Designing Digital Resourcing

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To my Family

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ABSTRACT

Digital innovation has become imperative for organizational survival and is increasingly contributing to the growth of national wealth. A central element of digital innovation, brought into light in this dissertation, is *digital resourcing*. Digital resourcing refers to actions managing digital resources in the discovery stage of the digital innovation process. The increased awareness of efficient resource management has spurred organizations to search for operational digital resourcing systems that can support their innovation effort. However, there is a lack of existing purposeful digital resourcing systems corresponding to the contemporary ideals serving the requirements of practitioners. This is problematic because it hampers human actors in service ecosystems from mobilizing, decoupling, and pairing digital resources that can leverage sustainable competitive advantages. The problem addressed has provided the momentum to concentrate the research effort into one single research question: *How should digital resourcing systems be designed to spur the discovery of digital innovations?* Consequently, the purpose of this study has been to identify design knowledge supporting the development of digital resourcing systems, and, to provide an operational digital resourcing system supporting organizations in the discovery stage of the digital innovation process. The main theoretical contribution corresponds to three abstraction levels of design knowledge: 1) an operational web-based digital resourcing system, 2) design principles, and finally, 3) an IS design theory for digital resourcing. The results show that the design knowledge works, provides utility for its purpose, helps to solve the problem, and is correct.

Keywords: Digital Innovation · Digital Resourcing · Digital Resourcing Systems · Information Systems Design Theory · Design Science Research · Action Design Research · Design Principles · Service-Dominant Logic · Resource-Based Theory · IT Service Management

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SAMMANFATTNING

Digital innovation är den starkaste transformativa kraften i dagens samhälle och den kommer att få större påverkan på organisationers verksamheter än vad t.ex. ångmaskinen hade på 1700-talet eller järnvägen hade på 1800-talet. Det råder därför ingen tvekan om att digital innovation är nödvändigt för organisationers möjligheter att bibehålla eller förbättra sin konkurrenskraft. I studien introduceras det engelska begreppet *Digital Resourcing* som en central del av den digitala innovationsprocessen. Med *Digital Resourcing* avses de aktiviteter som möjliggör en effektiv hantering av digitala resurser i innovationsprocessens initiala fas. Den ökade medvetenheten om de fördelar som en effektiv hantering av digitala resurser kan föra med sig sporrar organisationer att söka efter digitala system som kan stödja dem i deras innovationsarbete. Marknadens befintliga digitala system har emellertid inte utvecklats utifrån organisationers moderna ideal vilket gör att det råder en brist på system som motsvarar deras krav. Detta är problematiskt eftersom det kan resultera i en försämrad organisatorisk förmåga att överleva på en alltmer konkurrensutsatt marknad. Problemet som adresseras har lett fram till följande forskningsfråga; *Hur bör digitala system för Digital Resourcing designas i syfte att främja digital innovation?* Syftet med studien är tvåfaldigt; att identifiera designkunskap som möjliggör utveckling av system för *Digital Resourcing* samt att operationalisera ett digitalt system som lotsar organisationer i innovationsarbetet. Studiens huvudsakliga bidrag består av tre abstraktionsnivåer av designkunskap: 1) ett digitalt system, 2) designprinciper, och, 3) en designteori för *Digital Resourcing*. Resultatet visar att alla abstraktionsnivåer bidrar med nytta och till att lösa det adresserade problemet.

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CONTENT

1 PROBLEM FORMULATION

The purpose of the first chapter is to introduce the problem and to argue for its significance for both theory and practice. Furthermore, the purpose is to present a brief overview of previous findings concerning major key concepts. In order to provide the direction of the dissertation, the 'purpose and scope,' the research question, and an outlook on the contributions are presented. The structure of the contents of the first chapter is; 1.1 Introduction, 1.2 Purpose, Research Question, and Scope, 1.3 Anticipated Contributions, and 1.4 Disposition.

