realise future, as well as current, business.
Principle of holism	The PCM is theoretically built upon a holistic approach, and does not focus only on IT, process modelling or methods. Strategy, governance, people and culture, together with IT and models are considered.
Principle of institutionalisation	The PCM is configurable to analyse 'which processes within what context'. As a result, organisational structure is embedded in the PCM.
Principle of involvement	Using the PCM requires all of the process stakeholders to actively participate in process evaluation, resulting in a democratic and transparent evaluation that can benefit everybody.
Principle of joint understanding	The PCM creates a shared understanding among key stakeholders who participate in process evaluations. In interactive evaluation sessions, a common understanding of the processes is generated naturally.
Principle of purpose	The results of the PCM serves as the foundation for top-management decision-making regarding companies' process improvement and strategic movement towards the to-be situation.
Principle of simplicity	The PCM is easy to use. Satisfactory results can be obtained in a relatively short time.
Principle of technology appropriation	The use of the PCM in process evaluation is supported by a web-based tool in the cloud. The tool can document all of the evaluation interactions, comments, and aggregate/visualise the results. Although for security reasons, companies, like Ericsson, would develop their own tool for supporting the use of the PCM.

6.5.2 Good Design Science Research

In this section, we describe the assessment of this research based on the seven DSR research guidelines (Hevner et al. 2004). The evaluation is presented in Table 11.

Table 11 . Evaluating research as good Design Science Research

DSR research guidelines	**Our DSR research - the design of the PCM**
1. Design as an Artefact	The PCM, as a method is developed. The method consists of two models, the heat map and the categorisation map. The PCM has instantiated in several business settings.
2. Problem Relevance	The PCM aimed to solve problems in the domain of process management, especially of process prioritisation. The problem has high relevance to business.
3. Design Evaluation	Case studies have been adopted to demonstrate and evaluate the PCM in businesses. The case studies were carried out rigorously by following the method guidelines proposed by Yin 2013; Eisenhardt 1989 and the others.
4. Research Contributions	Through critical reflection, the three design principles are articulated for being nascent design theory.
5. Research Rigor	The design of the PCM principally follows the DSRM (Peffers et al. 2008). Case studies have been used for the evaluation of the PCM in businesses.
6. Design as a Search Process	We acknowledge process prioritisation and process improvements are ill-structured problems. To solve them, a design exploration process is adapted based on the theoretical framework of Maher et al. (1996), Dorst and Cross (2001) and Simon (1996).
7. Communication of Research	The research results are published in the five original papers, my Licentiate thesis (2015), and this Ph.D dissertation. The papers are published in both technical orientated (paper 1 & paper 3) and managerial orientated (paper 2, paper 4, & paper 5) outlets. This research was also communicated to business and public audiences (my interviews by CIO Sweden, Rosengren 2016).

7 Conclusions

This thesis presents a five-year Design Science Research journey to develop the Prioritisation and Categorisation Method (PCM). This chapter revisits the main results, highlights the key contributions both to knowledge and practice, and finally discusses the limitation and future research.

7.1 The main results revisited

This research designed and evaluated a new context-aware, easy-to-use and holistic method for BPM, the Prioritisation and Categorisation Method (PCM). The demonstration conducted at Seco Tools and the evaluation at Ericsson showed that the PCM can support companies when prioritising their processes. By using the PCM, the tacit knowledge of process stakeholders was collected and served as the foundation for any decision-making with regards to process prioritisation, and the vision of the future for the process as well as future business. The PCM also introduced a transparent and democratic procedure for process management decision-making, it provided evidence of why the decisions were made, and what motivated them. Top management, both at Seco Tools and Ericsson, was satisfied with the insights that were gained through the PCM demonstration and evaluation. At Ericsson, the PCM was included in their enterprise business management framework and more process stakeholders were trained to use the PCM.

This research also conducted an empirical investigation regarding the impact of disruptive technology on process innovation. The disruptive technology – a smartphone user based insurance application – was piloted in a large insurance company. The lessons learnt deepened the understanding of the challenges that are faced by a company when exploring new capabilities (e.g. process and IT) for future business in dynamic environments. Such lessons also emphasised the necessity to configure the PCM based upon business contingencies and industry factors in process prioritisation.

7.2 The research contributions

The dissertation contributes knowledge to IS research in two areas. First, the knowledge contributions to explorative Business Process Management research, which include the PCM as a novel method and exploring process innovation with disruptive technologies. Second, the knowledge contributions to Design Science Research, which include the PCM as an invention, empirical instantiations, and the three design principles for the PCM. We summarise the contributions briefly in the following.

The PCM contribution to explorative BPM:

- The PCM is both business and IT–driven.
- The PCM can be viewed as a kind of co-creation effort, in which business plays a more important role than IT.

- The PCM supports decisions to be made on the basis of a 'collective intelligence'. The PCM is able to involve the managers/owners of the processes from different levels within an organisation in defining their process domain as well as the alignment between the processes, business and strategy.
- The PCM raises awareness among managers about what to think, what to do and how to understand the processes in their entirety, and not as 'separate' processes.
- The PCM is easy to use, simple and can yield results within a short period of time.

This research also provides empirical evidence to investigate the impact of disruptive technology on process innovation. Although the explorative BPM attempted to support companies to craft innovative process visions, in reality, most of companies are not yet ready to explore processes. And the related ambidextrous capability has not been established to embrace disruptive technologies.

The PCM contribution to DSR knowledge:

- The PCM is considered as an invention and a novel method for supporting decision-making in process prioritisation.
- The design principles for the PCM: design by holistics, design by commitments, and design by exploration are a significant contribution to DSR knowledge. The design theory for the PCM is a nascent theory that can guide other people to design methods for process management.
- Because the practitioners' reflections and professional knowledge have shaped the design of the PCM significantly, the artefact has embodied a high level of relevance to business problems. Thus, the artefact shows genuine applicability in businesses.

To conclude, the PCM provides a more explorative approach to Business Process Management, taking into account business processes in business contexts, business cultures, governance and governance mechanisms, related to the availability of resources and capabilities. The PCM is able to be configured to fit every organisations' business contingencies. Thus, the PCM has a high level of generalisation. Moreover, the research contributes significant knowledge to Design Science Research. The three design principles for the PCM exhibit possible generalisability to different contexts. The research is assessed as both good BPM research and good Design Science Research.

7.3 Limitations and future research

The PCM has high generalisability as discussed in section 6.4. However, it is worth mentioning that the research presented in this thesis is based on the design and cases within specific cultural and organisational settings (Sweden and Swedish organisations). It could be argued that the results may not necessarily be generalisable to other cultural, business and industry settings. Organisations need to configure the PCM in consideration of their own processes and business contingencies to explore and fulfil their unique process management purposes. This task is more crucial for businesses operating in dynamic environments. Furthermore, it has not been proven that the PCM can support a company in becoming more successful in exploring its BPM by generating new revenue streams based on decisions and prioritisations directly from the PCM.

There are several things worth exploring in future research that are related to this thesis, both regarding Design Science Research and the design of collaborative decision and management methods, as well as improvements to the PCM. Below are some suggestions.

