

# The Impact of Technology on the Strategic Management of a Knowledge-Intensive Project Organization

Action Design Research of a Competence Management System



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The Impact of Technology on  
the Strategic Management of  
a Knowledge-Intensive Project Organization

Action Design Research of a Competence Management System

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The combination of digitalization and globalization will have a dramatic impact on organizations and the way people work. Demographic upheavals and societal changes, as well as the inevitable focus on environmental issues, will amplify the effect of these trends. As a result, business executives around the world will face new challenges with business models on one hand and organizational practices on the other hand. There is now a great opportunity for information systems and human resources scientists and practitioners to work together in order to improve understanding of how technology can be utilized to make organizations more effective and inspiring.

The “future of work” is already affecting strategic management, HR organizations, and technology in practice. As a result, this has created many exciting research opportunities, identified by scholars looking at human resource information systems, human resource management, enterprise systems, competence management systems, knowledge management, information management, agile software development, or design science.

In this action design research I build on top of existing design science research on competence management systems and aim at 1) gaining more understanding about the organizational and technological aspects of enterprise systems design, especially regarding competence development, and 2) increasing understanding of the design of competence management as a strategic capability. In this action design research project we participated in the design, development, and evaluation of a particular organizational instantiation and a management system instantiation that both address important, previously unsolved problems.

This study contributes to the existing body of scientific knowledge on information systems. The theoretical contribution is the improved design principles for competence management systems. The practical contribution of the study builds upon the guidance provided to system designers and managers through several frameworks, IT artifacts, and management practices for information systems design processes. In conclusion, this research provides new evidence of how action design research can lead to significant business benefits by integrating theory and practice in a real business context.

**Keywords** action design research, case study, competence management system, design principle, enterprise system, human resource development, information governance, knowledge-intensive firm, knowledge-intensive project organization, strategic management

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# Acknowledgements

My experience with computers and software development originates from the early 1980s and I have been developing customer-focused digital services as an entrepreneur since the 1990s. This resulted in my self-image being that of a hands-on practitioner, able to utilize the latest technology in various business development challenges. So, I surprised myself when I started dreaming about a doctoral degree pretty much ten years ago (in 2007) as a consultant walking along the corridors of the Nokia headquarters in Keilaniemi, Finland. I realized that we were designing something that had never before existed anywhere and I was yearning for more time to dig deeper in the scientific knowledge. As we all know, Nokia's business suffered some unfortunate setbacks in the early 2010s and malicious people seem to condemn everything coming from that context. However, especially now, looking back with hindsight, I think it is easy to appreciate the brilliant minds and wisdom that had been gathered from around the world to design information systems, including organizational and technological capabilities, on a global scale. Indeed, I personally learned so much during those five years I spent with Nokia that it encouraged me to spend the next five years of my life pursuing a PhD degree at Aalto University, starting in 2012. Moreover, I have been very fortunate to have been able to conduct my studies while at the same time leading the technology strategy of a fast-growing consulting company, Siili Solutions PLC, which provided me with a great place to apply my new theoretical knowledge in a real business environment. It has been a powerful combination, helping me to get started on my current journey from subject-matter expertise towards strategic leadership.

The focus of my dissertation is on the impact of technology on strategic management, which I think is today even more important than when I started my research. In my opinion technology development is progressing so fast that it forces people to choose from only two viable alternatives: either utilize artificial intelligence and robotics in everyday work or focus completely on human interaction, utilizing empathic skills. As a result, in the future I expect strategic competence management to be highly relevant for leaders and individuals alike.

I am extremely happy and fortunate to have so many great friends, dear colleagues, and a lovely family helping me on this journey. I could never have made it without your continued support and encouragement. However, I am most honored by and grateful for the help of doctoral candidates Sami Laine and Seppo Kuula who are two amazing friends, fellow researchers, and colleagues from Siili Solutions PLC.

Sami's input in the conceptual development of my dissertation and his relentless focus on rigorous scientific method made it possible for me to develop my skills from those of a consultant into those of a scientist. In addition, under Sami's leadership we were able to create and deliver a multi-year joint project between business and technology schools of Aalto University, conducting

research in two university hospitals and a globally operating manufacturing company. Moreover, I am extremely proud about our joint achievements, co-writing five published peer-reviewed papers with one best paper award and one accepted in the prestigious ICIS conference.

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The most important key strength of my dissertation seems to be the way it utilizes previous theoretical knowledge in a longitudinal study in a real-life business context. Therefore, I want to give my biggest thanks to the people who contributed to the empirical study of the research. I am most grateful to the people at Siili Solutions PLC for sharing their valuable ideas and time with me. In addition to my above-mentioned colleagues, Seppo Kuula (CEO) and Sami Laine, I would like to thank my fellow management team members Kristiina Burtsoff, Kari Pirttikangas, Pasi Ropponen, and Samuli Siljamäki, as well as my service development colleagues Ari Anturaniemi and Verner Åberg. I also thank my former colleagues Katja Leppälä, Saku Laitinen, Aki Ahlroth, and Tytti Lönnqvist for inspiring discussions and new ideas. Last but not least, many thanks to all the numerous software developers contributing to KnoMe and everyone taking part in the development of the Tribal Network.

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In the current, sad post-truth era, scientific knowledge seems to get ignored or people even disapprove of it. In official statements many Finnish politicians claim to stand for knowledge and education, but in practice there have been substantial cuts in the funding of research and education. In contrast, I have been lucky to enjoy considerable funding coming for my research from several organizations. So, I wish to express my thanks for the funds I received from the HSE Foundation, the Academy of Finland, TEKES – the Finnish Funding Agency for Innovation, and of course Siili Solutions PLC.

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As has been the case so many times before during this journey, I am here once again, late in the evening, enjoying the peacefulness of the empty Siili office in Helsinki, Finland.

October 1<sup>st</sup>, 2017

*Erkka Niemi*

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## **PART 2: The original research papers**

1. Niemi, E. and Laine, S. (2016): "Competence Management as a Dynamic Capability: A Strategic Enterprise System for a Knowledge-Intensive Project Organization", *49<sup>th</sup> Hawaii International Conference on System Sciences (HICSS)*, AIS Electronic Library.
2. Niemi, E. and Laine, S. (2016): "Designing Information Governance with focus on Competence Management in a Knowledge-Intensive Project Organization", *21<sup>st</sup> International Conference on Information Quality (ICIQ)*, MIT ICIQ electronic library.
3. Niemi, E. (2016): "Designing a Competence Management System with Agile Methodologies", *10<sup>th</sup> Mediterranean Conference on Information Systems (MCIS)*, AIS Electronic Library.
4. Niemi, E. and Laine, S. (2016): "Competence Management System Design Principles: Action Design Research", *37<sup>th</sup> International Conference on Information Systems (ICIS)*, AIS Electronic Library.

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## PREFIX: Key Concepts

In this dissertation I use the term *capability* in the context of organizational-level strategic capabilities, which provide competitive advantage. In contrast, human resources (HR) literature seems to favor using the term *capability* instead of *competence* (Lester 2014) when talking about an individual employee's ability to perform a job.

Action Design Research (ADR)	A research method for generating prescriptive design knowledge through building and evaluating an ensemble of IT artifacts in an organizational setting ( <i>Sein et al. 2011</i> )
Agile software development	This stresses the importance of short iterative cycles, where dynamic prioritization, feature planning, and implementation take turns; however, equally important in regard to speed and agility is the ultimate aim of delivering good-quality releases ( <i>Highsmith and Cockburn 2001</i> )
Competence	The demonstrated ability to apply knowledge, skills, and attitudes for achieving observable results ( <i>CEN 2010</i> )
Competence management	The specification of an organization's competence needs, the identification of competence gaps, competence sourcing, competence development through training and coaching, and the staffing of projects ( <i>Baladi 1999</i> )
Competence management system (CMS)	An information system specifically designed to help organizations manage competence, both at the individual and organizational level ( <i>Lindgren et al. 2004</i> )
Design science	A scientific method creating and evaluating IT artifacts, intending to solve identified organizational problems ( <i>Hevner et al. 2004</i> )
Dynamic capability	The firm's ability to integrate, build, and reconfigure internal and external competences in order to address rapidly changing environments ( <i>Teece 2009</i> )

Enterprise systems (ES)	Large-scale organizational systems built around packaged software including enterprise resource planning, customer relationship management, supply chain management, and product life cycle management ( <i>Shang and Seddon 2002</i> )
Hedgehog Concept	A strategic management concept meaning a simple understanding of three intersecting circles: competence, demand, and passion ( <i>Collins 2001</i> )
Human resource development (HRD)	A process of developing and unleashing expertise for the purpose of improving individual, team, work process, and organizational system performance ( <i>Swanson and Holton 2009</i> )
Information systems (IS)	Software, hardware, people, data, and procedures ( <i>Silver et al. 1995</i> ) and an academic and professional field that bridges business and computer science ( <i>Lempinen 2013</i> )
Information governance	The formal framework that includes the structure and execution of authority and accountability over information assets, used to encourage, enforce, and monitor meeting the desired organizational objectives ( <i>Niemi and Laine 2016</i> )
Knowledge-intensive firm (KIF)	A firm that relies more on intellectual capabilities and professional skills than on physical activities or natural resources; the distinctive characteristics are high knowledge intensity, low capital intensity, and a professionalized workforce ( <i>Niemi 2017</i> )
Knowledge-intensive project organization (KIPO)	A KIF with organization based on project teams, often delivering customer-specific solutions ( <i>Niemi 2017</i> )
Strategic management	A field that deals with the major intended and emergent initiatives taken by general managers on behalf of owners, involving the utilization of resources to enhance the performance of firms in their external environments ( <i>Nag et al. 2007</i> )

# 1. Introduction

This chapter provides an overall introduction to the thesis. First, I discuss the research background and motivation. Second, I move on to research questions of the thesis. I conclude the chapter with a description of the structure of the thesis.

## 1.1 Background and Motivation

The combination of digitalization and globalization will have a dramatic impact on organizations and the way people work. Demographic upheavals and societal changes, as well as the inevitable focus on environmental issues, will amplify the effect of these trends. As a result, business executives around the world will face new challenges with business models on the one hand and organizational practices on the other hand. There is now a great opportunity for information systems (IS) and human resources (HR) scientists and practitioners to work together in order to improve understanding of how technology can be utilized to make organizations more effective and inspiring.

The service sector is the biggest employer in developed economies. Traditionally the economies are categorized in three sectors: materials, manufacturing, and services. Usually development shifts the focus in an economy toward services and in most of the biggest economies of the world (e.g., those of the USA, Japan, Germany, the UK, France) services amount to over 70% of the GDP.

The service sector includes knowledge-intensive firms (KIFs), which rely more on intellectual capabilities and professional skills than on physical activities or natural resources. Their distinctive characteristics are high knowledge intensity, low capital intensity, and a professionalized workforce. They form the so-called knowledge economy, consisting of intellectual industries providing information and communication services, consultancy (business, legal, finance), media and culture, information technology, and research and development, as well as education, financial planning, and design. Many KIFs provide knowledge-intensive support for the business processes of other organizations with a highly educated workforce and their clients usually co-produce the service solution along with the service provider.

On the global level these knowledge-intensive occupations are already the biggest factor affecting economic growth and productivity. In Northern America and Western Europe perhaps 10–20% of the entire workforce work in knowledge-intensive occupations.

The change is progressing at an increasing pace and, as a result, it is more and more difficult for companies to establish a sustainable competitive advantage. Therefore, the traditional strategy approaches have been challenged with dynamic evolutionary approaches combining the benefits of the external market-

based approach with the internal resource-based competency movement. These modern theories emphasize the dynamic nature of evolving business environments, which calls for experimental business models and agile change in reaction to learning in real business practice.

The most valuable strategic assets of the modern organization are its knowledge workers and data resources. As a result, many HR directors and organizations aim at, or at least wish for, a strategic position, but still more often they end up in a tactical role in their organizations. Global trends, including the importance of knowledge workers, have changed the context, rules, and practices for HR organizations. Therefore, new, innovative thinking and digital skills are needed in order to be able to facilitate reinvention on both individual and organizational levels.

A recent study (in 2017) showed that about 70–90% of organizations consider the following important or very important: the organization of the future, careers and learning, talent acquisition, employee experience, performance management, leadership, digital HR, and people analytics (see 2.1.1). Moreover, in 2017 the top five HR initiatives are: business process improvement, HR systems strategy, talent management, service delivery, and workforce analytics. In conclusion, HR organizations need to be able to 1) implement distinctive way of management, 2) design an optimal organization, and 3) utilize technology and data. Together these create new research opportunities, as will be described at the end of this section.

KIFs rely on intellectual capital and highly educated employees delivering high-value solutions instead of standardized products or services. Therefore, companies need to be able to manage and develop this intangible knowledge, including attracting and retaining the scarce experts. Consequently, the KIFs require distinctive management theories and practices focusing on strong employee involvement, self-organizing teams, and cross-team collaboration. The opposite approach would be top-down, in which the highest-ranking officers define processes for the employees to follow according to the command chain almost without thinking. As more and more organizations are becoming knowledge intensive, the value of KIF-related theories is expected to increase. These theories include, for example, knowledge and competence management.

Scientists and practitioners are constantly looking for the optimal organization structure. The perception of the ideal structure has evolved from a bureaucratic, rigid form into a more adaptive and reactive way of organizing, which is thought to be especially suitable for KIFs, with less routine and more innovative work. In fact, current literature claims that professional service firms (PSFs) are the ones pioneering today the optimal organization of the future.

Many PSFs focusing on delivering customer-specific solutions have created their organizations based on project teams and are thus called knowledge-intensive project organizations (KIPOs). In the past, project-based organizations were mainly used in traditional industries, but they have become common in modern high-technology industries as well. A project-based organization is seen as optimal in situations requiring cross-functional expertise, delivering customer-specific solutions and innovations in fast-changing environments.

As organizations aim to attract talented employees and empower them to choose the optimal customer solutions, they are inclined to utilize a flat and flexible organization structure with less hierarchy and formal roles. They often strive for co-creation close to the customer, which results in a need for distributing both the employees and work all over the world. However, even though this way of organizing might result in more customer-friendly solutions it creates internal challenges for coordinating work and optimizing utilizations. As a result, these kind of globally operating, decentralized organizations need many IT systems to help in coordination and collaboration between autonomous teams.

There is a growing gap in technology adoption between individuals in their private lives versus their working life in organizations, which is an inevitable understanding for competent HR experts. In fact, the HR experts could take a unique position in helping business leaders and organizations adapt to technology at the same time as helping people adapt to new models of work and careers. As a result, the organizations as a whole could prosper by exploiting the current major trends and changes. This might be a possibility for HR experts to utilize knowledge and capabilities in technology in order to make the position of the HR function more strategic.

Businesses have already been impacted on by IS aiming at improving organizational effectiveness since the 1950s. In the early days organizations used transaction processing IS as point solutions, but nowadays there is an almost limitless variety of enterprise-wide solutions available on cloud. A long time ago these IS changed and improved how business functions—such as customer experience, production, supply chain management, or financial accounting—are managed, but one of the last functions to change has been human resource management (HRM). However, according to the latest studies, nowadays almost all large organizations use human resource information systems (HRIS) and the adoption is also increasing in smaller organizations. For example, HR experts and business managers are using technology and data to help make decisions and evaluate the effects of the decisions.

As described above, the “future of work” is already affecting strategic management, HR organizations, and technology in practice. As a result, this has created many exciting research opportunities, identified by scholars looking at HRIS, HRM, enterprise systems (ES), competence management systems (CMSs), knowledge management, information management, agile software development, or design science. In the following I present a brief summary of all these areas, which I will elaborate on more in chapter 2.

First of all, as digitalization and globalization progress more and more, firms are becoming knowledge intensive (von Nordenflycht 2010), so the value of KIF-related theories is expected to increase (Alvesson 2004, Starbuck 1992). Moreover, the best of the existing PSFs represent the ideal, adaptive, efficient organizations with strong employee involvement that most ambitious organizations aim to be (Greenwood et al. 2009), so it provides an interesting environment for empirical IS research (Mattila 2012). Future-oriented research (e.g., McAfee & Brynjolfsson 2017) even goes so far as to argue that by utilizing technology like

artificial intelligence and scientific knowledge humankind could create a better society than ever before in just a few decades.

According to Johnson et al. (2016), there is an abundance of both practitioner and academic communities specializing in many other business functions, but the interest in HRM technology was slower to pick up and scientific research on the design and use of HRIS has been scarce. Therefore, these IS scholars identified six HRIS research opportunities: 1) researching eHRM applying knowledge from existing e-commerce research, 2) researching HRIS with design science methods, 3) researching how technology can benefit HR-specific decision-making, 4) researching the adoption and use of HRIS, 5) researching the effective implementation of HR outsourcing, utilizing technology, and 6) many HR researchers are lacking a technological focus so IS researchers should conduct joint research with them.

On the other hand, many researchers have noticed the importance of technology in knowledge-intensive organizations (e.g., Niederman 1999, Hustad and Munkvold 2005). Moreover, HRM scholar Huselid (2011) identified four major research opportunities and two of them are very closely related to the opportunities identified by Johnson et al. (2016): 1) designing and implementing strategic competence management (“workforce strategy”) and data (“workforce analytics”), including HRIS and ERP technology, and 2) bringing research closer to practice.

From an IS point of view, there are also several other identified research opportunities regarding HRIS, which can be categorized in many IS genres. First, there is a long tradition of ES research, but implementation projects often still fail (Pekkola et al. 2013). Second, knowledge management researchers (Alavi and Leidner 2001) have identified the need to study the relationship between organizational knowledge and competitive advantage. Third, according to Tallon (2013) a focus on data may be the only technology resource that is able to create a sustainable competitive advantage, but research in this area is still scarce. In addition, the new data protection regulation (EU GDPR 2016) aiming at improving the Digital Single Market in the EU will further strengthen the focus on data in large European organizations. Fourth, according to Vasconcelos et al. (2016) there is a limited amount of literature regarding CMSs. Fifth, Dingsøy et al. (2012) identified a need for more empirical research focusing on experienced agile software development teams and organizations giving more attention to management-oriented approaches. And finally, design science research (DSR) has a long tradition in other fields, but DSR in IS was formalized fairly recently by Hevner et al. (2004, 2007) and the sub-genre of action design research (ADR) is even more recent (Sein et al. 2011) so there is a need for more research utilizing these methods in practice.

## 1.2 The Research Problem

In this ADR I build on top of existing DSR on CMSs and aim at 1) gaining more understanding about the organizational and technological aspects of ES design, especially regarding competence development and 2) increasing understanding of the design of competence management as a strategic capability.

There is only a limited amount of IS research regarding the design of CMSs, as described in the previous section. In this research, I am building on top of the work of Lindgren et al. (2004) and utilizing the CMS design principles (DPs) they published previously. Therefore, in the following I first present my own research problem. Second, I present the key challenges that Lindgren et al. (2004) identified and, finally, I present the CMS DPs that they proposed in order to address those challenges.

**The overall research question (RQ) of the thesis can be formulated as follows:**

***RQ: How does technology affect HR development and vice versa?***

***In more detail, what are the most important issues when designing CMSs supporting KIPOs?***

In order to achieve the objective, the overall research question can be divided into sub-questions that address different points of view in this complex problem:

- RQ1: How to design and deploy a strategic management framework focusing on a CMS in a KIPO? (Paper 1)
- RQ2: How to improve the necessary information governance capabilities for a CMS? (Paper 2)
- RQ3: How to design and implement a CMS from technological and methodological points of view? (Paper 3)
- RQ4: What is the formalized learning from an ADR in a CMS project? (Paper 4)

Lindgren et al. (2004) studied commonly used CMS and summarized the key challenges:

1. CMS were usually primarily designed for traditional personnel administration and only secondarily for competence management. Thus, they concluded that the systems were in fact unusable for competence management.  
→ The need for specific CMSs, separate from HRM
2. Most of the studied CMSs only passively stored information about past competences in a way formalized by HR organizations.  
→ The need for current competences to be actively specified and managed by employees themselves



3. The employees of the studied organizations did not consider the stored competence information useful.  
→ The need for useful information to be stored in order to activate employees to use a system that they see as beneficial
4. CMSs had an adverse effect on individual career changes. The systems usually had predefined and hierarchical competence descriptions, which resulted in strengthening the existing practices inside the competence domains the employees already knew.  
→ The need to look forward, take interests into account, give the possibility for flexible data input, and enable individual development
5. The competence information in the CMSs was only accessible to a limited number of managers and HR professionals. In other words, most of the employees could only access their own competence descriptions and could not assess the descriptions of others.  
→ The need for transparency and wide usage
6. CMSs did not have adaptability to changing conditions, because they tended to only support analyses of existing individual competencies in predefined groups at single points of time.  
→ The need for flexibility and dynamic visualization on a longer time scale

Lindgren et al. (2004) proposed four DPs for CMSs to tackle the above-described challenges:

- **DP 1: User-controlled transparency** aims at a better and more flexible description of existing competences. In addition, the goal is to promote the transparent sharing of competence information, resulting in supporting competence communities. However, individuals should be given power to control what they are publishing about themselves.
- **DP 2: Real-time capture with a feedback loop** aims at automatically creating competence information while the employees are working. The main idea of this principle is to create useful and up-to-date information based on the employees' actions. However, they should be given the possibility to give feedback in order to enrich or correct the automatically created data.
- **DP 3: Multi-perspective interest integration** aims at visualizing the future competence interests of the employees and, therefore, encouraging them to create communities with similar interests. This principle describes Lindgren's strongest proposal of stressing the importance of individual **interests** while collectively managing the development of future competences.
- **DP4: Flexible reporting** aims at enabling the aggregated visualizations of the current competencies and future interests of the employees. The reporting should allow visualization of the data at a particular point of time, as well as visualization of trends over longer periods of time.

