

Jouko Nuottila

FLEXIBILITY IN AGILE PROJECTS

CONTRACTING PRACTICES AND ORGANISATIONAL
ARRANGEMENTS

UNIVERSITY OF OULU GRADUATE SCHOOL;
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FLEXIBILITY IN AGILE PROJECTS

Contracting practices and organisational arrangements

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Abstract

The adoption of agile methods in software projects has been fast. The majority of new software projects utilises agile methods, and they have radically changed the internal dynamics of software development projects. This has created a need for adjustments in the management of software projects. The current literature rarely discusses the early phases of agile projects: contracting and organising agile projects. The literature also lacks investigations on the project management practices of agile projects.

This dissertation focuses on flexibility as it occurs in agile software projects. The main objective of this research is to explore the nature of flexibility in agile software projects and study the challenges of project contracting and management in leveraging agile development methods. The research was conducted as a mixed methods research. The research findings contribute to the emerging literature on agile project management. Secondly, the results contribute to proactive contracting literature.

The results indicate that agile methods can be used to increase flexibility and efficiency in software projects, but flexibility needs to be planned by projects parties. This planning activity already starts in the negotiation phase, and it is optimally summarised in the project contract. Thus, it is also important that lawyers contributing to project contracts are aware and informed of the business contexts. The traditional project management approach needs adjustments in adopting agile practices. This research reports several categories of challenges faced in adopting agile practices and increasing flexibility in projects. The results also indicate that projects delegate part of the decision-making authority to implementation teams in order to increase flexibility. By taking some of the decisions closer to project implementation, flexibility can be used to manage uncertainties caused by a complex environment.

Keywords: agile methods, agile project management, proactive contracting, project management

Nuottila, Jouko, Joustavuus ketterissä projekteissa. Sopimuskäytännöt ja organisaatoriset järjestelyt

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Tiivistelmä

Ketterien kehitysmenetelmien käyttö ohjelmistoprojekteissa on yleistynyt nopeasti. Suurin osa alkavista ohjelmistoprojekteista käyttää jo ketteriä menetelmiä ja niiden soveltaminen on muuttanut radikaalisti kehitysprojektien sisäistä dynamiikkaa. Tämän vuoksi on syntynyt tarve tarkastella tarkemmin ketterien projektien johtamista. Kirjallisuudessa on harvoin tarkasteltu ketterien projektien alkuvaiheita, sopimuskäytäntöjä ja organisoitumista. Kirjallisuudessa ei myöskään vielä käsitellä ketterien projektien projektinhallinnan käytänteitä.

Tämä väitöskirjatutkimus tarkastelee joustavuutta, joka ilmenee ketterissä ohjelmistoprojekteissa. Työn päätavoite on tarkastella joustavuuden luonnetta ketterissä ohjelmistoprojekteissa ja tutkia mitä haasteita ketterien menetelmien käyttö aiheuttaa projektin sopimusprosesseissa ja projektinhallinnassa. Väitöskirjatutkimus on toteutettu monimetelmä tutkimuksena. Tutkimustulokset kohdistetaan tuoreeseen tieteelliseen projektitutkimuksen keskusteluun ketteristä projektinhallintamenetelmistä. Toisekseen, väitöskirja osallistuu ennakoivaa sopimista käsittelevään oikeustieteellisen tutkimusalan keskusteluun.

Tutkimustulokset osoittavat, että ketteriä menetelmiä voidaan käyttää lisäämään joustavuutta ja tehokkuutta ohjelmistoprojekteissa, mutta joustavuus tulee olla suunniteltua, jotta siitä voidaan hyötyä. Joustavuuden käytön suunnittelu alkaa jo projektin neuvotteluvaiheessa ja kirjaukset joustavuuden hyödyntämisestä on optimaalisesti kirjattu jo projektisopimukseen. Tämän vuoksi on tärkeää, että sopimuksen muotoiluun osallistuvat juristit ovat hyvin perillä liiketoiminta-alasta ja ovat tietoisia, että sopimus tulee sisältämään joustavuusnäkökohtia tarkoituksellisesti. Perinteinen projektinhallinta kaipaa myös muutoksia ketterien projektien johtamiseen. Tutkimus osoittaa seitsemän pääkategoriaa haasteita, joita yritykset kohtaavat siirtyessään käyttämään ketteriä menetelmiä. Tutkimus osoittaa myös, että ketterissä projekteissa päätöksenteko on joustavuuden lisäämiseksi hajautettu itseohjautuville tiimeille. Kun päätöksentekovaltaa siirretään lähemmäs varsinaista kehitystyötä, voidaan joustavuuden avulla hallita epävarmuutta kompleksissa ympäristössä.

Asiasanat: ennakoiva sopiminen, ketterä projektinhallinta, ketterät menetelmät, projektinhallinta

*This doctoral dissertation is dedicated
to my wife, Tanja Helena.
Your love, your support and encouragement,
your sacrifices brought me here. I love you.*

*“Without You I’m Nothing”
-Placebo-*

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I am finally here, writing the last pages of my doctoral dissertation. What a journey! Pursuing a doctoral degree involves a commitment of several years of one's life and dedication. The journey takes a lot, but it is also truly rewarding. I have learned much of preparing research, conducting research, analysing collected data and reporting research results. These are the core skills needed to work as a researcher, but for me, the greatest reward was the further development of analytical, critical thinking—an ability to recognise that any phenomenon, including human actors, forms a complex research setting with a variety of influencing factors, variables, values and motives. We live in a complex world, in which there are no short and simple truths or facts.

Pursuing a doctoral degree is also an emotional journey. It involves feelings of enthusiasm, excitement, hope, joy and confidence. Sometimes, it also involves feelings of disappointment, failure, desperation, uncertainty and doubt. To overcome these emotional ups and downs, a doctoral researcher needs support from academia for professional development and support from family and friends to maintain a healthy balance between research work and private life. I am truly delighted and grateful that I have had support from academia and from my loved ones along my doctoral journey. I would like to mention a few individuals and organisations without whom it would have been impossible to complete my doctoral dissertation.

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Veitservasa, September 12, 2019

Jouko Nuottila

Abbreviations

SM	Scrum Master
PO	Product Owner
SW	Software

Original publications

This dissertation is based on the following publications, which are referred to throughout the text by their Roman numerals:

- I Kujala, J., Nystén-Haarala, S., & Nuottila, J. (2015). Flexible contracting in project business. *International Journal of Managing Projects in Business*, 8(1), 92–106.
- II Nuottila, J., Kujala, J., & Nystén-Haarala, S. (2015). Flexible contracting in software project business: What we can learn from agile methods in the software industry. In S. Nystén-Haarala, T. D. Barton & J. Kujala J (Eds.), *Flexibility in contracting – Lapland Law Review 2* (pp. 29–54). Rovaniemi, Finland: University of Lapland.
- III Nuottila, J., Kauppila, O., & Nystén-Haarala, S. (2016). Proactive contracting: Emerging changes in attitudes toward project contracts and lawyers' contribution. *Journal of Strategic Contracting and Negotiation*, 2(1–2), 150–165.
- IV Nuottila, J., Aaltonen, K., & Kujala, J. (2016). Challenges of adopting agile methods in a public organization. *International Journal of Information Systems and Project Management*, 4(3), 65–85.
- V Nuottila, J., Aaltonen, K., & Kujala, J. (2017). Agile project management in a public context: case study on forms of organising. *International Journal of Project Organisation and Management*, 9(3), 230–248.

The author of this dissertation was the primary author of all of the original publications, except Publication I. He had the main responsibility for the research work, gathering and analysing the research data and writing the publications. The co-authors supported the research work by participating in designing the study and gathering data, as well as reviewing and commenting on the manuscripts. For Publication III, co-author Kauppila led the process of statistical analysis. The survey design was developed collaboratively in a research project led by co-author Nystén-Haarala. For Publication I, the author of this dissertation participated in the conceptual development and wrote the sections considering the software industry.

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1 Introduction

1.1 Background and research environment

This dissertation studies project contracting and project management of software development projects utilising agile methods. The research focuses on the nature of flexibility in agile software projects and the related considerations regarding contracting and managing agile projects. Several schools of thought (Barton, 2015; Hobbs & Petit, 2017; Jennejohn, 2008; Nystén-Haarala, Lee, & Lehto, 2010; Serrador & Pinto, 2015) claim that flexibility in projects increases cooperation and communication between project participants, and this facilitates increased co-creational value in projects. Such suggestions are made by the scholars of proactive contracting (Barton, 2015; Jennejohn, 2008; Nystén-Haarala et al., 2010), agile development methods (Cockburn, 2002; Conboy & Morgan, 2011; Dybå & Dingsøy, 2008) and agile project management (Conforto, Salum, Amaral, da Silva, & de Almeida, 2014; Conforto, Amaral, da Silva, Di Felippo, & Kamikawachi, 2016; Serrador & Pinto, 2015). They also suggest that traditional, control-oriented project management practices may not be suitable for all complex project contexts, but instead, or in parallel, project management practices enabling flexibility could lead to better results. This dissertation contributes to the aforementioned discussion by adding empirical considerations to the topic in the areas of proactive contracting and agile project management. The theoretical contribution of this research is directed primarily at the emerging literature of agile project management and secondarily at proactive contracting literature.

Mainstream project management as a practical discipline still emphasizes the detailed planning of project activities, followed by the close monitoring of the implementation of these activities (Atkinson, 1999; Gaddis, 1959; Lock, 1992; Morris, 1997; Turner & Müller, 2003; White & Fortune, 2002). Traditional project management is reluctant to allow changes during the project implementation phase (Dvir & Lechler, 2004; Lenfle & Loch, 2010; Lock, 1992; Morris, 1997). This control-oriented view of project management has two clear implications for hindering co-creational activity by project participants. First, project contract tends to be detailed and rigid (Barton, 2008; Nystén-Haarala et al., 2010; Siedel & Haapio, 2010). Contracts are used to define responsibilities, and the main purpose of a contract is to safeguard the project participants' legal positions in the event of conflicts and failures (Nystén-Haarala, 1998). This kind of formal, legal-centric

contracting process prepares for the worst case, a serious dispute in the business relationship, and does not consider contracting as a tool to increase cooperation and facilitate business performance (Barton, 2008; Haapio, 2013; Nystén-Haarala et al., 2010; Pohjonen & Visuri, 2008; Siedel & Haapio, 2011; Tayyeb, 2014). Second, the project plan tends to be implemented as it is; changes are not accepted or accepting them is formal and bureaucratic. A project plan is used to control the schedule, cost and quality to the extent agreed in the project contract (Atkinson, 1999; Dvir & Lechler, 2004). This is, of course, important, but the sole focus on the iron triangle does not facilitate collaborative opportunities to innovate in the project (Barton, 2008; Haapio, 2013). It fails to recognize collaborative learning by project participants during the project and does not enable flexibility when the need for change occurs based on increased knowledge and learning in the project (Barton, 2008; Haapio, 2013; Pohjonen & Visuri, 2008). Proactive contracting, agile development methods and agile project management have sought solutions for the abovementioned problems. They have based their considerations on the scientific legacy of their own discipline but brought up suggestions with similar characteristics.

Proactive contracting literature suggests that in order to enhance the management of uncertainties in projects, companies should proactively prepare for contingencies already in the contracting process (Haapio, 2013; Pohjonen, 2003). Proactive contracting identifies the need for a change in companies' approaches to project contracts (Barton, 2009; Nystén-Haarala, 1998). Scholars promote contract as a tool to increase cooperation, facilitate business performance and enable flexibility when changes to plans are needed (Barton, 2008; Haapio, 2013; Nystén-Haarala et al., 2010; Pohjonen & Visuri, 2008; Siedel & Haapio, 2011; Tayyeb 2014). They also suggest that corporate lawyers should serve business objectives instead of prepare for possible litigation while contributing to contracts (Barton, 2008, 2009; Barton & Cooper, 2000; Haapio, 2006a; Siedel & Haapio, 2010).

The literature on software development methods that paved the way for agile development methods has sought to find solutions to the efficiency, quality and operational challenges of software projects (Aoyama, 1993; Basili & Turner, 1975; Beck et al., 2001; Boehm, 1986, 1988; Cockburn, 2002; Curtis, Krasner, Shen, & Iscoe, 1987; Davis & Sitaram, 1994; Highsmith & Cockburn, 2001; Mills, 1976; Warsta, 2001). The agile development methods were created as a practical solution to these challenges, and they were collected under one collective vision and terminology in the *Manifesto for Agile Software Development* in 2001 (Beck et al., 2001; Cockburn, 2002; Highsmith & Cockburn, 2001). Agile methods promote a

few key changes in the way software projects are managed when compared to traditional projects. They suggest a more intensive customer collaboration and interaction during the project to ensure that feature requirements are up to date and aligned with increased understanding by project parties (Misra, Kumar, & Kumar, 2009; Sidky, Arthur, & Bohner, 2007). Agile methods favour incremental product releases instead of delivering the whole product at the end of the projects (Boehm & Turner, 2005; Siakas & Siakas, 2007; Vijayasathy & Turk, 2012). And finally, agile methods suggest that changes to plans should be accepted as a routine task in a project when reviewed together with the customer (Adolph, Kruchten, & Hall, 2012; Coram & Bohner, 2005; Iivari & Iivari, 2011; Livermore, 2008).

Agile project management was first introduced in software engineering literature (Alleman, 2002) and later in project management literature (Berggren, Järkvik, & Söderlund, 2008). Agile project management refers to adjusted practices of project management for managing agile software projects (e.g., Conforto & Amaral, 2010; Couillard, Garon, & Riznic, 2009; Maylor, Vidgen, & Carver, 2008). The literature on agile project management recognizes a possible need for change in project management discipline to respond to special characteristics of agile software projects (Fernandez & Fernandez, 2008; Leybourne, 2009; Pellegrinelli, 2011).

This dissertation builds on tensions between the traditional, control-oriented project management views and the recognised need for flexibility by proactive contracting literature and the literature on agile development methods. The dissertation aims to improve the understanding of how agile methods can increase flexibility in projects and what the issues to be considered in contracting and organising while managing agile projects are. The topic is approached by identifying key challenges in agile adoption regarding project contracting and management. A related issue of organising agile projects is studied. The role of lawyers in project contracting, as well as roles in agile projects, is problematized in this research.

1.2 Objectives and scope

The adoption of agile methods in software projects has been fast; they are now used in more than 50 percent of new software projects (CollabNet, 2019; Hewlett Packard Enterprise Development LP, 2017). Agile methods have radically changed the internal dynamics of software development projects. However, projects also have external connections and interfaces. Although agile methods were originally

created to enhance the internal efficiency and quality of one development team, the agile approach was soon scaled up and applied to larger teams, several teams and larger projects. The wider adoption of agile practices raises a question regarding if there is a need for adjustments in other areas of managerial considerations. The key motive of this dissertation is the fact that in spite of the numerous publications on agile methods, the focus has been on the implementation of agile practices in software development teams (Conforto & Amaral, 2010; Dybå & Dingsøy, 2008; Gemünden, 2015). There is an obvious need to study the early phases of agile projects: contracting and organising the project management for the projects adopting agile methods. The assumption of agile literature is that agile methods increase flexibility by enabling continuous changes. It is important to gain knowledge on the nature of flexibility and study the impact of increased flexibility on project contracting and project management. In addition, project contracting and project management are traditionally considered to be rigid and control-oriented. Thus, the adoption of agile methods might require approach changes in contracting and project management. The main objective of this research is to *explore the nature of flexibility in agile software projects and study the challenges of project contracting and management in leveraging agile development methods*. The dissertation contributes primarily to the emerging agile project management literature by examining the role of flexibility in project contracting of agile software projects and characteristics of project management required to profit from agile methods. The dissertation secondarily contributes to the proactive contracting literature by examining selected assumptions of proactive contracting in the context of software projects. The dissertation includes five original studies. First, the concept of flexibility is studied based on agile methods in software projects. Then project contracting is studied based on the assumptions described in proactive contracting literature. Finally, project management is studied in a public organisation adopting agile methods. Research questions for the original studies were induced along the research process; based on the literature and identified gap in empirical research, research themes were selected. The research questions for the original studies are presented in Table 1.