- How could DSR be categorised (with the purpose of supporting researchers and practitioners with common references, for example, using applicable DSR methods to conduct practice-oriented research). The value of doing this research would contribute more relevant judgement to the different types of DSR methods. This could be done by defining different approaches of DSR; such as explorative DSR, which would be circular and interactive; and exploitative DSR, which would be more linear and nominal.
- Designing more pragmatic methods for process innovation (based on the three design principles: design by holistics, design by commitments and design by explorations). This would be relevant because of the digitalisation and innovation issues that address most industries and organisations today.
- Using the PCM for evaluating units of analysis other than processes. Doing this type of research would be relevant because of the contexts for making decisions regarding other objects, other than business processes, that inhabit similar criteria, e.g. ill-structured problem situations and soft system characteristics. This research can be done by making the PCM even more configurable and also implementing it with other units of analysis, e.g. project portfolio objects, capabilities and/or product and services, the principles of the PCM can be used in other types of decision contexts.
- Using data from the PCM to create patterns regarding good practice in different areas and contexts, such as industry sectors. This type of

research could be relevant to support companies regarding "the next steps" after process assessments by the PCM, i.e. how to work with certain improvement capabilities for identified process problems by certain types of patterns. For example, where would lean-approaches suit and adaptive case management approaches fit to improve a process, this should also be contextually driven. It should not only be linked to improvement methods as mentioned above, but also linked to patterns regarding the degree of change, e.g. radical changes regarding governance or organisational structures for certain processes. This research could probably be conducted by more exploitative research approaches such as a quantitative analysis of the PCM repository, comparing data from different cases and combining these with literature studies and cases identifying similarities to generate patterns.

- Balancing exploitation and exploration in companies is challenging. This has been discussed and debated in organisation science and management science (e.g. O'Reilly and Tushman 2013; Raisch et al. 2009). An exploration approach is quite new for the BPM community. Although this research argued the importance of exploration in designing the process prioritisation method, the ambidextrous capabilities related to exploitation and exploration are not addressed. This is a promising avenue for future research to continuously explore solutions for prioritisations.

References

Ackoff, R. L. (1981). "The art and science of mess management," *Interfaces*, (11:1), pp. 20-26.

Ackoff, R. L. (1994). *The democratic corporation: a radical prescription for recreating corporate America and rediscovering success*. Oxford University Press.

Al-Debei, M. M., and Avison, D. (2010). "Developing a unified framework of the BM concept," *European Journal of Information Systems*, (19:3), pp. 359-376.

Ami, T., and Sommer, R. (2007). "Comparison and evaluation of business process modelling and management tools," *International Journal of Services and Standards*, (3:2), pp. 249-261.

Andersson, B., and Johannesson, P. (2009). "Aligning goals services through goal and business modelling," *Information System E-Business Management*, (7:2), pp. 143-169.

Bandara, W., Guillemain, A., and Coogans, P. (2010). "Prioritizing process improvement: an example from the Australian financial services sector," In vom Brocke, J., and Rosemann, M. (Eds.) *Handbook on business process management 2,* pp. 177-195, Springer-Verlag Berlin Heidelberg.

Baskerville, R., and Pries-Heje, J. (2014). "Design theory projectability," In Doolin et al. (Eds.) Proceedings of *IFIP WG 8.2 Working Conference on Information Systems and Organizations,* pp. 219-232. Springer-Verlag Berlin Heidelberg.

Becker, J., Kugeler, M., and Rosemann, M. (Eds.) (2013). *Process management: a guide for the design of business processes*. Springer Science & Business Media.

Benbasat, I., and Zmud, R. W. (1999). "Empirical research in information systems: the practice of relevance," *MIS Quarterly*, (23:1), pp. 3-16.

Beer, S. (1979). *The heart of enterprise* (Vol. 2). John Wiley & Sons.

Burlton, R. (2010). "Delivering business strategy through process management," In vom Brocke, J., and Rosemann, M. (Eds.) *Handbook on business process management 2,* pp. 5-37, Springer-Verlag Berlin Heidelberg.

Bharadwaj, A., El Sawy, O. A., Pavlou, P. A., and Venkatraman, N. V. (2013). "Digital business strategy: toward a next generation of insights," *MIS Quarterly*, (37:2), pp.471-482.

Chang, J. F. (2005). *Business process management systems: strategy and implementation.* CRC Press.

Checkland, P. (1981). *Systems thinking, systems practice*. Wiley.

Cole, M., and Avison, D. (2007). "The potential of hermeneutics in information systems research," *European Journal of Information Systems*, (16:6), pp. 820-833.

Curtis, W., Kellner, M. I., and Over, J. (1992). "Process modelling," *Communication of the ACM*, (35:9), pp. 75-90.

Davenport, T. H. (1993). *Process innovation: reengineering work through information technology.* Harvard Business Press.

Dijkman, R., Lammers, S. V., and de Jong, A. (2016). "Properties that influence business process management maturity and its effect on organizational performance," *Information Systems Frontiers*, (18:4), pp. 717-734.

Dorst, K., and Cross, N. (2001). "Creativity in the design process: co-evolution of problem–solution," *Design studies*, (22:5), pp. 425-437.

Drucker, P. F. (2007). *The practice of management*. Elsevier Ltd.

Dumas, M., La Rosa, M., Mendling, J., and Reijers, H. A. (2013). *Fundamentals of business process management.* Springer-Verlag Berlin Heidelberg.

Duffy, D. (1994), "Managing the white space (cross-functional processes)," *Management*, pp. 35–36.

Eisenhardt, K. M. (1989). "Building theories from case study research," *Academy of Management Review*, (14:4), pp. 532-550.

Eisenhardt, K. M., and Martin, J. A. (2000). "Dynamic capabilities: what are they?" *Strategic Management Journal*, (21:10-11), pp. 1105-1121.

Franz, P. H., Kirchmer, M., and Rosemann, M. (2012). "Value-driven business process management: impacts and benefits," *Accenture*. Available at http://www.accenture.com/SiteCollectionDocuments/PDF/Accenture-

Value-Driven-Business-Process-Management.pdf. (Last accessed on 8 March, 2014).

Gerow, J. E., Grover, V., Thatcher, J. B., and Roth, P. L. (2014). "Looking toward the future of IT-Business strategic alignment through the past: a meta-analysis," *MIS Quarterly*, (38:4), pp. 1059-1085.

Giaglis, G. M. (2001). "A taxonomy of business process modeling and information systems modeling techniques," *The International Journal of Flexible Manufacturing Systems,* (13:2), pp. 209-228.

Good, D., and Michel, E. J. (2013). "Individual ambidexterity: exploring and exploiting in dynamic contexts," *The Journal of Psychology*, (147:5), pp.435-453.

Gregor, S. (2006). "The nature of theory in information systems," *MIS Quarterly,* (30:3), pp. 611-642.

Gregor, S., and Hevner, A. R. (2013). "Positioning and presenting design science research for maximum impact," *MIS Quarterly,* (37:2), pp. 337-335.