The case study in this research will give us an understanding of CMS design in a complex enterprise environment and can extend experience or add strength to what is already known through previous research. The research analyzes real-life situations in a KIPO during 2013–2016 and provides a basis for the application of ideas and extension of models, methods, and practice in business environments and in future research.

The research constitutes the author's doctoral research on this area, for which only a little scientific research exists thus far. Therefore, the research expected to result in new knowledge for IS science. In addition, it will make a contribution for practitioners, such as business executives and IT managers, by providing them with generalized, prescriptive, and practically relevant scientific knowledge for setting up and improving the human resource development (HRD) capabilities in their organizations.

### **1.3 The Structure of the Thesis**

The thesis comprises of two parts. **The first part** (chapters 1–6) provides a general overview of the topic and the research framework, within which a summary of the findings and contributions of the thesis are presented.

**Chapter 1** is the introduction, including the background and motivation as well as the research questions.

**Chapter 2** positions the thesis in relation to the existing literature. First is the research framework, presenting positions on strategic management, ES, KIPOs, and design science. Next the chapter presents the guiding concepts of the research: the dynamic capability framework (DCF), information governance, agile software development, and the Hedgehog Concept.

**Chapter 3** first presents the philosophical assumptions, then it describes the design science discipline as well as the ADR method.

**Chapter 4** describes the design process, including the case organization, and finally it discusses the research quality as well as ethical considerations.

**Chapter 5** provides an overview on the key results in each research paper.

**Chapter 6** contains discussion and the conclusion based on the research findings. It includes the theoretical and practical contribution of the research as well as the limitations and suggestions for future research.

**Chapter 7** contains the references for part 1.

**The second part** of this dissertation consists of the original research papers.

## 2. The positioning of the research

In this chapter I analyze the literature relevant to my research. First, I describe the research framework and, second, I provide a brief introduction to the scientific knowledge base utilized in the research. Finally, I describe the guiding concepts used in each research paper.

### 2.1 The Research Framework

In this section I present the research framework (figure 1) that I have utilized in this research. The framework was used in order to find the correct balance between scientific rigor and practical business relevance. I have applied the original conceptual framework (with minor modifications) that Hevner et al. (2004, 2007) published for understanding, executing, and evaluating DSR in IS.

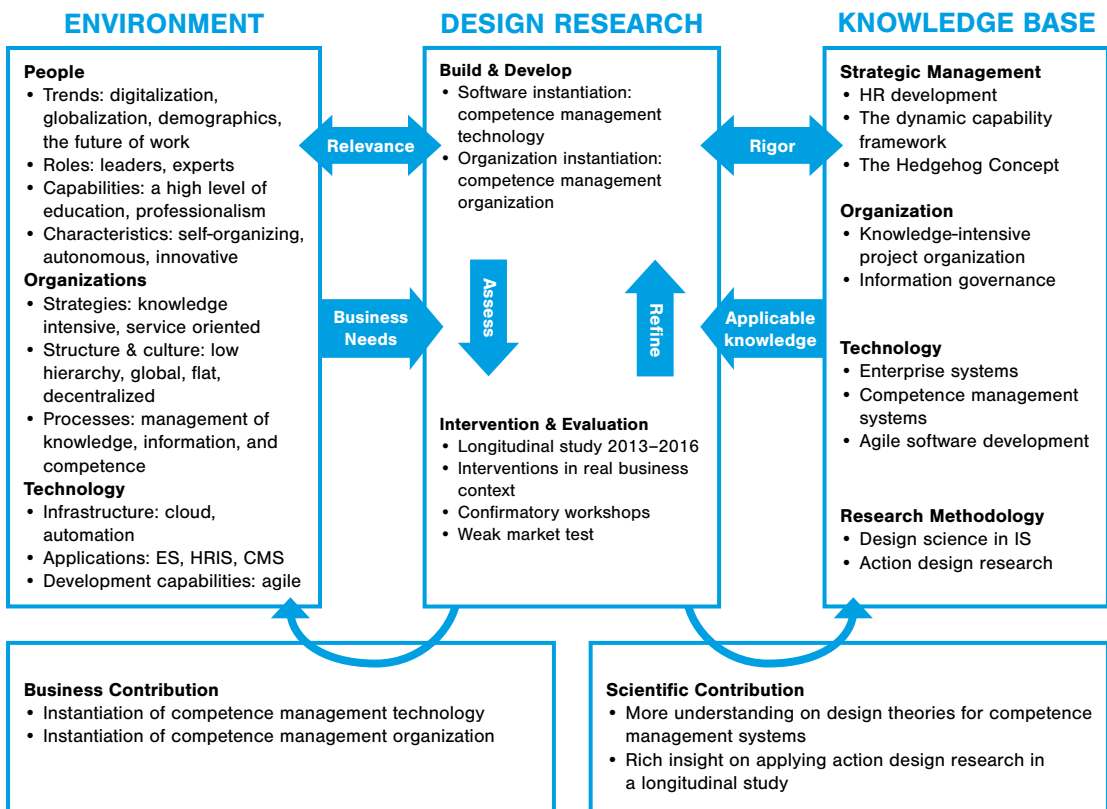


Figure 1. The research framework (inspired by Hevner et al. 2004, 2007)

## ENVIRONMENT (RELEVANCE):

According to Hevner et al. (2004): *“The environment defines the problem space in which reside the phenomena of interest.”* In other words, all DSR activities should aim at solving real business problems, which is expected to guarantee the relevance of the research.

Hevner et al. elaborated on this to say that in IS research the environment consists of people, business organizations, and the existing or planned technologies. It includes the goals, problems, and opportunities that are used to define the organization’s business needs. They reflect the intuition and opinions of the **people** and are affected by their roles, capabilities, and characteristics. Moreover, the **organization’s** strategies, structure, culture, and existing processes form the overall context used to describe and evaluate the business needs. On the other hand, the business needs should be positioned with **technological** maturity regarding infrastructure, applications, and development capabilities. As a result, all of these environmental aspects together define the business need or problem as perceived by the researcher.

In this research the environment was described in section 1.1, “Background and Motivation,” providing the foundation for building this whole research. It suggests that the competence management problem in modern knowledge-intensive organizations is a wider phenomenon and not limited to a single case organization. It aims to prove that this research intends to solve business needs that have relevance in a real business context.

## DESIGN RESEARCH (UTILITY VIA EMPIRICAL RESEARCH):

According to Hevner et al. (2004): *“The goal of design science research is utility.”* In other words, DSR aims at building and evaluating artifacts that meet the business needs identified in the environment.

First, the **building and development** of technological and/or organizational artifacts are informed by a prior knowledge base and aim at solving business needs. Second, the artifacts are used in real business-context **interventions and evaluated** scientifically in accordance with DSR methodology. As a result of the evaluation, the researchers might find strengths or weaknesses either in the existing theories or in the artifacts. Depending on the chosen research approach the findings may lead in further building and development iterations before publishing the scientific and business **contributions**.

In this research the business need identified in the environment is studied via empirical research in a single case organization. The researchers designed software and organization instantiations and used them in intervention and evaluation in a real business environment during 2013–2016. The findings were evaluated using confirmatory workshops and a weak market test proved the significance of the results. This is described in chapter 4, “Empirical Research.”

## THE KNOWLEDGE BASE (RIGOR):

According to Hevner et al. (2004): *“The knowledge base provides the raw materials from and through which IS research is accomplished.”* In other words, the appropriate usage of existing foundations and methodologies is expected to guarantee the scientific rigor of the research.

The **foundations** include, for example, theories, frameworks, models, and concepts from prior scientific research in IS or some other discipline. These foundations should be used to guide the development of the artifacts. In turn, the **methodologies** include, for example, techniques for data collection and analysis, providing principles that ensure the scientific evaluation of the quality and effectiveness of the artifacts.

In this research the scientific rigor is achieved by applying the following existing knowledge base (table 1). The prior knowledge (sections 2.1.X) provides us with the guiding concepts (sections 2.2.X) utilized in each of the published research papers. Moreover, design science provides us with the research methodology (chapter 3).

**Table 1.** The knowledge base utilized in this research

Prior Knowledge	Section
Strategic management and HRD	2.1.1
KIPO, Information governance	2.1.2
ES, HRIS, and competence management	2.1.3
Design science in IS	2.1.4 & 3.2.1

Guiding Concepts	Section
Paper 1: The DCF	2.2.1
Paper 2: Information governance	2.2.2
Paper 3: Agile software development	2.2.3
Paper 4: The Hedgehog Concept	2.2.4

In this dissertation the focus is in the impact of technology on the strategic management of a KIPO. Therefore, in the next section (2.1.1) I will describe my approach to the strategic management, focusing especially on HRD. In the following section (2.1.2) I will then move on to modern leadership and organization design in KIPOs. In the next section (2.1.3) I focus on the relevant technology before concluding the description of the research framework with the introduction to design science as the research method (section 2.1.4, chapter 3).

### 2.1.1 Strategic Management and HRD

*The field of **strategic management** deals with the major intended and emergent initiatives taken by general managers on behalf of owners, involving utilization of resources to enhance the performance of firms in their external environments.* (Nag et al. 2007)

Mintzberg (1998) lists five types of business strategy: 1) planning a vision of the future—how to get from here to there, 2) identifying the pattern of the common factors of historical success, 3) positioning successful products or services in particular markets, 4) finding the company a unique way of doing things, and 5) creating a specific operation to beat the competitors.

In my opinion, by enriching Nag et al. with Mintzberg we notice that strategic managers should aim at combining understanding of the external market and the internal resources in order to be able to plan and implement actions improving the firm performance in relation to its competitors. Therefore, in order to be able to answer the research questions of this dissertation, we first need to take a look at the external environment of KIPOs before moving on to internal resources employees, data, and technology.

According to Johns and Gratton (2013), there are five external forces that are fundamentally changing the future of work. The combination of digitalization and globalization will have a dramatic impact on organizations and the way people work. Demographic upheavals and societal changes, as well as the inevitable focus on environmental issues, will amplify the effect of these trends.

The service sector is the biggest employer and source of growth in the world economy (ILO 2015, 2016). Traditionally the economies are categorized in three sectors: raw materials, manufacturing, and services (Fisher 1939). According to this categorization, economic progress shifts the main focus in an economy toward services and, in fact, OECD statistics (2017) show that in most of the biggest economies of the world (e.g., the USA, Japan, Germany, the UK, France) services amount to over 70% of the GDP.

According to Drucker (1969) the global economic restructuring has progressed from agricultural economy—via industrial economy and post-industrial economy—to the current knowledge economy. In the knowledge economy, the knowledge workers use knowledge to create tangible or intangible value (Alvesson 2004). It has even been argued that we are in the middle of the fourth industrial revolution (Schwab 2017)—which means the fusion of the physical, digital, and biological worlds—or the second machine age (Brynjolfsson and McAfee 2011, 2014), which means that automation utilizes artificial intelligence and could eventually substitute for human work (Ford 2015). However, I agree with the optimistic conclusion of McAfee and Brynjolfsson (2017) that stated that it is up to us humans to think about our values and utilize technology to improve the lives of societies, companies, and individuals in order to attain a better situation than ever before.

The most valuable assets of the modern organization are knowledge workers (Drucker 1993, 1999) and the data resources (Davenport 2007, Goodhue et al.

1988). Consequently, knowledge-intensive occupations are considered the main sources of growth and productivity (Castells 2010). On the other hand, the knowledge workers' productivity can be seen as the biggest leadership challenge (Drucker 1999).

All these rapid changes demand that business managers around the world drive employee engagement and retention, improve leadership, and build a meaningful culture (Deloitte 2016, 2017). It has been said that there is an ongoing "War for Talent" (Hankin et al. 1997, Michaels et al. 2001, Sutton 2007), referring to an increasingly competitive landscape for recruiting and retaining talented employees. According to them, the War for Talent is intensified by demographic shifts, primarily in the United States and Europe. This is characterized by increasing demand along with decreasing supply (demographically). While the definition for *talent* was vague, their underlying assumption is that, for knowledge-intensive industries, the knowledge worker (Drucker 1999) is the key competitive resource.

PSFs provide specialist advice to their customers and their value creation depends entirely on the usefulness and relevance of employee competence, in other words, of their knowledge, skills, and attitudes (Maister 1985, 2012). Consequently, in dynamic environments it is very important for managers in KIPOs to understand the current and future needs of customers and provide them with the right experts at the right time (Accenture 2017). Therefore, the managers in KIPOs need comprehensive information on the competences and the project allocations of the HR in order to match them with customer demand and guide competence management on an individual and organizational level (Mattila 2012). This kind of information is often managed with the help of ES.

In conclusion, business managers face new challenges with business models (see section 2.2.1) on one hand and organizational practices on the other hand. Mattila (2012) argues that contemporary HR organizations in KIPOs need to be able to 1) implement a distinctive way of management, 2) design an optimal organization, and 3) utilize technology and data.

In fact, recent studies confirm this conclusion. According to Deloitte (2017), in 2017 about 70–90% of organizations consider the following important or very important: the organization of the future, careers and learning, talent acquisition, employee experience, performance management, leadership, digital HR, and people analytics. Moreover, according to Sierra-Cedar (2016) the top five HR initiatives in 2017 are: business process improvement, HR systems strategy, talent management, service delivery, and workforce analytics.

***Human Resources Development (HRD)*** is a process of developing and unleashing expertise for the purpose of improving individual, team, work process, and organizational system performance. (Swanson and Holton 2009)

Charan (2014) argues that HRD should be viewed as a separate strategic function from the more administrative and operative HRM and recruitment functions. Swanson and Holton (2009) continue to state that HRD is realized in practice as organizational development, and individual-level training and development.

Lindgren et al. (2004) complete these perspectives, specifying that **competence management** consists of defining an organization's competence needs and then filling the gaps with sourcing and development activities. Furthermore, they state that, usually, the focus of strategic management is on defining the competence needs and gaps, whereas the focus of the HR function is on the actual management of competences.

### 2.1.2 KIPO

The idea of knowledge intensiveness in organizations and in work has become very important from many points of view: those of research, business, and politics (Alvesson 1995, 2004, Rylander and Peppard 2015). In Northern America and Western Europe perhaps 10–20% of the entire workforce work in knowledge-intensive occupations (Thompson et al. 2001, Alvesson 2004, Eurostat 2017). On the global level these knowledge-intensive occupations are already the biggest factor affecting economic growth and productivity (Castells 2010).

However, according to Alvesson (2004), despite the economic importance and researcher focus, it is still problematic to clearly define the key concepts of knowledge intensiveness. In fact, he even states that “knowledge is an all-embracing concept within the organization science literature, covering everything and nothing.” As a result, Rylander and Peppard (2015) suggest that researchers should clearly describe their research context and highlight which features of KIFs are relevant to the study. Therefore, in this section I describe the usage of the KIF-related terminology in this dissertation in order to position the research in the context of KIPOs.

Since the 1960s organization theory and sociology researchers have been interested in *professional organizations* employing a large number of professionals as an institutional alternative for bureaucratic control (von Nordenflycht 2010, Malhotra et al. 2006). A key concept in this research area was the *profession* characterized by scientifically based theory, resulting in a common knowledge base, a long period of formal education, professional association, institutionalized training, licensing, work autonomy, colleague control, and a code of ethics (Groß and Kieser 2006). However, during recent decades there has been an increase in knowledge-intensive occupations (e.g., accountants, architects, computer experts and management consultants) not fulfilling all the above-mentioned formal criteria of a profession (von Nordenflycht 2010).

Furthermore, managerially oriented literature on *PSFs*, focusing on commercial firms, started to come out in the 1980s and 1990s (e.g., Greenwood et al. 1990, Maister 1982). These two genres complemented each other—the major difference was that the PSF literature was more interested in the challenges of the motivation and retention of highly skilled employees who could easily change employer. The PSF literature was already then connected with the emerging scientific research on *KIFs* (e.g., Starbuck 1992, Alvesson 1993, 1995), which often used PSFs as examples of KIFs.

There is a parallel classification to KIFs and PSFs, *knowledge-intensive business services (KIBS)*, which are companies providing knowledge-intensive



inputs to the business processes of other organizations based heavily on advanced technological or professional knowledge and their clients usually co-produce the service solution along with the service provider (Eurofound 2017). The classification into knowledge-intensive business services is used at least in service innovation literature (e.g., den Hertog 2000), European Commission innovation policy (e.g., Schricke et al. 2012), and the statistical office of the European Union (Eurostat 2017). However, in this dissertation I use the abbreviations *KIF* and *PSF*, which seem to be more common in IS and organization theory literature.

Alvesson (2004) defines **KIFs** as organizations that offer the market the use of fairly sophisticated knowledge or knowledge-based products. He continues that the core activities are based on intellectual skills (rather than physical activities or natural resources) and that a large portion of employees usually have an academic education and relevant experience. Moreover, he argues that a key characteristic for a KIF is often the capacity to solve complex problems through creative and innovative solutions. Finally, an important feature of a KIF is the ambiguity concerning the quality of the delivered value, meaning that the results of the work are difficult to evaluate for both the supplier and customer.

As for the PSF, von Nordenflycht (2010), defined their distinctive characteristics as having high knowledge intensity, low capital intensity, and a professionalized workforce. He uses the variations in the level of capital intensiveness and professionalism of the workforce to create a taxonomy of PSFs (see table 2): 1) classic PSFs, 2) professional campuses, 3) neo-PSFs, and 4) technology developers. Classic PSFs (e.g., law firms) do not need capital and the workforce is professional; professional campuses (e.g., hospitals) need capital as well as a professional workforce; neo-PSFs (e.g., management consultants) do not need capital and the workforce is only weakly professional; technology developers (e.g., R&D laboratories) need capital and the workforce is only weakly professional. Further, as other organizations are becoming more knowledge intensive, the distinctive features of PSFs seem to be increasingly relevant to other organizations (von Nordenflycht 2010).

**Table 2.** A taxonomy of PSFs (adapted from von Nordenflycht 2010)

	<b>Classic PSFs</b>	<b>Professional campuses</b>	<b>Neo-PSFs</b>	<b>Technology developers</b>
Knowledge intensity	X	X	X	X
Low capital intensity	X		X	
A professionalized workforce	X	X		

Increased interest in the knowledge economy has convinced many researchers and practitioners that a *project-based organization (PBO)* is a desirable way to organize work in many industries in order to respond to the highly differentiated

and customized nature of customer demand (Sydow et al. 2004). In contrast to, for example, a functional or matrix organization, in a PBO the project is the primary unit for production organization, innovation, and competition (Galbraith 1971, 1973). Sydow et al. (2004) define that *PBO* refers to a “variety of organizational forms that involve the creation of temporary systems for the performance of projects tasks.” They continue that it has been a standard way of operating in traditional industries (e.g. construction) delivering high-value sophisticated capital goods for a long time but that it has more recently expanded to, among other services, consulting and professional services.