1.1 INTRODUCTION

Digital innovation[1] has become imperative for organizational survival, and will increasingly become the source of national wealth. A central element of digital innovation, revealed in this dissertation, is *digital resourcing*. Digital resourcing refers to the synthesized *actions*[2] of resource liquefying (e.g., Lusch and Nambisan 2015), resource pairing (e.g., von Hippel and von Krogh 2016) and resource opting (e.g., Sandberg et al. 2014) which enable efficient management of digital resources in the discovery stage of the digital innovation process (see chapters 2 and 3). Actions are identified, synthesized, and refined, in order to show that they, supported by a digital resourcing system, enable multiple actors[3] to collaborate and turn digital resources with potential value into novel value propositions ultimately communicated as a digital service[4].

In this dissertation, digital resources have been placed at the heart of digital resourcing. Digital resources promise to have a more pervasive impact on society than the steam engine had in the 18th century, or the railroads had in the 19th century (e.g., Lanzolla 2018). Moreover, digital resources constitute the organizational means and building blocks of digital innovation (e.g., Henfridsson et al. 2018; Kohli and Melville 2019). In this study, digital resources

[1] In this dissertation, digital innovation is defined as the recombination of diverse resources that create novel value propositions embodied in or enabled by IT. This broad definition manifests the idea that digital innovation is both a process *and* an outcome (see further chapter 2). A value proposition has often been presented as a promise/invitation to co-create value (c.f. Vargo and Lusch 2009; Toivonen and Touminen 2009; Skålén et al. 2015).

[2] Action is a process of doing something, typically to achieve an aim (a contrast to activity where things are happening) (e.g., Merriam Webster 2019).

[3] Although actors can appear many forms, the term refers to human actors such as practitioners (i.e., someone who are involved in a skilled job) belonging to departments, or organizations of service providers and service customers in this dissertation.

[4] A digital service could be defined as the "*process of using one's resources (e.g., knowledge) for someone's (self or other) benefit*" (Barrett et al. 2015, p.138).

are defined as digitally represented information and software that can be viewed as an integrated resource (Goldkuhl and Röstlinger 2019). The move to focus on digital resources in digital innovation supports this research effort by redirecting the attention from specific types of innovation *outcomes* toward a socio-technical (e.g., Mumford 2006; Trist and Bamforth 1951) view of digital resources. In this way, digital resourcing provides a granularity through which the discovery of digital innovations can be studied. Facing a new reality permeated by digital resources, organizations across sectors recognize that those who fail to embrace efficient management of digital resources risk being outcompeted by those who do (e.g., Arvidsson and Mønsted 2018). The increased recognition of the benefits of efficient digital resource management has spurred organizations to search operational digital resourcing systems supporting human actors in service ecosystems[5] to manage digital resources in their innovation efforts[6] (c.f., Nambisan 2013; Bieler 2016).

Given that digital resources are core elements in digital innovation, it is surprising that existing digital systems elaborate and manage actions related to digital resources inadequately (e.g., Ciriello et al. 2019)[7]. This deficiency is caused by at least three challenges. One challenge is that existing digital innovation management systems do not materialize recent research results related to digital resources (see chapter 3). That is, theoretical insights are *fragmented* within diverse forms of literature, which makes it difficult for researchers and practitioners to get a full understanding of, and to utilize the digital resourcing actions through which the discovery stage of digital innovation occurs (e.g., Vargo et al. 2014). Consequently, existing digital innovation management systems, which digital resourcing systems are an instance of, do not materialize recent research results related to digital resources (see chapter 3). This information also implies that there is a need for improved *synthesized* knowledge that better prescribes how such knowledge should be used during design.

The second challenge is that existing purposeful digital systems are often based on ideals derived from a traditional technical or product-oriented perspective (e.g., Göbel and Cronholm 2016a; 2016b; Henfridsson et al. 2018). A product-oriented perspective implies that the locus of value exchange is the underlying digital technologies or infrastructure that *embed* value focusing on output (see also chapter 2). Such a perspective fosters developers to design IT-artefacts

[5] Service ecosystem is defined as a "*relatively self-contained, self-adjusting system[s] of resource-integrating actors connected by shared institutional logics and mutual value creation through service exchange*" (Lusch and Vargo 2014a, p.161).

[6] 53% of more than 6000 decision makers in the IT sector have a need to invest in emerging technology to drive innovation[6] (Forrester 2016).