Gregor, S., and Hevner, A. R. (2015). "The front end of innovation: perspectives on creativity, knowledge and design," In Donnellan, B. et al. (Eds.): *International Conference on Design Science Research in Information Systems, DESRIST* 2015, *LNCS* 9073*,* pp. 249-263. Springer International Publishing Switzerland.

Gregor, S., and Jones, D. (2007). "The anatomy of a design theory," *Journal of the Association for Information Systems*, (8:5), Article 2.

Hammer, M. (1990). "Reengineering work: don't automate, obliterate", *Harvard Business Review*, (68:4), pp. 104-112.

Hammer, M., and Champy, J. (1993). "Reengineering the corporation: a manifesto for business revolution," *Business Horizons,* (36:5)*,* pp. 90-91.

Hammer, M. (2007). "The process audit," *Harvard Business Review,* (85:4), pp. 111-123.

Hammer, M. (2010). "What is business process management?" In vom Brocke, J., and Rosemann, M. (Eds.) *Handbook on business process management 1,* pp. 3-16, Springer-Verlag Berlin Heidelberg.

Hammer, M., and Champy, J. (2003). *Reengineering the corporation: a manifesto for business revolution*. Harper Business.

Harrington, H. J. (1991). *Business process improvement: the breakthrough strategy for total quality, productivity, and competitiveness* (Vol. 1). New York: McGraw-Hill.

Hevner, A. R., March, S. T., Park, J., and Ram, S. (2004). “Design science in information systems research,” *MIS Quarterly,* (28:1), pp. 75-105.

Huxley, C. (2003). *An improved method to identify critical processes.* Queensland University of Technology.

Händel, P., Ohlsson, J., Ohlsson, M., Skog, I., and Nygren E. (2014). “Smartphone-based measurement systems for road vehicle traffic monitoring and usage-based insurance,” *IEEE Systems Journal*, (8:4), pp. 1238-1248.

Jackson, M. (2003). *Systems thinking - creative holism for managers.* John Wiley & Sons.

Johannesson, P., and Perjons, E. (2014). *An introduction to design science.* Springer International Publishing Switzerland.

Keen, P. G. W (1991). *Shaping the future: business design through information technology*. Harvard Business School Press.

Keen, P. G., and Scott, M. (1978). *Decision support systems; an organizational perspective*. Addison-Wesley Publishing Company.

Kettinger, W. J. (1997). “Business process change: a study of methodologies, methods, and tools,” *MIS Quarterly*, (21:1), pp. 55-80.

Klein, G., Jiang, J. J., and Saunders, C. (2006). “Leading the horse to water” *Communications of the AIS*, (18), pp. 259-274.

Klein, H., and Rowe, F. (2008). “Marshalling the professional experience of doctoral student: a contribution to the practical relevance debate,” *MIS Quarterly*, (32:4), pp.675-686.

Kirchmer, M., and Pantaleo, D. (2005), “Business process automation: a framework for combining best and next practices for the agile organization,” In Pantaleo, D., and Pal, N. (Eds.) *The Agile Enterprise*, pp. 33-48, Springer Science & Business Media.

Kohlborn, T., Mueller, O., Poeppelbuss, J., and Roeglinger, M. (2014). “Interview with Michael Rosemann on ambidextrous business process management,” *Business Process Management Journal,* (20:4), pp. 634-638.

Kokkonen, A., and Bandara, W. (2010). “Expertise in business process management,”. In vom Brocke J., and Rosemann M. (Eds.) *Handbook on business process management 2,* pp. 401-421. Springer-Verlag Berlin Heidelberg.

Kothandaraman, P., and Wilson, D.T. (2001). “The future of competition: value creating networks,” *Industrial Marketing Management*, (30:4), pp. 379-389.

Kuechler, B., and Vaishnavi, V. (2011). "Promoting relevance in IS research: an informing system for design science research," Available at : http://www.inform.nu/Articles/Vol14/ISJv14p125-138Kuechler570.pdf (Last accessed on 26 September, 2016)

Langefors, B. (1970). *System för företagsstyrning*. (in Swedish) Studentlitteratur, Lund.

Lankhorst, M. M., Proper, H.A., and Jonkers, H. (2009). "The architecture of the Archimate language," In Halpin. T. et al. (Eds.) *BPMDS 2009 and EMMSAD 2009*, *Lecture Notes in Business Information Processing,* pp. 367-380, Springer-Verlag Berlin Heidelberg.

Lee, A. S., Thomas, M., and Baskerville, R. L. (2015). "Going back to basics in design science: from the information technology artefact to the information systems artefact," *Information Systems Journal*, (25:1), pp. 5-21.

Lee, L. G., and Dale, B. G. (1998). "Business process management: a review and evaluation," *Business Process Management Journal*, (4:3), pp. 214-225.

Lee, J. S., Pries-Heje, J., and Baskerville, R. (2011). "Theorizing in design science research," In Jain, H., Sinha, A.P., and Vitharana P. (Eds.): *International Conference on Design Science Research in Information Systems, DESRIST 2011, LNCS 6629,* pp. 1-16. Springer-Verlag Berlin Heidelberg.

Lin, F.R., Yang, M. C., and Pai, Y.H. (2002). "A generic structure for business process modeling," *Business Process Management Journal*, (8:1), pp. 19-41.

Lindman, M., Pennanen, K., Rothenstein, J., Scozzi, B., and Vincze, Z. (2016). "The value space: how firms facilitate value creation," *Business Process Management Journal*, (22:4). pp. 736 – 762.

MacLean, D., and MacIntosh, R. (2015). "Planning reconsidered: paradox, poetry and people at the edge of strategy," *European Management Journal*, (33:2), pp. 72-78.

Maher, M. L., Poon, J., and Boulanger, S. (1996). "Formalising design exploration as co-evolution: a combined gene approach*"*. In Gero, J. S. et al. (Eds.) *Advances in Formal Design Methods for CAD*, pp.3-30, Springer Science & Business Media Dordrecht.

March, S. T., and Smith, G. F. (1995). "Design and natural science research on information technology," *Decision Support Systems*, (15:4), pp 251-266.

Markus, M. L., and Jacobson, D. D. (2010). "Business process governance," In vom Brocke, J., and Rosemann, M. (Eds.) *Handbook on business process management 2,* pp. 201-222. Springer-Verlag Berlin Heidelberg.

McKay, J., and Marshall, P. (2007). "Science, design, and design science: seeking clarity to move design science research forward in information systems," In *Proceedings of the 18th Australasian Conference on Information Systems Science, Design and Design Science,* pp. 604-614.

Mithas, S., Ramasubbu, N., and Sambamurthy, V. (2011). "How information management capability influences firm performance," *MIS Quarterly,* (35:1), pp. 237- 256.

Niehaves, B., Plattfaut, R., and Becker, J. (2013). "Business process management capabilities in local governments: a multi-method study," *Government Information Quarterly,* (30:3), pp. 217-225.

Niehaves, B., Poeppelbuss, J., Plattfaut, R., and Becker, J. (2014). "BPM capability development–a matter of contingencies," *Business Process Management Journal*, (20:1), pp. 90-106.

O'Neill, P., and Sohal, S. S. (1999). "Business process reengineering: a review of recent literature," *Technovation*, (19:9), pp. 571-581.