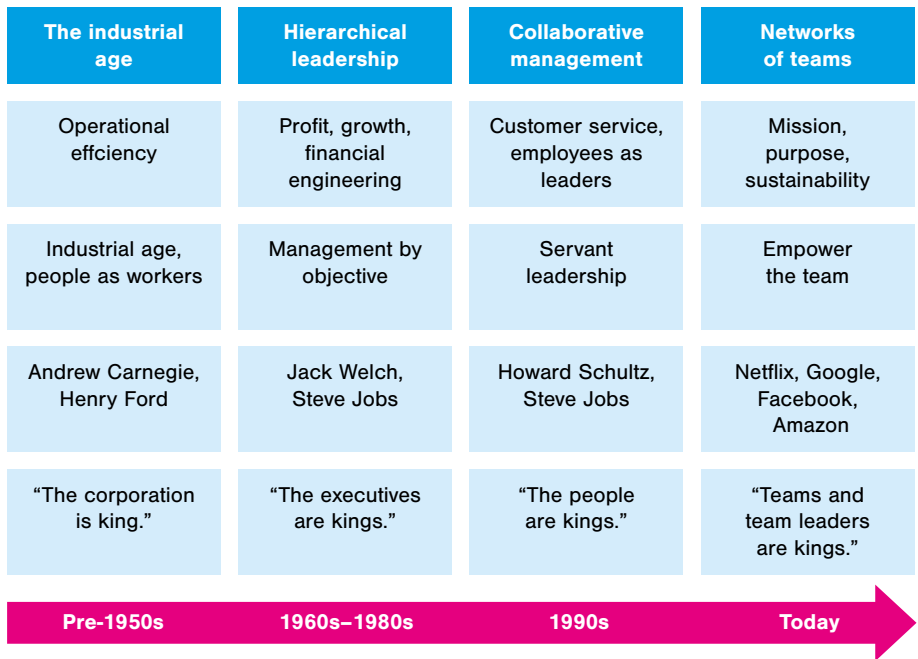
According to Hobday (2000), the PBO is strong where functional organization is weak and vice versa. Moreover, he expects the PBO to be suitable in large risk-intensive projects combining numerous different kinds of resources from both the organization and other firms. He argues that a PBO can speed up innovation and improve project leadership, because it always creates new organizational structures to fit current customer needs. On the other hand, the PBO is weak in executing routine engineering tasks and, therefore, achieving economies of scale. As a result, the PBO can worsen the firm’s strategic capabilities, coordination of resources, cross-project communications, and company-wide organizational learning. Numerous researchers (e.g., Turner and Keegan 2001, Bresnen et al. 2004, Lindqvist 2004) have tried to find out the best possible governance mechanisms to ensure optimal company-wide management, innovation, and learning. Recently many PSFs delivering customer-specific solutions in rapidly changing environments have utilized modern management theories and created KIPOs (Mattila 2012).

Hinings and Leblebici (2003) argue that the PSF is “the contemporary organization that has not previously existed” and emphasize the uniqueness of the required management theories. Also, Malhotra et al. (2006) and von Nordenflycht (2010) have noticed the need for distinctive management theories, because PSFs are organized so differently from other organizations.

According to Alvesson (2004), organizations have transformed into more flexible forms, giving knowledge workers more space for initiative and discretion to effectively use their intellectual assets. Furthermore, there are three trends characterizing this organizational evolution: 1) more employees are expected to be self-organized around their core tasks, 2) more employees are expected to perform entrepreneurial tasks identifying and capturing value from customer needs, and 3) there are new opportunities for employees to experience psychological ownership over certain customers, markets, or services (Miles et al. 1997). As a result, companies are expected to invest heavily in human capabilities and apply a unique managerial philosophy.

Huemann et al. (2007) argue that HRM should be one of the core processes in the PBO. They state that HRM has the possibility to influence how the people are assigned to projects as well as what kind of employee experience they have. However, the temporary nature of projects makes the PBO environment unusually challenging for HR professionals.

According to Mattila (2012), knowledge workers need a new kind of modern leadership in order to be retained and to motivate them. Adaptability, creativity, and a strong respect for the competence of the employees are the new leadership drivers, meaning that the management concepts focused on control and efficiency no longer guarantee business success (Hamel and Breen 2007). According to Deloitte (2016), modern leadership practices are built on mission and purpose, utilizing networks of self-organizing teams (see figure 2).



**Figure 2.** Management evolution (adapted from Deloitte 2016)

There is more elaboration on the subject in section 2.2.4.

Zardkoohi et al. (2011) argue that the definition of a PSF is irrelevant when compared with the question how a given service is optimally organized. In fact, scientists and practitioners are constantly looking for the optimal organization structure (Mattila 2012). The perception of the ideal structure has evolved from a bureaucratic, rigid form into a more adaptive and reactive way of organizing, which is thought to be especially suitable for KIFs, with less routine and more innovative work (Deloitte 2016). In fact, present literature claims that PSFs are the firms pioneering today the optimal organization of the future (Greenwood et al. 2009).

As organizations aim to attract talented employees and empower them to choose the optimal customer solutions and innovations in fast-changing

environments, they are inclined to utilize a flat and flexible organization structure with less hierarchy and formal roles (Mattila 2012). Moreover, the organizations often strive for co-creation close to the customer, which results in a need for distributing the employees and work all over the world. However, even though this way of organizing might result in more customer-friendly solutions, it creates internal challenges for coordinating work and optimizing utilizations (Sydow et al. 2004). As a result, this kind of globally operating, decentralized organization needs many IT systems to help in coordination and collaboration between autonomous teams.

Companies should treat corporate information as a key strategic asset in order to achieve competitive advantage (Davenport 2007). Information-driven decision-making seems to lead to higher productivity and improvements in performance (Brynjolfsson 2011). Like any other asset, information needs good corporate governance and related quality controls across the entire information life cycle.

Information governance is a relatively new research area. It combines the best practices from many fields, such as strategic management, business process management, risk management, and IT governance.

Although the roots of information governance research are in the early 1980s, there are still not many papers today presenting prescriptive knowledge on how to design and implement information governance in an organizational context (Otto 2011).

The General Data Protection Regulation (GDPR; EU GDPR 2016) is intended to strengthen and unify data protection for all individuals within the European Union (EU). It also addresses the export of personal data outside the EU. The primary objectives of the GDPR are to give citizens and residents control of their personal data and to simplify the regulatory environment for international business by unifying the regulation within the EU. The data protection reform is a key enabler of the Digital Single Market which the commission has prioritized. The reform is expected to allow European citizens and businesses to fully benefit from the digital economy.

The GDPR has a long history starting from 2012 when the European Commission proposed a comprehensive reform of data protection rules in the EU. The regulation was finally adopted on April 27<sup>th</sup>, 2016 and on May 4<sup>th</sup>, 2016, the official texts of the regulation and the directive were published in the *Official Journal of the European Union* in all the official languages. The regulation applies from May 25<sup>th</sup>, 2018 after a two-year transition period and, unlike a directive, it does not require any enabling legislation to be passed by national governments. When the GDPR takes effect, it will replace the current data protection directive (officially Directive 95/46/EC) from 1995.

Companies can no longer rely on technology alone as a source of competitive advantage (Carr 2003). They need an enterprise-wide information strategy and information governance in the current information-intensive, knowledge-based economy (Davenport 2007, Castells 2010). In 1998 Redman (1998) already argued that many enterprises have not achieved the needed awareness of poor

data quality, which has adverse effects on the operational, tactical, and strategic levels of business. Nowadays, the leading organizations have learned the lesson that information quality problems are business problems rather than technical IT problems (Lee et al. 2014). The claim seems justified since, for example, Aiken et al. (2011) have found out that the data management profession is moving from low-level operations towards managerial functions, such as information governance.

The above calls for business-driven information governance have gotten empirical support from a wide set of studies. In the 2000s studies showed evidence that the relationship between information quality and organizational outcomes is systematically measurable and that the measurements of information quality can be used to predict organizational outcomes (Brynjolfsson 2011, Sheng and Mykytyn 2002, Slone 2006). Moreover, companies that have top-level accountable information owners seem to perform better financially (EIU 2011). However, several studies (Pierce et al. 2008, EIU 2008, EIU 2011) indicate that only a few companies have enterprise-wide information governance policies in place. There is a clear business need to study how to effectively design and implement information governance in a real business context. In the context of IS research the convention seems to be moving towards using the term *information* (e.g., Tallon et al. 2013) rather than *data* (e.g., Otto 2011), so accordingly in this paper we speak about *information governance*. In addition, in this paper *governance* refers to the decisions that must be made and who makes the decisions, whereas *management* involves the making and implementing of decisions (Khatri and Brown 2010, ISO/EIC 2008).

Therefore, in paper 2 we defined **information governance** as *the formal framework that includes the structure and execution of authority and accountability over information assets, in order to encourage, enforce, and monitor meeting the desired organizational objectives*—building on the OECD (2015) definition of *corporate governance* and inspired by Thomas (2006), Weber et al. (2009), Khatri and Brown (2010), Otto (2011), Tallon et al. (2013), and Seiner (2014).

The leadership focus in KIFs has shifted from the coordination of processes and resources to cultivating intangible knowledge capabilities, because their customers prefer innovative customized services instead of standard products (Starbuck 1992, Yoo et al. 2006). On the other hand, in addition to customers, KIPOs compete for talented professionals and must invest heavily in the development of human capital assets (Maister 1985, 2012).

In a KIF the individuals and teams that form the organization collectively produce *organizational knowledge* with their expertise, experience, and skills (Starbuck 1992). However, it is unfortunately easy to lose the knowledge due to high turnover of key personnel or, for example, downsizing or restructuring (Vasconcelos et al. 2016).

According to Alvesson (2004), one of the most important tasks for a KIF is to systematically manage and share their knowledge resources. He continues that the main function of the knowledge workers (employees) is to solve complex problems dealing with abstraction and uncertainty in a dynamic environment. Finding answers and making decisions requires data from many different information

sources, both inside and outside the organization (Vasconcelos et al. 2007). The knowledge can be explicitly stored in an enterprise's IS, it can be implicitly stored in employees' minds, or it can even be embedded in organizational culture, rituals, policy, and procedures (Alvesson 1995). Moreover, the organizational knowledge is often involuntarily and unknowingly hidden in numerous silo repositories inside large organizations (Dzbor et al. 2000). Therefore, effective knowledge management is a significant challenge for a modern organization (Wang and Wang 2012).

Morgan (1998) suggests that learning organizations must develop competences that allow them to: 1) scan and anticipate chance in the wider environment in order to detect significant variations, 2) develop an ability to question, challenge, and change operating norms and assumptions, and 3) allow an appropriate strategic direction and pattern of organization to emerge. In other words, learning organizations can use their competencies and be able to detect the early warning signals that give clues to shifting trends and patterns. In order to effectively manage the organizational knowledge, KIFs should gather best practices (O'Dell and Grayson 1998) and new ideas (Hertog 2000), focus on efficiency improvement (Zander and Kogut 1995), and intentionally manage organizational learning (Starbuck 1992) and existing skills (Hansen et al. 1999), as well as identify sources of information (Davenport et al. 1996).

Knowledge and competence as concepts are tightly connected with each other (Hellström et al. 2000, Lindgren et al. 2004). **Competence** can be defined as “*a demonstrated ability to apply knowledge, skills, and attitudes for achieving observable results*” (CEN 2010). Accordingly, in this dissertation I follow the IS convention and speak about CMSs. However, nowadays HR literature seems to favor the term *capability* instead of *competence* (Lester 2014) when talking about an individual employee's ability to perform a job. In contrast, in this dissertation I use the term *capability* in the context of the organizational-level strategic capabilities, which provide competitive advantage. Moreover, I follow the convention of many other IS scholars and assume that there can be many dynamic capabilities (as opposed to only one dynamic capability) in a particular organization.

Prahalad and Hamel (1990) argued that the most powerful way to succeed in global competition is to identify, cultivate, and exploit the core competencies of the organization. According to Vasconcelos et al. (2003), KIFs widely use competence management practices, aiming at the effective utilization of employees' skills and knowledge. It influences the way the organization acquires and allocates HR and how employees experience working for the company. However, there are major design challenges across the whole organization regarding how to define the relevant competencies and, especially, how to reach a consensus regarding relevant competence models and taxonomies (Abel 2008).

Lindgren et al. (2004) developed a **typology of competence**: competence-in-stock, competence-in-use, and competence-in-the-making (see Figure 3). The typology takes a life-cycle perspective of competence, meaning that, in addition to the **past** and **present** stages of competence, there is also a **future** stage.

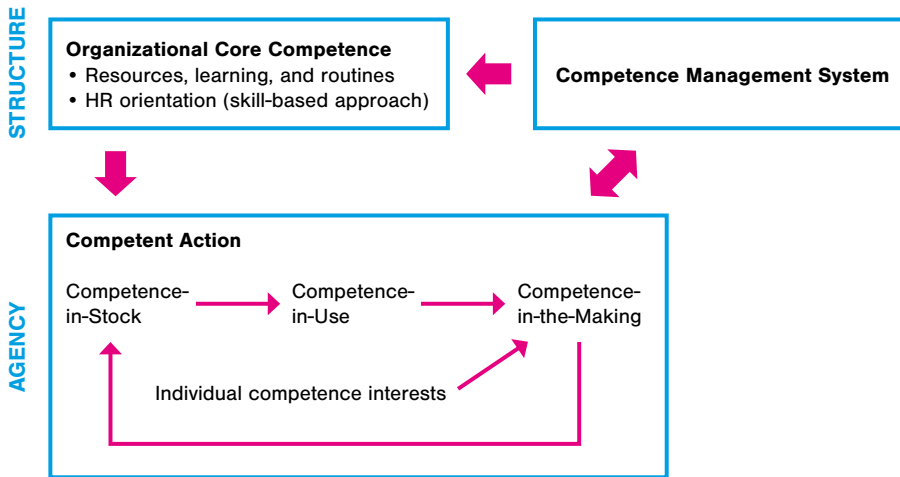


Figure 3. Competence typology and a CMS (adapted from Lindgren et al. 2004)

### 2.1.3 ES and Competence Management

Already in the 1950s the interaction between organizational structure and technology selection were important research topics in organization science (Mattila 2012). In particular the management of KIFs appreciate the importance of IS (Niederman 1999, Hustad and Munkvold 2005). Furthermore, Huselid (2011) argues that the one of the most important research areas in HR should be strategic competence management (“workforce strategy”), including the design and implementation of technologies as well as the development of “workforce analytics” capabilities.

There is an abundance of both practitioner and academic communities specializing on many other business fields, but the interest in HRM technology was slower to pick up and scientific research on the design and use of HRIS has been scarce. In fact, IS scholars Johnson et al. (2016) identified six HRIS research opportunities: 1) researching eHRM applying knowledge from existing e-commerce research, 2) researching HRIS with design science methods, 3) researching how technology can benefit HR-specific decision-making, 4) researching the adoption and use of HRIS, 5) researching the effective implementation of HR-outsourcing, utilizing technology, and 6) many HR researchers are lacking a technological focus so IS researchers should conduct joint research with them.

Shang and Seddon (2002) defined **ES** as *large-scale organizational systems built around packaged software* including enterprise resource planning (ERP), customer relationship management (CRM), supply chain management (SCM), and product life cycle management (PLM). They argue that organizations use

ES in order to achieve many benefits, like improved customer coordination or resource coordination, or better control of business performance.

The first ES studies in the 2000s focused mainly on the implementation of the ES (Kähkönen et al. 2017). The researchers studied, for example, project success factors and best practices in order to improve the implementation and further the development of the ES.

However, it seems that there is a limited amount of research regarding the interaction between the ES and the organization. Mattila (2012) studied the way an organization increases efficiency through the restructuring and implementation of a strategically important project delivery model. Hustad and Munkvold (2005) studied the issues related to implementation of IT-supported strategic competence management. Otherwise, there do not seem to be any other studies regarding the HRM modules of ES.

There is plenty of IS research on knowledge management, as well as on ES, but implementation initiatives often still fail (Kähkönen et al. 2017, Momoh et al. 2010, Pekkola et al. 2013). In addition, there is only a limited amount of research regarding the utilization of CMS DPs.

The knowledge-management research community has identified the interplay between organizational knowledge and firm-level competitive advantage as an important research topic (Alavi and Leidner 2001). Indeed, KIPOs compete in a dynamic business environment with their organizational knowledge base. Knowledge workers' productivity and work quality vary significantly (Drucker 1999). Accordingly, knowledge workers' effectiveness has been noted to be a critical research area (Alavi and Leidner 2001).

ES can provide organizations with substantial competitive advantage but the failure rate of implementation is high (Kähkönen et al. 2017, Momoh et al. 2010, Pekkola et al. 2013). ES are large suites of applications supporting operational and analytical business processes on an enterprise level (Brown and Vessey 2003). In other words, they provide organizations with the technological support to integrate business processes and to seamlessly integrate and share all the information flowing through the company (Lee and Lee 2000, Davenport 1998).

There is a limited amount of literature available regarding the organizational aspect of ES projects and especially competence management functionality. Grabski et al. (2011) divide current ES research into three major ES research areas: critical success factors, organizational impact, and economic impact. Hustad and Munkvold (2005) studied the issues related to the implementation of IT-supported strategic competence management. Corallo (2010) studied the optimization of competence management processes. Simon (2010) discussed CMSs from a design theory perspective. Chae et al. (2011) performed an exploratory study on information sharing and HRIS. Mattila (2012) studied the way an organization increases efficiency through restructuring and through the implementation of both a strategically important project delivery model and ES.

**A Competence Management System (CMS)** *is an information system specifically designed to help organizations manage competence, both at the individual and organizational level. (Lindgren et al. 2004)*



In December 2016 there was a special issue of the journal *Information Systems Frontiers* on knowledge and competence management, focusing on the design and implementation of the required tools. In this issue Zimmerling et al. (2016) and Allal-Chérif et al. (2016) studied the utilization of games in competence management, Sánchez-Segura (2016) argued that IT companies are not making the best possible use of intangible assets, Goncalves et al. (2016) proposed an information management model for competencies and learning outcomes, Lacheheb and Maamri (2016) introduced an enterprise solution to construct a business process using competence and knowledge management aspects, Sousa and González-Loureiro (2016) aimed at identifying different knowledge profiles and analyzing their innovation contribution, Kimble et al. (2016) describe an architecture suitable for use in a CMS in KIFS, Charband and Navimipour (2016) conducted a systematic literature review of online knowledge sharing papers in 2009–2015, Chang et al. (2016) explore technology and knowledge integration mechanisms in new product development, and Bououd et al. (2016) studied competence management in 3D virtual worlds. In conclusion, all of these articles highlighted the importance of knowledge and competence management and, although a few articles focused on technology, none of them utilized previously published CMS DPs (Lindgren et al. 2004).

Lindgren et al. (2004) formulated a set of DPs for developing strategic CMSs. Sein et al. (2011) revisited the same research with new methods. I have used the CMS DPs of Lindgren et al. (2004) as the foundation for this ADR and end up proposing improvements to the original DPs in this dissertation. I described the problem formulation stage in more detail in paper 1, introduced a new CMS DP called “information as an asset” in paper 2, described the technical solution in yet another paper, paper 3, and combined all these together by describing a complete formalization of the learning in paper 4.

#### **2.1.4 Design Science in IS**

In this thesis I am using design science as an overall paradigm and the basis for the rigorous empirical study. I will discuss this in more detail in section 3, “Methodology.”

## **2.2 Guiding Concepts in this Research**

In this section I briefly describe the guiding concepts used in each of the published papers: paper 1 (HICSS), paper 2 (ICIQ), paper 3 (MCIS), and paper 4 (ICIS).

### **2.2.1 The DCF (Paper 1)**

Business environments have become more and more dynamic, so the traditional strategy approaches, like Porter’s (1979) market-based view, have been challenged with a resource-based view (RBV) (Pennrose 1959). RBV means that instead of a strategic focus on the external market, the focus is on internal resources and capabilities. The RBV’s supporters (Wernerfelt 1984) are convinced that the

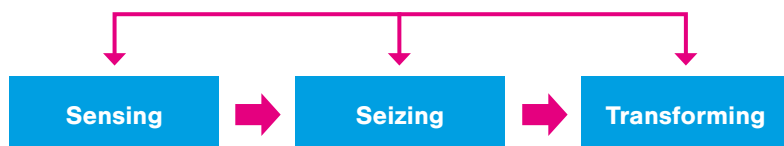
competitive advantage and above-average profits are on a more secure basis in this way, rather than focusing on industry attractiveness. It has been said that the RBV works especially well in high-velocity environments (e.g., the global hi-tech industry) when new companies are created to exploit specific technological capabilities (Minzberg 1998). The RBV is also commonly utilized in IS research (Wade and Hulland 2004).

However, nowadays in the continuously changing global environment, even a RBV is not enough to provide strategy practitioners with the knowledge of how to gain sustainable competitive advantage. For instance, Haeckel (1992) introduced Sense and Respond as a concept for adaptive enterprises. Furthermore, Teece et al. (1997, 2009) supplemented the RBV with the concept of routines, using evolutionary organization theories to create a DCF. These modern theories emphasize the dynamic nature of evolving business environments and the active development of company resources with, for example, knowledge and competence management.

A DCF was chosen as a theoretical lens to analyze the case organization at the beginning of the research project. Teece (2009) defines **dynamic capability** as *“the firm’s ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments.”* The basic assumption of the framework is that core competencies should be used to modify short-term competitive positions that can be used to build longer-term competitive advantage. The literature on dynamic capabilities grew out of the RBV of the firm and the concept of routines in evolutionary theories of organization. It thus provides a bridge between the “traditional” strategy literature and evolutionary approaches to organizations.