[7] Ciriello et al. (2019) use the term *knowledge* i.e., an essential type of resource (see chapter 2).

from *the* perspective of digital technology or, at the most, as a service provider who considers internal resources. A product-oriented perspective also implies that service providers determine the value to be delivered to customers who then destroy that value when using a product. This perspective is problematic because it ignores the customers' view of value in the digital innovation effort, and it neglects external sources of value-enabling resources, which remain unused.

The third challenge is that existing digital systems aiming to support digital innovation are seldom aimed to provide structured support to the *discovery* stage[8] of the digital innovation process (see Appendix 5); a stage that is especially important since it is associated with creative activities fostering novel solutions to contextualized problems in practice[9]. The latter also implies that research on digital innovation has failed to fully acknowledge the initial stage of the digital innovation process, a statement strengthened by Kohli and Melville (2019). In total, the three challenges suggest that academics have not sufficiently communicated normative and prescriptive design knowledge[10] in support of developers designing instances of digital resourcing systems that would enable the discovery of digital innovations. This lack is problematic because it could hamper actors in service ecosystems from integrating and bundling digital resources into novel value propositions, which affects the sustainable competitive advantages. The lack of digital support could also explain why organizations are not ready to respond to digital trends (e.g., Kane et al. 2015; Bieler 2016; Kohli and Melville 2019). Consequently, there is a need to identify new design knowledge of digital resourcing, which would correspond more favorable to contemporary theories, ideals, and that fulfill the requirements of practitioners more adequately.

Based on the three challenges discussed, the problem addressed in this dissertation can be summarized in one sentence as; *there is a lack of design knowledge for digital resourcing systems*. A digital resourcing system refers to digital systems[11] supporting actors to manage digital resources in order to co-create novel value propositions in the discovery stage of the digital innovation

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[8] Kohli and Melville (2019) use the term 'initiate' when referring to the early stage of the innovation process. In this study, I will rather use the term 'discovery' (e.g. Fichman et al. 2014). The reason is that 'discovery' implies a search for something new (see chapter 2 and 3). Moreover, the term 'stage' does not necessarily mean that the innovation process is stage-gated.

[9] In this dissertation, 'practice' is referred to as someone who does something for someone (in the empirical field).

[10] Design knowledge can consist of a design theory, design principles or other knowledge supporting design of a class of IT-artefacts (e.g., Gregor and Hevner 2013).

[11] The term digital is in this dissertation is used synonymously with IT and its associated processes.

process. Digital resourcing systems differ qualitatively from the traditional product- and technological-oriented innovation systems; i.e., they aim to materialize digital resourcing actions supporting actors to manage value-enabling digital resources in a synthesized approach, and they are developed from a contemporary service-oriented perspective (see chapter 2). This means that digital resourcing systems have unique and specific requirements that are not all thoroughly supported by familiar system classes.

The problem addressed is important to solve for the practice, since the lack of general design knowledge could hamper practitioners when developing instances of digital resourcing systems. Eventually, this lack could decrease sustainable competitive advantages. As a result, the problem from a practitioner perspective has constituted the main trigger for this study. The problem is also important to solve from a theoretical perspective; it implies that there is an opportunity to fill a knowledge gap consisting of insufficient design knowledge for digital resourcing systems. Design knowledge is vital in the digital innovation research stream since the research approach leading to such knowledge *per se* falls within the digital innovation research paradigm (Kohli and Melville 2019). Design knowledge also enables researchers and practitioners to rely on normative, prescriptive, and grounded principles when developing new instances of a systems class, and by doing so, it contributes rigor and legitimacy (e.g., Gregor and Jones 2007; Sein et al. 2011; Gregor and Hevner 2013). Hence, design knowledge could support the creation of IT-artifacts[12] that are likely to be more functional than other IT-artifacts, not based on that knowledge (Gregor and Jones 2007). Moreover, design knowledge "*articulates the boundaries within which particular design apply*" (Markus et al. 2002 p.180), it supports the cumulative building of knowledge, and it raises the IS field above a craft (Gregor and Hevner 2013). The latter is essential, and is the reason why leading IS journals and IS conferences find studies presenting design knowledge especially interesting (c.f., MIS Quarterly 2018; DESRIST Web 2018). The solving of the problem addressed by searching for new design knowledge related to digital resourcing is also strengthened by recent research.