Table 1. Research questions.

RQ#	Research question
RQ1	How can flexibility be implemented into the contracting process and project contracts to manage uncertainty?
RQ2	How do agile software projects implement flexible approaches into project contracting and project contracts?
RQ3	What is the role of lawyers in contributing to project contracts?
RQ4	What are the challenges an organisation faces while adopting and utilising agile methods?
RQ5	What are the changes needed for a traditional project organisation to benefit from agile methods?

1.2.1 Research structure

This dissertation incorporates five original studies with dedicated research questions that contribute to its main research objective (Table 2). The first two research questions explore flexibility in software projects. The traditional project management approach is to minimize the number of changes during the project implementation. Conversely, agile methods prefer constant changes during the project to increase flexibility. The tension between contradictory views and the concept of flexibility is explored using Publications I and II. The third research question explores the dynamics of project contracting. Proactive contracting suggests that traditional business lawyering focuses on the safeguarding function and should contribute more to building cooperation between the contracting parties. This idea is also identified in agile literature, emphasizing the importance of customer collaboration. Publication III studies the role of a business lawyer in project contracting. The last two research questions explore the adoption of agile methods in the context of public organisations. The widely accepted assumption of public organisations being rigid provides an interesting research setting to study the challenges that the adoption of agile methods sets for an assumedly rigid organisation and traditional project management. Publications IV and V study these research questions, focusing on the challenges of agile adoption and exploring the organizing practices of an agile project organisation.

Table 2. Research papers overview.

Publication	RQ#	Article title	Name of the journal
I	1	Flexible Contracting in Project Business	International Journal of Managing Projects in Business
II	2	Flexible Contracting in Software Project Business: What We Can Learn from Agile Methods in the Software Industry	Lapland Law Review
III	3	Proactive Contracting: Emerging Changes in Attitudes toward Project Contracts and Lawyers' Contribution	Journal of Strategic Contracting and Negotiation
IV	4	Challenges of Adopting Agile Methods in a Public Organization	International Journal of Information Systems and Project Management
V	5	Agile Project Management in a Public Context: Case Study on Forms of Organising	International Journal of Project Organisation and Management

The original studies presented above contribute to the main research objective of the dissertation, even though their focuses slightly differ. Publications I and II build on the literature on proactive contracting and agile methods. Publication III builds on the literature on proactive contracting, and finally, Publications IV and V build on the literature on agile methods and project management. The publications complement each other to produce the research results of this dissertation.

1.3 Considerations on philosophy on science

Scientific work is required to be structured and organized. This is essential if a scientist aspires to contribute with his or her research to the development of science and seeks to discuss his or her contribution with other scientists. To be able to discuss and argue for new findings of scientific work, researchers need to share a common ground. They need to agree with other researchers upon the basis of

scientific facts, reality and assumptions in the disciplines they represent (Kuhn, 1970). By agreeing on what constitutes the foundation of a scientific discipline, cognitive capacities of curious minds are freed to concentrate on new findings, building new theories, instead of arguing on the basics time and again. Similarly, academia and disciplines have built widely accepted views over time on how research process should be organized and what techniques should be used to get scientifically reliable research results. The history and philosophy of science has provided academia with concepts and terminology to be used as tools to organize and structure research and, most importantly, discuss research with other scientists. For this dissertation, the chosen interpretations of the concepts used to describe a research process are discussed below.

There are many definitions of a *paradigm* or a *research paradigm* (Kuhn, 1970; Masterman, 1970; Shapere, 1964). Based on Kuhn's work (1970), Masterman (1970) elaborated several interpretations of the concept of paradigm in scientific work—including metaphysical paradigms, sociological paradigms and construct paradigms. One of the most common interpretations of a paradigm is to define it as a *world view* (Cobern, 1991; Kuhn, 1970; Masterman, 1970; Slevitch, 2011), a set of linked assumptions about the world (Slevitch, 2011) or an observable set of habits (Masterman, 1970). A paradigm can also be interpreted as a *way of seeing* (Masterman, 1970). While Kuhn (1970) discussed a possibility of conducting scientific work without paradigms and Masterman (1970) discussed non-paradigm science, multiple-paradigm science or dual-paradigm science, there is a wide consensus in academia that any scientific inquiry is based on a particular paradigm (Slevitch, 2011). However, the definitions of a paradigm as a world view, or a way of seeing, are vague and do not define characteristics or criteria for a paradigm. This makes it difficult to evaluate what characteristics are needed to make a paradigm, and thus, in addition to the established ones, new suggestions of research paradigms occasionally occur in the literature.

For this research, the definition of a paradigm is obtained from Denzin and Lincoln (2005b). A paradigm contains, or is arisen from, four incorporeal elements: *axiology* (ethics), *ontology*, *epistemology* and *methodology* (Denzin & Lincoln, 2005b). Axiology is part of philosophical studies investigating the concept of value in a philosophical sense (Hart, 1971). Axiology includes studies of moral values (ethics) and values of beauty and harmony (aesthetics). In the concept of a paradigm, axiology appears as values embedded in a research process (Denzin & Lincoln, 2005b; Guba & Lincoln, 2005). Ontology is another part of philosophical studies investigating the concept of being, understood in the largest possible sense

(Fine, 1991). It is a philosophical study on what there is, which entities make up reality and what the material and immaterial constructs the world (and reality) are made from (Hofweber, 2005). An ontology is also used as another term, as Fine (1991) suggests, “An ontology consists of all those items which are, in an appropriate sense, accepted” (p. 264). An ontology is total, including everything that is accepted to be real (Fine, 1991). But a specific ontology is debatable. Everyone has an implicit and dominant ontology, a private set of beliefs respecting what is primarily real (Feibleman, 1949). An ontology can be unconsciously constructed and a person may not know about it, but it directs how he or she instinctively acts (Feibleman, 1949). In the concept of a paradigm, ontology usually means a patterned set of assumptions concerning reality (Sale, Lohfeld, & Brazil, 2002; Slevitch, 2011). It is a researcher’s perspective on what is real and what reality is. Epistemology focuses on studying the relationship between an inquirer and his or her contemplation of reality (Denzin & Lincoln, 2005b). Historically, epistemology has focused on the philosophy of knowing and on the nature of knowing on a level of logical thinking (Becker, 1996; Slevitch, 2011). Later, epistemology has also concerned formal and rationalistic empirical inquiries by discussing the ability of such inquiries to gain legitimate knowledge (Becker, 1996; Guba, 1990; Kincheloe & McLaren, 2005; Slevitch, 2011). In the concept of a paradigm, epistemology appears as considerations on what the truth is and what the truthful knowledge is. Methodology is a philosophical and theoretical study on the best approach and means to acquire legitimate knowledge by scientific inquiry (i.e., research) (Denzin & Lincoln, 2005b; Guba, 1990; Slevitch, 2011). It is not an isolated, solely rational consideration, but it is related to a researcher’s stand on axiology, ontology and epistemology. Finally, these four considerations intertwined make up a research paradigm for a researcher—his or her way of seeing (Masterman, 1970), a philosophical approach to conducting science.

Academic disciplines or smaller academic communities have developed, or identified with, particular paradigms for the studies they conduct (Becker, 1996; Guba, 1990). Research paradigms are human constructs approved to be used by a specific academic community (Becker, 1996; Guba, 1990). Guba (1990) illustrated this by stating that research paradigms “... cannot be proven or disproven in any foundational sense; if that were possible, there would be no doubt how to practice inquiry” (p. 18). Disciplines, especially the ones involved with the studies on social reality, introduce new qualitative paradigms, which does not pursue objectivity in its classical meaning (Becker, 1996; Denzin & Lincoln, 2005b). Interpretation plays a key role in qualitative paradigms, but there are also considerations if

quantitative paradigms are more objective as they are traditionally considered to be (Guba, 1990). As interpretation is a key factor for the quality of qualitative paradigms, similarly, the development of conceptual models and operationalizing variables is crucial for the quality of quantitative paradigms (e.g., Bisbe, Batista-Foguet, & Chenhall, 2007; Denzin & Lincoln, 2005b; Guba, 1990). A researcher needs to consider these abovementioned aspects of the philosophy of science and articulate his or her position in the field of paradigms. This allows academia to understand his or her position and evaluate the qualities of his or her research based on the claimed position and paradigm.

Research methods are the selection of tools to collect and analyse research data. They are selected based on the methodology considerations to serve the research paradigm in the most optimal way. This is the ideal option for planning the research process. There are typically restrictions and obstacles faced during the research process; often, they are related to challenges of funding and access to data.

1.4 Research approach

The main objective of this research includes several inquiries. First, there is a target to explore the nature of flexibility in agile software projects. In addition, there is a related target to study the challenges of project contracting and management in leveraging agile development methods. Theoretical contribution is directed at the literature of agile project management and the literature of proactive contracting.

There are some assumptions (prior to research activities) embedded in the description above. Flexibility is considered to be intentional, as a deliberate management choice to leave some issues open. Flexibility is assumed to be somehow connected to uncertainty. Traditional project management seeks to minimise uncertainties; flexibility relates to a management approach of accepting uncertainties. Project contracting is considered to be a set of activities to seek an optimal, profitable commercial agreement for a company participating in a project. Project management is considered to be a set of management activities designed to organise and manage projects with a target of profitability. A project is assumed to create value. Basic management goals of optimally using resources, and maximizing profit or value are assumed to be valid. Both project management and proactive contracting as academic disciplines are multidisciplinary with a strong focus on practice and applicability. Both disciplines are developed from several theoretical traditions; they have multidisciplinary histories. The research conducted in the field of project management and proactive contracting contributes to

theoretical discussions and also seeks to enhance practices of managing businesses. These assumptions above also reflect the author's experience of over 10 years in several positions in the software business.

This research applies *pragmatism* as a research paradigm (Biesta, 2010; Burks, 1946; Feilzer, 2010; Jacobs, 2010; James, 1907; Kraushaar, 1940; Lotze, 1884, 1887; McCaslin, 2008; Morgan, 2014; Peirce, 1905a, 1905b; Simpson, 2018). Pragmatism was first a philosophical movement (James, 1907; McCaslin, 2008) but soon further developed as a research paradigm (Peirce, 1905a; Simpson, 2018). Pragmatism is "based on the principle that truth is provisional rather than absolute and fixed" (Jacobs, 2010, p. 724). Truth is relative to the current situation (McCaslin, 2008), or truth consists in the agreement between fact and idea (Törnudd, 1915). The meaning of ideas (concepts, theory) lies in their consequences, how they work in reality (Kraushaar, 1940). Pragmatism turns towards concreteness and adequacy (James, 1907). It is open for discovery and against dogmas and "the pretence of finality in truth" (James, 1907, p. 51). Pragmatism does not stand for any special results, but it is a tool for continuous scientific consideration and seeks an indication of a change in existing realities (James, 1907; Peirce, 1905a). Pragmatism considers theories as instruments of scientific work, not as ultimate goals of scientific work. Theories are considered to be useful if they represent actions and activities correctly. If this is not the case, then there is a need to engage inquiry to actions and activities and prepare a more precise description of an idea explaining the actions and activities. Pragmatism closely links theory and praxis (Greenwood & Levin, 2005).

The founders of pragmatism as a research paradigm soon stated its separation from deduction as a method of reasoning (Burks, 1946; James, 1898; Peirce, 1906). They also distanced themselves from inductive logic (Burks, 1946; James, 1907). Thus, pragmatism introduced a new type of argument called *abduction* (Anderson, 1986; Burks, 1946; Peirce, 1883). Peirce first developed the concept of abduction, calling it a hypothesis by saying, "Hypothesis is a weak kind of argument" (Peirce, 1878, p. 473). Making a hypothesis is a specific sort of inference different from deduction or induction, Peirce (1878) claimed. Peirce (1878) argued that abduction is very similar to induction, but there is a clear difference. Abduction does not jump into conclusions but is cautious and avoids ultimatums. Abduction works with presumptions and retroduction; the abductive method of reasoning explores possibilities and seeks explanations (Peirce, 1878). It seems that scientists using induction and presenting absolute suggestions of truth irritated Peirce. Thus, he tried to avoid absolutism and searched for a scientific method having a continuous

dialogue between theories and practices. The original rules of abduction were written to reflect this approach (Peirce, 1878, p. 476):

The hypothesis should be distinctly put as a question before making the observations which are to test its truth. In other words, we must try to see what the result of predictions from the hypothesis will be.

The respect in regard to which the resemblances are noted must be taken at random. We must not take a particular kind of predictions for which the hypothesis is known to be good.

The failures as well as the successes of the predictions must be honestly noted. The whole proceeding must be fair and unbiased.

Pragmatism is widely applied as a research paradigm in modern times, but abduction still heats up discussions over its applicability as a method of reasoning (e.g., Plutynski, 2011). However, critique is placed in philosophical concepts of abduction more than its capabilities to gain new knowledge (Locke, 2010). Abduction is considered to be suitable for case research and a mix of different methods with rich data (Feilzer, 2010; Locke, 2010). It is also said to be useful for the empirical study of practice in business and management (Simpson, 2018). This research adopts *an abductive approach*. The research is *explorative* by nature; it builds on the weak hypotheses of several traditions of literature and explores them in several research settings with several research methods. The *mixed methods research* is applied to this research (Biesta, 2010; Bryman, 2012; Greene, Caracelli, & Graham, 1989). It is often identified with pragmatism (Biesta, 2010; Feilzer, 2010; Morgan, 2014), and it supports the abovementioned objectives and assumptions of this research.

1.5 Research methods and data

Mixed methods research is defined as an intellectual and practical synthesis based on qualitative and quantitative research (Johnson, Onwuegbuzie, & Turner, 2007). Utilised in connection with pragmatism as a research paradigm, mixed methods research is said to mix characteristics of quantitative and qualitative approaches by identifying practical solutions for research (Johnson & Onwuegbuzie, 2004; Shannon-Baker, 2016). Mixed methods research allows innovative implementations, but it is important to describe the research process and state the types of data involved in research (Guest, 2012). It is also a necessity to describe

the timing of integration of different data sets and the purpose of integration (Guest, 2012). The transparent description of the process makes it possible for the audience to evaluate the accuracy and precision of data, quality of analysis and credibility and situational groundedness of the research (Becker, 1996; Denzin & Lincoln, 2005a; Greene, 2013; Hall, 2013; Ketokivi & Choi, 2014; Mertens & Hesse-Biber, 2013). These qualities are often listed as quality criteria for qualitative research, case study research and mixed methods research mainly utilising qualitative features (Becker, 1996; Denzin & Lincoln, 2005a; Greene, 2013; Hall, 2013; Ketokivi & Choi, 2014; Mertens & Hesse-Biber, 2013). The qualities will be utilised in the critical evaluation of the present research in Chapter 4.3.

This dissertation incorporates five published studies. The research methods and data used in the publications are presented in Table 3. The design diagram of the mixed methods research (Guest, 2012; Morse, 2010) utilised in this dissertation is presented in Figure 1. Appendices 1–3 include information on informants and collected data for Publications II, III, IV and V.

Table 3. Research methods and data used in publications.

Publication	Method	Data collection
I	Conceptual paper	-
II	In-depth interviews	Qualitative data from in-depth interviews. Primary data: five semi-structured interviews. Secondary data: documentation related to projects three informants had been involved with at the time of the interviews.
III	Survey	Quantitative data from a survey. Primary data: survey data, N = 355.
IV	Single case study	Qualitative data from a case project. Primary data: 10 semi-structured interviews. Secondary data: project-related documentation, project procurement documentation, project contract templates, public presentations and internal research reports.
V	Single case study	Qualitative data from a case project. Primary data: 10 semi-structured interviews. Secondary data: project-related documentation, public presentations and internal research reports.