O'Reilly, C. A., and Tushman, M. L. (2013). "Organizational Ambidexterity: Past, Present and Future," available at http://www.hbs.edu/faculty/Publication%20Files/O'Reilly%20and%20Tushman%20AMP%20Ms%20051413_c66b0c53-5fcd-46d5-aa16-943eab6aa4a1.pdf (Last accessed on 9 October 2016)

Ohlsson, J. (2015). *Supporting business process improvement initiatives by prioritizing and categorizing business processes*. Licentiate Thesis, Stockholm University.

Ohlsson, J., Han, S., Johannesson, P., Carpenhall, F., and Rusu, L. (2014a). "Prioritising business processes improvement initiatives: The Seco tools case," In Jarke, M. et al. (Eds.) *Proceedings of 26th International Conference on Advanced Information Systems Engineering* (CAiSE), *Lectures Notes in Computer Science*, LNCS 8484, pp. 256-270, Springer International Publishing Switzerland.

Ohlsson, J., Han, S., Johannesson, P., and Rusu, L. (2014b). "Developing a method for prioritising business process improvement initiatives," In *Proceedings of Pacific Asian Conference on Information Systems* (PACIS 2014), Paper 342, Association of Information Systems (AIS).

Ohlsson, J., Händel, P., Han, S., and Welch, R. (2015). "Process innovation with disruptive technology in auto insurance: Lessons learned from a smartphone based insurance telematics initiative,". In vom Brocke, J., and Schmiedel, T. (Eds.) *Business Process Management: Driving Innovation in a Digital World*, pp. 85-101, Springer International Publishing Switzerland.

Ohlsson, J., Han, S., and Bouwman, H. (accepted). "The prioritization and categorization method (PCM): an evaluation at Ericsson," *Business Process Management Journal*.

Osterwalder, A., and Pigneur, Y. (2010). *Business model generation: a handbook for visionaries, game changers, and challengers*. John Wiley & Sons.

Owen, C. L. (1998). "Understanding design research: toward an achievement of balance," *Design Studies*, (19:1), pp. 9-20.

Peffers, K., Tuunanen, T., Rothenberger, M. A., and Chatterjee, S. (2008). "A design science research methodology for information systems research," *Journal of Management Information Systems,* (24:3), pp. 45-77.

Porter, M. E. (1980). *Competitive strategy*. Free Press, New York, NY.

Porter, M. E. (1996). "What is strategy?" *Harvard Business Review,* (74:6), pp. 61-78.

Rai, A., Pavlou, P. A., Im, G., and Du, S. (2012). "Interfirm IT capability profiles and communications for cocreating relational value: evidence from the logistics industry," *MIS Quarterly,* (36:1), pp. 233-262.

Raisch, S., Birkinshaw, J., Probst, G., and Tushman, M.L. (2009). "Organizational ambidexterity: balancing exploitation and exploration for sustained performance," *Organization Science*, (20:4), pp. 685-695.

Reijers, H. A. (2003). *Design and control of workflow processes: business process management for the service industry*. Springer-Verlag Berlin Heidelberg.

Recker, J. C., and Rosemann, M. (2009). "Teaching business process modelling: experiences and recommendations," *Communications of the Association for Information Systems*, (24:1), pp. 379-394.

Robey, D., and Markus, L. M. (1998). "Beyond rigor and relevance: producing consumable research about information systems," *Information Resources Management Journal*, (11:1), Winter, pp. 7-15.

Rosemann, M. (2011). "Ambidextrous business process management", presentation slides, available at: http://www.wiwiss.fu-berlin.de/fachbereich/bwl/angeschlossene-institute/gersch/ressourcen/Ambidextrous_BPM_Rosemann_12-3-13_Handout_klein.pdf (Last accessed on 6 October 2016)

Rosemann, M. (2014). "Proposals for future BPM research directions," In Ouyang, C., and Jung, J.-Y (Eds.) *Proceedings of Second Asia Pacific Business Process Management conference*, LNBIP 181, p. 1-15, Springer International Publishing Switzerland.

Rosemann, M., and vom Brocke, J. (2010). "The six core elements of business process management," In vom Brocke, J., and Rosemann, M. (Eds.) *Handbook on Business Process Management* 1, pp. 107-122, Springer-Verlag Berlin Heidelberg.

Rosemann, M., and de Bruin, T. (2005). "Towards a business process management maturity model," In *Proceedings of the 13th European Conference on Information Systems* (ECIS), pp. 521-532.

Rosemann, M., and Vessey, I. (2008). "Toward improving the relevance of information systems research to practice: the role of applicability checks," *MIS Quarterly,* (32:1), pp.1-22.

Rosengren, L. (2016). "Digitaliseringen kräver rätt processer – nu vet forskarna hur du ska göra," *CIO Sweden,* (in Swedish, interview with Jens Ohlsson), available at http://cio.idg.se/2.1782/1.654259/digitalisering-processer (Last accessed on 15 October 2016)

Roeser, T., and Kern, E. M. (2015). "Surveys in business process management–a literature review," *Business Process Management Journal*, (21:3), pp. 692-718.

Rossi, M., and Sein, M. K. (2003). "Design research workshop: a proactive research approach," *Presentation delivered at IRIS* 26, pp. 9-12.

Röglinger, M., Pöppelbuß, J., and Becker, J. (2012). "Maturity models in business process management," *Business Process Management Journal,* (18:2), pp. 328-346.

Saint-Onge, H. (1996). "Tacit knowledge the key to the strategic alignment of intellectual capital," *Strategy & Leadership,* (24:2), pp. 10-16.

Scheer, A. W. (1998). *ARIS - Business Process Frameworks*, 3rd ed. Springer-Verlag Berlin Heidelberg.

Schmiedel, T., vom Brocke, J., and Recker, J. (2013). "Which cultural values matter to business process management? results from a global Delphi study," *Business Process Management Journal,* (19:2), pp. 292-317.

Schön, D. A. (1983). *The reflective practitioner: How professionals think in action*. New York: Basic Books. (Reprinted 2013)

Sein, M., Henfridsson, O., Purao, S., Rossi, M., and Lindgren, R. (2011). "Action design research," *MIS Quarterly*, (35:1), pp. 37-56.

Simon, H. A. (1957). *Models of man; social and rational*. New York, Wiley & Sons.

Simon, H. A. (1973). "The structure of ill structured problems," *Artificial intelligence*, (4:3-4), pp.181-201.

Simon, H. A. (1996). *The sciences of the artificial*, 3rd ed. Cambridge, MA: MIT Press.

Simon, H. A. (1997). *Administrative behaviour*, 4th ed. The Free Press.

Smith, D. (2003). "Five principles for research ethics," *Monitor on psychology*, (34:1), pp. 56-60.

Solaimani, S. and H. Bouwman (2012). "A framework for the alignment of business model and business processes: a generic model for trans-sector innovation," *Business Process Management Journal,* (18:4), pp. 655-679.

Stabell, C. B., and Fjeldstad, O. D. (1998). "Configuring value for competitive advantage: on chains, shops and networks," *Strategic Management Journal*, (19:5), pp. 413-437.