[12] The term IT-artifact is used as an overall term for man-made digital artifacts. Expository instance, digital tool, IT solution, digital solution, and IT-system are used synonymously with IT-artifact. An IT-artifact is defined as a socio-technical ensemble system recognized as hardware and software shaped by organizational contexts (e.g., Hevner et al. 2004; Sein et al. 2011; Lee et al. 2015). It could be designed as e.g., a model, a method, an instance or a construct. The term 'socio-technical ensemble' refers to the dual characteristics of technological embeddedness and the role of IT-artifacts as contextual carriers (e.g., Purao et al. 2013; Orlikowski and Iacono 2001). Such IT-artifacts are usually built to address heretofore unsolved problems and to fulfil the objectives of a specific IT-artifact system class (e.g., Hevner et al. 2004; Sein et al. 2011). System class is often referred to as a solution class in contemporary information systems research.

Ponsignon et al. (2011) and Guruduth et al. (2010) found that there is a need to explore and empirically investigate the design of innovation artifacts. Moreover, an excellent scientometric, and systematic literature review on digital innovation finds vastly uneven coverage, diversity, and diffusiveness of digital innovation in research streams (Kohli and Melville 2019)[13]. The scholars found that especially the early stage of innovation has been overlooked by IS researchers. One implication is that this critical area remains understudied and poorly understood (ibid). Consequently, there is an urgent need to focus on this crucial stage of the digital innovation process (ibid). Finally, Henfridsson et al. (2018) call for researchers to view and study *digital resources* as a central component of digital innovation. To this end, this dissertation is especially focused on contributing design knowledge for digital resourcing systems managing digital resources as part of the discovery stage of digital innovation.

1.2 Purpose, Research Question, and Scope

The purpose of this study has been dual; i.e., to identify and present design knowledge supporting researchers and practitioners developing digital resourcing systems, *and*, to provide a fully functional and operational digital resourcing system supporting practitioners in their digital innovation efforts. With its dual purpose, the problem addressed has provided the momentum to concentrate the research effort into one single research question:

How should digital resourcing systems be designed to spur the discovery of digital innovations?

Finding answers to the research question could support researchers and practitioners in the development of other instances of the systems class. Since it renders a materialized digital resourcing system, it could directly support practitioners when creating novel valuable-enabling solutions presented as a digital service (a.k.a., a digital innovation). For this reason, an answer to this research question could fulfill the dual purpose of the study. The research effort could also be viewed as a response to the specific calls asking researchers to focus on digital resources at the early stages of innovation (Henfridsson et al. 2018; Kohli and Melville 2019). Alternatively, it could be viewed as a response to a more generic call for IS researchers to develop research that may guide and inform both practice and the research community, into innovation in a digital age (Barrett et al. 2015).

[13] Moreover, the scholars suggest that researchers should broadened their view to a perspective on IS design that includes a socio-technical view which corresponds to the view of digital resources in this dissertation (Kohli and Melville 2019).

The dual-purpose has helped to set the scope of the research effort. The scope should be viewed as defining the delimitations of this dissertation. One delimitation of the study is that the research question is *mainly* studied and developed in one context. However, this does not mean that the designed digital resourcing system has not been evaluated at all in relation to other contexts (see chapters 4 and 7). Another delimitation is that the study focused on certain constructs in the underlying theory, e.g., resource liquefying, resource pairing, resource opting. Such constructs have indeed supported the design of the digital resourcing system, but they have also set the scope and boundaries of this research effort. Another delimitation is that the design knowledge in this dissertation is primarily focused on supporting the development of digital resourcing systems leveraging the discovery stage of digital innovation (see chapter 2 for a description of all phases). As previously described, recent findings show that the early stage of innovation (i.e., discovery) is not in focus in current research streams on digital innovation (Kohli and Melville 2019). Hence, the digital resourcing system is designed to support the discovery stage of the digital innovation process. This means that the digital resourcing system supports human actors to identify digital resources, co-create problem-solution pairs, and to opt-in or out a problem-solution pair to realize. It also means that other digital innovation stages such as development, implement or exploit have not been in focus in this study and that other digital systems could be needed in order to manage digital resources to package and implement the digital service in practice. A third delimitation is that the developed design knowledge is instantiated in one single digital resourcing system instead of multiple ones. To develop multiple instances would have required several more years of research, which was not possible at the time. Finally, the study has focused on digital resourcing as a central part of digital innovation. This entails that the outcome of innovation is viewed as a novel value proposition communicated as a digital service. This could obviously be regarded as a delimitation because other types of perspectives have not been applied evaluated in this study. Yet, the perspective taken implies that it super-ordinates digital service to other types of outcomes (see chapter 2). Again, this choice was derived from the research context and the considerable effort required to design and evaluate an instance in multiple practices in order to solve the addressed problem.