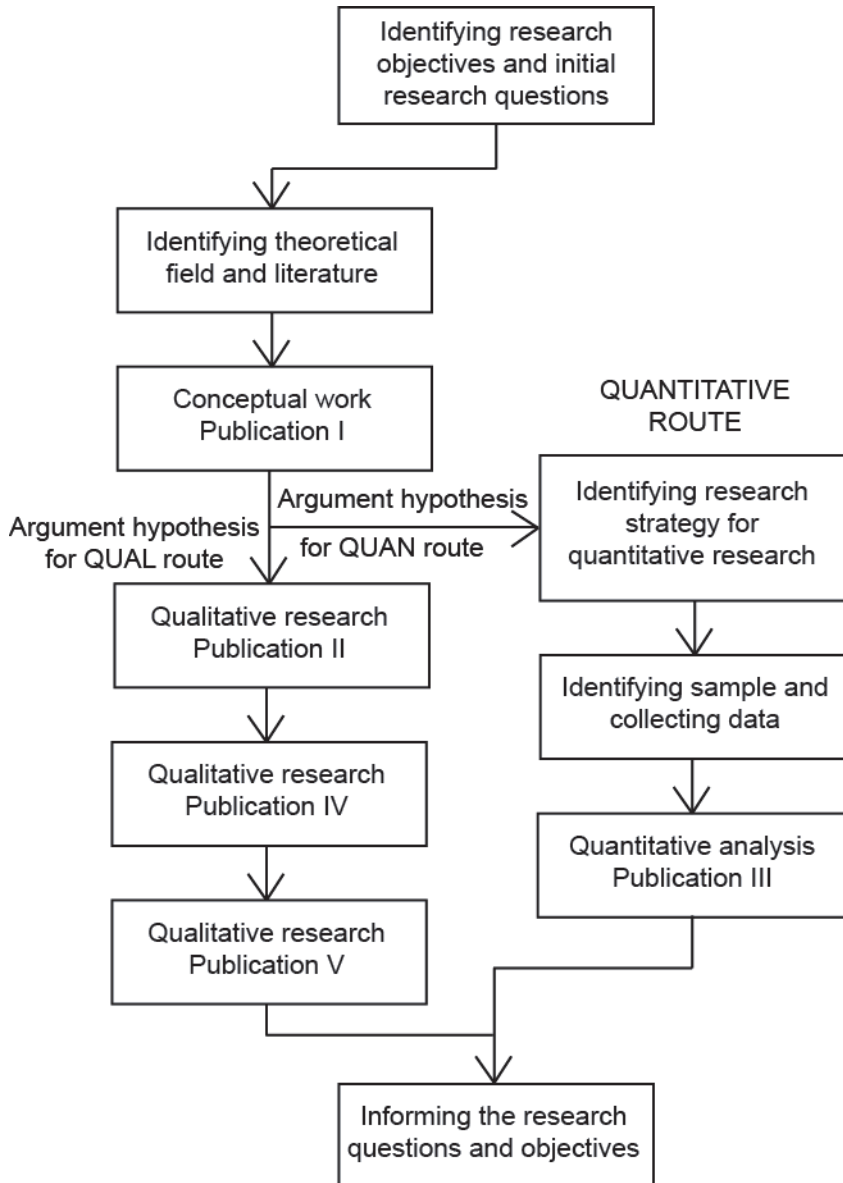


Fig. 1. Process diagram of the mixed methods research presented in the dissertation.

Publication I is a conceptual paper (Cropanzano, 2009; Gilson & Goldberg, 2015). Conceptual papers develop logical and complete arguments for associations but rarely test them empirically (Gilson & Goldberg, 2015). Conceptual papers can also

link theoretical contributions across disciplines (Gilson & Goldberg, 2015). Publication I was prepared as the joint work of an experienced academic representing project research, an experienced academic representing proactive contracting research and an experienced practitioner representing software business (the author of this dissertation). Over a period of two years, the authors had several in-depth discussions with software practitioners, participated in international research collaboration working on a concept of flexibility and held several intensive working sessions on conceptualising the suggestions of the paper. Publication I links project management literature with proactive contracting literature. It suggests an association of uncertainty management with increased flexibility in agile software projects. It also suggests an association of lawyer-driven contract planning with inflexible project contracts.

Publication I provided weak hypotheses for facilitating the research proceeding to two directions. It contributed to the development of research questions for the research presented in Publication II and informed context selection for the research. In addition, Publication I contributed to the initiation of the research presented in Publication III. The qualitative research (presented in Publication II) continued the qualitative route of the research. This route proceeded sequentially. However, the quantitative route of the research was simultaneously started, as illustrated in Figure 1 (Guest, 2012; Morse, 2010).

Publication II continued studying the concept of flexibility. The selected method of qualitative inquiry was in-depth interviewing (Guest, Namey, & Mitchell, 2013). This decision was based on a target to reach software project practitioners with remarkable experience from the industry and get insights from several companies in the software business. The primary data were collected through semi-structured interviews. The author collected the secondary data as research notes while having a possibility to browse through project documentation with three of the informants. The interviews were recorded and transcribed for analysis, except one that was transcribed during the interview and the transcription was reviewed with the informant immediately after the interview. The transcriptions were analysed with a computer-assisted qualitative data analysis software. The data were subjected to qualitative content analysis before the interpretation phase. The unit of analysis was the managerial activity related to uncertainty and flexibility.

Publication III studied the lawyers' contribution to project contracts. Quantitative research strategy was deployed mainly for two reasons (Bryman, 2012; Leeuw, Hox, & Dillman, 2008). First, global survey enabled a larger scale of inquiry, as there was an assumption made that there might be remarkable

differences between companies and between business lawyers. Second, with this research question especially, there were serious difficulties identified with access to data for research if qualitative research strategy was to be deployed. It was a challenge also for quantitative research strategy, along with identifying representative sample. The data collection was organised with an international association representing professionals in the field of commercial contract management. The members of the association are mainly lawyers, executives and managers and a variety of specialists such as engineers, industry analysts, technical consultants and advisors. The questionnaire was designed by a group of five researchers, and the survey was piloted with a closed group of respondents. The survey was internet-based; respondents were invited to participate by an email sent by the association. Demographic information was used to separate the selected specific sample from the research data. Analysis was conducted by two researchers. The results and interpretations presented by the author were reviewed and discussed with the co-authors.

Publications IV and V followed a single case study method (Eisenhardt, 1989; Dul & Hak, 2008; Eriksson & Kovalainen, 2008; Ketokivi & Choi, 2014). Publication IV focused on the challenges a public organisation faces while adopting agile practices for contracted software projects. Publication V studied the organisation and management of agile projects in the public sector. The unit of analysis in Publication IV was the agile software project adopting agile methods. The unit of analysis in Publication V was the project-based organisation. The primary data were collected through semi-structured interviews. The secondary data were acquired from the public organisation in question, and from the public sources. The interviewees were selected from an agile software development project, and they represented the key roles in the project. In addition, selected management representatives organising agile adoption and procurement were interviewed. The interviews were recorded and transcribed. The transcriptions were analysed with a computer assisted qualitative data analysis software. The data were subjected to qualitative content analysis; it was coded and then structured using first-order and second-order categories based on the research theme in Publication IV. The categories formed during the analysis were discussed and reviewed with the co-authors. For Publication V, the data were subjected to qualitative content analysis and structured using the categories of the framework utilised in the research. The interpretations of the analysis were discussed and reviewed with the co-authors. Publications IV and V utilised triangulation with multiple types of data

and multiple investigators to increase the quality of research and interpretation (Denzin, 2012; Given, 2008; Jick, 1979).

The qualitative and the quantitate route of producing research results were integrated to inform the research questions and serve the objectives of the present research. Separate studies were combined and once more analysed together to produce the research results of this dissertation. Research findings were discussed along with the related literature to reflect the present research on the theory and sharpen the focus of the contribution.

2 Literature review

2.1 Theoretical foundation

The theoretical foundation of this dissertation is based on the synthesis of proactive contracting literature and the selection of the literature on agile development methods. They have similarities in their approach to embracing change in projects and long-term commercial transactions. These similarities have not been thoroughly captured in the academic literature before. In addition, proactive contracting and agile development methods suggest that contracting parties can benefit from increased cooperation during the project or other long-term transactions. Both of these suggestions are contradictory to the traditional project management approach on strict change management and isolated project implementation, which are also covered in the literature review to demonstrate the widely accepted and utilised project management methods. Finally, the theoretical synthesis is presented as a theoretical setting for the empirical part of the dissertation.

2.2 Proactive contracting

Proactive contracting was a term initiated by scholars in legal science. These scholars represent the movement of *proactive law*, which is an emerging school of researchers and practitioners applying the ideas of *preventive law* into business practices and contracts. It is important to acknowledge the history of these ideas to set them in the scene of project business.

2.2.1 History of preventive law

Preventive law was first introduced by Louis M. Brown (1909–1996), a U.S. law professor and legal practitioner (Dauer, 2008; Haapio, 2006b). As a lawyer, he observed people getting into legal trouble unnecessarily. People either did not know the law well enough or they did not know how to prepare and act for their best interests. He wanted to help people to minimize the risk of legal trouble and maximize the legal benefits and decided to publish a book regarding the topic (Haapio, 2006b). *Manual of Preventive Law* (Brown, 1950) tried to increase legal

awareness among the public. This motivation was clearly described in the marketing material of the book at the time of publication:

Manual of Preventive Law is a necessary reference book for every businessman and homeowner. This book is to law what hygiene is to medicine. It is designed to show you how to keep out of legal difficulties. Written in layman's language, Preventive Law tells you what your rights are in every business deal, what legal remedies you have in case of default, and how to protect your interest at all times. (Brown, 1950: Text in the jacket blurb by the publisher Prentice-Hall Inc.)

Brown's intentions were good, but he faced some critiques from his colleagues who did not see his point and accused him of encouraging people to bypass lawyers and thus inducing more serious problems in their case. In his book review of Brown's publication, Charles E. Corker, another U.S. law professor, fiercely attacked Brown and blamed him for being irresponsible on his endeavour to educate laymen to consider their legal issues without consulting a lawyer (Corker, 1951). It is not possible to say whether the critique appeared because of other lawyers' real concern for the citizens or their concern over the positioning of lawyers as professionals in the society at the time. However, an interesting observation is that the debate has some similarities with the modern discussion on the role of business lawyers in the corporate environment and the question of how much legal awareness managers should have. Despite the criticism, Brown refused to back down on his principles of preventive law, and he continued publishing on the subject (Brown, 1956, 1969; Brown & Schaffer, 1972), paving the way for proactive law several decades later.

Brown's work received positive attention by some legal practitioners, and his work was extended and carried further by other scholars in the U.S. (e.g., Homer, 1965; Redmount, 1961; Shapiro, 1951; Stumpf, 1965). The scholars kept publishing preventive law-related articles on a regular basis; it started to reach a wider audience, and finally, in 1986, the National Center for Preventive Law (NCPL) was founded (National Center for Preventive Law, 2016). The NCPL operates under California Western School of Law in San Diego. The school also administrates the Louis M. Brown Program in Preventive Law and a full professor position in preventive law.

2.2.2 The emergence from preventive law to proactive contracting

Proactive contracting was first introduced in literature by Helena Haapio (1998, 2006b), a Finnish law researcher and legal practitioner. She started to familiarize herself with the legacy of preventive law and developed the ideas for the industrial context (Pohjonen, 2002). Haapio defined the term *proactive contracting* in her conference paper *Quality Improvement through Proactive Contracting: Contracts Are too Important to Be Left to Lawyers* as follows:

Proactive contracting, as used in the title of this session, refers to recognizing and making use of contracts and contracting processes as planning tools to guide and support the success of your business. It provides the support needed to identify opportunities in time to take advantage of them—and potential problems in time to take preventive action. Proactive contracting provides tools and techniques for the early detection of gaps, traps, and problems and the prevention of negative surprises. (Haapio, 1998, p. 246).

Haapio's conference paper initiated academic work on proactive approach in commercial contracts and relationships. Other Finnish scholars were working on similar topics at the time, and they collaborated to publish the first book on proactive contracting (Pohjonen, 2002). As a result of this work, the first international conference dedicated to proactive law was organised in 2003 (Nordic School of Proactive Law, 2016). The next conference was organized in 2005, which led to the founding of the Nordic School of Proactive Law (Haapio, 2006b; Nordic School of Proactive Law, 2016). Since then, several books and dozens of articles have been published on proactive law and proactive contracting.

2.2.3 Research status of proactive contracting

Proactive contracting is a practice-oriented research stream, and this orientation is reflected in the literature. Scholars focused on proactive contracting have suggested fundamental changes for corporate contracting and several improvements for contracts. However, the literature on proactive contracting is still scattered, ranging from general topics on contracting capabilities to the more specific interests of individual scholars. Proactive contracting is building on top of several research disciplines and contributes to several academic discussions, but it still lacks a solid theoretical foundation. In addition, although there is a consistent continuum of

publications on proactive contracting, this literature lacks wider empirical evidence on the effects of suggested changes in business operations.

2.2.4 Literature on proactive contracting

There are various issues related to contracting capabilities addressed by proactive contracting scholars. Haapio (1998) highlighted the challenge of the deficient understanding of contracts in business contexts. The general opinion is that a contract is a single document signed by contracting parties. This is not the case. A legally binding agreement, or a contract, can be formed in several ways, and a contract can evolve gradually. A purchase order, exchange of business letters, letter of intent or a quotation can create a legally binding agreement without signing a contract (Haapio, 1998). A commercial contract can be created by all sorts of documents used in business exchanges, by verbal communications or by conduct or work performed in a way that a business transaction is started (Haapio, 1998). Haapio (1998, 2003, 2013) also discussed contractual literacy (also contract literacy or legal literacy), the ability to understand what is written as well as what is not written in the contract documents and the ability to recognise binding, contractual elements in business communication and relationships.

Pohjonen (2003) approached contracting capabilities from a contracting process point of view. According to Pohjonen (2003), contracts are an integral part of business, and thus, contract literacy is something that all personnel involved in businesses should manage (Haapio, 2013; Pohjonen, 2003). Leaving contracts for only lawyers to handle separates contracting from operational business relationship and prevents the contracting process from contributing to business objectives. This is also acknowledged in traditional management research; Argyres and Mayer (2007) argued that in addition to lawyers, managers and engineers should also contribute to project contracts.

Nystén-Haarala (1998) addressed the contradictions between contract law and business contracting in practice. She discussed the principal difference in how they approach contracting. Business people seek to contract in order to make business deals and conduct business transactions. They see contracting as an *ex ante* activity, practical agreements that need to be taken care of to start or to retain business relationships (e.g., Macaulay, 1963; Macneil, 1978). Contract law, however, always considers contracts *ex post* (Nystén-Haarala, 1998). Contract law is written to solve disputes; one of the main purposes of law is to legislate and deliver dispute resolutions. Because of this basic nature of law, lawyers are also educated to

perform utilising an ex post approach (Barton, 2008, 2009; Barton & Cooper, 2000; Haapio, 2006a; Siedel & Haapio, 2010). The ex post approach is used in courtrooms, but lawyers tend to use a similar approach in business contracting. They focus on including safeguard clauses into contracts and prepare to win in court in case of a major dispute (Nystén-Haarala, 2006).

The majority of scholars representing proactive contracting suggest corporate lawyers should serve business objectives instead of prepare for possible litigation. This argument is based on the relational contract theory initiated by Macaulay (1963), who argued that business people want to avoid bad reputation in business and, for this reason, companies rarely go into litigation. This observation is repeated by Macneil (1978), who also acknowledged the need for flexibility and change over the course of commercial relationships. Companies can either resist the change, use the original agreement as a reference point and try to win their cases or use the business relation as a reference point and try to find a mutually agreeable solution for the situation in question (Macneil, 1978). The last option seems to be the preferred approach by companies in practice. Lumineau and Oxley (2012) studied severe disputes between contracting parties and found out that even in a case of serious conflict, companies still tried to avoid litigation and looked for a private dispute resolution. Proactive contracting literature suggests that companies should proactively prepare for contingencies; they should use the contracting process and contracts as tools to increase cooperation, facilitate business performance and enable flexibility when the need for change occurs (Barton, 2008; Haapio, 2013; Nystén-Haarala et al., 2010; Pohjonen & Visuri, 2008; Siedel & Haapio, 2011; Tayyeb, 2014).