Suchman, L. (1993). "Do categories have politics?" *Computer Supported Cooperative Work* (CSCW), (2:3), pp. 177-190.

Swenson, K. D., and Palmer, N. (2010). *Mastering the unpredictable: how adaptive case management will revolutionize the way that knowledge workers get things done* (Vol. 1). Tampa: Meghan-Kiffer Press.

Tarhan, A., Turetken, O., and Reijers, H. A. (2016). "Business process maturity models: a systematic literature review," *Information and Software Technology*, (75), pp. 122-134.

Tidd, J., and Bessant, J. (2009). *Managing innovation: Integrating technological, market and organizational change,* 4th ed. John Wiley & Sons Ltd. England.

Treacy, M., and F. Wiersema, F. (1995). *The discipline of market leaders*. Reading, MA: Addison Wesley.

Trkman, P. (2010). "The critical success factors of business process management," *International Journal of Information Management,* (30:2), pp.125-134.

Van de Ven, A. H. (2007). *Engaged scholarship: a guide for organizational and social research.* Oxford University Press.

Van den Bergh, J., Thijs, S., and Viaene, S. (Eds.), *Transforming through processes,* SpringerBrief in Business Process Management, Springer.

Van der Aalst, W. M. P. (2013). "Business process management: a comprehensive survey," *ISRN Software Engineering*, pp. 1-37.

Van der Aalst, W. M. P., ter Hofstede, A. H. M. and Weske, M. (2003). "Business process management: a survey," *Business Process Management Conference*, *Lecture Notes in Computer Science*, LNCS 2678 (1019), pp. 1-12, Springer-Verslag Berlin Heidelberg.

Versteeg, G., and Bouwman H., (2006). “Business architecture: a new paradigm to relate business strategy to ICT,” *Information Systems Frontiers,* (8:2), pp. 91-102.

vom Brocke, J., Schmiedel, T., Recker, J., Trkman, P., Mertens, W., and Viaene, S. (2014). “Ten principles of good business process management,” *Business Process Management Journal,* (20:4), pp. 530-548.

vom Brocke, J., Zelt, S., and Schmiedel, T. (2016). “On the role of context in business process management,” *International Journal of Information Management*, (36:3), pp. 486-495.

Watson, E.F., and Holmes, K. (2009). “Business process automation,” In Nof, S. Y. (ed.) *Springer Handbook of Automation*, Part I, pp. 1597-1612, Springer Science & Business Media.

Weber, C. V., Curtis, B., and Gardiner, T. (2004). “Business process maturity model (BPMM),” Version 1, www. omg.org/spec/BPMM/1.0/ (Last accessed 3 January, 2013)

Weber, R. (2004). “Editor's comments: the rhetoric of positivism versus interpretivism: a personal view,” *MIS Quarterly,* (28:1), pp. iii-xii.

Winograd, T., and Flores, F. (1986). *Understanding computers and cognition: a new foundation for design.* Addison-Wesley Publishing Company.

Yin, R. K. (2013). *Case study research design and methods,* 5th ed. Sage Publications, London Great Britain.

Yu, B., and Wright, T. (1997). “Software tools supporting business process analysis and modelling,” *Business Process Management Journal*, (3:2), pp. 133-150.

Österle, H., Becker, J., Frank, U., Hess, T., Karagiannis, D., Krcmar, H., Loos. P., Mertnes, P,. Oberweis, A., and Sinz, E. J. (2011). “Memorandum on design-oriented information systems research,” *European Journal of Information Systems*, (20:1), pp. 7-10.

Appendix 1- The web-based tool for the PCM

This appendix, presenting the web-based tool for the PCM, is divided in three sections: 1) How to configure and set-up an assessment, 2) how the tool facilitates and supports interviews, and 3) how the tool facilitates and supports decision by aggregations of results.

The descriptions of the tool in the appendix are similar to those of my Licentiate thesis (Ohlsson 2015, p. 49-56).

1) How to configure and set-up assessments

The first activity in the tool is to create and set up an assessment. See Figure A1 below.

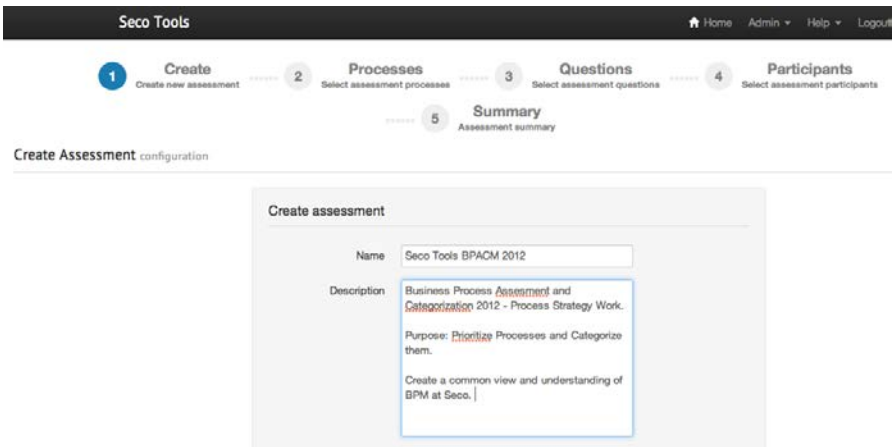

Figure A1. Example of the PCM tool in the Seco Case

The next step is to document the business structure, by either modelling the process architecture or inserting the process structure based on existing documentation. The PCM is engaged in the assessments from Level 1 to Level 3, which are the core corporate processes (Level 1), process areas (Level 2) and main processes (Level 3).

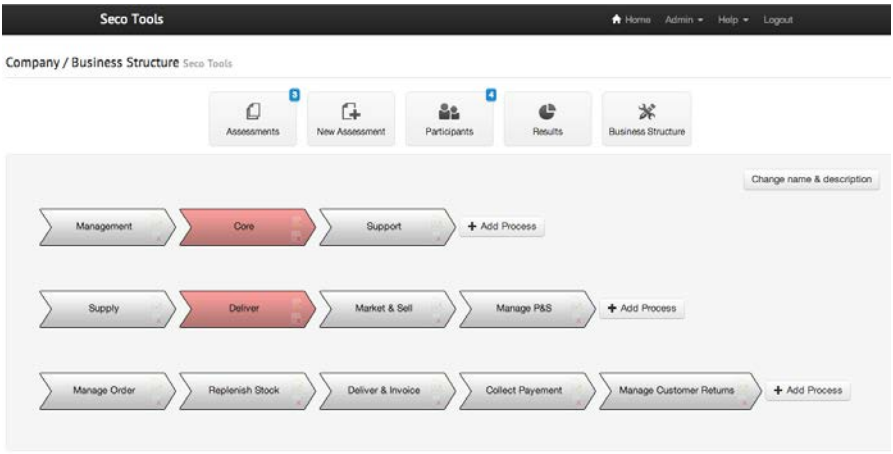

Figure A2. Example of the company business structure in the PCM tool of the Seco Case

The next activity is to select the processes (units of analysis) that should be in scope for the PCM.