1.3 ANTICIPATED CONTRIBUTIONS

This dissertation offers design knowledge enabling the design of *Digital Resourcing Systems*. The design knowledge offered corresponds to three interrelated abstraction levels (e.g., Gregor and Hevner 2013). The different abstraction levels include:

1) a situated implementation of the IT-artifact (i.e., a digital resourcing system as an instance of a system class)
2) a nascent design theory formulated and communicated as design principles
3) an IS design theory[14] formulated as a mid-range theory[15]

The first abstraction level constitutes the fully functional and operational *web-based digital resourcing system* enabling actors (e.g., customers and service providers) to co-create value-enabling digital service(s) by digital resourcing actions. The second abstraction level constitutes normative[16] and prescriptive *design principles* guiding developers to design other instances of digital resourcing systems. Finally, the third abstraction level consists of an *Information Systems (IS) Design Theory*[17], adding knowledge to both theory and practice about the system class. Altogether, the three abstraction levels intend to offer benefits over a non-theoretical requirements-driven development approach; they provide knowledge that is difficult to reach merely through anecdotal experience. All levels provide guidance for practitioners and researchers for how to design digital resourcing systems, a knowledge that offers greater utility and better competitive advantages over contemporary approaches. Such advantages include, but are not limited to, increased efficiency in the management of digital resources as well as improved innovation outcome, e.g., value propositions presented as a digital service. According to Gregor and Hevner (2013), a research project can produce knowledge at one or more of the abstraction levels. In contrast to a major part of IS research, where contributions rarely consist of an IS design theory, this research presents all levels of design knowledge (e.g., Hevner et al. 2004; Jones 2011). The refined design knowledge has emerged during the study. It is presented using the three different abstraction levels of design knowledge (table 1.1).

[14] Gregor (2006, p.615) argue that theory "*is seen as an abstract entity, an intermeshed set of statements about relationships among constructs that aim to describe, explain, enhance understanding of, and, in some cases, predict the future*".

[15] A mid-range theory integrates theory and empirical research (e.g., Merton 1957; Boudon 1991).

[16] Normative statements that concern questions about how something *should* be, what is right (or wrong). A prescriptive statement extends the normative statement to include also how something could be performed (e.g., a guideline).

[17] In the remaining part of this dissertation the term IS design theory is used synonymously with the term *design theory*.

Table 1.1. Three design-related research contributions (inspired by Gregor and Hevner (2013)).

	Contribution Types	Developed Artifacts
More specific, limited, and less mature knowledge	The first abstraction level is the digital resourcing system, i.e., a situated implementation of an artifact solving a problem. Gregor and Hevner (2013) also use the term expository instantiation.	An instantiation of a digital resourcing system (i.e., an IT-system of hardware and software shaped by context)
↕ ↕ ↕	The second abstraction level is design principles. It should be viewed as a nascent design theory knowledge as operational principles/architecture.	Three design principles are supporting developers in designing digital resourcing systems while adding knowledge to the system class.
More abstract, complete, and mature knowledge	The third abstraction level is a well-developed IS Design theory about an embedded phenomenon (e.g., digital resourcing).	An IS design theory for digital resourcing. Such a theory is seen as a mid-range theory that integrates theory and empirical research (e.g., Merton 1957; Boudon 1991)