2.3 Agile development methods

Agile development methods are an evolutionary solution developed gradually along the fast growth of software products to increase the efficiency of software development and to be able to serve customers with products they need. The nature of software as a commercial product enabled certain flexibility in managing development projects and also required different types of project management approaches, compared to projects in other industries.

2.3.1 History of agile methods

Software development is characterised by a high volume of projects. The vast majority of work related to developing and producing software is projectised. Originally, software development projects were managed similarly to traditional industrial projects (Benington, 1983; Boehm, 1976; Liu & Horowitz, 1989; Royce, 1970). A software development model was organised accordingly, and thus, the first systematic and sequential software development model, the waterfall model, defined different project tasks in separate, isolated stages (Boehm, 1976, 1986, 1988; Royce, 1970; Warsta, 2001). It specified subsequent tasks required to create software products from an idea to operational delivery (Benington, 1983; Royce, 1970). The waterfall model was well organized, but it was also rigid. It prevented simultaneous activities, and a previous stage was always to be completed first before it was possible to get started on the following one (Benington, 1983; Boehm, 1976; Royce, 1970). The waterfall model is illustrated in Figure 2.

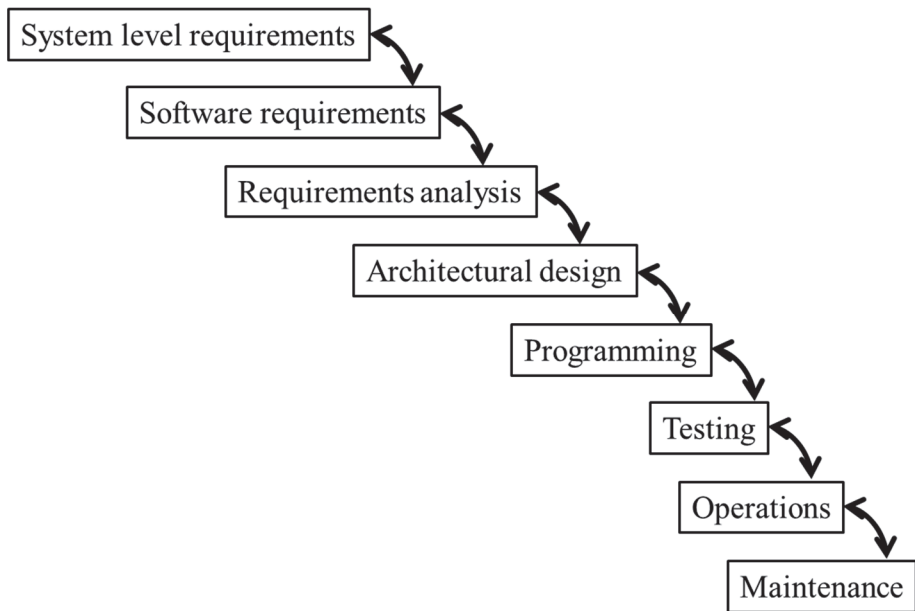


Fig. 2. A generic waterfall model.

The sequential form of the waterfall model turned out to be one of its weaknesses, as sequentiality made the model ineffective and inflexible. The waterfall model

assumed that the product requirements were known from the beginning of a project and required lots of documentation, and the change management was bureaucratic and slow (Boehm, 1986, 1988; Curtis et al., 1987; Davis & Sitaram, 1994; Warsta, 2001). To overcome these challenges, software practitioners started to invent software-specific development models. Several ideas and proposals followed this work: the iterative approach (Basili & Turner, 1975), incremental development (Mills, 1976), the spiral model (Boehm, 1986, 1988) and the concurrent process model (Aoyama, 1993; Davis & Sitaram, 1994) were introduced in the following years. All these ideas paved the way for agile development methods. Mills (1976) was already at the very core of agile methods, as he stated, “Software development should be done incrementally, in stages with continuous user participation and replanning” (p. 265). These fundamental principles of yet-to-be-born agile methods became common in several software development methods in the 1990s. Lightweight methodologies such as adaptive software development, XP, Scrum and Crystal focused on developing features customers needed without the burden of heavy processes and project management (Cockburn, 2002; Rising & Janoff, 2000). After several years of experiencing light software development methods, the creators and other experts of these methods organised a meeting which resulted in the declaration of the Manifesto for Agile Software Development (the Agile Manifesto) in 2001 (Beck et al., 2001; Cockburn, 2002; Highsmith & Cockburn, 2001).

The Agile Manifesto was not a precise description of a software development method. It was a value statement based on practice and experience in order to publicly agree on a common ground on how to organise software development towards increased customer satisfaction (Beck et al., 2001; Cockburn, 2002). Originally, the Agile Manifesto was a summary of the common values of its creators (Beck et al., 2001):

We are uncovering better ways of developing software by doing it and helping others do it. Through this work we have come to value:

- **Individuals and interactions** over processes and tools
- **Working software** over comprehensive documentation
- **Customer collaboration** over contract negotiation
- **Responding to change** over following a plan

That is, while there is value in the items on the right, we value the items on the left more.

In addition to the four fundamental values of the Agile Manifesto, the group of founding members of the Agile Alliance agreed on 12 principles to support the fundamental values (Cockburn, 2002). These principles give guidance on organizing software development and related project as well as guidance on aiming for high customer satisfaction, good communication and continuous improvement. Since the declaration of the Agile Manifesto, agile methods have gained vast popularity among technology industries developing software.

2.3.2 Research status of agile methods

Research related to agile methods has been very practice-oriented and focused mainly on the agile methods, software development techniques and inner issues of development teams. There is a challenge of present agile literature not being integrated with management science and project management literature. Thus, there exists only a few studies on the management of organisations utilizing agile methods and the implementation of agile methods at the organisational level (Abrahamsson, Conboy, & Wang, 2009). In addition, scholars have identified a need to explore the role of agile approaches for the management of projects (Gemünden, 2015). Furthermore, Conforto et al. (2016) suggested that agility “might be dependent upon a combination of organisation, team and project factors” (p. 660). There are several studies on agile techniques and methods, but scholars agree on a need to study more on managing agile organisations and managing agile projects.

2.3.3 Literature on agile methods

This dissertation focuses on the issues related to project management of agile projects and organisations. This focus is reflected in the literature of agile methods found relevant to the topic. After reviewing nearly 200 publications on agile methods, there were approximately 50 publications found relevant to the research setting in this dissertation. A publication was considered to be relevant if it discussed the fundamental principles of agile methods, managerial considerations of agile methods, challenges of adopting agile methods or agile projects contracting. These publications are summarized in Table 4.

Table 4. Literature on agile methods utilised in this dissertation.

Topic and key concepts	Reference
Agile methods, values and implementation.	Abrahamsson, Salo, Ronkainen, & Warsta, 2002; Adolph et al., 2012; Cockburn, 2002; Cockburn & Highsmith, 2001; Conboy, 2009; Dingsøy, Moe, & Seim, 2018; Dybå & Dingsøy, 2008, 2009; Highsmith & Cockburn, 2001; Iivari & Iivari, 2011; Martin, 2003; Misra et al., 2009; Rising & Janoff, 2000; Ramesh, Mohan, & Cao, 2012; Senapathi & Srinivasan, 2012; Strode, Huff, Hope, & Link, 2012; Tate, 2006; Vijayarathy & Turk, 2012.
Challenges in software development and projects.	Cerpa & Verner, 2009; Charette, 2005; Kwak & Stoddard, 2004.
Agile adoption, challenges of small teams adopting agile methods.	Asnawi, Gravell, & Wills, 2011; Boehm & Turner, 2005; Cao, Mohan, Xu, & Ramesh, 2009; Conboy, Coyle, Wang, & Pikkarainen, 2011; Chow & Cao, 2008; Mangalaraj, Mahapatra, & Nerur, 2009; Tolfo, Wazlawick, Ferreira, & Forcellini, 2011.
Agile adoption, challenges of large organisations adopting agile methods.	Atkinson, 2010; Bowers, May, Melander, Baarman, & Ayoob, 2002; Kärkkäinen, 2012; Lindvall et al., 2004; Mahanti, 2006; Pikkarainen, Salo, Kuusela, & Abrahamsson, 2012; Ramesh, Cao, Mohan & Xu, 2006; Sarker & Sarker, 2009.
Agile project management.	Augustine, Payne, Sencindiver, & Woodcock, 2005; Conforto et al., 2014; Conforto et al., 2016; Coram & Bohner, 2005; Karrbom Gustavsson & Hallin, 2014; Karlesky & Vander Voord, 2008; Kwak & Stoddard, 2004; Larman, 2004; Nerur, Mahapatra, & Mangalaraj, 2005; Serrador & Pinto, 2015.
Agile software development, contracting.	Atkinson, 2010; Eckfeldt, Madden, & Horowitz, 2005; Ramesh et al., 2012; Sidky et al., 2007.
Agile projects, governance.	Drury, Conboy, & Power, 2012; Lappi, Karvonen, Lwakatare, Aaltonen & Kuvaja, 2018; Larman, 2004; Moe, Aurum, & Dybå, 2012; Nerur et al., 2005.

The key concepts of agile methods and agile implementation are presented next based on the selected literature listed above.

2.3.4 Agile implementation

There are several agile methods implemented for software development. One of the most common agile methods is Scrum (Schwaber, 1995), which was created in the early 1990s. A Scrum-based agile development method is illustrated in Figure 3.

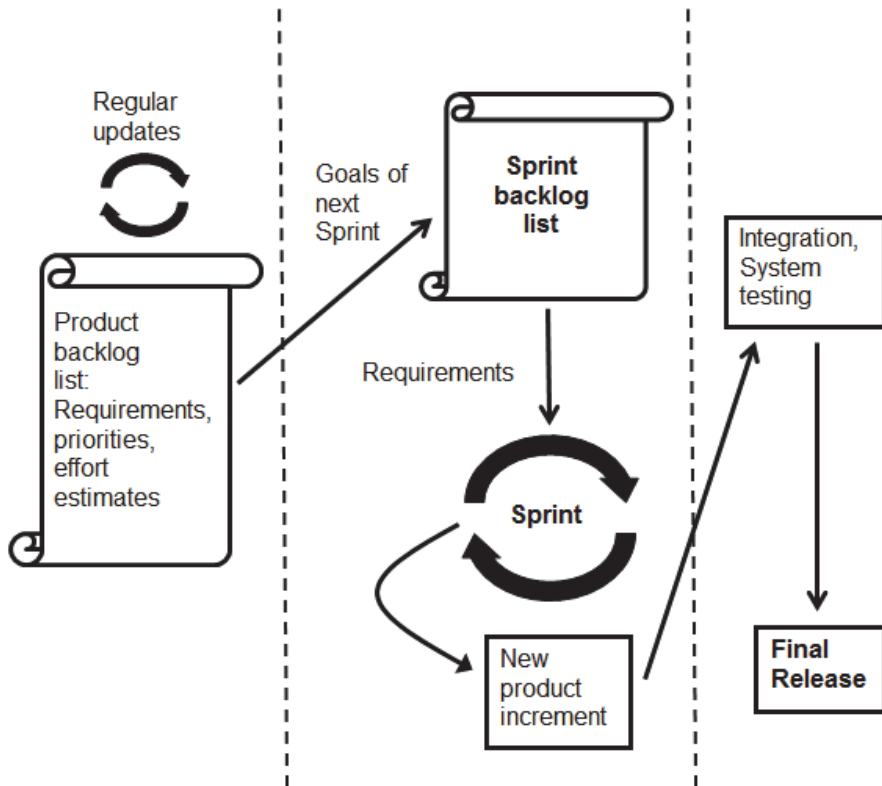


Fig. 3. An agile development model (Scrum) (Reprinted by permission from Publication II © 2015 Authors).

A product backlog is a list of customer feature requirements which is regularly updated in dialogue with a customer (Abrahamsson et al., 2002; Schwaber, 1995). In an agile development project, there is the role of the product owner (PO), who is responsible for communicating with a customer and updating the product backlog. The PO also gives a priority for each requirement and regularly reprioritizes requirements based on the information from the customer (Boehm & Turner, 2005). The backlog also includes work effort estimates for each requirement; this estimation is done by the scrum master (SM), the software

architect and the agile development team (Abrahamsson et al., 2002; Coram & Bohner, 2005). This process of continuously defining and prioritizing requirements during the project (on the left side in Figure 3) is called a pregame phase (Schwaber, 1995).

The programming work and actual software development are done in sprints. A sprint is a period of implementation which usually lasts a couple of weeks. Based on the priorities and work effort estimates, the agile team decides on the features it would include in a sprint backlog list for the following sprint (Coram & Bohner, 2005). This decision freezes the sprint backlog list for the duration of the whole sprint, and there will be no more changes or additions before the next pregame (Adolph et al., 2012). After each sprint, the preselected product features is completely implemented, and they can be integrated into the product increment (Bowers et al., 2002; Coram & Bohner, 2005). The sprint and related activities are called the game phase (Schwaber, 1995).

The features completed in a sprint is added to a new product increment, which will be integrated into an existing version of the operational product (Boehm & Turner, 2005; Coram & Bohner, 2005). After customer approval and system testing, this sub-release is delivered to production and can be taken into use by customers (Cao et al., 2009; Vijayasarathy & Turk, 2012). This process (on the right side in Figure 3) is called the postgame phase (Schwaber, 1995). Finally, after several iterations of sprints, the final product release is completed and the development project can be taken into conclusion.

2.3.5 Value statements of the Agile Manifesto

The four value statements of the Agile Manifesto emphasize individuals and interactions, a working software, customer collaboration and response to change. These values are originally based on the practical experience of software development projects, and they include beliefs which are in some areas quite contradictory to the assumptions of traditional project management literature.

The first statement, “Individuals and interactions over processes and tools,” emphasizes the skills and expertise of individuals. It is during the interaction between individuals that value is co-created, and thus, the quality of interaction is important (Cockburn, 2002, p. 217).

The second statement, “Working software over comprehensive documentation,” emphasizes the results delivered to the customer throughout the project. The working software system, executable code running flawlessly, is the only reliable

proof of what was actually built in the project (Cockburn, 2002, p. 217). Extensive planning documentation or hours put into the project guarantee neither successful implementation nor customer satisfaction in the project.

The third statement, “Customer collaboration over contract negotiation,” emphasizes the importance of customer involvement in software development projects. Open and fast communication contributes to an amicable relationship between project parties, which is important to be able to innovate together towards a high-quality software product (Cockburn, 2002, p. 217).

The fourth statement, “Responding to change over following a plan,” emphasizes the importance of refocusing the development efforts while performing the project after gaining new knowledge and understanding during the development (Cockburn, 2002, p. 218). The customer has the authority to add and change feature requirements between the sprints and reprioritise them in the backlog.

In addition to the 4 value statements upon which the creators of the Agile Manifesto easily agreed, 12 more detailed value statements, or principles, were announced (Beck et al., 2001; Cockburn, 2002; Fowler, 2006). The creators, 17 leading software specialists at the time, announced the principles as guidance on how to implement the value statements in software projects (Cockburn, 2002; Fowler, 2006). There are some principles, which are especially interesting compared to the assumptions and beliefs of traditional project management literature: “Welcome changing requirements, even in late development. Agile processes harness change for the customer’s competitive advantage,” “Business people and developers work together daily throughout the project” and “The best architectures, requirements, and designs emerge from self-organizing teams” (Beck et al., 2001; Cockburn, 2002, p. 220–221). Some practices of agile approach in software projects are conflicting to the ones of traditional project management. A key reason for this is that the tradition of project management evolved with investment-intensive projects requiring machinery and manufacturing.

2.4 Project management in traditional projects

Project management is one of the most important activities in corporations and society to ensure that large industrial investment projects will reach their goals and targets. The purpose of project management in investment-intensive industries has been to plan, coordinate and control project activities (Atkinson, 1999; Gaddis, 1959; Lock, 1992; White & Fortune, 2002). This kind of projects typically tie up a lot of resources, and thus, it is important to manage allocations of resources and

personnel during the project. Large industrial projects usually deliver a final product, which consists of several separately manufactured components. While a project's goal is to deliver a large physical product, it is crucial to plan the schedule of manufacture and assembly so that they will not delay the project.