The main elements of the framework are (see figure 4):

- **Sensing:** analytical systems that learn and sense internal strengths and external opportunities
- **Seizing:** enterprise structures, designs, procedures, and incentives for seizing opportunities
- **Transforming:** continuous alignment of specific tangible and intangible assets



**Figure 4.** The DCF (adapted from Teece 2009)

### 2.2.2 Information Governance (Paper 2)

Companies should treat corporate information as a key strategic asset in order to achieve competitive advantage (Borek et al. 2013, Davenport 2007). Information-driven decision-making seems to lead to higher productivity and improvements in performance (Brynjolfsson 2011). Like any other asset, information needs good corporate governance and related quality controls across the entire information life cycle.

Information governance is a relatively new research area (paper 2) having its origin in the 1980s and 1990s. It was researched in the strategic planning of information resources (Goodhue et al. 1988, 1992, Levitin and Redman 1998) and in looking at information as a product (Wang et al. 1998). It combines the best practices from many fields, such as strategic management, business process management, risk management, and IT governance (e.g., Tallon et al. 2013, Otto 2011, Borek et al. 2013, Khatri and Brown 2010, Weber et al. 2009). It is important to notice that the governance of data should be separated from IT governance (Weil and Ross 2007). I elaborated on the subject of information governance and introduced a new CMS DP (*“information as an asset”*) in paper 2.

In paper 2 we defined **information governance** as *“the formal framework that includes the structure and execution of authority and accountability over information assets, in order to encourage, enforce, and monitor meeting the desired organizational objectives.”*

### 2.2.3 Agile Software Development (Paper 3)

The previous plan-driven IS development methods could not manage with rapid changes in the environment (e.g., requirements, scope, technology), which created opportunities for the emergence of agile methods (Highsmith and Cockburn 2001, Conboy 2009). They originate from many lightweight methods (e.g., extreme programming, lean development, scrum) and were promoted in 2001 with the publication of the Agile Manifesto, which is a set of principles guiding iterative development of software in self-organizing teams (Fowler and Highsmith 2001).

The IS development field has changed substantially since the publication of the Agile Manifesto (Dingsøyr et al. 2012). The change has mainly been driven by practitioners (e.g., Leffingwell 2011) as often happens with new methods, tools, and practices in IS development, but there has been an increasing interest in the research on agile software development (Abrahamsson 2009). The earlier research has identified a need for more empirical research focusing on experienced agile teams and organizations giving more attention to management-oriented approaches (Dingsøyr et al. 2012).

The Agile Manifesto is founded on the worldview that organizations are complex systems that are constantly changing. Therefore, development projects should not try to struggle against these changes but rather improve the practices so that they are capable of embracing the inevitable changes that occur during the development life cycle. Moreover, one key principle is the decentralization of the organization and strong trust in independent, competent individuals who are

guided by few general rules and empowered to self-organize and create innovative emerging solutions. In other words, agile methods stress the importance of short iterative cycles, where dynamic prioritization, feature planning, and implementation take turns. However, with speed and agility the ultimate aim of delivering good quality releases is equally important (Highsmith and Cockburn 2001).

The Lean Startup methodology is one of the adaptable approaches to avoid making fixed strategies based on predictions of future customer demand and it seems to be gaining popularity in organizations of all sizes (Blank 2013). It has its roots in lean thinking (Womack et al. 1990, 1994, Womack and Jones 2010), which in turn expands the concept of lean manufacturing (Ohno 1988, Krafcik 1988) in service organizations.

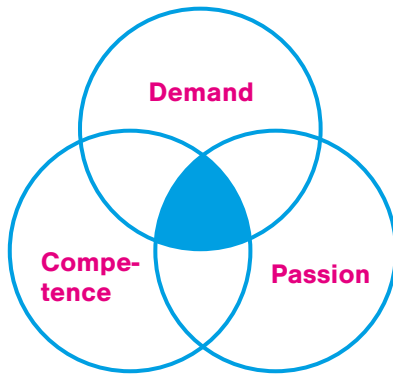
According to Appelo (2011), management is the biggest obstacle on the way to agile development. Collins (2011) introduced the concept of Level 5 Leadership, referring to the highest level in a hierarchy of executive capabilities—the ones able to push their ego aside in order to let the employees thrive. Leaders at the other four levels in the hierarchy can produce a high degree of success but not enough to elevate companies from mediocrity to sustained excellence. Robertson (2006, 2007) went so far in his concept of *holacracy* that he proposed giving each “circle” inside the company total autonomy to implement its purpose. Logan et al. (2008) argue that in each company there are anything from a few natural *tribes* to hundreds of natural tribes that leaders can leverage to build successful businesses.

#### **2.2.4 The Hedgehog Concept (Paper 4)**

One of the evolutionary management approaches is Collins’ (2001) above-mentioned concept of Level 5 Leadership, including the Hedgehog Concept, which is based on an ancient Greek parable that states: “The fox knows many things, but the hedgehog knows one big thing.”

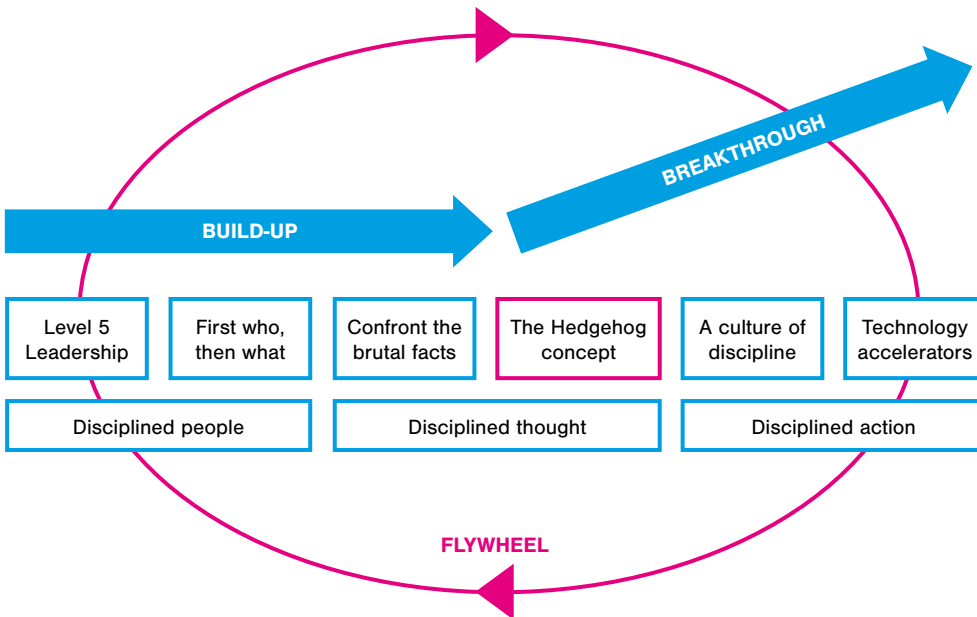
The philosopher Berlin (1953) applied the parable in the modern world and divided people into two categories. He argued that “foxes” pursue many goals and interests at the same time and, as a result, their thinking is unfocused limiting their long run achievements. “Hedgehogs,” on the other hand, are slow and steady, which is why people often overlook them, but due to their ability for simplification they have an overarching vision and focus, helping them to eventually succeed.

Collins (2001) applied this classic idea in business world and defined the **Hedgehog Concept** as a simple understanding of three intersecting circles: The circles represent what a company can be best in the world at, how its economics work best, and what best ignites the passions of its people. According to him, breakthroughs happen when a company becomes systematic and consistent with its Hedgehog Concept and eliminates virtually anything that does not fit in the three circles. As a result of this strategy, the company is able to beat the competitors and become truly great in business (see figure 5).



**Figure 5.** The Hedgehog Concept (adapted from Collins 2001)

The Hedgehog Concept is part of Collins’ (2001) bigger concept of Level 5 Leadership (see figure 6), which (according to him) is the strategic key to truly great companies. Collins argues that each great company has to first patiently go through the build-up phase by finding the right leaders and employees (“disciplined people”) as well as formulating the right strategy (“disciplined thought”) before the Hedgehog Concept ignites the breakthrough phase, consisting of systematic implementation (“disciplined action”). As a result, business operations gain more and more momentum and eventually the business thrives, seemingly effortlessly, like a big flywheel turning unstopably.



**Figure 6.** The Level 5 Leadership flywheel (adapted from Collins 2001)

## **3. Methodology**

In this thesis I use design science (Hevner et al. 2004) as an overall paradigm and the basis for the research framework. In fact, this research is conducted using the ADR method, applied according to Sein et al. (2011). Moreover, the research exploits the organization-dominant version of the method, which is described in detail in section 3.2.

The research constitutes my doctoral research consisting of four published papers. Paper 1 described the problem formulation, paper 2 described information governance, paper 3 described the technology, and the final paper, paper 4, concludes the research and formalizes the learning from the research project as a whole.

This chapter first provides an overview of the research methodology applied in this empirical study, including the adopted research philosophy and a detailed account of the chosen research method ADR.

It is important to point out that my intention is not to exhaustively contrast various research philosophies and paradigms, but to explain how the research paradigm and methods are chosen in light of the nature of this thesis.

### **3.1 Philosophical Assumptions**

#### **3.1.1 Qualitative Research in IS**

Over recent decades, there has been a general shift in IS research away from technological issues to managerial and organizational issues, which has resulted in an increasing interest in applying qualitative research methods (Myers 1997). Qualitative research aims at generating in-depth knowledge of the phenomena under investigation and is thereby a particularly suitable approach for exploratory work on topics that are new and for which there is not much previous scientific knowledge (Myers 2009). However, the case study approach has not always been recognized as a proper scientific method, mainly because of the argument that case studies provide little basis for scientific generalization (Yin 2013), but it has a long tradition in IS research (e.g., Benbasat et al. 1987).

Qualitative research methods were developed in the social sciences to enable researchers to study social and cultural phenomena (Myers 1997) through understanding people and the social and cultural contexts within which they live (Myers 2009). Qualitative research methods include action research, case study research, ethnography, and the grounded theory approach. Data sources, in turn, include observation and participation, interviews and questionnaires, documents and texts, and researchers' impressions and reactions (Myers 2009).

Both quantitative and qualitative research are based on some underlying assumptions that define what is regarded as valid research and that govern the

choice of appropriate research methods (Myers 1997). These assumptions need to be written out in order to build solid foundation for conducting and evaluating qualitative research. The most relevant philosophical assumptions regarding research methods relate to the underlying epistemology that defines the researcher's assumptions about knowledge and how it can be obtained (Goles and Hirschheim 2000). Orlikowski and Baroudi (1991) suggest three research categories based on the underlying research epistemology: positivist, interpretive, and critical.

### **3.1.2 The Pragmatic Epistemological Stance**

This research is conducted as an ADR in a single case organization and it adopts a pragmatic research approach in order to answer the research questions presented in section 1.2. The pragmatic epistemological stance is aimed at creating prescriptive knowledge to improve a given situation and finding solutions to problems that actually occur in practice (Baert 2005).

#### ***The Ontology and Epistemology of Pragmatism***

In the philosophy of social science, *ontology* refers to the nature of reality and *epistemology* describes the relationship between the researcher and the research subjects. Therefore, the implications for a research project are especially the assumptions regarding how it is possible to collect scientific evidence.

According to pragmatic ontology an external reality exists for a researcher. However, pragmatists argue that absolute *truth* about this reality is impossible to obtain (Rorty 1991). On the other hand, they believe that (via experience and experimenting) it is possible to obtain *indirect truth*, which can be applied in some situations (Johnson and Onwuegbuzie 2004).

Moreover, Guba (1999) argues that according to positivists it is possible to obtain an objective worldview, whereas interpretivists think that reality is socially constructed, which only results in subjective worldviews. Teddlie and Tashakkori (2009) continue, stating that pragmatists have challenged these extreme points of view and think that knowledge acquisition is a continuum and not limited to the above-mentioned extremes. Goles and Hirschheim (2000) argue that this allows a pragmatic researcher "to select the approach and methodology most suited to a particular research question, providing a conceptual foundation for the use of both quantitative and qualitative tools."

In other words, the ontological and epistemological assumptions in pragmatism can be seen to be somewhere between the extremes of positivism and interpretivism. According to positivists, it is possible to obtain an objective view of the world, which is opposite to the interpretivist idea that reality is always socially constructed and all knowledge is subjective. However, pragmatists challenge these perspectives and see knowledge acquisition as a continuum rather than being constrained by extremes.

### ***The Origin of Pragmatism***

Goles and Hirschheim (2000) note that paradigms change if they no longer provide the desired results. According to Baert (2005), social sciences intend to “map the social world as accurately and completely as possible,” which is usually in conflict with positivism: “utilizing methods of natural science ignores the meaningful dimensions of social life and as a consequence, does not allow for accurate depicting of the social.”

In fact, Benbasat and Zmud (1999) argue that there has been a lot of criticism for the positivist paradigm in social sciences because it leads to academic research without practical relevance. Hoshmand and Polkingthorne (1992) state that it means “minimal instrumental use of research literature and low participation in research by practitioners.” On the other hand, they call for “theories of action that can inform practice and provide more adequate maps of the social realities of practice.”

Many American authors (e.g., Dewey, James, Mead, Peirce) challenged positivism with pragmatic epistemology in the early 19<sup>th</sup> century (Baert 2005). Creswell (2007) defines that pragmatists “focus on the outcomes of the research—the actions, situations, and consequences of inquiry—rather than antecedent conditions (as in post-positivism).” However, in the 1990s Tashakkori and Teddlie (1998) still argued that American pragmatism has not been properly appreciated in the philosophy of science, which seems to be focusing on positivism and interpretivism. Van Aken and Romme (2009) also argue that contemporary research in organization and management is modeled after natural science, meaning that it aims at positivistic ideals of objective and value-free research by employing deductive and empirical approaches. However, pragmatists aim to create theories of actions and, therefore, the pragmatic paradigm in social sciences has been revived by neo-pragmatists like Donald Davidson, Richard Rorty, Willard Quine, and Hillary Putnam (Baert 2005).

### ***The Principles of the Pragmatic Paradigm***

The pragmatic paradigm is more interested in the results of the research than in “tyranny of the methods” (i.e. in how the research is conducted) (Gallupe 2007). Pragmatists often conduct research using mixed methods, which gives the researcher practical flexibility. Johnson and Onwuegbuzie (2004) quote Pierce: “reasoning should not form a chain, which is no stronger than its weakest link, but a cable whose fibers may be ever so slender, provided they are sufficiently numerous and intimately connected.”

Goles and Hirschheim (2000) argue that, for a pragmatist, values are only relevant and important when they influence what to study (units of analysis and variables) and how it is studied (research methodology) in accordance with a value system to achieve original outcomes. Teddlie and Tashakkori (2009) state: “this description of pragmatists’ behaviors is consistent with the way that many researchers actually conduct their studies, especially research that has important societal consequences.”



Pragmatists believe that an objective point of view is an impossible ideal and should be forgotten. For example, Baert (2005) argues, “the belief that a neutral algorithm underscores all scientific activities rests on a selective and distorted view of science as an accomplished and neatly demarcated activity.” Straub, and Straub and Boudreau (2004) also remind us that absolute truth is impossible because research is always done in some specific cultural context with its conventions, restrictions, and language.

Pragmatists like Rorty (1991) challenge the viewpoint of absolute truth or a “god’s eye view,” as they believe that no one can “step out of history” given that any position is situational and not absolute. Pragmatists are skeptical about finding “the one reliable method of science for reaching the truth about the nature of things” (Rorty 1991) as “for pragmatism, truth has no speculative function: all that concerns it is its practical utility” (Durkheim, 1914/2011). Pragmatism goes beyond the mere observation of the phenomena of positivist and interpretivist philosophy—it is intended “to change existence” (Goldkuhl 2004). Pragmatists like Rorty thus propose “an edifying form of philosophy in which we no longer search for atemporal foundations, but redescribe ourselves in conversation with others” (Baert, 2005).

### ***Why use Pragmatism in this Research?***

IS science conducts research in increasingly complex and dynamic organizational settings and, therefore, previously established epistemologies are no longer able fulfill research objectives. Davenport and Markus (1999) elaborated on the problems of positivism: “A cumulative research tradition hinders relevance in an era of rapid business change.” Moreover, IS researchers have to be able to study the organizational impacts in full scope and not only focus on a “neatly demarcated area,” as Baert (2005) described studying closed systems. The researcher is always engaged in a cultural context with conventions and restrictions, as well as language, that make the acquisition of absolute truth impossible (Straub and Boudreau 2004).

There are many reasons why the research objective in this thesis requires taking a pragmatic epistemological stance. First, HRM improvement is such a new phenomenon that there is not much existing research on it or theories regarding it. Therefore, this research aims at creating new theories and DPs for HRM improvement. Second, in this case it would be impossible to gain enough knowledge by objective observation or interpretive approach. The required rich information and tacit knowledge can only be achieved by collaborating with employees, customers, and partners of the case organization during several years of personal involvement. Finally, there was a need to design and implement a new ES and modify the organizational practices of the case organization. As a result, the researcher had to take part in an R&D project to improve the problematic HRM situation. In conclusion, the pragmatic approach—“*action that improves existence*” (Goldkuhl 2004)—fits this research well.

### *The Limitations of the Pragmatic Epistemological Stance*

Johnson and Onwuegbuzie (2004) remind us that even though there are many practical benefits, it is important to understand the limitations of pragmatism as well:

- Pragmatic research often results in practical applied research, which may lead to less of a focus on basic research
- Pragmatism may highlight smaller improvements and neglect fundamental or revolutionary change
- Some researchers following other paradigms have pointed out that pragmatists do not always clearly answer for whom the results are useful
- The practical contribution of pragmatic research can be vague if the researcher does not explicitly write it out

### *The Contribution of Pragmatic Research*

Hoshmand and Polkinghorne (1992) define that in pragmatic research “the test of knowledge is not whether it corresponds exactly to reality [...] instead the test for knowledge is whether it serves to guide human action to attain goals.” As a result, the fundamental question regarding the contribution of pragmatic research is do “the actions, based on this knowledge indeed produce the intended outcomes?” (van Aken and Romme 2009).

Worren, Moore and Elliott (2002) describe alternatives for evaluating the contribution of models created by pragmatic research:

- **The level of adoption:** If the models are widely adopted and extensively used it is most likely that they have some value for the users
- **The experimental method:** Direct assessment by providing different tools for different groups and analyzing the differences in performance that may be the result of the created model
- **Interview:** Evaluate the contribution by asking the users to give their opinions about the model

Patton (2003) also describes ways to address the contribution of social science research by Utilization-Focused Evaluation. He argues that it should be done by judging it by the utility and the actual use—in other words, by whether or not the intended users actually use the results for the intended purpose.

### *Conclusion*

In sum, pragmatism is somewhere in the middle of the positivist and interpretivist paradigms using quantitative and qualitative research methods. Baert (2005) argues that “knowledge is a form of action, which, like any action, brings changes to the world.” Goldkuhl (2004) continues this, noting that a practical contribution is the result of action based on knowledge in the form of theories. Tashakkori and Teddlie (1998) conclude that pragmatists “consider the research questions

to be more important than either the method they use or the worldview that is supposed to underlie the method.”

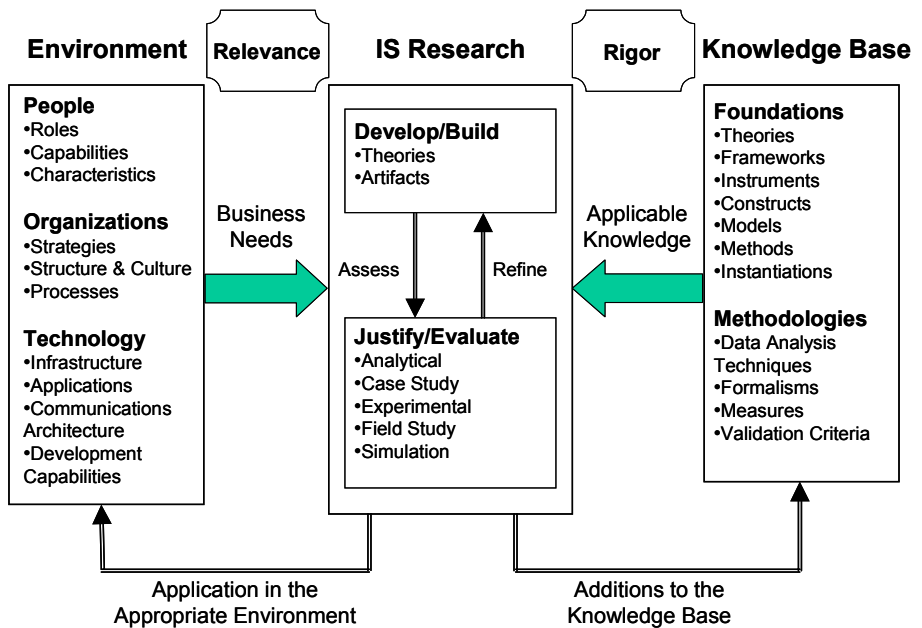
## 3.2 The Research Approach

### 3.2.1 Design Science in IS

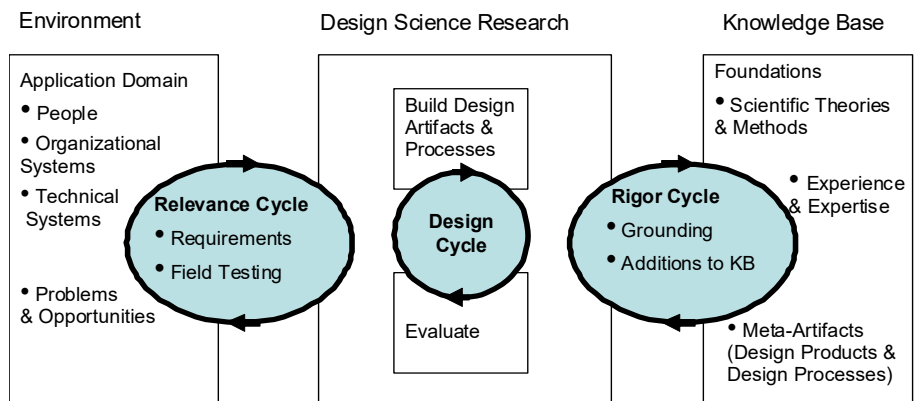
IS research, and especially design science, aims at solving practical problems as well as producing scientific contributions. The design-science paradigm has its roots in engineering and the sciences of the artificial (Simon 1996). March and Smith (1995) argue that IS research literature affirms the importance of design. On one hand, the work of IS practitioners often includes design directly or indirectly in the form of the development, implementation, operation, and maintenance of IT systems. On the other hand, IS research often aims at practical relevance, as Hevner et al. (2004) pointed out.