The method and tool also includes configuration ability, where the configuration can be iterated with focal stakeholders to suit the specific preferences of the respective company or organisation. Configuration can be done at a language level and at a question level. The tool has a pool of questions. If the company or organisation wants to create their own questions, new questions can be formulated in the tool. A quality assurance procedure, where the researcher accepts the question, has to be followed before the question can be included in the existing question pool for each perspective. For efficiency purpose no more than two questions are recommended for each perspective.

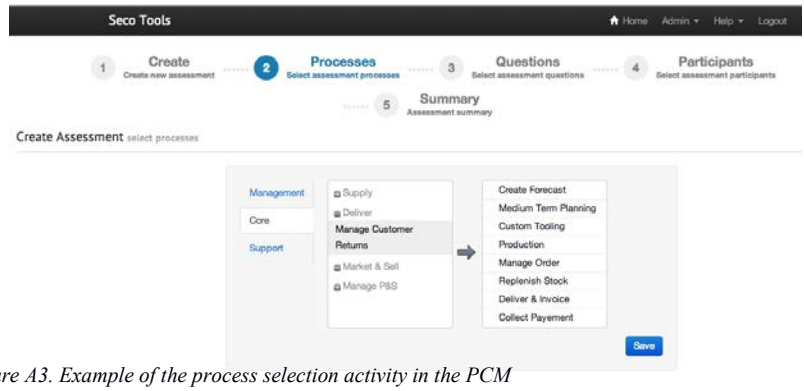

Figure A3. Example of the process selection activity in the PCM

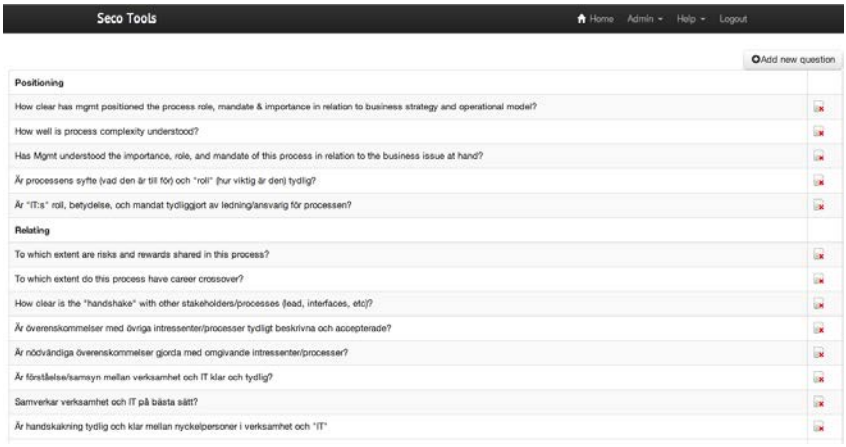

Figure A4. Example configuration of question in the PCM

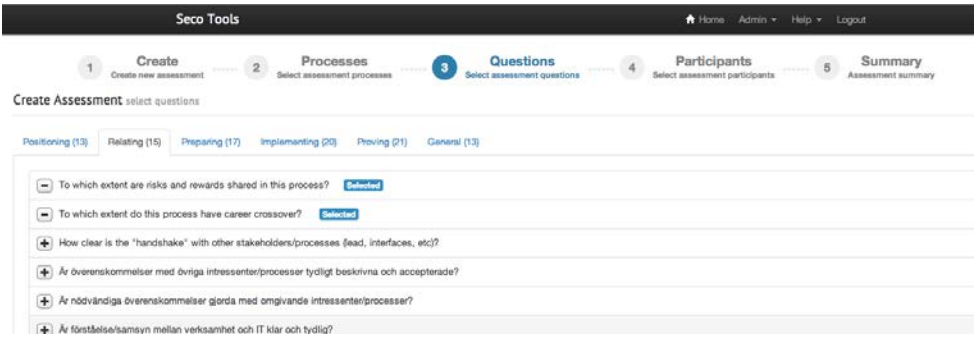

Figure A5. Example selection of questions in the PCM

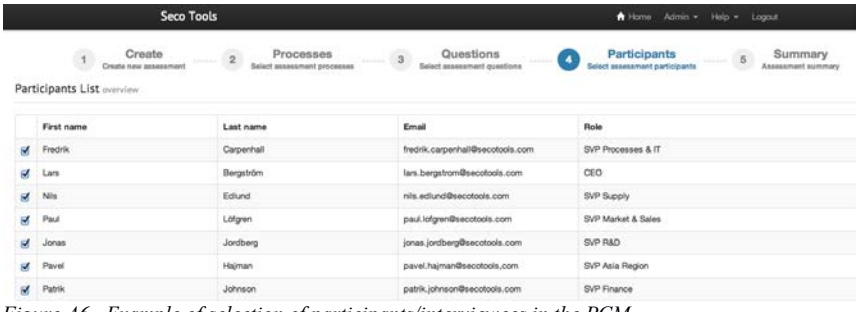

Figure A6. Example of selection of participants/interviewees in the PCM

The tool then generates a summary of the actual PCM set-up and its configuration, which processes are selected, the questions selected and the selected participants. Selection of participant can also be done iteratively e.g. by asking for relevant interviewees after an interview.

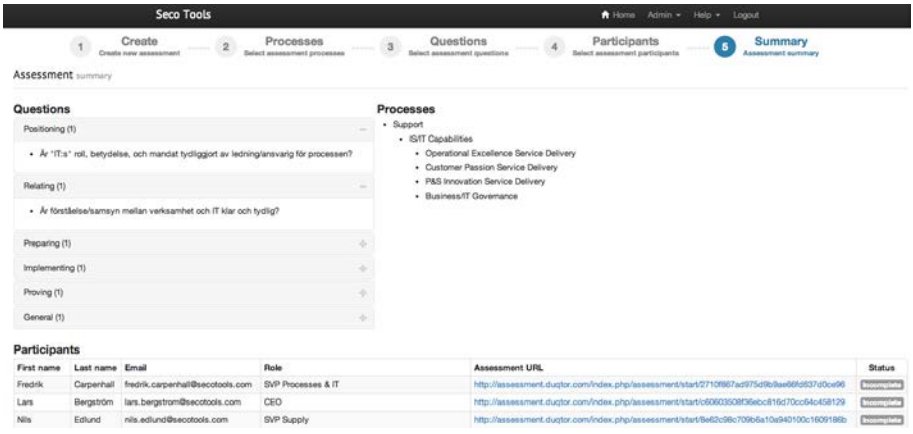

Figure A7. Example of a summary with selected processes, questions and participants in PCM

2) How the tool facilitates and supports interviews

In this phase the interviewer or facilitator simply selects the participant and starts an interview by clicking the url: link of the participant/interviewee. The tool starts the Process Assessment Heat Map (PAHM) interview template. When the form is filled the tool guides the interviewer/facilitator to the next step. The PAHM can also be completed by a participant, without facilitation by an interviewer (this has not yet been evaluated.) Comments can and should also be added for each question. A typical comment for quality assurance of the selected colour is to ask the respondent for a practical example and reason for choosing the colour.