Although several of the contributions presented in this dissertation are intended to supply both researchers and practitioners, I argue that a significant contribution for practitioners is the fully functional and operational web-based digital resourcing system. The digital resourcing system constitutes a practical solution to the problem addressed, and it could be implemented and used in real contexts. This contribution could directly support practitioners to process digital resources and co-create novel digital service(s). By doing so, practitioners could access new sustainable competitive advantages and benefits derived from the generated innovations. This contribution is recognized as the first abstraction level of design knowledge (see Table 1.1), and it is essential since it is less abstract and easier to understand than a design theory. Yet, this contribution level also contains some degree of abstraction, and therefore it is regarded as a fully established contribution from a design-related research project (c.f., March and Smith 1995; Gregor and Hevner 2013). This implies that if an artifact is novel and useful, then, out of necessity, it will contribute to design knowledge; the instance visualizes a design theory, and it provides an example of how that theory can be operationalized in a specific context (Baskerville et al. 2018). Furthermore, Gregor and Hevner (2013, p.341) argue that;

"*demonstration of a novel artifact can be a research contribution that embodies design ideas and theories yet to be articulated, formalized, and fully understood.*" Finally, Baskerville et al. (2018) praise the role of the IT-artifact and claim that although a design theory is a desirable goal, the building and evaluation of an artifact as a solution to a real-world problem must come *first*.

An IS design theory comprises a number of components of which a crucial one is the 'principle of form and function.' Such principles define "*the structure, organization, and functioning of the design product or design method*" (Gregor and Jones 2007, p. 325). In order to support the presentation of 'form and function,' the concept of design principles has been adhered to in this dissertation (c.f., Markus et al. 2002; Sein et al. 2011; Gregor and Hevner 2013). Design principles correspond to the second abstraction level of design knowledge, and they are crucial on at least three accounts. First, design principles are needed in order to articulate the principles upon which the construction was based (e.g., Hevner et al. 2004). Second, a design principle "*allows abstracting away from singular settings and thus generalizing prescriptive knowledge*" (Chandra et al. 2016a, p.4040). Finally, "*the construction of an IT-artifact and its description in terms of design principles, and technological rules are steps in the process of developing more comprehensive bodies of knowledge or design theories.*" (Gregor and Hevner 2013, p.341). The scholars also call design principles a *nascent* design theory, a term debated in Iivari (2019). In other words, the purpose of design principles is to communicate design knowledge about how to create IT-artifacts that address a class of problems (Dasgupta 1996; Purao 2002; Gregor and Hevner 2013; Dwivedi et al. 2014). The argument to contribute design principles is that these have become the predominant way to capture abstract knowledge about the design of IT-artifacts (Gregor and Jones 2013; Heinrich and Schwabe 2014; Chandra et al. 2016b). Several scholars have focused on generating design principles, a fact which confirms their legitimacy (e.g., Markus et al. 2002; Lindgren et al. 2004; Göbel and Cronholm 2016b). Finally, design principles, can on further reflection, contribute refinements to underlying theories. That is, in order to fulfill the latter and to be considered as a contribution, the design principles should be discussed in relation to existing theories that contributed to the design (c.f., Goldkuhl 2004a; Zadeh 2014). The second abstraction level is presented in chapter 6 of this dissertation. A related anticipated contribution of the dissertation is a generalized problem instance, i.e., class of problems that the design principles (and other contributions) help to solve. This is in line with Sein et al. (2011), who argue that one contribution from design-related research projects consists of casting an original problem as an instance of a problem class, i.e., a lack of design knowledge for digital resourcing systems. To generalize a problem is important since it ensures that the research effort is not reduced to a consultant initiative, and it could motivate researchers to use the problem contribution as a base for further research. Moreover, a generalized problem could make practitioners aware of, and thus reduce the risk of that very problem. This contribution is presented and formulated in chapter 1 and 2. Finally, another anticipated contribution is the generalization and extension of a systems class. It entails the re-conceptualizing of the specific digital resourcing system (i.e., the instance designed in this study) into a systems class. To cast an instance of a solution to a class is important because it further increases the abstraction level of design knowledge. That is, without this kind of casting activity, the digital resourcing system could result in a highly organization-specific solution and be misunderstood as consultant work. Therefore, casting increases the possibility of creating theoretical statements. This contribution is mainly presented in chapter 5. To sum up, the design principles supporting developers to design digital resourcing systems, are viewed as an essential step towards an IS design theory for digital resourcing (see Table 1.1).