Hevner et al. (2004, 2007) formalized the DSR method (see figures 7 & 8). First, in the *relevance cycle* the role of research is to create solutions in real contexts. The interesting phenomena are related to individuals, groups, organizations, and markets and their relationships with existing or planned technologies. In this context the researchers and the practitioners define the organizational needs based on how they perceive, for example, strengths and weaknesses. Second, in *the rigor cycle* the role of the researcher is to use existing scientific knowledge to solve practical problems and to contribute to improving the knowledge base. This scientific knowledge consists of foundational theories, frameworks, instruments, constructs, artifacts, and methodologies from IS, as well as from other disciplines such as sociology and natural science. In addition to *descriptive theoretical* knowledge, the knowledge base also includes *prescriptive design* knowledge, resulting from the evaluation of previously built artifacts, built to solve specific business needs.

Gregor (2006) categorizes theories in the IS discipline into five types: 1) theories for analyzing, 2) theories for explaining, 3) theories for predicting, 4) theories for explaining and predicting, and 5) theories for design and action. In this thesis I am using and contributing to the knowledge base of theories for explaining, as well as to the base of theories for design and action. According to Gregor, theories for explaining aim at answering how and why some phenomenon occurs, which means that they are part of the descriptive knowledge base. Moreover, theories of action and design aim at giving guidance on how to build innovative artifacts, which means that they contribute to prescriptive knowledge.



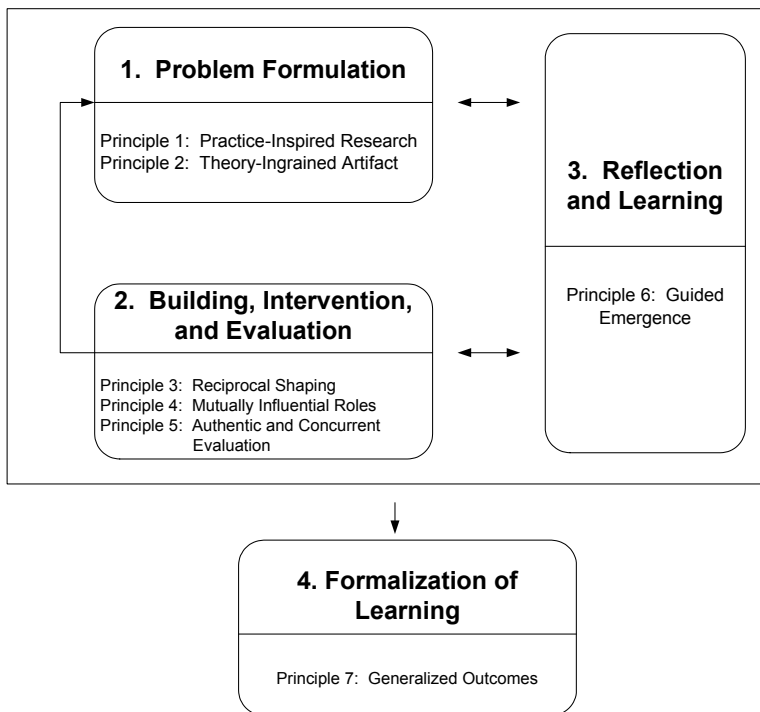
**Figure 7.** Design science in IS (Hevner et al. 2004)  
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**Figure 8.** DSR cycles (Hevner 2007, reprinted with permission from SJIS)

### 3.2.2 ADR

ADR (Sein et al. 2011) is a design science research method for generating prescriptive design knowledge through building and evaluating an ensemble of IT artifacts in an organizational setting. ADR is based on four stages, with several iterative loops, for doing highly interactive constructive research (see figure 9). The first stage, *problem formulation*, identifies and conceptualizes a research opportunity based on existing theories and technologies. The second stage—*building, intervention, evaluation (BIE)*—is carried out as an iterative process in a target environment. It includes the building of the artifact, intervention in the organization, and evaluation. The outcome of the BIE stage is the realized design of the artifact. The third stage, *reflection and learning*, moves conceptually from building a solution for a particular instance to applying that learning to a broader class of problems. The fourth stage aims at *formalizing* the learning from the study. Each ADR stage includes DPs that can be used to guide a research (see paper 4) and evaluate its quality (see section 4.4.2).



**Figure 9.** The ADR method: stages and principles (Sein et al. 2011)  
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This ADR is conducted in a case organization and, therefore, utilizes some aspects of case study research as well. Yin (2013) defines case study research as “an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident.” In fact, according to Orlikowski and Baroudi (1991) case study research is the most common qualitative method used in IS research. Benbasat et al. (1987) argue that the case study research method is seen to be well suited to IS research, because the object of the discipline is the study of IS including the usage of the systems in organizations.

Yin (2013) states that the case study methodology has a distinct advantage when a *how* or *why* question is being asked about a contemporary set of events over which the investigator has little or no control. Galliers (1991) argues that the case study approach is also beneficial since it enables both the capture of “reality” in considerably greater detail and the analysis of a considerably greater number of variables than is possible with most quantitative research methods.

Myers (1997) reminds us that the term *case study* has different meanings—it can describe the research method or the unit of analysis. In this research the research method is ADR and the unit of analysis is a particular organization (i.e., the case organization).

I think it is worthwhile elaborating on the many reasons why I ended up choosing ADR as a method for this study before moving on to the actual empirical case in chapter 4. I was looking for a research method that would allow me to exploit my extensive experience in consulting projects but at the same time bringing in a rigorous, widely acknowledged scientific method. There was a need to construct an IT artifact, which led me to design science. However, there was also a need for major organizational changes and ADR seemed to address this aspect of combining organizational and technological changes better. ADR allows the researcher to firstly start from a practical problem and then start studying theories, which was a perfect way to tackle the start of this particular case. The case organization culture had a strong support in grounding major decisions and change initiatives in scientific knowledge, which seemed to be a good match with the ADR principle of designing theory-ingrained artifacts. The ADR method expects conducting several BIE rounds allowing for iterative design, development, and learning, which was very suitable for the planned three-year-long longitudinal research. ADR has a built-in mechanism for researchers and practitioners working together, which provided me with a way to combine my daily work at the case organization and conduct scientific research at the same time. Finally, the ADR method was published just before (2011) I started my research (2013) and I was excited about the possibility of utilizing a new and fascinating research method and hopefully being able to contribute incrementally to the IS research method knowledge base.

## 4. The empirical case

This chapter first presents the case organization and research design process, then goes on to review research quality and the validity of the chosen research methodology, as well as ethical considerations affecting this thesis.

### 4.1 The Case Organization: Siili Solutions PLC

Siili Solutions PLC was founded in 2005 and offers business and technology consulting services to enterprise-scale B2B customers. It operates in Finland, Germany, Poland, and the USA and in most of the cases the employees work at customer premises. Siili Solutions PLC is commonly viewed as a technology-independent trusted partner, co-creating the solutions with agile methods together with the customers. Most of the work is charged on a monthly basis, by man-hour, with prices following the average in Finland. The company relies heavily on the technical expertise of its employees, who have worked as consultants much longer than is customary in the field.

The company has grown very rapidly and profitably: the average annual revenue growth has been over 40%, with about 10% EBITDA from 2010 to 2016. The annual revenue amounted to €48M in 2016 (+16% from 2015) and is expected to reach €60M in 2017 (see figure 10).

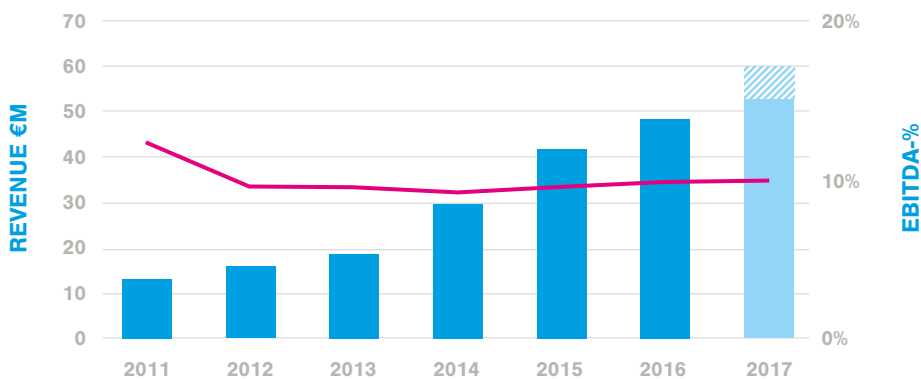
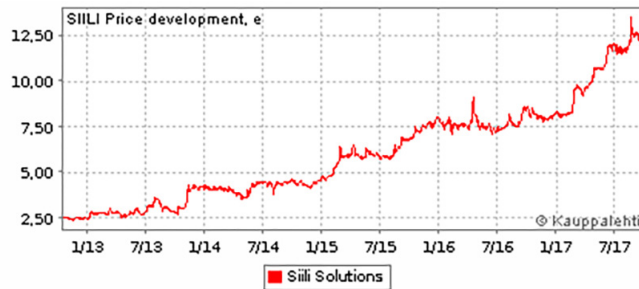


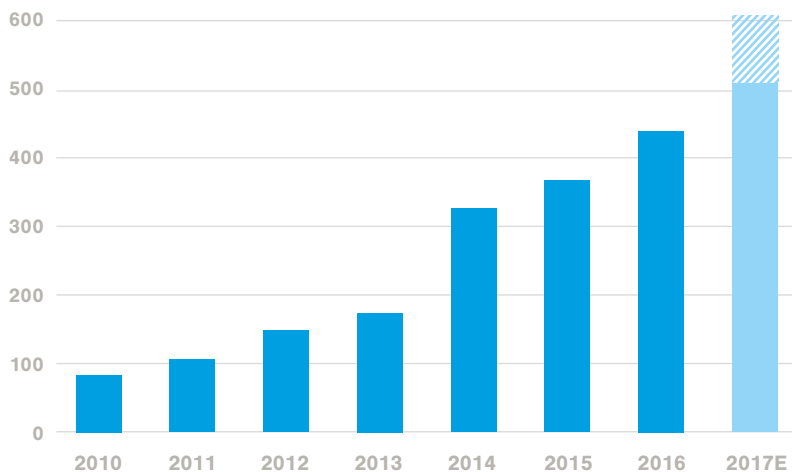
Figure 10. Siili Solutions PLC revenue and EBITDA-% 2011–2017

Siili Solutions PLC's shares were listed on the Nasdaq stock exchange with the initial public offering stock price of €2.33 on Oct 15<sup>th</sup>, 2012. The all-time high stock price was €13.48 euros (August 23<sup>rd</sup>, 2017), which equals a 478% increase (see figure 11) and over €90M market capitalization.



**Figure 11.** Siili Solutions PLC stock price 10/2012–9/2017 (KauppaLehti 2017, reprinted with permission from Alma Media PLC)

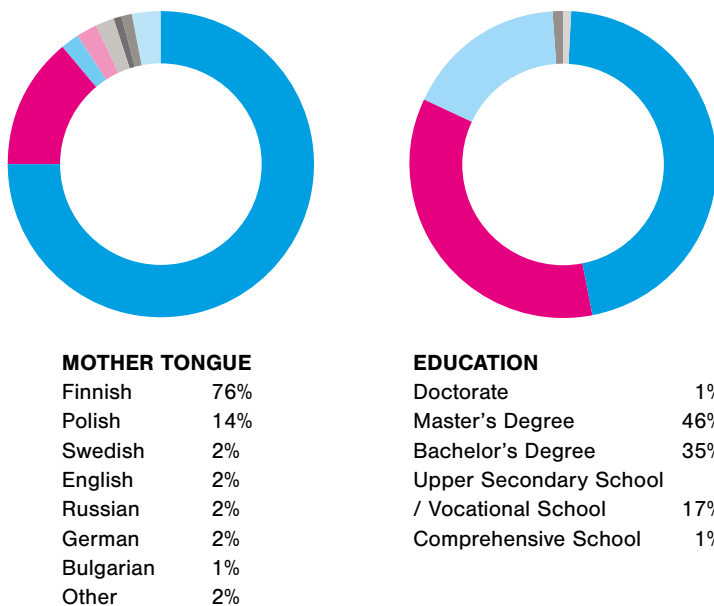
The headcount has increased from 84 in 2010 to over 500 in 2017. About 85% of the employees are male, over 80% have a university degree, the average working experience is over 13 years with about three years at Siili Solutions PLC. The company employs about 20 different nationalities, but the majority of employees are either Finnish (76%) or Polish (14%). The official company language is English (see figures 12 and 13).



**Figure 12.** Siili Solutions PLC headcount 2010–2017

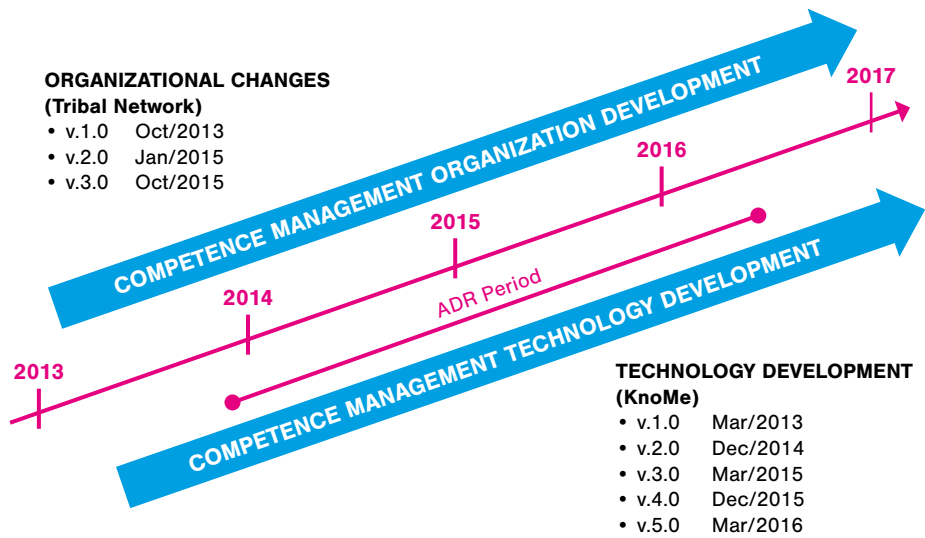


Men **86%**  
 Women **14%**  
 Total number of employees **440**  
 Average Siili career length **2,8 years**  
 Average career length **13,0 years**



**Figure 13.** Siili Solutions employee statistics on December 31st, 2016

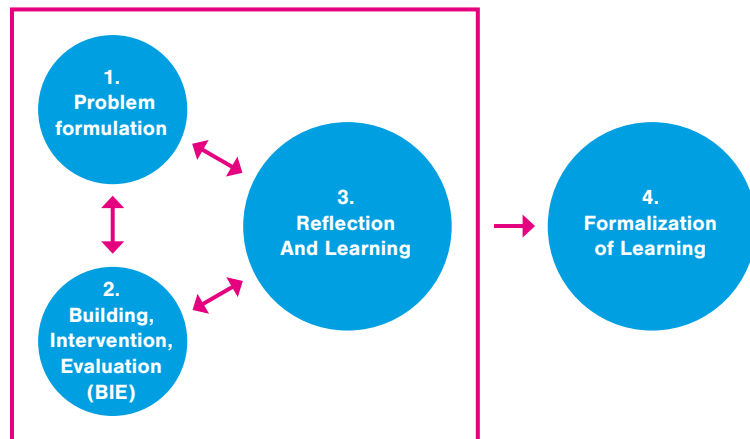
Siili Solutions PLC conducted an R&D initiative aimed to improve competence management in order to meet current and future customer demand from January 2013 to October 2016. During the R&D initiative there were three major organizational changes and five major releases of the competence management technology (see figure 14). The heaviest development efforts were between 2014 and 2015 and Siili Solutions PLC has invested over €2 million in the program.



**Figure 14.** Organizational development resulted in the competence-based Tribal Network and the technological development in the competence management software solution KnoMe

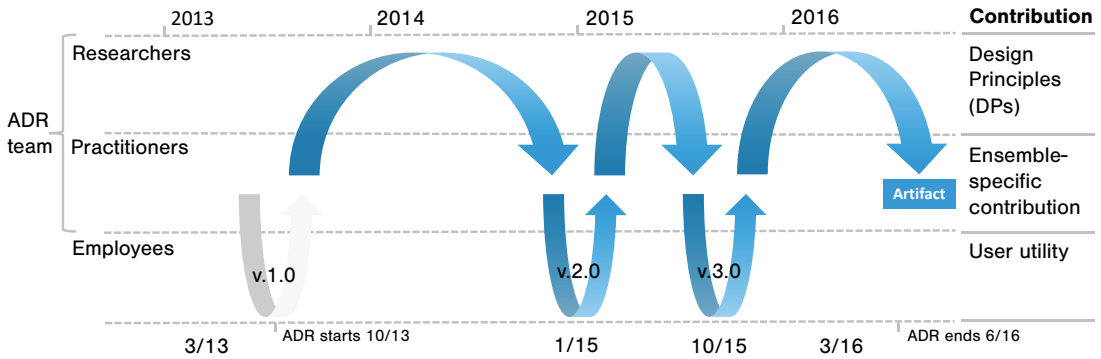
## 4.2 The Design Process in this Research

ADR (Sein et al. 2011) is practice-inspired research, resulting in a theory-ingrained artifact. In line with ADR methodology, this research consists of four stages (see figure 15). Stages 1 to 3 were repeated several times before eventually moving on to stage 4. All the papers were published in 2016 (January, June, September, and December).

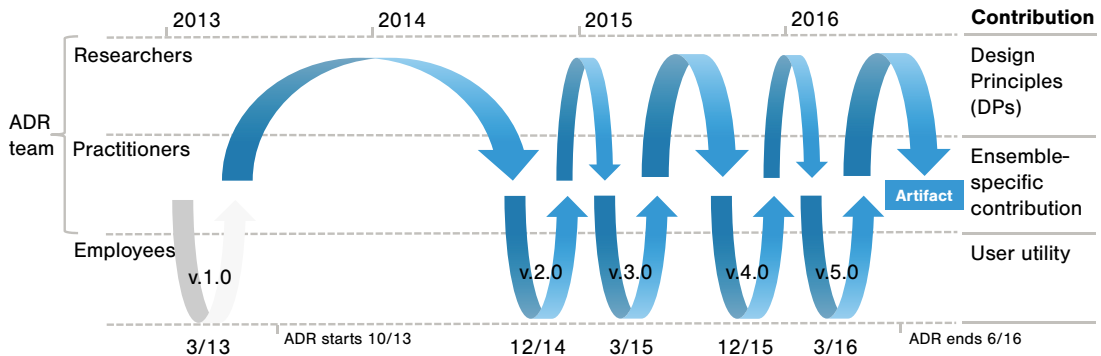


**Figure 15.** The applied ADR method (adapted from Sein et al. 2011)

Figures 16 and 17 describe the BIE rounds, each contributing a new iteration to the research. The rounds lasted from 3 to 12 months. The organizational and technological interventions (Gash and Orlikowski 1991) are described in more detail in section 4.3.