Project management of large industrial projects also tends to be reluctant to allow changes during the implementation phase. Lundin and Söderholm (1995) describe the desired project implementation phase by saying, "The whole operation should proceed like a train ... without any unwanted stops" (p. 448). Traditional project management seeks to minimise and manage risk and uncertainties during the implementation (Dvir & Lechler, 2004; Lenfle & Loch, 2010; Lock, 1992; Morris, 1997). Conversely, the literature recognises that projects typically include several sources of uncertainty, and thus, changes are inevitable in projects (Atkinson, Crawford, & Ward, 2006; Bröchner & Badenfelt, 2011; Hanisch & Wald, 2011). Agile software projects are even intentionally left to include unknowns and uncertainties for the implementation phase as described above. Despite acknowledging this, the literature often focuses on the traditional management approach and does not recognise different types of projects (Packendorff, 1995) and different project contexts (Hanisch & Wald, 2011). Only recently, the literature dedicated to project management issues has acknowledged agile projects more widely (e.g., Conforto & Amaral, 2010; Conforto et al., 2014, 2016; Dingsøyr et al., 2018; Hobbs & Petit, 2017; Lappi et al., 2018).

2.5 Literature summary

The key concepts of proactive contracting and agile methods are presented above. The literature on proactive contracting suggests that companies should proactively prepare for contingencies; they should use the contracting process and contracts as tools to increase cooperation between project parties. Proactive contracting literature also claims that this approach will facilitate business performance and enable flexibility when the need for change occurs. The literature on agile methods is widely scattered, mainly focusing on practical implementations and software engineering perspectives. The adoption rate of agile methods in the software industry confirms the practical benefits of agile methods, but there are no consistent, established management literature or project management literature connecting this to theory building. The literature on agile methods suggests optimized working practices for software projects; the co-creation of value in close collaboration with customer and project parties throughout the project, allowing changes as natural

consequences of learning in the project; and the deployment of software for use as early as possible during the project. The key concepts of proactive contracting and agile methods drive change to traditional project management; this dissertation seeks to contribute to this area of multidisciplinary scientific discussion.

3 Research contribution

3.1 Flexibility in project contracting

Publications I and II explore flexibility in project contracting. Publication I is a conceptual paper and approaches flexibility as a technique to manage uncertainty in projects characterized by a high level of complexity and uncertainty. Traditional project management seeks to complete the project plan before the project starts by defining the tasks and responsibilities required in the project. Similarly, traditional project contracting seeks to define the responsibilities of all related tasks in detail as part of negotiations. This traditional approach assumes that all project deliverables, or the end product with all related tasks to make it, are known and can be specified in the project contract. During the project, it is then one of the project management activities to monitor and control the implementation of specified tasks and ensure that responsible parties take care of the tasks allocated to them. This approach, however, faces serious challenges with projects creating unique and novel products that include complexity and uncertainty.

Proactive contracting literature suggests that project contracts including flexibility can be used to overcome the challenges caused by complexity and uncertainty regarding project implementation (Haapio, 2006b; Nystén-Haarala et al., 2010; Siedel & Haapio, 2010). Proactive contracting claims that project contract can be aligned with the subsequent business model and the project in question. A project contract could contribute in decreasing the negative effect of uncertainty by not focusing on safeguarding one's legal position but by increasing the cooperation between project parties and preparing the joint adjustment of actions in case of contingencies. This would also increase the relevance of the contracting process and project contract to project planning and the actual implementation phase of the project. The traditional separation of contract preparation by lawyers and business relationship maintenance by business people does not acknowledge the fact that a contract is an evolving object. It is not just a formal, written document; it is also gradually developed by oral agreements, specifications, informal written communications and management handshakes. Many of these contract elements are legally binding, but in case of not being legally binding, they create commitments that business people respect, thereby creating the psychological demand to behave according to the agreement. These contract elements are illustrated in Figure 4 as part of the project contracting process.



Fig. 4. Contracting process and contracting elements in different phases of the project lifecycle (Reprinted by permission from Publication I © 2015 Emerald Group Publishing Limited).

Publication I studies the contract formation during the project lifecycle from business and legal perspectives. Based on proactive contracting literature and illustrative examples from the software industry, Publication I suggests two approaches to implementing flexibility in the contracting process and project contract. First, postponing the decisions until there is adequate information for decision-making, and second, making decisions that allow flexible adaptation to changes during the project lifecycle. Flexibility, implemented as suggested, allows a proactive and deliberate approach to managing complexity and uncertainty in projects. However, the use of flexibility requires project parties to develop a contract beyond safeguarding and approach the contract as a business tool to increase cooperation and manage uncertainty.

Publication II continues to examine flexibility. The focus of the study is agile software projects and practices to increase flexibility in agile projects. The research data covered the contracting process of agile projects and project practices during the implementation phase. The study found that a signed contract in agile software projects typically is a framework agreement or a framework contract between the project parties on project practicalities and governance defining main responsibilities and, most commonly, the price per hour. Project parties agree on a mutual goal for the project with a high-level definition of the product to be created in the project. The detailed scope of the product, including detailed feature requirements, is then a co-creational activity utilizing the most suitable resources from project parties throughout the project. Frequent and regular interactions between project parties make it possible to make project-related decisions at the most optimal moment. The core technical team meets on daily basis following the

agile meeting practices. A larger meeting is organized after each sprint to have a follow-up on already implemented features and discuss the next phases. Thus, the agile methods and related project contract enable project parties to continuously renegotiate and redefine project deliverables. Similarly, these practices allow project parties to agree on required changes on project scope and features to maximize the value created in the project. The effect of agile methods on the traditional project contracting process is illustrated in Figure 5.

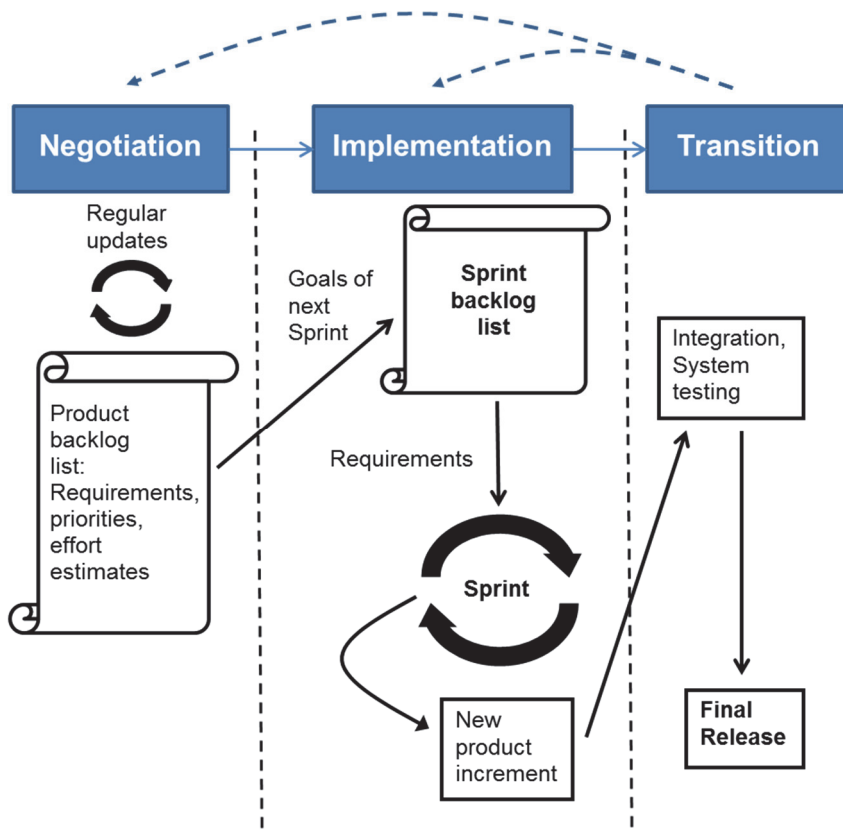


Fig. 5. Renegotiation of agile methods (Reprinted by permission from Publication II © 2015 Authors).

Based on the study, agile methods increase flexibility in software projects, as project parties voluntarily and intentionally leave negotiable items open for later phases in order to avoid misguided decisions at the beginning of the project. They

also accept changes as an inevitable result of continuous learning during the project and use the changes to increase the value of the project. The study identified activities in agile projects supporting two flexibility approaches suggested in Publication I. These are presented in detail in Table 5.

Table 5. Flexibility approaches in agile development projects (Reprinted by permission from Publication II © 2015 Authors).

Postpone decisions to reach adequate information	Allow flexible adaptation to changes
Detailed list of features for each software release decided on during the project implementation phase	The list of features for each software release can be changed based on the priority change, technical reasons etc.
The customer can influence project personnel during the project	The customer is allowed to set new requirements and change the old ones in the meetings after each sprint
Product specification, in detail, is done during the project implementation phase incrementally	

Product backlog is a feature requirement inventory of software projects utilizing agile methods. It is a database where all possible product features are stored. The features are prioritized by customers, and based on the prioritization, the features are taken for implementation in a sprint planning meeting. The meeting and negotiation practices of agile methods make it possible to allow the flexibility approaches presented in Table 5. Based on the latest knowledge on technology choices, usability, user studies, market situation and stakeholders, customers can add, remove and change features in the product backlog. Customers can also change the order of feature implementations in any of the sprint meetings. An additional finding in the study was that the cohesion of an agile team was thought to be an important issue. Thus, the customer was given the authority to influence project implementation personnel during the project. Agile teams were jointly selected by project parties, and later, the customer was provided with an option to change the team members to increase cohesion or bring along some specific expertise.

3.2 Project contracts and lawyers' contribution

Publication III explores the role of lawyers contributing to project contracts. The literature has recognised that business managers and lawyers may have different

approaches to contracting; managers tend to emphasize relational aspects, while lawyers tend to emphasize legal aspects (Macaulay, 1963; Macneil, 1978; Haapio, 2013; Nelson & Nielsen, 2000; Nystén-Haarala, 1998). Because of this, tensions may arise in contracting collaboration between managers and lawyers, while the optimal result in contracting can be achieved by combining both aspects to facilitate business goals and minimise contracts risks (Haapio, 2013; Pohjonen & Visuri, 2008; Siedel & Haapio, 2011; Tayyeb 2014). Based on a survey among contracting professionals representing various businesses, the research data were analysed to identify differences in views and expectations towards the lawyers' role in contracting by managers and lawyers. The results are presented in Figure 6.

In the survey, there were five statements regarding the role of lawyers and business-oriented people in contracting and the cooperation of lawyers and business people in contracting. In the two, there were no statistically significant differences between the responses by lawyers and managers. Three questions, however, demonstrated significant differences between their responses. First, there was a statement: "In our business, lawyers and business personnel collaborate effectively." Most of the lawyers (84%) agreed that business people and lawyers collaborate effectively, whereas 56% of the managers agreed. Second, there was a statement: "In our business, lawyers rather than business personnel design and draft contracts." Again, most of the lawyers (52%) agreed with the statement, but only 27% of the managers shared this perception. Finally, there was a statement: "Lawyers rather than business personnel should have the primary role in drafting contracts." Over half of the lawyers (52%) agreed with this statement, whereas 22% of the managers thought that lawyers should lead the contract design. These results indicate that lawyers' perception of their collaboration quality with business people is more positive than how managers experience the situation. Similarly, a bigger portion of lawyers than managers think that the lawyers' role is essential in drafting contracts.

In the survey, there were also four statements regarding the role of lawyers and business-oriented people in resolving disputes. The questions focused on how often lawyers and managers participate in dispute resolution. The results are presented in Figure 6 and Figure 7. There is a shared understanding among lawyers and managers that business people play an important role in resolving disputes. The majority of respondents agreed that business people have an important role in avoiding and solving situations of disagreements among project parties.

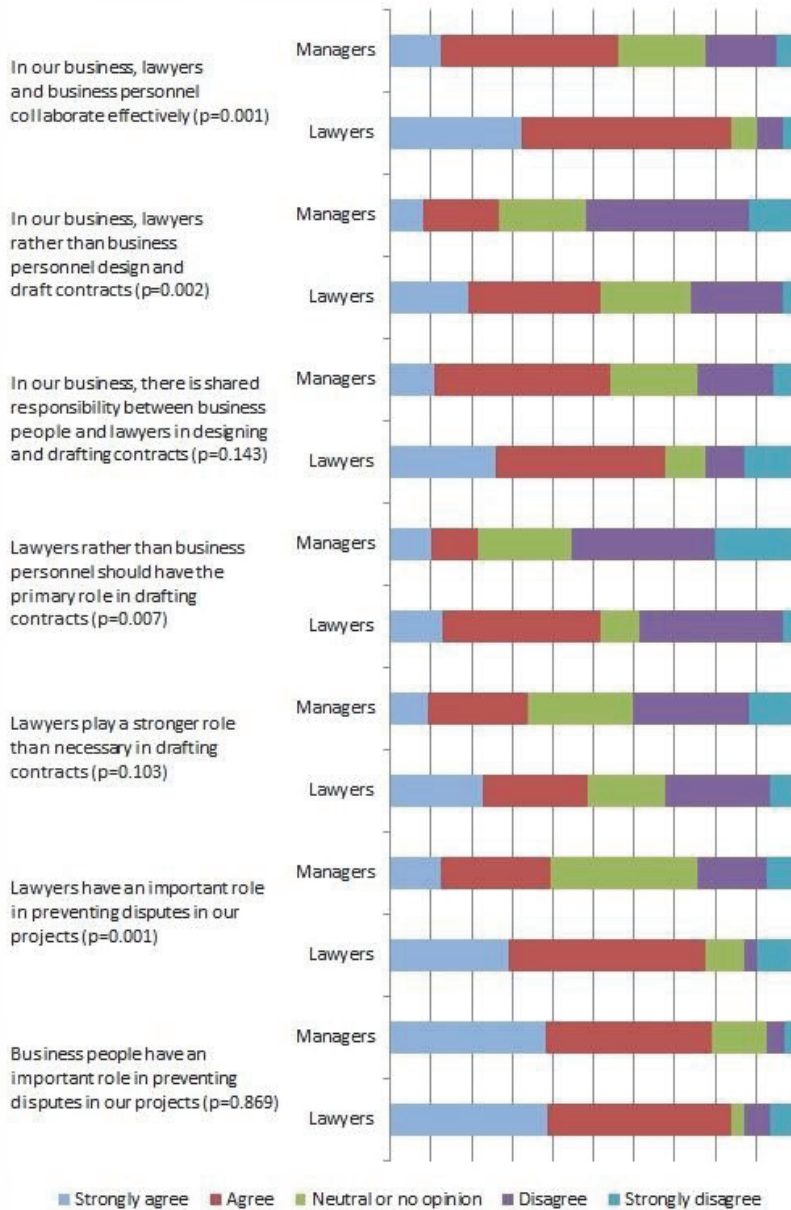


Fig. 6. Lawyers' role in contributing to project contracts: Perceptions of business managers and lawyers. The p-values represented the Mann–Whitney U-test for each statement (Reprinted by permission from Publication III © 2016 Authors).

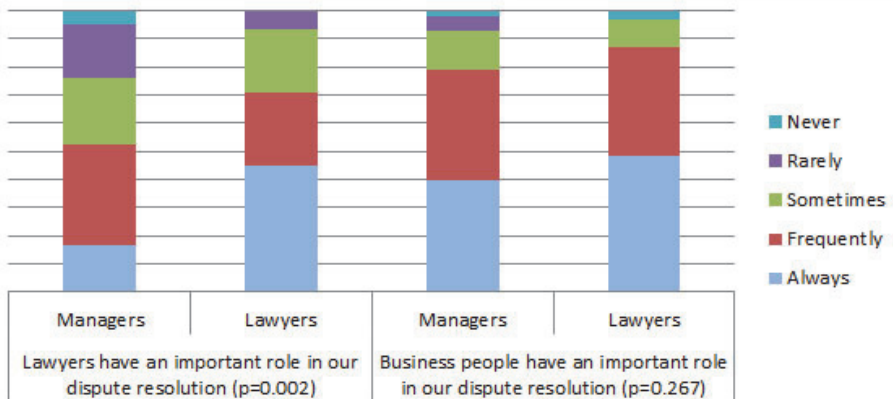


Fig. 7. Roles of lawyers and business people in resolving disputes: Perceptions of business managers and lawyers. The p-values represented the Mann–Whitney U-test for each statement (Reprinted by permission from Publication III © 2016 Authors).