The ultimate form of design knowledge is an IS design theory. A design theory for digital resourcing corresponds to the third abstraction level of the results presented in this dissertation. The recognizing attribute of design theory is that it focuses on *how to do something* (Gregor and Jones 2007). This means that it gives explicit prescriptions for *how* to design and develop an IT-artifact for a specific purpose (ibid). According to Walls et al. (2004), a design theory includes two aspects; "*one that deals with the product of design and one that deals with the process of design*" (2004, p.45). The two aspects are dependent on one another; the design process must produce the artifact to be designed (ibid). However, in a well-recognized article published by Gregor and Jones (2007), the scholars argue that there is a dilemma in the design theory specification made by Walls et al. (1992). In their work, unnecessary separation of theory components for a design process and a design product is made. The scholars' argument is, "*Surely, a design theory as a whole could apply to either a process or a product, and only sometimes to both*" (Gregor and Jones 2007, p.319)[18]. The contributions provided in this dissertation apply to both the design process and design product concerning digital resourcing systems. There are different views of what constitutes an IS design theory. Gregor (2006) presents a design theory as; a) statements that say how something should be done in practice, b) statements providing a lens for viewing or explaining the world, and c) statements of relationships between constructs that can be tested. The statements can be combined. Therefore, Gregor (2006) suggests five different

[18] The scholars also show how Walls et al. (1992) actually recognize the generation of either product or process because they are presenting examples of design theories for a single "method". That is, "design theories can include IT-artifacts that are either products (for example, a database) or methods (for example, a prototyping methodology or an (IS management strategy)" (Gregor and Jones 2007, p.322).

types of IS theories whereof one is the theory of 'Design and Action' (i.e., IS design theory). To constitute a design theory scholars agree that it should at least communicate knowledge about the 'purpose and scope', essential constructs, design principles (i.e., principles of form and function), artifact mutability, testable propositions, and justificatory knowledge (Walls et al. 1992; Gregor 2002; Gregor and Jones 2004; Gregor and Jones 2007). Gregor and Jones (2007) also add two additional components: principles of implementation and an expository instantiation (i.e., an IT-artifact such as the digital resourcing system) (see Table 1.2). The design theory I aim to contribute will include all of the components mentioned. Today, IS publication provide numerous examples of design theories that have contributed design knowledge in various domains (Markus et al. 2002; Chiang and Mookerjee 2004; Jones 2011; Zhang et al. 2011; Löhe and Legner 2014; Spagnoletti et al. 2015; Ebner et al. 2016; Zahedi et al. 2016; Zhang and Venkatesh 2017). This suggests that design theory is a widely accepted, relevant, and legitimate research contribution within the IS field. Consequently, the third anticipated contribution and abstraction level of design knowledge is an IS design theory, a.k.a. a theory of design and action (c.f., Walls et al. 1992; 2004; Markus et al. 2002; Gregor 2006; Gregor and Jones 2007; Gregor and Hevner 2013). It is possible to view my contribution as a design theory of type 4, i.e., a union of design theory types aiming to describe relationships between kernel theory, the IT artifact, and effects/utility (Iivari 2019). The contribution is elaborated on in chapter 6, and it is vital, since developing theory "*...is what we are meant to do as academic researchers, and it sets us apart from practitioners and consultants"* (Gregor 2006, p.613).

Table 1.2. Components of an IS Design Theory (Gregor and Jones 2007).