**Figure 16.** The BIE stage and release versions of the competence management organization (inspired by Sein et al. 2011)



**Figure 17.** The BIE stage and release versions of the competence management technology (inspired by Sein et al. 2011)

**Table 3.** Research timeline 2013–2016

Year	Month	Research	Technology	Organization
2013	Jan		KnoMe v.1.0	
	Feb			
	Mar			
	Apr			
	May			
	Jun			
	Jul			
	Aug			
	Sep			
	Oct	ADR starts		Tribal Network 1.0
	Nov	Interviews 1		
	Dec			
2014	Jan			
	Feb			
	Mar			
	Apr			
	May			
	Jun			
	Jul			
	Aug			
	Sep			
	Oct		1st wave of interventions	
Nov			Information governance	
Dec		KnoMe v.2.0		
2015	Jan			Tribal Network 2.0
	Feb			
	Mar		KnoMe v.3.0	
	Apr	Interviews 2		
	May			
	Jun			
	Jul			
	Aug	Confirmatory WS 1		
	Sep		2nd wave of interventions	
	Oct			Tribal Network 3.0
Nov				
Dec		KnoMe v.4.0		
2016	Jan			
	Feb			
	Mar		KnoMe v.5.0	
	Apr	Confirmatory WS 2&3		
	May	Confirmatory WS 4		
	Jun	Confirmatory WS 5		
	Jul			
	Aug			
	Sep			
	Oct	ADR ends		
Nov				
Dec				

### *The ADR team*

The formal scientific ADR program was conducted from October 2013 to October 2016 (see table 3) by the first author as an “involved researcher” and the second author as an “outside researcher” (Walsham 1995, 2006). The first author was hired as a director (chief technology officer [CTO]) to lead the R&D initiative in Siili Solutions PLC in October 2013 and has therefore actively participated in the design of organizational objectives and implementation projects. The second author did not participate in these development activities, although he joined the same organization as a consultant in February 2015 and was promoted to tribal lead position in November 2015. Besides the two researchers, the ADR team consisted of three permanent members of Siili Solutions PLC’s service development organization. In addition, numerous software developers implemented the changes in the KnoMe competence management software solution.

### *Data Collection*

The involved researcher conducted an initial data collection with 40 open interviews from October to December 2013 and performed a current-state analysis of R&D activities with a DCF (Teece 2009) in 2014. From May to June of 2015 the involved researcher conducted 20 semi-structured interviews to formalize the scientific learning and evaluate the progress of the initiative. During the first year of the formal ADR program we focused on understanding the current and target states and designed the major organizational intervention (Tribal Network v.2.0), as well as major technological interventions (KnoMe v.2.0 and v.3.0). The authors described this in more detail in paper 1 of this dissertation.

The design ideas and plans were created using several exploratory workshops as well as openly gathering feedback from all employees with a dedicated channel in a collaboration tool (open to all employees) and a development team email address. The researchers also collected secondary research material, such as management documents, reports and instructions on the intranet, the version control and documentation tool, the project and requirement management tool, the collaboration tool, and the emails of Siili Solutions PLC, as well as publicly available information such as stock exchange releases and semi-annual financial statements. Moreover, the involved researcher also observed the usage of the HRM systems and used many of the software himself on an almost daily basis.

The involved researcher kept a research diary according to Schultze’s (2000) criteria:

- **Authenticity:** the role and identity of the researcher is explained in the text)
- **Plausibility:** the text is structured, following the timeline according to the empirical case and project meetings
- **Criticality:** the diary helps to understand the attitude of the researcher and questions the objectivity of the data

## ***Data Analysis***

In ADR, data collection and analysis are simultaneous processes and, as a result, it is difficult to know exactly when the data was analyzed versus collected. The data collection and analysis are described in greater detail in each paper and the different stages of the research are clarified as well.

## ***BIE***

The building and intervention of organizational and technological competence management was done in a real business environment—in Siili Solutions PLC—as depicted in figures 16 and 17 as well as in the next section of this paper. The DPs and other research results were evaluated in five confirmatory workshops (WSs): one in August 2015, two in April 2016, one in May 2016, and one in June 2016. The analysis of the feedback of the workshops is included in section 5, “Review of the Findings.”

### **4.3 Reflection on the ADR interventions**

In this section I reflect on the ADR interventions (three organizational changes and five major technology releases) during 2013–2016. There is a more detailed description of each stage utilizing ADR DPs in paper 4.

#### ***The situation before the ADR (from the end of 2012 to early 2013)***

At the end of 2012 the competence data of Siili Solutions PLC was poorly managed, which resulted in communications problems between sales, business unit managers (BUMs), HR, and R&D. The company employed 149 persons (41% growth from the previous year) and competence data was stored in Word documents on a network drive that was only open to management. The data included only the consultants and the data quality was very poor.

In addition, Siili Solutions PLC had grown rapidly since its foundation in 2005 and the flat line organization was stretching its limits in 2013. Each BUM had 35 reporting consultants, and competence management responsibility was shared between HR and R&D functions. As a result, company culture suffered from a lack of communication within the fragmented network of consultants, their supervisors, and two management functions.

These technological and organizational problems adversely affected employee satisfaction and complicated finding the right persons for customer projects or requests for help between colleagues.

#### ***The first attempts to improve the situation (March–October 2013)***

The competence management technology KnoMe v.1.0 was launched in March 2013 in order to provide complete transparency of the stored data for all employees. The first version of the technology included CVs (migrated automatically from Word documents), basic search capabilities, and the ability to print out the CVs

for customers. The competence management organization Tribal Network v.1.0 was launched in October 2013 to improve the common company culture and to create a better commitment to Siili and secondarily to support competence management.

Both interventions seemed to move the company in the right direction but also painfully showed early signs how big an effort the systematic competence management was going to be.

#### ***ADR start and planning (October 2013 to November 2014)***

The author was hired to lead the R&D initiative in October 2013. He decided to use the ADR method and started the problem formulation stage with current state analysis. He formed an ADR team, dedicated full-time developers to take KnoMe to the next level, conducted 40 open interviews during October–December and familiarized himself with the relevant literature during the year 2014.

This analysis was accepted as a lightweight paper in an IRIS conference in August 2014: “Problem Formulation for the Design and Deployment of Strategic Dynamic Capabilities in a Knowledge-Intensive Project Organization.”

#### ***The first wave of interventions (December 2014 to March 2015)***

The KnoMe v.2.0 was launched in December 2014 and was the first true competence catalogue with a more structured data model than in v.1.0. These improvements were essentially needed to support the information governance practices launched in November 2014.

Tribal Network v.2.0 was launched in January 2015 to improve the systematic competence management and secondarily aimed to help new Siili employees to integrate with existing employees. KnoMe v.3.0 was launched in March 2015 to support the new Tribal Network 2.0 and added features supporting the organizational structure in contrast to the individual point of view of the previous release.

Our ADR team understood very soon that, in addition to competence organization and software solution improvement, there was a clear need to focus on improving the governance of information. Therefore, according to our recommendation, the executive management team of Siili Solutions PLC made several decisions on November 19th, 2014: 1) They generated an accountable process and appointed information owners (customers: the sales director; projects: the COO; people: the HR director; competence: the R&D director; finance: the CFO); 2) they ratified an enterprise data standard for employee master data (including: name, title, year of birth, career start year, phone number, competence tribe, role, employment type, start date, end date), 3) they approved the target architecture for ES (CRM, CMS, ERP, MDM, DW/BI, and a content and document management system), and 4) they appointed service owners for these systems (e.g., the R&D director was appointed as the owner of the CMS KnoMe). After the go-live of KnoMe v.2.0 we evaluated the success and got good feedback on the functionality but realized that there was a need to improve the information quality. Therefore, two management team members, the HR director

and the R&D director, approved the People MDM process on February 15th, 2015. The data quality was now ensured by a daily HR follow-up, monthly management team meeting reports, and by using the KnoMe headcount as a basis for quarterly bonus payments. After these improvements it was relatively easy to implement and deploy KnoMe versions 3 to 5 between 2015 and 2016.

### ***Reflection and evaluation (April to September 2015)***

The author conducted 20 semi-structured interviews to formalize the scientific learning and evaluate the progress of the initiative in May-June 2015. Moreover, he conducted a formal confirmatory workshop to review the findings with major stakeholders in August 2015.

This analysis and problem formulation was written during spring-summer 2015 and eventually published in paper 1 of this thesis, in the HICSS conference: “Competence Management as a Dynamic Capability: A Strategic Enterprise System for a Knowledge-Intensive Project Organization.”

### ***The second wave of interventions (October 2015 to March 2016)***

Based on the learnings of previous interventions and analyses, the ADR moved on to the second wave of interventions.

Tribal Network v.3.0 was launched in October 2015 and aimed to encourage tribes to work closely with BUMs, R&D, and HR. Tribes and related knowledge areas began to craft their unique service visions and development plans. KnoMe v.4.0 was launched in December 2015 to support this new Tribal Network 3.0.

KnoMe v.5.0 was launched in March 2016 to integrate the ERP system, which contained the master data and realized hours of each project for invoicing purposes. This was the first major attempt to also provide technological support when looking outside the organization and utilizing this insight in competence development.

During this time, the author also wrote paper 2: “Designing Information Governance with a Focus on Competence Management in a Knowledge-Intensive Project Organization” for the ICIQ 2016 conference.

### ***The Evaluation and Formalization of Learning (April to October 2016)***

In line with the ADR method, we moved next to the formalization of learning stage. We conducted four formal confirmatory workshops to review the findings with major stakeholders from April to June 2016. The main goals of each organizational and technological release are summarized in tables 4 & 5.

During spring-summer, the author wrote paper 3: “Designing a Competence Management System with Agile Methods: Case Siili Solutions PLC” for the MCIS 2016 conference. The early version of this paper was published as a short prototype paper in DESRIST 2016.

During summer-fall, the author wrote paper 4: “Competence Management System Design Principles: Action Design Research” for the ICIS 2016 conference.



**Table 4.** The major Tribal Network releases in Siili Solutions PLC

Release	The main goal of the release	Time
1.0	Common company culture	Oct 2013
2.0	Systematic competence management	Jan 2015
3.0	Tribes to work closely with BUMs, R&D, and HR	Oct 2015

**Table 5.** The major KnoMe releases in Siili Solutions PLC—in addition, there have been smaller releases on an almost weekly basis

Release	The main goal of the release	Time
1.0	Complete transparency of the stored data for all employees	Mar 2013
2.0	To provide the first true competence catalogue including information on the ongoing and latest projects and a more structured data model	Dec 2014
3.0	To support the new organization, launched in Jan 2015, and the management of recruits and partners	Mar 2015
4.0	To support the new organization, launched in Oct 2015, and to provide a completely renewed user interface, as well an early release of customer and project management	Dec 2015
5.0	Integration with the ERP system, which contained the master data and realized hours of each customer and project	Mar 2016

## 4.4 Research Quality

Research must always be of high quality in order to produce rigorous and relevant knowledge. In this section I first discuss the theoretical aspects of research quality and then critically evaluate my research using the ADR DPs published by Sein et al. (2011).

### 4.4.1 Quality Criteria

In this section I discuss the quality of this research according to quality criteria proposed by Lincoln and Guba (1985). They propose confirmability, credibility, transferability, and dependability, used together with “corresponding empirical procedures that adequately (if not absolutely) affirm the trustworthiness of naturalistic approaches.”

The first criterion of quality in qualitative research is **confirmability**, which refers to the confirmation of findings. In this research ongoing project member checks were conducted throughout the research in regular project meetings, interviews, and steering group meetings in order to confirm findings and recommendations.

A major component of trustworthiness is **credibility**. The researcher has to ensure that the study provides credible findings. Credibility starts with the sources of evidence; the researcher has to ensure such sources are credible in order to be able to establish the overall credibility of the study as a whole. In this study, the researchers established the credibility of sources and findings during the four-year long research project. Moreover, the research process is regularly reviewed in peer debriefings with the supervising professor, other professors, and PhD students, whose suggestions often trigger further inquiries and clarifications with members of the research project.

The third quality criterion Lincoln and Guba propose is **transferability**. It concerns how the findings of a study can be transferred to another setting, with the degree of transferability depending on the similarity of the source and the target context. A high degree of similarity between the two contexts may thus suggest the findings from the source context are applicable to a new target context. To enable other researchers to assess the transferability of the findings of this study, a full description is provided, including specific details of the researched context (such as the properties of the artifacts designed to address the problematic situations, and details of the organizational setting and culture).

The criterion of **dependability** is used to assess the reliability of research findings and their underlying research process. Lincoln and Guba recommend demonstrating the reliability of the study to establish its dependability through overlapping methods that operate in a similar way to triangulation and the use of an inquiry audit in which the researcher provides evidence that allows the audience to audit the research process and findings independently. In this study, the ADR methodology is vigorously employed, incorporating routines in the BIE, and reflection and learning phases that make use of triangulation and checks with members of the organization in confirmatory workshops, aiming at verifying design outputs and research findings.

Action research, being essentially pragmatic, uses Lincoln and Guba's principle of **trustworthiness**, aiming at rigor. It is assumed that ADR, as a combination of action research and design research, provides sufficient quality criteria to ensure the results of research undertakings utilizing the ADR approach indeed produce valid results that change and improve human situations.

#### **4.4.2 ADR DPs**

In order to improve the validity of research it should be guided and evaluated by explicit quality criteria (Sarker et al. 2013). In this section I discuss the quality of this research according to the DPs that Sein et al. (2011) proposed in their seminal ADR paper (see table 6).

**Table 6.** The ADR DPs (Sein et al. 2011) used for the evaluation of the research quality

<b>ADR DPs (and the respective ADR stage in brackets)</b>	<b>Quality criteria: the actualization of ADR DPs in this research</b>
DP1. Practice-inspired research ( <i>problem formulation</i> )	Research was started due to the need for better organizational and IT support for competence management in Siili Solutions PLC.
DP2. A theory-ingrained artifact ( <i>problem formulation</i> )	The design and development of the artifacts were informed by scientific theories, as described in the section 5.5.
DP3. Reciprocal shaping ( <i>BIE</i> )	The organizational and IT artifacts were analyzed and designed together. New releases were deployed to the whole organization.
DP4. Mutually influential roles ( <i>BIE</i> )	The ADR team consisted of researchers and practitioners. The lead designer was a PhD candidate working in Siili Solutions PLC.
DP5. Authentic & concurrent evaluation ( <i>BIE</i> )	Decisions regarding the design of both the organizational and IT artifacts were done continuously as a part of usage and evaluation in real business context in Siili Solutions PLC.
DP6. Guided emergence ( <i>reflection and learning</i> )	The ADR team guided the emergence of the artifacts (the organization and IT) by utilizing concurrent evaluation (DP5). These artifacts reflect the intentional design (DP2) as well as evolutionary shaping by organizational use (DP3 & DP4).
DP7. Generalized outcomes ( <i>the formalization of learning</i> )	The research resulted in the generalized problem and solution, as well as revised CMS DPs, as described in the next chapter of the dissertation.

Principles 1 and 2 are related to **Stage 1: Problem Formulation** of ADR.

**Principle 1: Practice-Inspired Research** means that the research problems should arise from practice and should be treated as opportunities for the creation of knowledge. In other words, the aim is not to just solve a problem as a consultant, but instead try to generate knowledge that can be generalized to a group of similar problems. In addition, this principle contributes to research quality by ensuring that the research generates practically relevant and useful knowledge.

In my research the problem came up in practice: Siili Solutions PLC wanted to improve its service offering and develop the competences of the employees. However, the problem has been generalized and I ended up proposing improved DPs for CMSs.

**Principle 2: Theory-Ingrained Artifacts** means that whatever artifacts are created using ADR should be informed by scientific theories. In this research I used existing scientific knowledge to analyze the current situation as well as to guide the design and development of the artifact.

Principles 3–5 are related to **Stage 2: Building, Intervention, Evaluation (BIE)** of ADR.

**Principle 3: Reciprocal Shaping** means that the IT artifact and organizational context should be analyzed and designed together. In this research I used an iterative process in which the organizational and IT artifact are improved with small iterations, which are then deployed and the organizational and technological impacts are analyzed together and affect the design of the next iterations.

**Principle 4: Mutually Influential Roles** means that the researchers and practitioners should both aim at learning from each other. In this design research I simultaneously worked as an employee in Siili Solutions PLC and conducted my doctoral studies at university. Therefore, I was able to share my researcher knowledge in the organization and at the same time benefit from the practical knowledge and practices of the rest of the employees. In addition, via my doctoral studies I had access to valuable academic peer support and got feedback from more experienced researchers.

**Principle 5: Authentic and Concurrent Evaluation** means that decisions regarding the design of the artifact and organizational practices should be done continuously. In this research there were several consecutive BIE rounds and the evaluation of each round was used as an input for the problem formulation of the next round. Moreover, my main task in the organization was to improve the external service offering and internal competencies so the artifacts and practices would be immediately deployed when they were ready, so I only had to make sure that the results were properly evaluated in real business context.

Principle 6 is related to **Stage 3: Reflection and Learning**, which aims at moving to a more abstract level from building a solution for a particular instance.

**Principle 6: Guided Emergence** means that the artifact should reflect the theory and practical influence of organization and the participants of the project, as well as the continuous evaluation. In this research the ADR team guided the emergence of the artifacts (the organization and technology) by utilizing concurrent evaluation (DP5). These artifacts reflect the intentional design (DP2) as well as evolutionary shaping by organizational use (DP3 & DP4). In addition, the results were published as scientific research papers, which provided an important risk management tool in the research project.

Principle 7 is related to **Stage 4: The Formalization of Learning**, which aims at general DPs and possibly in the refinement of the initial theories.

**Principle 7: Generalized Outcomes** means the critical conceptual move from an artifact (representing a specific solution to a specific problem) to generalized

outcomes. Sein et al. (2011) stated: “This move from the specific-and-unique to generic-and-abstract is a critical component of ADR.” My research aimed at:

- generalization of the problem instance
- generalization of the solution instance
- the derivation of DPs

These generalized outcomes are reported as scientific results in the form of my doctoral thesis, consisting of this overview and the four published papers.

## **4.5 Ethical Considerations**

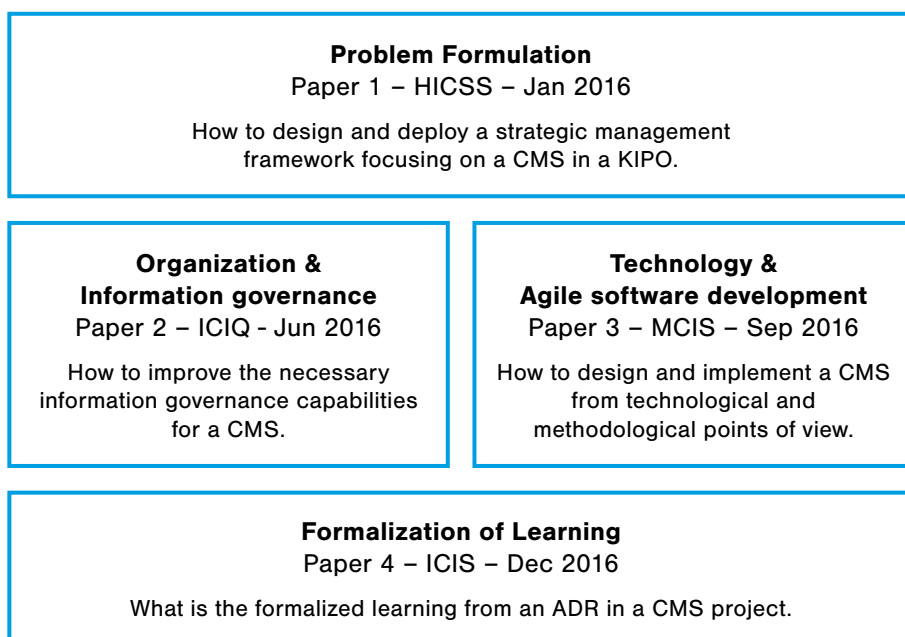
Organizational studies and interventions have to respect the feelings and privacy of the employees because they allow researchers to take part in their daily lives. In order to guarantee the safety and security of the employees and the case organizations, social scientists have to apply ethical guidelines. The goal of an ADR is to change practices via organizational and technological interventions in a co-operation between scientists and practitioners and, therefore, ADR has to pay critical attention to ethical considerations. In the worst-case scenario, violations of ethical guidelines could destroy the trustworthiness of some individuals or even get them fired. However, ethical guidelines do not only exist for risk management—they can instead help in creating a fruitful environment for transparent research and encourage the participants to openly come forward with hidden information, thus contributing to the research quality and utility.

In fact, Sieber (2009) argues that “the ethics of social and behavioral research is about creating a mutually respectful, win-win relationship in which important and useful knowledge is sought, participants are pleased to respond candidly, valid results are obtained and the community considers the conclusions constructive.”