However, there were differences in perception between managers and lawyers when it came to the role of lawyers in preventing disputes and resolving disputes. A bigger portion of lawyers than managers saw the lawyers’ role as important in preventing and resolving disputes. This is in line with other results of the study; lawyers value their contribution in contract design and contracting higher compared to the perceptions of business managers.

3.3 Challenges of adopting agile methods

Publication IV studies the challenges a public organisation, Agency, faces while adopting agile practices for software projects and software contracting. The literature rarely covers public organisations as agile adopters. This may be because public organisations have only recently started to utilise agile practices, and thus, research has focused on early adopters and large corporations. Some studies have discussed the topic. Asnawi et al. (2011) found out that some companies struggled to use agile methods for government projects. This was because governmental organisations were unfamiliar with agile practices. Kärkkäinen (2012) recognised difficulties in public agile project procurement. While a public organisation was planning to use agile methods, this was not visible in procurement announcements, which created confusion in procurement. Kärkkäinen (2012) also pointed out that it is not enough to generally agree on the usage of agile methods in a public project, but before the project is started, there should be an agreement on which agile

method will be used and how the roles will be defined and allocated. Based on the case study analysis, Publication IV reports the challenges that the public organisation faced while adopting agile methods. There were seven main categories of challenges identified. These challenges are presented in Table 6.

Table 6. Identified challenges of agile adoption in a public organization (Reprinted by permission from Publication IV © 2016 SciKA).

Identified challenge	Explanation
1.1 Documentation	Finding the right balance of documentation was challenging. One of the agile principles is “working software over comprehensive documentation,” but in a large public organization, there is a need to widely share information. Also, while the development team was working remotely, the requirement for documentation was more important.
2.1 Education, experience and commitment <i>Organizational readiness and commitment</i>	The ICT department initiated the adoption of agile practices. In other organizations, some people felt that the agile methods were brought in by the ICT department/management and, thus, that the planning and readiness were inadequate at the beginning. Change management in the transfer from the waterfall approach to the agile one was challenging.
2.2 Education, experience and commitment <i>Personnel education and commitment</i>	The introduction of agile methods was started by initiating PO training and training sessions on agile methods. However, when more teams and individuals were exposed to agile methods, some people thought that the agile methods were quickly introduced and, thus, the education and training was inadequate at the beginning. Many people needed to learn new skills in addition to their earlier area of responsibilities.
2.3 Education, experience and commitment <i>Agile knowledge, awareness of the method and experience</i>	The waterfall method is strongly based on specifications and documentation. Agile methods rely on fluent and continuous communication, trust and good cooperation. This continuous involvement and rhythm of planning caused challenges in the public organisation.

Identified challenge	Explanation
3.1 Stakeholder communication and involvement <i>Agile planning vs. stakeholder communication</i>	The software systems of the public organisation and the stakeholders were interdependent. The implementation plans needed to be anticipated early enough to allow all of the related organisations to make the changes needed. However, based on the agile planning principles, the interfaces were not defined early enough to be able to communicate the interfaces to the stakeholders as early as necessary.
3.2 Stakeholder communication and involvement <i>Flexible changes allowed by agile methods vs. stakeholder communication</i>	Agile practices accept changes in the plans during the project; the order of implementation can be changed or some features can be dropped. If any of these changes require stakeholders to change their implementation, it is a challenge, as stakeholders will be informed late.
3.3 Stakeholder communication and involvement <i>Agile processes vs. stakeholder involvement</i>	Agile planning and specification work was done incrementally during the project, and thus, it was challenging to involve stakeholders in the planning. Also, because of the incremental feature release cycle of agile methods, it was a complex task to involve customers and end users in pilot testing.
4.1 Roles in an agile setup <i>Role of the PO</i>	It is important for the successful implementation of agile methods that the PO is available to the agile team and is able to provide the team with clearly defined user stories/requirements in a timely manner, contribute to the prioritization of user stories in the backlog and support the team when they are deciding the activities for the next sprint. The PO role was totally new to many people; they had a lot of other tasks to perform simultaneously, and they were not used to close cooperation with the development team. Forming such a close working relationship with a vendor was also a new way of working for a public organization.

Identified challenge	Explanation
<p>4.2 Roles in an agile setup <i>Multiple interfaces of PO</i></p>	<p>The PO takes care of the responsibilities of requirement definitions and prioritization. The PO, however, collects the input from several business area owners, technical experts, legal advisors etc., so there is dependence between the contribution of the PO to the agile team and the availability of internal stakeholders and the information they provide.</p>
<p>4.3 Roles in an agile setup <i>Business PO vs. ICT PO</i></p>	<p>Agency utilizes two POs in agile projects: the business PO is responsible for business requirements, and the ICT PO is responsible for system requirements and technical questions. This approach can create confusion in the agile team on product ownership and responsibilities.</p>
<p>4.4 Roles in an agile setup <i>Project manager vs. business PO</i></p>	<p>Traditionally, a project manager owns the project budget, but in agile projects, there is a PO who manages the budget and uses it for the features prioritized for each sprint. Agency utilizes the model of an administrative project manager and a business PO in agile projects, which does not exactly follow the agile principles and might create conflicting situations between the roles.</p>
<p>4.5 Roles in an agile setup <i>SM vs. Business PO</i></p>	<p>The SM and the PO are the key roles in agile methods and determine if the project is managed successfully. The PO is responsible for defining what is to be implemented, and the SM is responsible for the implementation. In the beginning, the agency had some challenges with the cooperation between these central roles.</p>
<p>5.1 Location of the agile teams</p>	<p>Agency also has experience in a project in which an agile team and an SM were working remotely from a separate location. Although virtual communication tools were available, it was difficult to organize the agile development remotely, and the cooperation was not on the same level as the co-located teams.</p>

Identified challenge	Explanation
<p>6.1 Legislation</p> <p><i>Public Procurement Act</i></p>	<p>The Public Procurement Act prevents the usage of the past experience of cooperation or personal opinions in the evaluation of bidding companies. The objective of the Public Procurement Act is to guarantee a fair and neutral position for all companies participating in the bidding. Any possible long-term relationship between a public organisation and its vendors cannot put any vendor in a favourable position in the procurement process. However, as the successful implementation of agile methods builds trust and good dialogue between organizations, this type of legislation can be a hindrance for the most optimal vendor selection.</p>
<p>6.2 Legislation</p> <p><i>Information sharing</i></p>	<p>There are also some peculiar consequences for project implementation because of the Public Procurement Act. In the worst case, it prevents information sharing to all stakeholders, as would be necessary. This is a challenge, as agile methods are based on open communication and information sharing.</p>
<p>6.3 Legislation</p> <p><i>Timing of new legislation</i></p>	<p>The public organisation developed new and updated digital services which were based on new or changed legislation. There was a predetermined date when laws come into effect, and any corresponding digital services needed to be available immediately. This set a target date for a software project, as it usually was set for a project utilizing the waterfall development method. However, agile methods usually use continuous integration, and this difference in approaches can affect agile project dynamics.</p>
<p>7.1 Complexity of software (SW) architecture and system integration</p> <p><i>Complexity of SW architecture</i></p>	<p>Agency developed digital services that have several user groups in the market, integrate with several backend systems and databases and are developed by several teams. Technically, this means that the SW architecture of those services is complex and has many interfaces and integrations. As agile methods were originally meant for rather small and isolated systems, the complexity of developed systems causes challenges in agile adoption.</p>

Identified challenge	Explanation
7.2 Complexity of SW architecture and system integration <i>Complexity of system integration</i>	Agency developed digital services and complex systems by subcontracting software projects. These services also use other backend systems and databases which were developed earlier. The integration of separate systems was done through technical interfaces which were maintained by several companies. There were bilateral service level agreements regarding the implementation of changes and upgrades needed for the systems and interfaces. This kind of complex environment is challenging for agile methods, which promote continuous and instant release and integration.

The case study organisation generally agreed that agile adoption was successful based on the monitored metrics in the organisation. It demonstrates that agile methods provide development potential for public organisations, even though there were major challenges identified in the study.

The research results confirmed a public agency facing similar challenges in agile adoption, as earlier reported related to private companies. Some of these challenges can be more severe for public organisations because of the additional requirements for them as public actors. There were also unique challenges for a public organisation identified in the study. The governmental regulation of procurement procedures can create hindering challenges in the adoption of agile methods, compared to the private sector. In addition, the development of large software systems often inherits technology dependences on external systems, and this can create complexities that make agile method adoption more difficult.

3.4 Organising and management of agile projects

Publication V examines a public software development project which utilised agile methods and analyses how this project was organised and managed. The analysis was done with a framework (Puranam, Alexy, & Reitzig, 2014) built to identify novelty in the forms of organising. The four areas of examination were task division, task allocation, reward distribution and information flows. The analyses of these universal problems of organising in the public organisation are presented in Table 7.

Table 7. The form of organising in the case project (Reprinted by permission from Publication V © 2017 Inderscience Enterprises Ltd).

Area of organising	Solution
Task division	It was centralised for the individuals holding the formal authority to conduct task division at Agency. Agency defined and owned the project budget and operated as a project owner. The project was started without a detailed feature specification, but a high-level architecture specification was a basis for detailed planning. Detailed planning was done in cooperation with SW vendor during the project. The business PO represents Agency's authority to decide on the features to be implemented.
Task allocation	Self-selection by the SM and the development team. The development team (SW vendor) self-organised itself for the development and implementation of development tasks prioritised by Agency. The development team reviews the feature requirements, splits them into smaller tasks and allocates them within the team based on skills and competencies and personal interest.
Reward distribution	Salaries and monetary compensations as determined by related firms. Additional intrinsic motivation in the development team, as individuals found it satisfying to be part of a team developing new and innovative products. SW developers also enjoyed the possibility to influence the tasks allocated to them and the possibility to learn about new technologies. A project contract, however, includes several sanction mechanisms for the situations where the SW vendor does not deliver according to the commitments and Agency has an option to change individuals in the agile team.
Information flows	Physical collocation first, followed by virtual support infrastructure and tools later. Still, Agency and the development team met and physically collocated for sprint meetings once every three weeks. However, Agency noticed that they needed to put more emphasis on communication. A training session was planned to align agile practices in a particular project. In addition, Agency planned to revisit their guidance and instructions on communication, as good communication skills were found to be essential for an agile project.

Based on the case study analysis, the areas of organising and related management were mainly familiar to earlier project management research. However, contrary to traditional project management literature, the self-organising teams in the agile project utilised autonomous task allocation. There were also some additional findings reported in the study. First, agile setup as a form of organising significantly

decreased administrative costs when compared to a traditional project setup used earlier. Second, productivity measures improved in self-organised agile teams, compared to traditional project setup. However, there were also challenges identified. It was found that the agile form of organising requires intense communication between project actors, and thus, physical collocation is preferred. Also, an open question of utilising reward distribution and incentivising project participants was identified. Based on the study, both reward distribution and incentives are under-utilised in the agile form of organising.

3.5 Results summary

There were two main objectives planned for this dissertation. First, there was a target to explore the nature of flexibility in agile software projects. In addition, there was a related target to study the challenges of project contracting and management in leveraging agile development methods. The research for this dissertation involved several main phases. First, flexibility in project contracting was studied theoretically and empirically (Publications I and II). Second, the role of lawyers was studied in regard to how lawyers contribute to project contracts (Publication III). And finally, a public organisation was studied while adopting agile practices to gain flexibility and efficiency. The research focus on this phase was on the challenges faced and changes implemented in organising for agile projects (Publications IV and V). Table 8 summarises the research findings.

The results indicate that flexibility can be introduced to project contracting and project management by allowing an alternative approach to traditional contracting and project management. Project parties can agree to postpone decisions until there is adequate information to support decision-making. Project parties can also agree on a smooth and pragmatic approach to allow changes in projects and agree on the change management process accordingly. These methods to increase flexibility have been used in agile software projects, as reported in this research.

Flexibility, as described above, needs to be planned by projects parties. This planning activity to enable flexibility already starts at the negotiation phase, and it is optimally summarised in the project contract. There is a direct link between project contracting and the possibility to utilise flexibility during the project implementation phase. If flexibility is not planned in project contracting and taken into project contracts, project parties are locked in by rigid contracts, and opportunities to utilise flexibility are not available. Thus, it is important that lawyers contributing to project contracts are aware and informed of business

contexts, project operating environments and best possible practices to manage projects. However, the results of this research indicate that lawyers and managers do not agree on how lawyers should participate and contribute to project contracts. Furthermore, based on this research, it is acknowledged that the roles of lawyers and managers in project contracting and cooperation between them might require re-evaluation in complex, high technology project business.

Table 8. Research findings.

Research question	Research findings
How can flexibility be implemented into the contracting process and project contracts to manage uncertainty?	<ol style="list-style-type: none"> 1. Postponing the decisions until there is adequate information for decision-making. 2. Making decisions that allow flexible adaptation to changes during the project lifecycle.
How do agile software projects implement flexible approaches into project contracting and project contracts?	<ol style="list-style-type: none"> 1. A detailed list of features for each software release decided on during the project implementation phase and product specification in detail done during the project implementation phase incrementally. 2. Features of each software release can be changed (e.g., in case of priority change or technical reason) and the customer is allowed to set new requirements and change the existing ones after each sprint.
What is the role of lawyers in contributing to project contracts?	The managers and lawyers had different perspectives on the lawyer's role in contributing to the contracting process and contracts. Managers expect lawyers to have a supportive role in contracting; lawyers, in contrast, would prefer a leading role. In addition, the lawyers saw their role as more essential in contracting than the managers did.
What are the challenges an organisation faces while adopting and utilising agile methods?	The identified challenges were related to a) documentation, b) personnel education, experience and commitment, c) stakeholder communication and involvement, d) roles in an agile setup, e) location of the agile teams, f) legislation and g) complexity of SW architecture and system integration.
What are the changes needed for a traditional project organisation to benefit from agile methods?	Contrary to traditional project management literature, autonomous task allocation in an agile, self-organising team was identified.

The results also indicate that agile methods can be used to increase flexibility and efficiency in software projects. However, when an organisation that used to operate with the traditional contracting process and traditional project management

approach starts to adopt agile practices, the change will not happen without complications. This research reports several categories of challenges faced in adopting agile practices and increasing flexibility in projects.

Finally, this dissertation focused on the organising and management of agile software projects. The most important finding was that contrary to the traditional project management approach, the self-organising teams in the agile project utilised autonomous task allocation. This finding indicates that in order to increase flexibility with agile practices, part of the decision-making authority is delegated to implementation teams. Implementation teams are authorised to make decisions regarding the product features and order of implementation based on continuous discussions with customer representatives. By taking some of the decisions closer to project implementation and implementation teams, the flexibility approaches introduced earlier can be utilised in practice.

This dissertation studied flexibility and agility as a form of flexibility in projects, project contracting and project management. The detailed results are presented above—focusing on flexibility, project contracting and the management of agile software projects. Based on these results, a cautious claim can be presented that flexibility implemented in the form of agile methods can positively influence project implementation and increase project efficiency in a complex operating environment with a lot of uncertainties in the planning phase of the project. This suggestion applies to the context of software projects; based on this dissertation, it is not known if the results are generalizable to other industries. Furthermore, the results indicate that in order to achieve a positive impact, project management practices require context-specific adjustments. Adjustments towards agile project management include updating the traditional assumptions of roles and responsibilities in the area of project management. Implications of this will also reflect in the area of organisational management. However, the concept of agile project management requires further clarity in the theory of project management, and more empirical research project management is needed in the context of software projects.