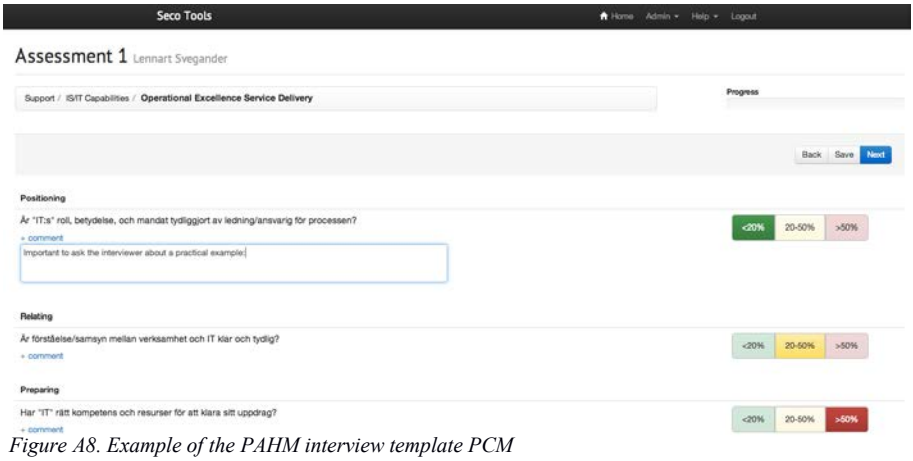

Figure A8. Example of the PAHM interview template PCM

When the PAHM is ready the tool starts the CM (Categorisation Map) interview template. (If the PCM is configured without the CM it will not start). For CM, See example in the CM figure further below. The interviewer or interviewee drag the dots: As-Is and To-Be, places them on the CM and make comments. The CM is constructed as a six-cell grid in two dimensions rather than a cube in three dimensions (See Figure A9). The reasons for this design choice are that: 1) the visualisation of results in two dimensions is easy to understand, and 2) a process that has the characteristics of being common and informal, independent from the question if it is a back or front process *ideally* should not exist. If such a process exists in reality, then A* is documented in the comment field to indicate this instance.

The **differentiating dimension** assesses the degree to which a process is superior to analogous processes of competitors, thereby differentiating the value proposition of the organisation (scale: differentiating to common). **Sample question:** Does the process in scope differentiate your company versus your competitors? Does the process in scope perform more poorly than for your competitors?

The **formality dimension** assesses the degree to which a process is strictly managed, repeatable, predictable, automatable, and involves applications rather than people (scale: formal to informal). **Sample question**: Does the process in scope reside in tacit knowledge? How strictly is the process in scope managed? How much of the process in scope is performed in an unstructured way? How much of the process is performed with manual work?

The **governance positioning** in the value network makes it clear whether process governance is positioned at the front-end or at the back-end (scale: back to front). **Sample question:** Does the process under governance concern suppliers, consumers or other internal or external actors? Where is the governance of the process positioned?

The tool shows the status of total PCM instances in the summary view, which shows interviews that has been completed.

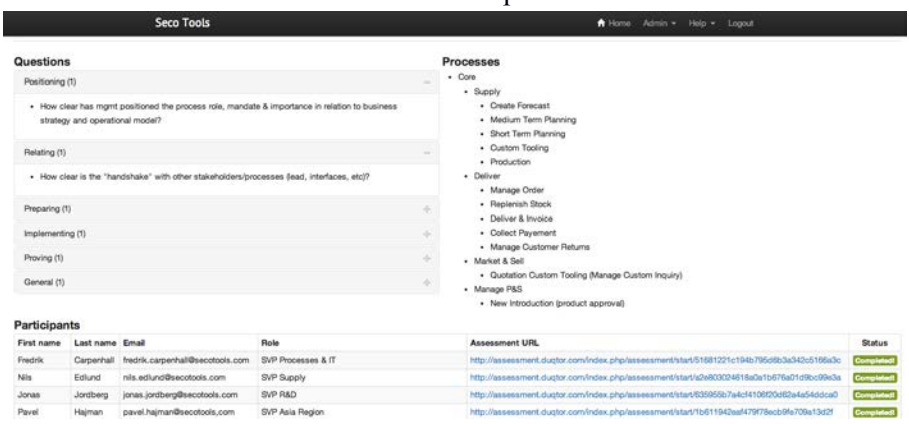

Figure A9. Example of summary and which interviews that has been completed

3) How the tool facilitates and supports decision by aggregations of results

An important feature of the PCM web-based tool is its aggregation of the results of the interviews. The aggregated models are used in the management meetings and workshops to facilitate the discussions and decisions to be made. Below are examples of aggregated models PAHM and PCM generated by the PCM web-based tool, by clicking the result at the bottom of the company page the tool generates the aggregated views. These can be generated on both individual and group levels with several interviewees included.

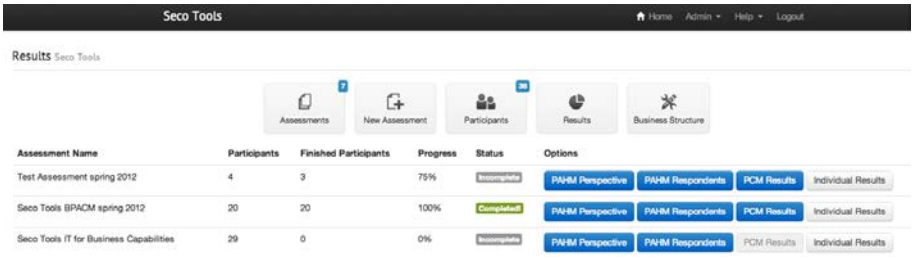

Figure A10. Example of result aggregations that can be generated

Example of aggregated result of PAHM perspective with individual comments:

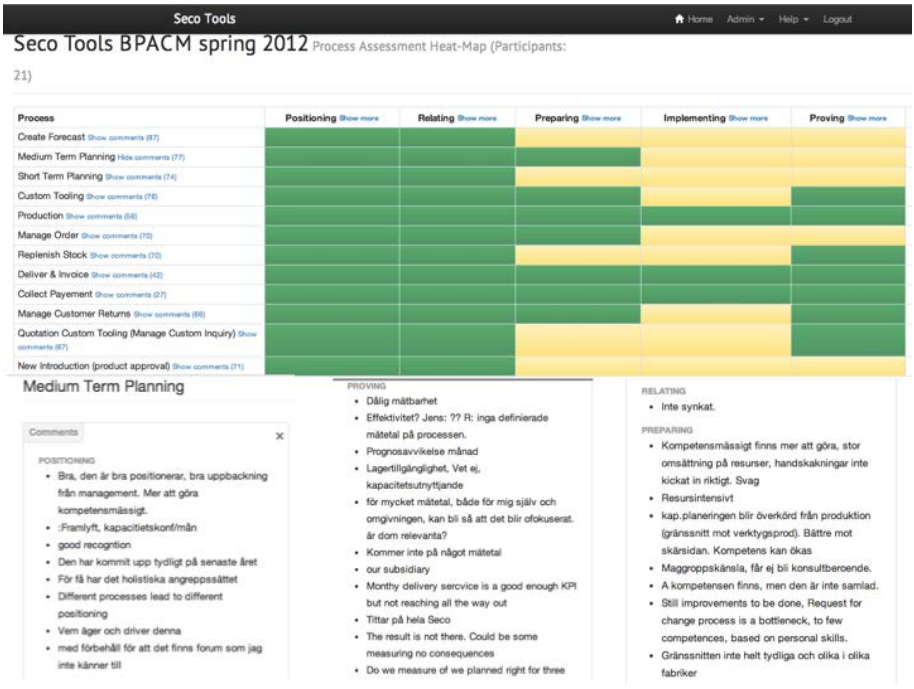

Figure A11. Example of aggregated result on PAHM Perspective with individual comments