In this research the employees participating in interviews or confirmatory workshops have been informed in advance that their input is going to be used in a scientific study so that, even though the name of the case organization will be published, the individual contributors cannot be identified (apart from the CEO of the company) and only the research team can access the original research data (e.g., interview recordings). Moreover, the research team has informed all the case organization employees about the ongoing research using the standard communication channels of the case organization at the beginning of the project and a few times during the research project. Finally, there is a written research agreement between the case organization, Siili Solutions PLC (signed by the CEO in October 2013), and the research team, agreeing that the name of the case organization can be publicly used in research publications in order to promote transparency and provide the readers with the possibility to obtain rich insight from other publicly available data sources.

## 5. Review of the findings

In this chapter, I summarize the four research papers constituting this dissertation. I provide an overview of the papers in figure 18 and present short summaries of each one thereafter. In the summary I review the research goals, questions, and contribution of each research paper. The complete research papers are provided in part 2 of the thesis. The aim of the research papers is to provide a rich description of how the CMS was designed in the case organization, as well as describing the formalization of the learning.



**Figure 18.** An overview of the four research papers

### Paper 1: “Problem Formulation”

In this paper I present the problem formulation and use the DPs of Lindgren et al. (2004) to evaluate the CMS design in the case organization. As a result, I found the DPs useful and noticed the importance of employee interest (Lindgren et al.) as well as customer demand (my finding).

### **Paper 2: “Organization & Information Governance”**

In this paper I noticed that a focus on technology and organization are not enough if the data is of poor quality. As a result, I introduced a new DP— *information as an asset*—which aims at providing a solid foundation for CMS design.

### **Paper 3: “Technology & Agile Software Development”**

In this paper I provide rich insight into CMS technology and the agile software development methodology applied in the case organization.

### **Paper 4: “The Formalization of Learning”**

In this paper I formalize the learning by improving the original CMS DPs (Lindgren et al. 2004) and by introducing one new DP: *alignment with customer demand*.

## **5.1 Paper 1: Competence Management as a Dynamic Capability**

Niemi, E. and Laine, S. (2016): “Competence Management as a Dynamic Capability: A Strategic Enterprise System for a Knowledge-Intensive Project Organization”, 49<sup>th</sup> *Hawaii International Conference on System Sciences (HICSS)*

### **In this research paper we aimed at:**

- 1) increasing understanding of competence management as a strategic dynamic capability and
- 2) gaining more understanding about the organizational and technological aspects of ES development, especially regarding competence management.

**We positioned this research paper** in the existing scientific discussion regarding strategic management, KIPOs, and ES focusing on competence management. We realized that there is a limited amount of literature available regarding the organizational aspect of ES projects and competence management functionality in particular.

**The initial current state analysis made with a DCF** recognized two important development issues in the case organization: 1) a need for the systematization of the competence management as a dynamic capability and 2) linking competences with customer needs in the design of the service offering. Moreover, according to HRD literature, the majority of competence management methods seem to require the description of current competences, the definition of target competencies, and a gap analysis, but Siili did not have any formal tools or methods for conducting these.

**Our findings offer theoretical and practical contributions:**

- Based on previous research (Lindgren et al 2004) we identified a competence typology and DPs for CMS, as well as the need to focus on the impact of technology on strategic management.
- We found the CMS DPs useful in designing the CMS in the case organization, Siili.
- Our research indicates that the development journey of competence management in Siili (seen in chronological order) has roughly followed the competence typology with increasingly demanding and useful competence structures.
- The Hedgehog Concept, introduced by Collins (2001), inspired the original competence management initiative in Siili. However, our analyses also found out some contradictions and the need for further research.

In conclusion, we pointed out the need to study both the organizational and technological aspects in CMS research. Moreover, our experiences suggest that competence management should aim towards customer demand and employee interests (competence-in-the-making) rather than only focusing on current strengths (competence-in-stock).

## **5.2 Paper 2: Information Governance and CMS**

Niemi, E. and Laine, S. (2016): “Designing Information Governance with a focus on Competence Management in a Knowledge-Intensive Project Organization”, *21<sup>st</sup> International Conference on Information Quality (ICIQ)*

**In this research paper we aimed at** *describing the design, implementation, and organizational impacts of information governance in a real business environment.*

The case organization decided to improve its competence management by creating a competence organization and related ES to support rapid growth (Niemi and Laine 2016a). However, the first ES releases and competence organization changes in the case organization did not provide the expected benefits due to information quality problems.

**In order to present an up-to-date understanding about this multidisciplinary topic, we conducted a systematic literature review** to extend and update the previous one conducted by Otto (2011). Companies should treat corporate information as a key strategic asset. Researchers and practitioners have recognized the importance of information governance, but it is still a relatively new research area.

We defined **information governance** as the formal framework that includes the structure and execution of authority and accountability over information assets, in order to encourage, enforce, and monitor meeting the desired organizational objectives.



**We used frameworks identified in earlier research** to describe the information governance situation in the case organization. First, we used an information governance research model (Tallon et al. 2013) to identify causal links between the deployed information governance, its contextual antecedents, and emerging business consequences. Next we used the morphology of data governance (Otto 2011) to indicate what actually has to be organized by information governance and what information governance may look like in the case organization.

**In the ADR project**, in its first two releases KnoMe did not provide high-quality data due to the lack of effective information governance practices. Therefore, the development program began to emphasize a business-driven goal setting and data ownership, as well as explicit organizational roles, across the entire data life cycle. KnoMe's development was heavily influenced by CMS DPs (Lindgren et al. 2004). This case study expanded them by proposing an additional DP: *information as an asset*.

**Our findings indicate that** a focus on information and its quality will result in a business benefit. The ADR program successfully implemented a real-life information governance organization to support competence management in a KIPO. Therefore, the research contributes to the existing set of information governance and master data management case studies. Our findings highlight the positive impacts of these initiatives on information quality in a real business environment.

**We contribute** to the prescriptive knowledge base on how to design and implement information governance in a real-life organizational context. Previous information governance research has emphasized the business-driven goal setting, information ownership, and management roles across the data life cycle. Our research points out that these functions do not have to be bureaucratic or massive. According to our experience the implementation of the *DP information as an asset* can lead to significant business benefits.

In conclusion, this paper focuses on the governance of information assets, which is a prerequisite in the design, development, and maintenance of competence managements systems. Moreover, we conducted a systematic literature review on information governance and applied the body of knowledge in a real-life setting, combining the organizational and technological points of view.

### 5.3 Paper 3: Agile CMS development

Niemi, E. (2016): “Designing a Competence Management System with Agile Methodologies,” *10<sup>th</sup> Mediterranean Conference on Information Systems (MCIS)*

#### **In this research paper I aim at:**

- 1) *increasing understanding of the technological aspect of the design of CMSs and*
- 2) *gaining more understanding about CMS development by software engineers with expertise in agile methodologies.*

**I positioned this paper** by pointing out that earlier research has identified a need for more empirical research focusing on experienced agile teams and organizations giving more attention to management-oriented approaches (Dingsøyr et al. 2012). Indeed, there has been increasing interest in research on agile software development (Abrahamsson et al. 2009) since the creation of the Agile Manifesto (2001). The manifesto consists of a set of principles guiding the iterative development of software in self-organizing teams (Fowler and Highsmith 2001).

#### **My findings regarding agile development and technology:**

- The ADR team decided to design and implement KnoMe following agile development principles aiming at functioning software with high end-user satisfaction. They utilized the Kanban method and DevOps principles as well as online tools for collaboration, version control, and test automation.
- The software development utilized CoachDB and Elasticsearch for the database layer, Node.js and REST for the application layer, and Angular.js for the user interface. The development infrastructure was implemented using cloud computing provided by Amazon’s Web Services (AWS) with an automated Chef environment. Authentication is done with Active Directory for internal users and with LinkedIn for external users. KnoMe is fully responsive and scales automatically for all common devices, including web and mobile.

**The contribution of this paper** is to provide rich insight and understanding on technological aspects of CMS design and implementation as well as on the agile software development practices of agile experts in an ADR context. The service vision and implemented functioning software were evaluated using the CMS DPs of Lindgren et al. (2004).

#### **My findings offer theoretical and practical contributions:**

- I elaborate on the utilization of CMS DPs—one the most important theoretical contributions of this dissertation—in practice in the case organization
- I describe the architecture and functionality of the technological artifact (the KnoMe application) designed and developed during the ADR
- I provide rich insight on how agile development methods can be combined in practice in rigorous, scientific ADR

In conclusion, the insight regarding the usage of agile methods provided in this paper could help the collaboration of researchers and practitioners in various ADR settings.

## 5.4 Paper 4: CMS DPs

Niemi, E. and Laine, S. (2016): “Competence Management System Design Principles: Action Design Research,” *37<sup>th</sup> International Conference on Information Systems (ICIS)*

**In this research paper we aimed to do the following:**

- 1) *We aimed to deepen the theoretical understanding of CMS design and development by improving and extending the DPs identified in earlier research.*
- 2) *We aimed to deliver business benefits for a case company by designing and developing organizational and technological artifacts for competence management.*

**We positioned this research paper** in the existing scientific discussion regarding modern leadership and HR practices, KIPOs, and ES focusing on competence management.

**An important contribution of this paper is to provide rich insight into this longitudinal ADR**, conducted during 2013–2016. We start with problem formulation, continue to the BIE stage, then move onto reflection and learning, and conclude the paper with the formalization of learning.

In line with Gregor’s (2006) theories for design and action, Sein et al. (2011) suggest the following three levels for the **conceptual move towards the development of general solution concepts** in the formalization of learning stage of ADR:

- (1) generalization of the problem instance,
- (2) generalization of the solution instance, and
- (3) the derivation of DPs from the design research outcomes.

In line with these suggestions, our **ADR program resulted in proposing three improvements** (figure 19) **to the previously published DPs** (Lindgren et al. 2004), which aim at guiding the development of CMSs as the generalized solution instance.

DESIGN PRINCIPLES	COMPETENCE TYPOLOGY	SERVICE VISION
DP1: Information as an asset ( <i>revised in this paper</i> )		
DP2: User-controlled transparency	competence-in-stock	
DP3: Real-time capture with a feedback loop	competence-in-use	
DP4: Multi-perspective interest integration	competence-in-vision	
DP5: Alignment with customer demand ( <i>introduced in this paper</i> )		

**Figure 19.** The CMS DPs, competence typology, and service vision in Silli Solutions PLC

First, we propose that the DP *flexible reporting* should be renamed *information as an asset* and moved from the last position to the first. This is the only principle Lindgren et al. (2004) did not revise during their study and, therefore, in our opinion it did not receive the attention it deserves. We see that instead of focusing on “supporting ad hoc analyses” the principle provides the foundation for the whole CMS and all the other principles. This is based on the work of Wang et al. (1998) and Tallon et al. (2013). Competence is the “sales item” of a consulting company and it needs to be articulated as an information asset in order to monetize its value. Moreover, we strongly believe that all modern knowledge-intensive organizations would benefit from the systematic development of a competence asset. In conclusion, we strongly believe that the governance of the information assets is a necessary prerequisite for successful CMS design and development.

Second, our research findings support the usefulness of DP2, DP3, and DP4, which reflect *competence typology* (Lindgren et al. 2004). The usefulness was proven in the case company, which gained significant business benefits from the guided emergence of organizational and technological artifacts utilizing the DPs. However, we suggest renaming *competence-in-the-making* as *competence-in-vision*, based on the original definition (Lindgren et al. 2004) that it should reflect an “individual’s interests as an indication of the skills and knowledge that they are motivated to develop.” We see that the main focus should be on what the individual is motivated to improve. In other words, we see that the original intention of *competence-in-the-making* was to reflect a future target state, whereas *competence-in-use* already includes learning that is currently happening (i.e., learning that is “in the making”). In our opinion, only this enables strategic

management target “how to get from here to there” (Minzberg 1998) utilizing resources to enhance the performance of the firm (Nag et al. 2007).

**Third, and most importantly, we introduce the new DP *alignment with customer demand***, which is needed to stress the importance of synching the competence management efforts with the external environment. This position is in line with the DCF (Teece et al. 1997, 2008), which encourages combining internal competences (the RBV; e.g., Penrose 1959) with the external world (the market-based view; e.g., Porter 1979). We see that DPs 1 to 4 mainly focus on internal points of view and DP5 is necessary in order to keep in mind the importance of understanding present and future customer demand (Collins 2001) as the source (e.g., pull-driven development according to lean thinking; Ohno 1988, Womack and Jones 2010) of all activities, including competence development.

**Our findings offer theoretical and practical contributions:**

- We summarize the whole ADR project and elaborate on how our practice-inspired research resulted in a theory-ingrained artifact.
- Based on rigorous longitudinal ADR in a real-life business context we propose incremental improvement to existing CMS DPs and critically evaluate each CMS DP in detail.
- We provide rich insight into the substantial researcher and practitioner collaboration effort invested in this ADR during 2013–2016.

In conclusion, the paper describes how the research progressed, starting from a real-life problem setting, utilized an existing scientific knowledge base, and designed and developed organizational and technological artifacts, which were used and evaluated in a real business context. As a result, there was practical utility for the case organization and an incremental improvement in the scientific knowledge, as will be elaborated on in more detail in the next section.

## **5.5 Evaluation of the Results**

ADR has a dual mission in knowledge creation: the first is to produce knowledge, supporting practitioners in solving current and anticipated problems, and the second is to add to existing theory. To contribute to the knowledge of both academics and practitioners, the insights gained from this research must be formalized. This section evaluates the learning obtained from the longitudinal ADR case study at Sili Solutions PLC, following the ADR principle of “generalized outcomes” in five distinct tasks (Sein et al. 2011, Alsleben 2012):

## 1. Abstract the learning into concepts for a class of field problems

This first task requires the generalization of the problem and solution instances into classes of problems and solutions for wider application beyond the studied setting.

The problem instances examined in this research were framed by the problems Siili Solutions PLC had experienced with the competence management of its growing employee pool. Based on the prior research outlined above, it can be argued that the problem instances identified in the case organization represent generic CMS design (a sub class of ES) focused on a KIPO.

The classes of solutions derived from the Siili Solutions PLC case study can be summarized as a CMS consisting of organization and technology. Therefore, the learning can help to understand how the organization affects the technology and vice versa.

## 2. Articulate outcomes as DPs

While not all DPs ultimately become design theories, the formalization of DPs still provides considerable utility for subsequent research projects, which make the process easier and make systems better. In this research we utilized and improved CMS DPs as follows.

**DP1: Information as an Asset** was applied in Siili Solutions PLC in designing the information governance organization and in articulating competence as an information asset in order to monetize its value. This principle thus provides the foundation for the whole CMS and all the other principles.

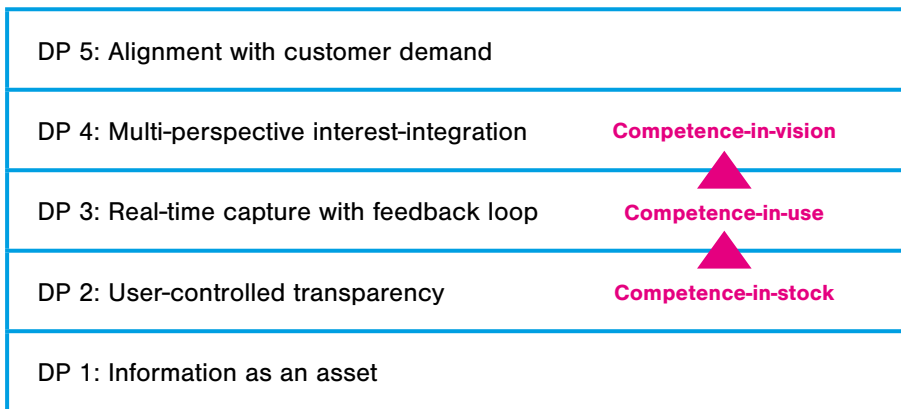
**DP2: User-controlled Transparency** enforces competence-in- stock. It was applied in Siili Solutions PLC in designing competence management technology, which shares all the data to all employees, and in forming a competence-based tribal organization that promotes the transparent sharing of information. However, the individuals have the power to control what they publish about themselves.

**DP3: Real-time Capture with a Feedback Loop** enforces competence-in-use. It was applied in Siili Solutions PLC in designing the integration with the ERP system, automatically creating competence data based on the customer assignments in which the employees are working. However, individuals have the possibility to give feedback to enrich or correct the automatically created data.

**DP4: Multi-perspective Interest Integration** enforces competence-in-vision. It was applied in Siili Solutions PLC in designing many kinds of visualizations of the current and future competence interests of the employees, therefore encouraging them to create communities with similar interests.

**DP5: Alignment with Customer Demand** was applied in Siili Solutions PLC 1) in designing the integration with the ERP system containing the forecasted customer assignment allocations; 2) in designing the tribe-specific mission statements and competence-in-vision, which are aligned with the service offering in collaboration with competence area leads, tribal leads, business unit leads, and sales leads; and 3) in using the Hedgehog Concept as the service vision guiding CMS design.

The formulated CMSDPs (figure 20) were published and critically evaluated in a scientific paper (paper 4 of this dissertation) and presented to peer researchers in the ICIS conference (figure 21).



**Figure 20.** CMS DPs enforcing the competence typology



**Figure 21.** The author presenting the CMS DPs to the peer researchers in ICIS 2016, Dublin, Ireland

### 3. Articulate learning in light of the theories selected

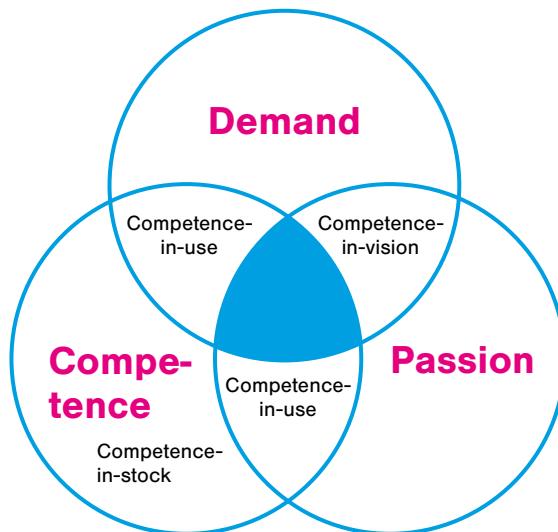
ADR is aimed at making contributions to a knowledge base. Design science has the principle of research contributions. In some cases, a designed solution can lead to the modification of kernel theories towards better theories. Researchers should therefore reflect their learning against the theories initially introduced during the research period. In this section I evaluate the learning against the theories in the four categories highlighted in the research framework: strategic management, the organizational theories, the technological theories, and the research method theories (figure 1).

#### *Strategic management theories*

*HRD literature* (e.g., Swanson and Holton 2009): The literature was utilized in problem formulation as well as when abstracting the learning into the class of problems.

*DCF* (Teece 2009): Strategic competence management was treated as a dynamic capability in Siili Solutions PLC.

*The Hedgehog Concept* (Collins 2001): This was used in the formulation and communication of the improved CMS DPs together with the *competence typology* (Lindgren et al. 2004), as presented in figure 22.



**Figure 22.** The Hedgehog Concept with the competence typology (adapted from Collins 2001)



### ***Organizational theories***

A *KIPO* (Alvesson 2004, Mattila 2012): the research resulted in more understanding of competence management in KIPOs.

*Information governance* (Tallon et al. 2013): We noticed in this research that KIPOs are lacking strategic management practices when it comes to the development and maintenance of competencies to utilize their information assets.

### ***Technological theories***

*ES* (Shang and Seddon 2002) and *CMSs* (Lindgren et al. 2004): These provide more understanding of agile software development. They are important because many implementations fail.

Lindgren et al. (2004) studied commonly used CMSs and summarized the key challenges (see section 1.2) and I use them to evaluate the success of the CMS in the case organization, Siili Solutions PLC:

1. The need for specific CMSs that are separate from HRA → We implemented the CMS technology KnoMe that was only focused on competence management and the people's master data is shared with HRA.
2. The need for current competences to be actively specified and managed by employees themselves → We gave access to all employees, who can update their profiles themselves whenever there is a need.
3. The need for useful information in order to activate employees to use a system that they see to be beneficial → We continuously gathered new ideas and requirements from the whole organization and the usage statistics show that over 50% of the employees are using the system on a monthly basis.
4. The need to look forward, take interests into account, give the possibility for flexible data input, and enable individual development → We designed KnoMe-utilizing mission statements and focused on the development of individuals. Data input is mainly done using flexible free-text attributes.
5. The need for transparency and wide usage → We gave access to all employees so that they are able to see almost all data on everyone. We designed the use cases so that there is a positive overlap of the needs of different functions like sales, business operations, and competence development. The usage statistics show that over 50% of the employees are using the system on a monthly basis.
6. The need for flexibility and dynamic visualization on a longer time scale → We utilized data scientists in creating many kinds of real-time analyses and visualizations. The focus of the reports is mainly on the current competences, but they are used to plan long-term actions.