4 Discussion

This dissertation focuses on flexibility as it occurs in agile software projects. The study seeks to improve the understanding of how agile methods can increase flexibility in projects and what the issues to be considered in contracting and organising while managing agile projects are. This chapter summarizes the key contributions of the dissertation to the relevant literature.

4.1 Theoretical implications

This dissertation contributes to the emerging literature on agile project management. It is a recent discussion in project management. Scientific papers on agile project management have been published since 2005, but the topic has only recently gained a wider interest, with an increasing number of publications on it. Secondly, this dissertation contributes to proactive contracting literature. Discussion on proactive contracting started to emerge in the early 2000s and has recently widened to several practically applicable paths in business lawyering.

4.1.1 Agile project management

This dissertation extends the emerging literature on agile project management (Conforto & Amaral, 2010; Conforto et al., 2014, 2016; Dingsøy et al., 2018; Hobbs & Petit, 2017; Lappi et al., 2018). Publication IV studies the challenges a public organisation faces while adopting agile practices for contracted software projects. As a research result, Publication IV reports seven main categories of challenges, including several sub-categories. The challenges are comprehensively presented in Table 6.

The first category of challenges is related to the problem of finding the right balance of the level of documentation in the project. The Agile Manifesto emphasizes working software over comprehensive documentation, but it does not give guidance on the recommended level of documentation in projects (Beck et al., 2001). Drury and McHugh (2011) suggested that if agile projects use less documentation than traditional projects, it might lead to a situation in which project managers or project management teams make decisions regarding the project with incomplete information. Agile methods rely on constant communication between individuals, which means that someone in the agile team has the information needed, but Drury and McHugh (2011) referred to the situation when not all team

members are available in the meeting in which the decision is made. Team members might have moved on to other assignments, they might be temporarily unavailable or they might even have left the company involved in the project. It is also noted that agile methods usually rely on direct communication on a development team's level, but as multiteam development projects increase in complexity, there might be a need for a higher level of documentation (Stettina & Hörz, 2015).

The second category of challenges identified in Publication IV is related to education, experience and commitment to agile methods in an adopting organisation. Kalenda, Hyna, and Rossi (2018) reported a similar finding; they suggested that a lack of knowledge, coaching and training is one of the most common challenges in adopting agile methods in large organisations. Surendra and Nazir (2018) emphasized the importance of the practical use of agile methods in the learning process and suggested that the more experienced team members have an important role in educating others in organisations. A commitment to agile methods and processes by customer (Conforto et al., 2016; Serrador & Pinto, 2015), project management (Conforto & Amaral, 2010; Stettina & Hörz, 2015) and agile team members (Kalenda et al., 2018) is important in successfully adopting agile methods.

The third category of challenges relates to stakeholder communication and involvement. Conforto et al. (2016) have similarly identified stakeholders and acknowledged their needs to be important for project success. There are also research findings suggesting that agile methods increase stakeholder satisfaction (Serrador & Pinto, 2015). However, it is not clear if the parties identified as stakeholders in this particular study had software level integrations with an agile project in which they were identified as stakeholders.

The fourth category of challenges in adopting agile methods was the definition and actualisation of roles in an agile setup. Similar findings have been reported in recent literature (Hobbs & Petit, 2017; Kalenda et al., 2018). One of the biggest challenges in transitioning from the traditional project approach to agile projects is a radical change in how the customer is expected to behave (Hobbs & Petit, 2017). Instead of delivering feature requirements for a software product once at the beginning of the project, the customer needs to commit significant resources to the project, be constantly available and regularly clarify requirements and priorities (Hobbs & Petit, 2017). Large organisations may also keep project managers involved in agile projects even if most of the agile methods do not recognise the role of the project manager. This potentially creates the confusion of responsibilities between the project manager and the SM (Drury & McHugh, 2011;

Hobbs & Petit, 2017; Kalenda et al., 2018). A similar confusion is possible between the roles of the PO in an agile setup and the product manager in a traditional software project (Hobbs & Petit, 2017; Kalenda et al., 2018).

The fifth category of challenges identified in Publication IV is related to the location of the agile teams. Agile team members working in different locations was not identified as a major problem, but as agile methods rely on direct and constant communication, the physical collocation of team members was seen as more efficient. However, it is common that in larger agile projects, teams and team members work at several locations (Conforto et al., 2014; Drury & McHugh, 2011; Kalenda et al., 2018; Sutherland, Viktorov, Blount, & Puntikov, 2007).

The sixth category of challenges identified in the case study project was caused by legislation regulating public procurements. Legislation or recommended public procurement methods are not in favour of utilising agile methods. A similar finding has been reported in Australia (Jamieson, Vinsen, & Callender, 2005), in Italy (Russo, Taccogna, Ciancarini, Messina, & Succi, 2018), in Poland (Kaczorowska, 2015), in Northern Europe (Hekkala, Stein, Rossi, & Smolander, 2017), and in the US. (Balter, 2011).

The seventh category of challenges identified was the complexity of software architecture and system integration. The complexity of software architecture is characteristic of large software systems interacting with several other existing systems or simultaneously with the systems under development. Similar findings have been reported recently, especially regarding large software systems (Dybå & Dingsøy, 2015; Hobbs & Petit, 2017; Jahr, 2014; Sutherland et al., 2007).

Publication V studies the organising and management of agile projects in the public sector. The case project utilised agile methods, including autonomous task allocation by self-organising teams. The key empirical findings suggest that two important project indicators were improved in an agile form of organizing, compared to the traditional project setup used earlier. Administrative costs were decreased significantly, and productivity measures of development teams were improved. The finding of productivity increase is supported by literature (Ahmed, Ahmad, Ehsan, Mirza, & Sarwar, 2010; Dybå & Dingsøy, 2008, Iqbal, Omar, & Yasin, 2019; Serrador & Pinto, 2015). However, Melo, Cruzes, Kon, and Conradi (2013) identified several factors having an impact on team productivity in an agile form of organizing, which suggests that it is not only important to utilize agile methods, leading to greater productivity, but also important to consider how the agile approach is implemented. Team management and team design factors were found to be important for productivity as well as inter-team coordination in larger

agile setups (Melo et al., 2013). In addition, agile team member turnover was found to be a clear decreasing factor for productivity (Melo et al., 2013). Another important finding in Publication V was that reward distribution between organisations and incentives on the individual level are under-utilised in an agile form of organising. Risk-reward distribution schemes between project parties are widely discussed in project management literature (e.g., Adler, Pittz, & Meredith, 2016; Brady & Davies, 2014; Jaafari, 2001; Lahdenperä, 2016; Rose & Manley, 2010; Sarkar & Mangrola, 2016; Song, Zhu, Klakegg, & Wang, 2018; Vuori, Mutka, Aaltonen, & Arto, 2013; Wang, Cui, & Liu, 2018; Zhang & Qian, 2017), but reward sharing in software projects is not thoroughly discussed in literature. Recent discussions on alliance projects (e.g., Halman & Braks, 1999; Hietajärvi, Aaltonen, & Haapasalo, 2017; Walker & Lloyd-Walker, 2016, 2018; Young, Hosseini, & Lædre, 2016) suggest that sharing both risks and rewards between project parties is an efficient form of project contract to facilitate collaboration and align efforts towards common goals. Projects requiring new collaborative innovations with the owner and characterized by high complexity and an unclear scope will benefit from an alliance model (Young et al., 2016). Large software projects carry these characteristics, and it is possible there are synergies to be obtained by utilizing the alliance model in agile software projects (Lappi, Aaltonen, & Kujala, 2019). On an individual level, Melo, Santana, and Kon (2012) suggested that managing individual motivation in agile teams is a critical factor for project success. Beecham, Sharp, Baddoo, Hall, and Robinson (2007) found out that individual motivation was supported by agile methods' emphasis on social interaction, learning and open communication. Conversely, agile methods do not support individual recognition, career progress or the ability to work alone (Beecham et al., 2007). Melo et al. (2012) also found out that the feeling of accomplishment and the lack of bureaucracy are motivating factors for individuals in agile teams. Vinekar, Slinkman, and Nerur (2006) suggested that incentivisation in traditional projects is based on an individual reward system, while in agile projects, it relies on a team reward system. In addition, Lapham (2012) suggested that team rewards in the form of training or mentoring could be more efficient than monetary reward. Some agile teams have been reported to autonomously recognize individuals inside teams rewarding individuals verbally and informally (McHugh, Conboy, & Lang, 2011; Lapham, 2012). However, formal monetary incentives are also used for individuals and teams on agile projects (McHugh et al., 2011). Based on this study and the literature discussed above, the role of reward distribution and incentivisation requires more research, as the literature does not cover the topic comprehensively.

4.1.2 Proactive contracting

This dissertation complements the previous literature on proactive contracting (e.g., Barton, 2008; Haapio, 2013; Nystén-Haarala et al., 2010; Pohjonen & Visuri, 2008; Siedel & Haapio, 2011; Tayyeb, 2014). Publications I and II study flexibility in project contracting. The studies report empirical evidence that there are two flexibility approaches in agile software projects; project parties postpone decisions until adequate information is gained for making decisions and allow flexible adaptation to changes during the project. This finding verifies an earlier suggestion (Nystén-Haarala et al., 2010) that flexibility aspects in contracting are incorporated to support a specific business model. Similarly, Haapio (2006b) suggested that flexibility is used context-specifically in contracting. Barton (2015) additionally stated that while looking at contracting as a collaborative learning process, flexibility is a virtue rather than a weakness. Barton (2009) also suggested that new businesses of the Information Age require quick responses and flexibility in operations; thus, contracting parties may rely on relational aspects of contracts to achieve joint operational flexibility. This dissertation supports these suggestions by proactive contracting literature and verifies them empirically in the context of agile software projects. The literature also includes suggestions of flexibility being a risk factor in contracting. If contracting parties increase flexibility to adjust when contingencies arise, how can they control possible opportunism among other contracting parties (Jennejohn, 2008)? Macaulay (1963) suggested that lawyers are more concerned about legal risk than business people, who often prefer a vague contract in order to be able to renegotiate when the circumstances change. Business people tend to rely more on relational, non-contractual aspects of a business relationship (Macaulay, 1963). Lumineau and Oxley (2012) similarly reported that the “shadow of the future” effectively guides contracting parties to find a mutually satisfactory solution in dispute situations. The “shadow of the future” means expectations about future commercial exchange by contracting parties. Malhotra and Lumineau (2011) also found out that coordination provisions in the contract, rather than control provisions, increase competence-based trust. Coordination provisions increased the likelihood of continued collaboration after a dispute situation (Malhotra & Lumineau, 2011). Relational aspects of business relationship, together with the development of cooperative norms, may explain how companies can increase flexibility safely without managing possible opportunism with safeguard clauses and control-oriented contract—which, in turn, would make flexibility impossible (Macaulay, 1963; Jennejohn, 2008; Lumineau & Oxley,

2012). Salbu (1997), however, suggested another explanation. Conditions of unforeseeable volatility—for example, because of an unstable business relationship or the high frequency of change in the operating environment—may guide a contracting party to propose additional flexibility clauses in the contract (Salbu, 1997). These “*acontractual planning sets*” would mean that a contracting party may tolerate high volatility with related uncertainties and risks but reserves a contractual right to trigger “complete forfeiture of commitment,” or “purchase of one-sided commitment in the form of options that leave the purchaser of the option free from obligation” in a certain, specified situation (Salbu, 1997, p. 351). Based on this dissertation, agile software projects rely on a relational, cooperative form of flexibility. Contracting parties learn, innovate and create value in a close collaborative relationship. Flexible contracting actualizes, as companies not only adjust the original plan but create the plan in the first place during the project (Jennejohn, 2008). However, it is important to note that the project owner holds remarkable authoritative power. In addition to the power related to administrative decision-making, the project owner can, in a certain situation, terminate the contract and leave the business relationship without additional monetary compensation.

Publication III studies the role of lawyers contributing to project contracts and complements the previous proactive contracting literature on the lawyers’ role in contracting and lawyers’ cooperation with business managers in contracting (Macaulay, 1963; Macneil, 1978; Nystén-Haarala, 1998; Nelson & Nielsen, 2000; Pohjonen & Visuri, 2008; Siedel & Haapio, 2011; Haapio, 2013; Tayyeb, 2014). Based on the results, both managers and lawyers saw that contracts are made to reach business objectives. However, lawyers saw their role more essential in planning contracts than managers did. Lawyers also thought that collaboration with managers is more effective than managers evaluated it to be. These findings are well aligned with the earlier literature on proactive contracting and support the literature suggestions with statistical evidence on some of the claims of the business lawyers’ role in corporations. The findings could be interpreted in a way that business lawyers acknowledge the importance of business objectives in their work but may lack competencies to perform as expected by managers. The earlier literature suggests that one explanation for this may be in legal education. Nystén-Haarala (2006) suggested that the traditional education of lawyers lacks the emphasis of business contracting and cooperative teamwork in corporations. Siedel and Haapio (2011) added that lawyers’ education and training prepare them to look at a contract as a judge who makes decisions in a contract dispute situation. An

additional explanation of the research findings on cooperation perspectives between managers and lawyers is that lawyers may still get identified as professionals of legal doctrine and not the ones contributing to the flourishing of business and business relationships (Haapio, 2006b). Lawyers could get rid of the traditional image by thoroughly considering the context they operate in (Barton, 2007); gaining a deeper understanding of business, strategy and people (Haapio, 2006b); and finally, establishing a mutually rewarding relationship with managers by demonstrating skilled cooperation and interaction (Haapio, 2006b; Nystén-Haarala, 2006).

Based on the results in Publication III, lawyers saw their role more essential in dispute resolution than managers did. The interpretation of this finding is not straightforward. Companies facing conflicts with their contracting parties try to avoid litigation and settle the dispute by negotiation or private dispute resolution (Lumineau & Oxley, 2012; Macaulay, 1963; Nystén-Haarala, 2006). However, the earlier literature does not provide a clear understanding of which role in a company is usually responsible for negotiations in conflict situations or which role gets the best result. This question may be context-specific. Macaulay (1963) studied manufacturing corporations in the US. Macaulay's (1963) finding was that business people are urged to handle conflicts by themselves with relational tactics, as both parties were assumed to protect current and future business transactions. Business people saw that lawyers might try to win the legal battle and ruin the relationship (Macaulay, 1963). Nystén-Haarala (2006) reported that in the study involving Finnish and Russian forest industries, conflict situations were solved by negotiations, which rarely involved lawyers. Lawyers were used as advisors in some cases (Nystén-Haarala, 2006). Lumineau and Oxley (2012) studied several industries in France and brought up another view on lawyers' involvement in dispute resolution. It was suggested that because of their legal competence, lawyers can quickly form a comprehensive picture of a conflict situation and provide managers with a set of different proceeding tactics and resolution proposals (Lumineau and Oxley, 2012). Lawyers also have an advantage of objectivity and relational distance of the conflict situation, and thus, they are in a good position to provide managers with several options (Lumineau and Oxley, 2012). Publication III utilised a sample with several industries globally. Based on this study and the literature discussed above, the roles of lawyers and managers in dispute resolution remains to be further studied and developed. More research is needed in the software industry and in the context of agile software projects to be able to evaluate lawyers' contribution to project contracts and flexibility in agile software projects.

4.2 Practical implications

The research results of this dissertation are applicable to project contracting, lawyers' contribution to project contracts and project management of agile projects. Publications I and II studied flexibility in project contracting and flexibility in agile software projects. Based on the findings, it is possible, by utilising agile methods, to increase flexibility in agile software projects. Increased flexibility can contribute to project success in two ways. First, it gives projects parties time to utilise the expertise of the members of agile teams to study and understand the requirements for the product to be developed in the context of the environment in which the product is going to be used. Second, it lowers administrative work and the related cost of the project to adapt to the changes in the project environment. Compared to traditional project management techniques, this means that a remarkable portion of planning and specification work is moved from the traditional planning phase to the implementation phase. Planning and specification work is collaboratively done with project parties and the project owner. For business lawyers, this is important to acknowledge. In agile projects, the negotiation phase is virtually lengthened to continue during the implementation phase. Project parties voluntarily leave negotiable items open for the implementation phase in order to avoid bad decisions and maximize co-created value in the project. Thus, organisations should pay attention to how contracts for agile projects are formed and how flexibility is (contractually) introduced to projects. As cooperation between project parties, and in agile teams, is crucial in agile projects, management should foster open, direct and continuous communication in the project.