Figure A 12. Example of aggregated result of PAHM perspectives

Example of aggregated result of Categorisation Map (CM) sub-process: Replenish Stock with comments

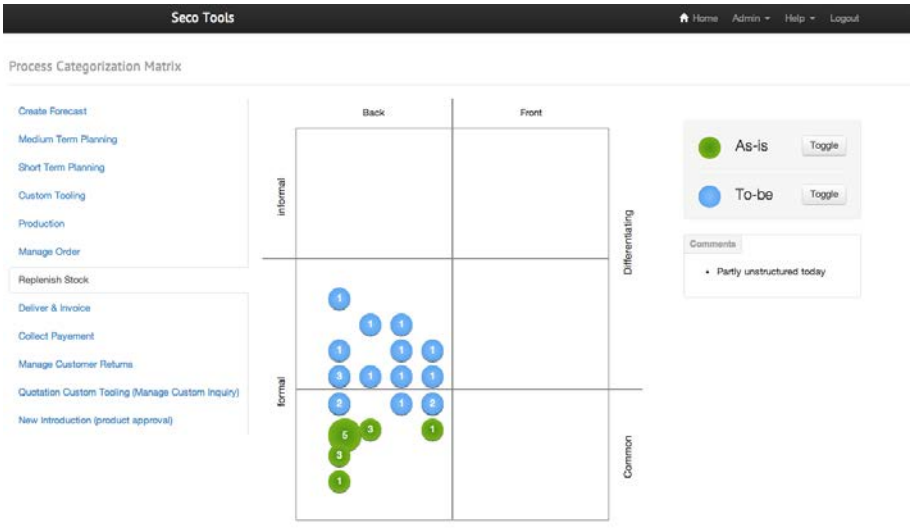

Figure A13. Example of aggregated result on CM, sub-process: Replenish Stock, with comments.

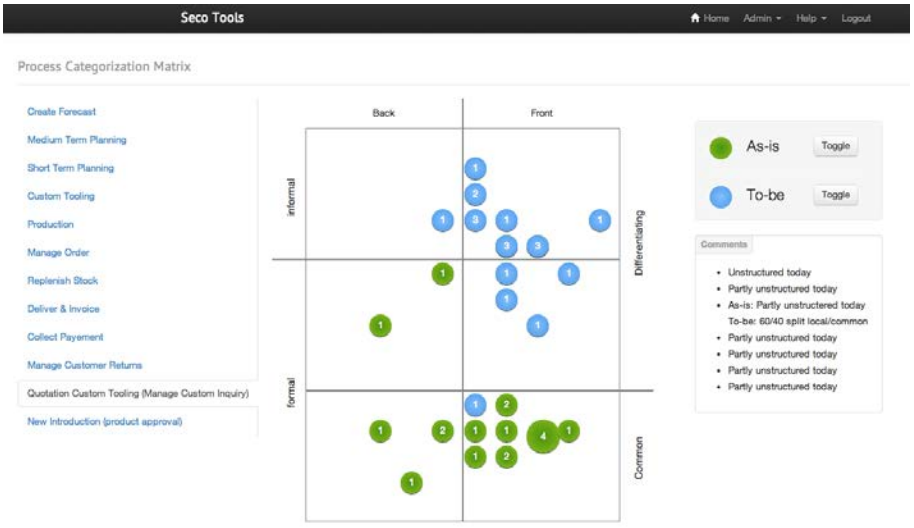

Figure A14. Example of aggregated result on Categorization Map (CM) sub-process: Quotation Custom Tooling, with comments

Part Two: Original Research Papers

This thesis consists of the following original publications:

Paper 1: **Ohlsson, J.**, Han, S., Johannesson, P., Carpenhall, F., and Rusu, L. (2014a). "Prioritising business processes improvement initiatives: The Seco tools case," In Jarke, M. et al. (Eds.) *Proceedings of 26th International Conference on Advanced Information Systems Engineering* (CAiSE), *Lectures Notes in Computer Science*, LNCS 8484, pp. 256-270, Springer International Publishing Switzerland.

Paper 2: **Ohlsson, J.**, Han, S., Johannesson, P., and Rusu, L. (2014b). "Developing a method for prioritising business process improvement initiatives," In *Proceedings of Pacific Asian Conference on Information Systems* (PACIS 2014), Paper 342, Association of Information Systems (AIS).

Paper 3: Händel, P., **Ohlsson, J.**, Ohlsson, M., Skog, I. and Nygren E. (2014). "Smartphone-based measurement systems for road vehicle traffic monitoring and usage-based insurance," *IEEE Systems Journal*, (8:4), pp. 1238-1248.

Paper 4: **Ohlsson, J.**, Händel, P., Han, S., and Welch, R. (2015). "Process innovation with disruptive technology in auto insurance: Lessons learned from a smartphone based insurance telematics initiative,". In vom Brocke, J., and Schmiedel, T. (Eds.) *Business Process Management: Driving Innovation in a Digital World*, pp. 85-101, Springer International Publishing Switzerland.

Paper 5: **Ohlsson, J.**, Han, S., and Bouwman, H. (accepted). "The prioritization and categorization method (PCM): an evaluation at Ericsson," *Business Process Management Journal*.

The author's contributions to the original publications:

Paper 1, 2 and 5.

JO designed the proposed method and carried out the case-studies (Problem formulation, objectives of design and the artefact, design of artefact, demonstration of artefact, and evaluation of artefact. JO drafted the manuscripts for publications. Other authors supported with supervision and improvement of the manuscripts quality, e.g. logic and argumentation, suggestion of relevant references and structures for academic presentation. All authors agree on the content of the final submissions.

Paper 3 and 4.

JO coordinated all activities from the design of the strategy, processes and business model solutions and was coordinating the case-studies (Problem formulation, objectives of design, design of artefact, demonstration of artefact, evaluation of artefact and drafted the parts (35%) of the manuscripts containing business process, strategies and business models in paper 3. The other authors listed in paper 3 were responsible for design and developed the disruptive technologies, the insurance telematics technologies.

JO drafted manuscript of paper 4. Other authors supported with supervision and improvement of the presentation quality, e.g. logic and argumentation, suggestion of relevant references and structure for academic presentation. All authors agree on the content of the final submissions.

Jens Ohlsson (JO)

Notes:

- Paper 1 and Paper 4 are reprinted by the permission granted from Springer.
- The copy right of Paper 2 belongs to the authors.
- Paper 3 is reprinted by the permission granted from IEEE.
- The submitted version of Paper 5 is printed here. The paper will be published in 2017.