*Agile software development methods* (Dingsøy et al. 2012): We answered to the previously identified need for providing rich insight about experienced practitioners utilizing agile methods in practice. Moreover, we went a bit further and combined the agile methods with the ADR method.

### ***Research methodology theories***

*Design science* (Hevner et al. 2004): The learning regarding the ADR method (Sein et al. 2011) was communicated by communicating how our research progressed utilizing the ADR stages 1) problem formulation, 2) BIE, 3) reflection and learning, and 4) the formalization of learning. Each ADR stage was described with rich insight and critically evaluated using ADR DPs (Sein et al. 2011) in the paper 4 of this dissertation.

## **4. Share outcomes and assessment with practitioners**

One of the key principles in ADR is the utility of solutions; practitioners thus have to comprehend the designed artifacts and their utility to approve them accordingly. An important part of the formalization of learning is the sharing of outcomes and assessments with practitioners. ADR follows the design science principle of the “communication of research,” in which artifacts are presented to both technology-oriented and management-oriented audiences (Hevner et al. 2004). Technology-oriented audiences require details in order to be able to construct the artifact, while management-oriented audiences need to understand what resources are required to construct the artifact and how to use it (Sein et al. 2011).

The outcomes and assessments of this research have been shared with management-oriented and technology-oriented audiences at Siili Solutions PLC (see figure 23). In addition, there have been several discussions with other mid-sized and big organizations who have been interested in either the tribal network or the technology.

The success of CMS DPs is evident based on employee statements—two examples of which follow:

*The competence management system we have implemented increases the utilization of our experts and improves our forecasting capabilities. According to my knowledge, it is the best system among competitors in Finland.*

(Siili Solutions PLC CEO at an investor conference, Helsinki, Finland, Feb 25th, 2016)

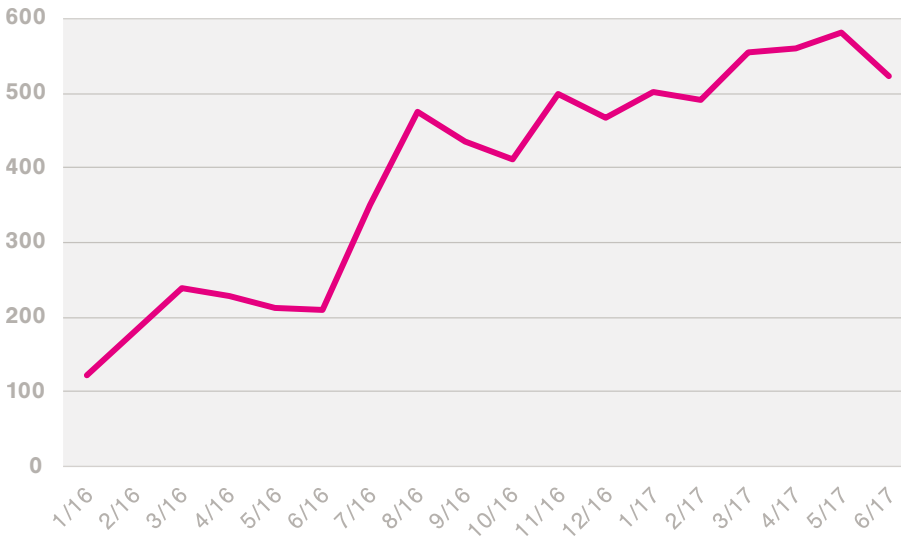
*KnoMe is the best [competence management] system I've seen and used during my 30-year-long IT career.*

(a senior consultant at a confirmatory workshop in April 2016)



**Figure 23.** Presentation of project deliverables to Siili Solutions PLC stakeholders

The success is also evident in the KnoMe usage statistics (see figure 24), generated with Google Analytics. Siili Solutions PLC has employed 390–535 employees and 50–100 subcontractors during this time period, which makes these numbers showing the active use of over 50% of the potential users even more impressive.



**Figure 24.** Unique users of KnoMe from January 2016 to June 2017

## **5. The formalization of results for dissemination**

Both knowledge of practice and knowledge of theory should be formalized and disseminated in a form suitable for the target group.

The results of this research have been communicated to practitioners as described above and to a scientific audience in the form of the four published papers and this will be added to with this dissertation.

## 6. Discussion and conclusions

The combination of digitalization and globalization will have a dramatic impact on organizations and the way people work. Demographic upheavals and societal changes, as well as the inevitable focus on environmental issues, will amplify the effect of these trends. As a result, business executives around the world will face new challenges with business models on one hand and organizational practices on the other hand. There is now a great opportunity for IS and HR scientists and practitioners to work together in order to improve understanding of how technology can be utilized to make organizations more effective and inspiring.

In this thesis I argued that the design of CMSs is a vitally important topic with practical relevance and significant research needs. It seems that, from a competence management point of view, KIFs could improve their strategic management practices in order to utilize their information assets, and it seems that currently their ES are not optimally able to support the HR management needs. Moreover, there is only a limited amount of existing scientific literature on designing and utilizing CMSs in practice.

In this ADR I built on top of existing DSR on CMSs and aimed at 1) gaining more understanding about the organizational and technological aspects of ES design, especially regarding competence development, and 2) increasing understanding of the design of competence management as a strategic capability.

**The overall research question of the thesis was formulated as follows:**

***RQ: How does technology affect HRD and vice versa?***

***In more detail, what are the most important issues when designing CMSs supporting KIPOs?***

The findings of the dissertation are based on the ADR that studied the building, intervention, and evaluation of a CMS in the case organization from 2013 to 2016. During the research period previously introduced theoretical concepts guided the organizational and technological interventions that aimed for practical business benefits while maintaining scientific rigor (see figure 25). The research quality was evaluated using ADR DPs (Sein et al. 2011) in section 4.4.2 of this dissertation. The main theoretical contribution and practical implications are discussed in this concluding chapter.

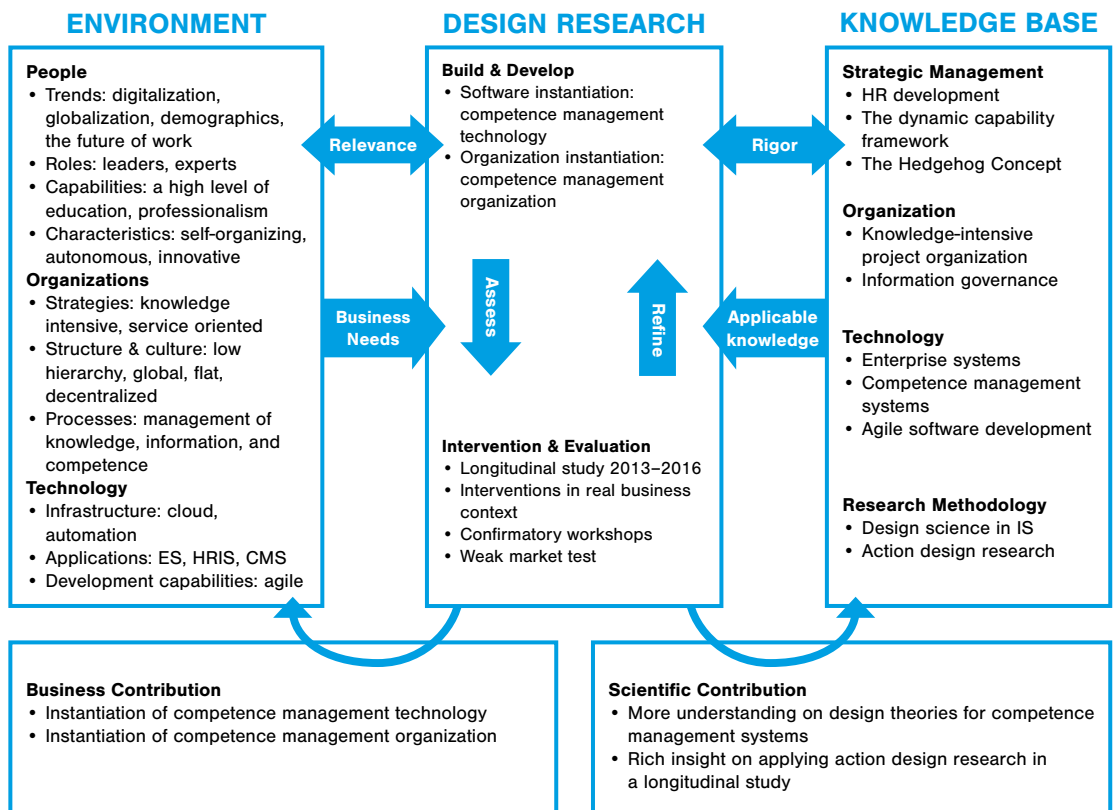


Figure 25. The research framework (inspired by Hevner et al. 2004, 2007)

## 6.1 The Theoretical Contribution

In this dissertation I addressed important, previously unsolved problems resulting in an incremental contribution to the scientific knowledge base. Hevner et al. (2004) argue that DSR differs from routine system design by clearly identifying the scientific contribution. Therefore, in the rest of this section I will summarize the scientific learning we gained in this ADR via participating in the design, development, and evaluation of a particular organizational instantiation and a technology instantiation.

Kasanen et al. (1993) introduced the concept of market-based validation for constructive research and it provides a useful way to evaluate the theoretical contribution. The research described in this thesis fulfills the criteria of a weak market test, meaning that the management of a single company has applied this construction and appreciates the usefulness of the CMS DPs. In addition, the case company has profitably increased its sales revenue and employee headcount, as

well as its stock market value, during the research period, which also indicates that the strategic R&D initiative has been successful.

The learning obtained in this thesis, following the ADR principle of “generalized outcomes” (Sein et al. 2011), was presented with five distinct tasks in section 5.5. It consists of 1) abstract learning of the class of problems, 2) articulating DPs, 3) articulating learning in the light of the selected theories, 4) sharing outcomes with practitioners, and 5) formalizing the results for dissemination. In the following I briefly elaborate on the main points.

Based on the prior research outlined in this thesis, it can be argued that the problem instances identified in the case organization represent generic CMS design (a sub class of ES) especially focused in a KIPO. The classes of solutions derived from the Siili Solutions PLC case study can be summarized as a CMS consisting of organization and technology. Therefore, the learning can help to understand how the organization affects the technology and vice versa.

In this ADR we have utilized previously published CMS DPs (Lindgren et al. 2004) and published improved DPs (section 5.5) addressing the above-described class of problems. The DPs define the design research contribution and represent design knowledge emerging from the application of ADR. The formulated CMS DPs were published and critically evaluated in a scientific paper (paper 4 of this dissertation). The usefulness of the CMS DPs was proven in Siili Solutions PLC, which gained significant business benefits from the guided emergence of organizational and technological artifacts utilizing the DPs.

First, we modified previously published DP1 and renamed it *information as an asset* with the aim of providing a solid organizational and technological foundation for building competence management. In strategic management, competence information should be seen as a useful asset for both employees and the company. Like any other asset, information needs good corporate governance and related quality controls across the entire information life cycle.

Second, our research findings support the usefulness of DP2, DP3, and DP4, which reflect the *competence typology* (Lindgren et al. 2004). On one hand, the principles provided us with guidance in the CMS design, addressing the needs for user-controlled transparency (DP2), real-time capture (DP3), and multi-perspective interest integration (DP4). On the other hand, our research provides more evidence that competence typology is a suitable concept for describing and guiding the development of competence management in KIPOs operating in the high-technology field. *Competence-in-stock*, *competence-in-use*, and *competence-in-vision* were useful classifications for Siili Solutions PLC in the design phase of the CMS and could, therefore, be beneficial for other companies in similar endeavors.

Third, we published a new DP5, *alignment with customer demand*, with the aim of stressing the importance of synching competence management efforts with the external environment. In fact, our research resulted in new insights for competence management as a strategic capability. Our findings indicate that aiming for the intersection of customer demand, employee interest, and existing competences according to the Hedgehog Concept (Collins 2001) functions

well but could be modified in high-velocity environments. The case company's experiences suggest that strategic competence management should aim towards customer demand and employee interests rather than focusing on current strengths.

Finally, in this research we have published rich insights into applying the ADR method in a real business context in a longitudinal study with multiple organizational and technological BIE cycles during 2013–2016. Each ADR stage was described with rich insight and critically evaluated using ADR DPs (Sein et al. 2011) in the paper 4 of this dissertation. The ADR method was introduced fairly recently (Sein et al. 2011) and there are many previously uncovered possibilities, like our experiment of combining ADR with agile software development (paper 3). Consequently, we have provided other design researchers with a possibility to learn from our experiences by articulating the scientific learning in the light of the selected theories.

## **6.2 Implications for Practice**

This is practice-inspired research resulted in a theory-ingrained artifact (Sein et al. 2011). According to the ADR principles, we have shared the scientific learning with the researchers and the practical outcomes with the practitioners.

The case organization, Siili Solutions PLC, needed to construct a future-oriented CMS, including the respective organization and technology. During the R&D initiative Siili Solutions PLC deployed three organizational changes and five major IT releases, all contributing to its business practice.

Ensemble-specific knowledge and user utility are also important contributions of an ADR project. In this strategic R&D initiative, Siili Solutions PLC's new CMS—including the Tribal Network organization and KnoMe technology with new features—provided such contributions. Based on the findings in our research, we expect that the learning from these constructs could be useful to other KIFs facing similar challenges.

Furthermore, this study provides insight and evidence for the CMS DPs, which we have utilized in a real business context during 2013–2016 in the case organization. In fact, Siili Solutions PLC gained important contributions to its business practices from the deployment of an instantiation of competence management technology and organization. Consequently, the experience in Siili Solutions PLC indicates that companies should pay more attention to information assets, transparency, privacy, automation, feedback, multiple-interest perspectives, and customer demand.

In conclusion, our research provides new evidence of how ADR can lead to significant business benefits by integrating theory and practice in a real business context. In my opinion this dissertation could be used as an example of design research that simultaneously adds to the scientific knowledge base and is highly useful for practitioners.



### **6.3 Limitations and Ideas for Future Research**

In this final chapter I have discussed the main theoretical contribution and practical implications, thus completing the ADR requirement of formalizing the results for dissemination. I have elaborated the incremental scientific learning and the substantial practical outcomes. However, there is always room for improvement and I conclude the dissertation by giving ideas for future research.

First of all, I think there is clearly a need to provide other researchers with more knowledge and guidance on how to apply the ADR method. Sein et al. (2011) provide surprisingly good guidance, especially via the ADR DPs, as to how to conduct rigorous research considering the novelty of the method. However, there are certain areas (e.g., the application of reflection and learning) where rich insights from other studies would be extremely useful. Therefore, I encourage future researchers to report not only the actual research findings, but also their lessons learnt in the application of ADR.

It would also be interesting to study and evaluate the success of competence management as a dynamic capability after longer usage. In addition, it would be beneficial to apply quantitative methods for the measurement of customer and employee satisfaction and to combine this understanding with the competence development history and plans. Moreover, there is potential for new artifact constructions, aiming at better integration and visualization of customer demand in a competence management context. Moreover, studying the wider adaptation of the artifacts and concepts could result in a semi-strong market test (Kasanen et al. 1993) of the constructions. Finally, in this research we have already aimed at automation and capturing data in real-time, but it would be extremely interesting to go even further and apply the latest artificial intelligence capabilities in order to deepen the study of the interaction between organization and technology.

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# Appendix 1:

## The interviews and workshops

### Interviews 1: October–December 2013

**Table 1.** The number and profiles of the interviewees Q4/2013

<b>Interviewees</b>	<b>#</b>	<b>Location</b>
Employees, management	5	Helsinki, Finland
Employees, consultants	15	Helsinki, Finland
Customers	10	Helsinki, Finland
Partners	5	Helsinki, Finland
Total	40	

## Interviews 2: May–June 2015

**Table 2.** The number and profiles of the interviewees Q2/2015

Date	Interviewee	Length	Role	Location
15.5.2015	Interviewee 1	16 min	Manager	Helsinki, Finland
15.5.2015	Interviewee 2	15 min	Employee	Helsinki, Finland
4.6.2015	Interviewee 3	37 min	Manager	Helsinki, Finland
5.6.2015	Interviewee 4	24 min	Manager	Helsinki, Finland
5.6.2015	Interviewee 5	16 min	Manager	Helsinki, Finland
8.6.2015	Interviewee 6	27 min	Manager	Helsinki, Finland
15.6.2015	Interviewee 7	38 min	Employee	Helsinki, Finland
15.6.2015	Interviewee 8	15 min	Manager	Helsinki, Finland
15.6.2015	Interviewee 9	15 min	Manager	Helsinki, Finland
22.6.2015	Interviewee 10	55 min	Manager	Helsinki, Finland
22.6.2015	Interviewee 11	47 min	Employee	Helsinki, Finland
23.6.2015	Interviewee 12	21 min	Manager	Helsinki, Finland
23.6.2015	Interviewee 13	35 min	Manager	Helsinki, Finland
23.6.2015	Interviewee 14	32 min	Manager	Helsinki, Finland
24.6.2015	Interviewee 15	21 min	Employee	Helsinki, Finland
26.6.2015	Interviewee 16	15 min	Manager	Helsinki, Finland
26.6.2015	Interviewee 17	29 min	Employee	Helsinki, Finland
26.6.2015	Interviewee 18	45 min	Employee	Helsinki, Finland
29.6.2015	Interviewee 19	43 min	Employee	Helsinki, Finland
29.6.2015	Interviewee 20	33 min	Employee	Helsinki, Finland
	Average	29 min		

## The workshops Q2/2015 and Q2/2016

**Table 3.** Confirmatory workshops 2015–2016

Date	Publication	Attendees	Length	Location
28.8.2015	HICSS	4	34 min	Helsinki, Finland
8.4.2016	DESRIST, MCIS	5	57 min	Helsinki, Finland
22.4.2016	ICIS (technology focus)	7	63 min	Helsinki, Finland
27.5.2016	ICIQ	3	31 min	Helsinki, Finland
30.6.2016	ICIS (organizational focus)	4	55 min	Helsinki, Finland

Certain information—such as the interviewee’s name, age, career length, email address, mobile number, or line of business—was excluded from the tables in order to retain interviewee anonymity.

## Appendix 2:

### An outline of the interviews

#### I. BACKGROUND INFORMATION [filled in, not recorded]

Interviewee:

Date:

Location:

Present job title:

How long is your work experience in this occupation? \_\_ years

How long have you worked within the present company? \_\_ years, \_\_months

How long have you been in your current position? \_\_years, \_\_months

Do you have any subordinates? Yes: \_\_ subordinates; No \_\_

What is your line of business? \_\_

Age (years): \_\_ 20-29, \_\_ 30-39, \_\_ 40-49, \_\_ 50-59, \_\_ 60 or more

Gender: \_\_ Female, \_\_ Male

#### II. INTERVIEW QUESTIONS (recorded and transcribed)

##### *Technology development questions:*

1. What is your view of the primary objectives for the ES (KnoMe), both in the beginning and now?

If the interviewee did not mention the service vision (aka the Hedgehog Concept), the researcher explained it briefly and asked how the interviewee considered it realized in practice.

2. What are the main business processes supported by the ES (KnoMe)? Who are the main people (or what are the main roles) participating in this process?
3. How do you consider KnoMe's
  - perceived usefulness?
  - perceived ease-of-use?
  - development & implementation process?

##### *Organizational transformation and data quality questions:*

4. What is your personal insight and experience regarding the data in KnoMe (especially considering coverage and content)?
5. What effect has the Tribal Network had on competence management? Or on any other organizational practices?



***Open question:***

6. Is there anything else you would like to say as feedback or do you have any future ideas regarding competence management (in regard to either technology or organization)?

All the above-described questions were used to provide the interviewer with a loose guideline for the semi-structured interviews and the interviewees were encouraged to openly describe their personal points of view and even opinions. The first draft of the interview outline was inspired by Mattila (2012) - thank you.

## Appendix 3:

### List of abbreviations

ADR	action design research
AI	artificial intelligence
BI	business intelligence
BIE	building, intervention, evaluation
BUM	business unit manager
CEO	chief executive officer
CMS	competence management system
CRM	customer relationship management
CTO	chief technology officer
DCF	dynamic capability framework
DP	design principle
DSR	design science research
DW	data warehouse
EBITDA	earnings before interest and taxes
eHRM	electronic human resource management
ERP	enterprise resource planning
ES	enterprise systems
EU	European Union
GDP	gross domestic product
GDPR	general data protection regulation
HR	human resource
HRD	human resource development
HRIS	human resource information system
HRM	human resource management
IS	information systems
IT	information technology
KIBS	knowledge-intensive business services
KIF	knowledge-intensive firm
KIPO	knowledge-intensive project organization
MDM	master data management
PBO	project-based organization
PLC	public limited company
PLM	product lifecycle management
PSF	professional service firm
R&D	research and development
RBV	resource-based view
RPA	robotic process automation
RQ	research question
SCM	supply chain management

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