Publication III studied the role of managers and lawyers contributing to project contracts and dispute resolution. The results suggest that business lawyers should build a good understanding of the context in which they operate. It is important to acknowledge the characteristics and the business model of the project in question. Lawyers and managers agreed that contracts are made to reach business objectives, but the results indicated that lawyers might put more emphasis on legal expertise in drafting contracts than managers see necessary. Managers also saw the lawyers' role as less important in dispute resolution than lawyers did. The results suggest that there is a need to clarify the roles of managers and lawyers in drafting contracts and negotiating in conflict situations. However, it would require additional context-specific research to be able to give specific suggestions.

Publication IV studied the challenges of adopting agile methods in a public organisation. Although the case project was considered to be successful by the

project owner, there were important findings reported for agile project management techniques. It is important to carefully consider how documentation activity is organised in an agile project. Agile methods suggest that because of the close collaboration in agile teams, less documentation is needed, but it is important to prepare for possible personnel or organisational changes. Formal training of agile methods is not enough for the first agile projects, but the more experienced agile experts should mentor others. As an agile way of working seems to require a different culture from that of traditional projects, it is important that the personnel builds commitment to agile methods on an individual level and an organisational level. Stakeholder communication is crucial, especially with the organisations managing the software systems having interaction or integration interfacing with the one developed during the project. If software development involves complex architecture and system complexity, integrations cause a severe risk of failure, as agile methods do not support integrations to external systems well. Agile methods were originally created mainly for developing stand-alone software systems, and this should be considered as part of agile project management. Roles in agile project differ from the ones in traditional industrial projects. It takes training and practice for individuals to manage new roles and way of working; the organisation and management should support the adaptation. Agile methods were originally meant for teams located near one other, as agile methods require several meetings in a week and, in addition, constant communication. However, for large projects with an emerging trend of subcontracting large portions of software components, this may not be possible. It is important to plan how to facilitate communication if agile teams do not collocate.

Publication IV studied the organising and management of agile projects in a public organisation. The study suggests public organisations can benefit from adopting agile methods for software development and software subcontracting. It is possible to decrease the administrative costs of software projects and increase the productivity of resources available. Agile methods enable an enhanced focus on gathering and analysing business requirements for the developed software system because the contracted specialists will concentrate on the detailed software design during the software project. The project owner can constantly monitor and guide development and the project, as there is a possibility to make changes easily during the project. Project management should pay attention to clarifying the role definitions in agile projects on both individual and organisational levels. Project parties need to commit to the agile practices, and they need to have competences in the specific agile method in use. Finally, reward distribution and incentive schemes

for agile projects should be considered to increase commitment, motivation and goal alignment.

4.3 Critical reflections on the research

The present research was conducted as a mixed methods research from the perspective of pragmatism as a research paradigm. Mixed methods research utilises quantitative and qualitative approaches by identifying practical solutions for research (Johnson & Onwuegbuzie, 2004; Shannon-Baker, 2016). The quality of mixed methods research can be evaluated by the accuracy and precision of data, quality of analysis and credibility and situational groundedness of the research (Becker, 1996; Denzin & Lincoln, 2005a; Greene, 2013; Hall, 2013; Ketokivi & Choi, 2014; Mertens & Hesse-Biber, 2013). Several actions were taken during the research process to carefully consider these qualities.

The research process was documented honestly and precisely in this dissertation. The research route diagram was presented for the mixed methods research utilised in the dissertation to demonstrate the sequential and simultaneous research activities with separate methods and highlight the points of interfaces (Guest, 2012; Morse, 2010). The details of data collection and the data sets were presented. The process of analysis was described in detail. Triangulation was utilised on several occasions during the research process (Denzin, 2012; Given, 2008; Jick, 1979). Careful planning and preparations were done with separate methods before engaging in data collection. Case selection was considered carefully; there were several meetings and initial interviews organised before making the final decision on the case (Eisenhardt, 1989; Dul & Hak, 2008; Eriksson & Kovalainen, 2008; Ketokivi & Choi, 2014). Several actions were taken to ensure validity and prevent the reliability issues (Darke, Shanks, & Broadbent, 1998; Eisenhardt, 1989; Ketokivi & Choi, 2014). The interviews were recorded and transcribed. The transcriptions were analysed with a computer-assisted qualitative data analysis software. Secondary data were acquired for the case studies from the case study organisation and public sources. The interpretations of the analysis were discussed and reviewed with the co-authors. The findings were reflected against similar, and conflicting, literature. Finally, feedback from the peer review processes was utilised to improve the quality of the research papers before the publication.

The dissertation presents the doctoral research of the author. The author has gained doctoral education during the research process. Thus, it is important to highlight the learning process. In addition to the doctoral studies at the University

of Oulu, the author participated in an international doctoral seminar on organisational design, which greatly contributed to the work in Publication V. The author also participated in an international doctoral seminar on temporary organizing and organizing by projects, which supported the preparation of Publications IV and V and the preparation of this dissertation. It is important to acknowledge that research and scientific work is also about constant learning. The author presented unpublished research and draft manuscripts of publications in this dissertation at three international conferences. The positive feedback, and critiques, contributed to a higher quality of the final published versions of the research papers.

This research has some limitations. Mixed methods research was selected as a method for this research. It was a well-informed choice and provided an opportunity to gain remarkable rich data. However, mixed methods research contains several phases of separated methods and includes the integration of different data sets and research findings. Thus, it requires careful considerations during the research process. Involving multiple investigators and triangulation was the selected technique to reduce possible bias while conducting integrations (Denzin, 2012; Given, 2008; Jick, 1979).

Separate inquiries of this research also include some limitations. Publication III was based on the survey. Instead of being random, the sample was based on the membership of an international association focused on managing commercial contracting. This choice comes with drawbacks. Membership of the association is voluntary, and it is assumed that the members are positively oriented towards developing themselves professionally. If so, the members might share professional characteristics that are different from those of non-members, and this might affect the transferability of research findings. The research presented in Publication IV was conducted as an exploratory single case study. Limitations come with this choice. However, the research was carefully prepared, and it provides new knowledge on agile approach adoption in the context not studied earlier. The research presented in Publication V includes similar limitations. It is a fair argument that the research would have benefited from studying other project organisations in a similar setting. A longitudinal approach over a period of several projects would also have provided meaningful data for analysis.

Research ethics is an important topic, which is always a concern when research involves humans and their social realities. The author puts emphasis on treating colleagues, students and informants in a fair, kind and respectful manner. The author is committed to, and exercises, academic integrity. The informants were informed about the purpose and use of the collected data. Permission for recording

the interviews was asked, and the recordings were stored in a secure location. Similarly, the research data were stored in a secure location. The research data were confidentially treated, allowing access only to involved researchers. The data provided by the informants were processed anonymously. At this point in the learning process, the author would like to apply one additional consideration to own research practices in the future. Crystallization (Denzin, 2012; Ellingson, 2009) is a promising form of scientific method. It combines multiple forms of analysis and multiple genres of representation into a coherent research presentation, building a rich and openly partial account of a phenomenon. As crystallization is open to multiple interpretations, it provides an expansion of methodological triangulation into the realities of multiple truths. The author would welcome such a fresh approach to the field of business management studies.

4.4 Recommendations for further research

This dissertation provides new knowledge on how agile methods can increase flexibility in projects and what the issues to be considered in contracting and organising while managing agile projects are. Some topics requiring more clarification were identified during the research process. Further empirical research on project contracting practices is needed (Barton, 2015). Research should also address specific issues related to the contracting process of agile projects (Eckfeldt, et al. 2005). An interesting question is, for example, how contracts for agile projects are actually drafted in practice. The literature suggests that utilising flexibility and agile methods demands trust between the project parties. Thus, trust, communication and cultural issues between the project parties should be further researched in the context of contracting and managing agile projects (Dingsøy et al., 2018).

Additional research on the lawyers' contribution to project contracts and agile projects is needed (Barton, 2015). It would be important to gain knowledge of the cooperation between managers and lawyers in an agile project environment. Agile project contracts are not discussed in the literature. Proactive contracting suggests that contracts could guide cooperation and the behaviour of organisations and individuals participating in project work, but the literature lacks further empirical evidence of this (Haapio, 2013). The context of agile projects would provide a fruitful research opportunity for this topic. Future research should also investigate how organisations build capabilities for agile project contracting and agile project management.

More research on the concept of agile project management is definitely required. Both theoretical discussions on the subject and further empirical research are needed to elaborate on agile projects and agility in project management literature (Conforto et al., 2016). In addition, more empirical research is required on the project role definitions in agile projects. The role of the project manager seems to be transforming in agile projects, and its relationship with other roles in agile teams needs further clarification. Finally, agile projects and agile project management in the public sector require further investigation.

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Appendix 1

Information on interviews and interviewees in Publication II. The interviews were conducted between March 2013 and September 2014 (Reprinted by permission from Publication II © 2015 Authors).

Informant occupation	Experience	Interview duration	No. of interviewers
CEO of SW company	+20 years	105 minutes	2 researchers
Chief SW Architect	+15 years	95 minutes	1 researcher
Technical Lead of SW	+10 years	29 minutes	1 researcher
SW Sales Manager	+15 years	57 minutes	2 researchers
Managing Director of SW company	+10 years	104 minutes	2 researchers

Appendix 2

The demographic information of the sample in Publication III is presented in Figure 8 and Figure 9. There were 355 respondents altogether in the survey, a response rate of 1.6%. The research questions focused on the perceptions of lawyers and managers; thus, demographic information was used to exclude other disciplines from the research data. After pre-processing, the primary data included 170 respondents for the analysis: 31 lawyers and 139 managers. The survey was conducted during the first half of 2014.

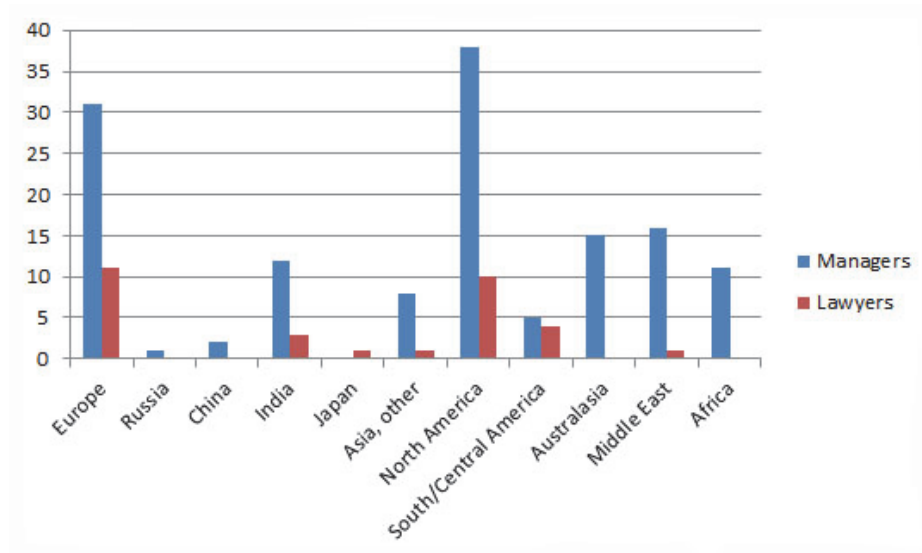


Fig. 8. Geographic distribution of operations as informed by respondents (Reprinted by permission from Publication III © 2016 Authors)).

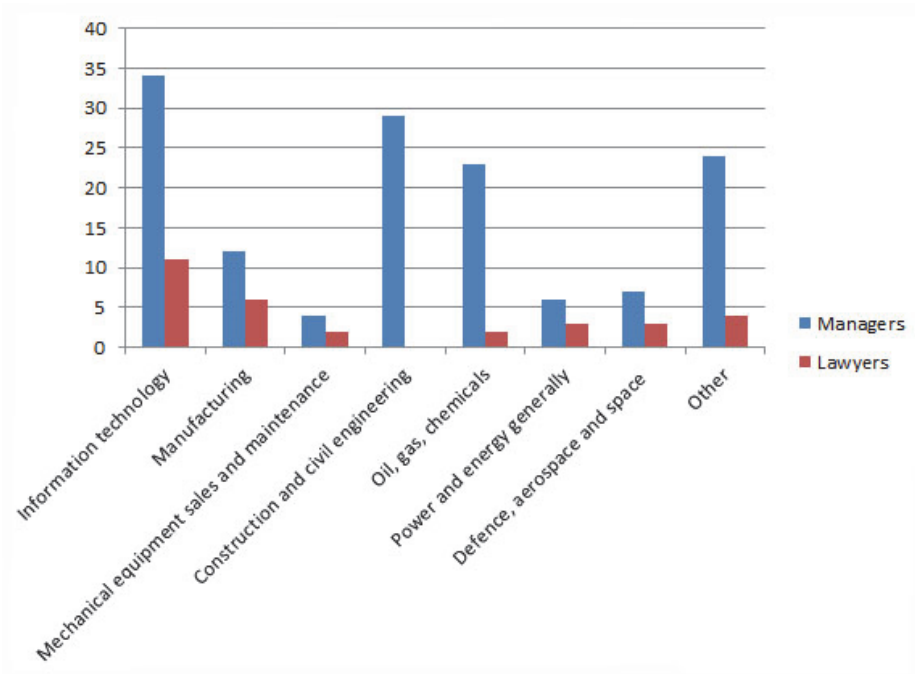


Fig. 9. Industries represented in the sample (in absolute values) (Reprinted by permission from Publication III © 2016 Authors).

Appendix 3

Information on interviews and interviewees in Publications IV and V. The interviews were conducted during the first half of 2015 (Reprinted by permission from Publication IV © 2016 SciKA).

Informant occupation	Organisation	Experience (years)	Interview duration	No. of interviewers
Business Product Owner 1	Agency	> 15 years	88 minutes	1 researcher
Business Product Owner 2	Agency	> 10 years	70 minutes	2 researchers
Development Manager	Agency	> 5 years	82 minutes	2 researchers
ICT Development Manager*	Agency	> 15 years	87 minutes	2 researchers
ICT Product Owner*	Agency	> 5 years	55 minutes	2 researchers
ICT Project Manager	Agency	> 10 years	50 minutes	1 researcher
Purchasing Manager	Agency	> 25 years	120 minutes	2 researchers
Scrum Master 1	SW Subcontractor	> 15 years	86 minutes	1 researcher
Scrum Master 2	SW Subcontractor	> 10 years	54 minutes	2 researchers
SW Developer	SW Subcontractor	> 10 years	57 minutes	1 researcher

*interviewed during a single session

Original publications

- I Kujala, J., Nystén-Haarala, S., & Nuottila, J. (2015). Flexible contracting in project business. *International Journal of Managing Projects in Business*, 8(1), 92–106.
- II Nuottila, J., Kujala, J., & Nystén-Haarala, S. (2015). Flexible contracting in software project business: What we can learn from agile methods in the software industry. In S. Nystén-Haarala, T. D. Barton & J. Kujala J (Eds.), *Flexibility in contracting – Lapland Law Review 2* (pp. 29–54). Rovaniemi, Finland: University of Lapland.
- III Nuottila, J., Kauppila, O., & Nystén-Haarala, S. (2016). Proactive contracting: Emerging changes in attitudes toward project contracts and lawyers' contribution. *Journal of Strategic Contracting and Negotiation*, 2(1–2), 150–165.
- IV Nuottila, J., Aaltonen, K., & Kujala, J. (2016). Challenges of adopting agile methods in a public organization. *International Journal of Information Systems and Project Management*, 4(3), 65–85.
- V Nuottila, J., Aaltonen, K., & Kujala, J. (2017). Agile project management in a public context: case study on forms of organising. *International Journal of Project Organisation and Management*, 9(3), 230–248.

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