Component	Description
1) Purpose and scope	"What the system is for," the set of meta-requirements or artifact goals[19] that specifies the type of IT artifact to which the theory applies and in conjunction also defines the scope, or boundaries, of the theory.
2) Constructs	Are representations of the entities of interest in the theory.
3) Principle of form and Function (design principle)	The abstract "blueprint" or architecture that describes an IS artifact, either product or method/intervention.
4) Artifact mutability	The changes in the state of the artifact anticipated in theory, that is, what degree of artifact change is encompassed by the theory.
5) Testable propositions	Consist of true statements about the design theory.
6) Justificatory knowledge	The underlying knowledge or theory from the natural or social or design sciences that gives a basis and explanation for the design (the 'theory' part of the justificatory knowledge are labeled 'kernel theories' by Gregor and Jones (2007)).
7) Principles of implementation (additional component)	A description of processes for implementing the theory (either the product or method) in specific contexts.
8) Expository instantiation. (additional component)	A physical implementation of the artifact that can assist in representing the theory both as an expository device and for purposes of testing. In this dissertation, the digital resourcing system constitutes the expository instantiation.

Altogether, I argue that the three abstraction levels of design knowledge should increase the understanding of digital resourcing. There is no doubt that also, the concept of *digital resourcing* should be regarded as a contribution offered by this study. During the initial search for existing knowledge that could inspire and justify the design of the digital resourcing system, I have found three fragmented and scattered resourcing actions; resource liquefying, resource pairing, and resource opting (see chapter 3). The resourcing actions found were

[19] Often called solution objectives by e.g., Walls et al. (1992) and Gregor & Jones (2007).

located in highly fragmented literature, the actions were not interlinked, and the actions were never intended to be used by developers for designing digital resourcing systems. Consequently, this study helps to interlink and synthesize the actions by using the *digital resourcing* concept. The concept has been refined during concurrent building and evaluation of the digital resourcing system, which I believe that it can support both researchers and practitioners in their future work concerning digital innovation.

1.4 DISPOSITION

The structure of the remaining part of this dissertation follows an adapted version of Gregor and Hevner (2013) generic template for publications contributing to design knowledge. In this study, the original version has been extended to integrate the discussed constructs by Gregor and Jones (2007) and Heinrich and Schwabe (2014). However, since the structure recommended by those scholars is aimed to be used to structure scientific articles in IS journals and conferences, further adaptions have also been conducted, in order to fit the purpose of this dissertation. After this introductory chapter, a reflection and description of prior work relevant to this study will be conducted. The chapter is called *The Need for Digital Resourcing,* and it includes a description of the contextual characteristics of the context within which the digital resourcing system is developed and evaluated. The third chapter includes information about the actions associated with *Digital Resourcing,* and a conceptual model, which is highly relevant to the study. In chapter 4, the *Research Approach and Research Method* are described and justified. The 5th chapter, *The Digital Resourcing System,* communicates the final design of the IT-artifact. The argument for dedicating a whole chapter for the final version is to provide a simple synthesized view of the digital resourcing system before the reader can learn about the emerging design knowledge. Another argument is to illustrate and visualize how this dissertation corresponds to the first level of design knowledge. The fifth chapter also contains meta-design, artifact goals, description of the solution class, and implicit specific requirements. In chapter 6, *Emerging Design Knowledge* is presented. The design knowledge is described, evaluated, and reflected upon in relation to theories partly presented in chapters 2 and 3, including empirical data to support (or reject) the fulfillment of artifact goals, is also presented. In the 7th chapter, the IS design theory for digital resourcing is communicated constituting the third and final abstraction level of design knowledge. The chapter includes references to the different components of the design theory presented in previous chapters, while the remaining theory components are elaborated. Finally, in chapter 8, the formalization and learning (i.e., contributions) for research and practice are restated, meaning that the epistemological loop between the sum of the design and the achieved contributions are discussed and closed.

2 The Need for Digital Resourcing

The purpose of the second chapter is to introduce theoretical insights that have justified the need for a design theory for digital resourcing. The description includes a summary of recent research on service-orientation, resource management, and digital innovation. The knowledge described should also be viewed as an *initial* enabler for designing the digital resourcing system. However, since the knowledge identified in this study has emerged along with the intervention and evaluation of a digital resourcing system, additional justificatory knowledge had to be added during the design. Such elaborated and more in-depth knowledge is presented in chapter 3 *and* in the presentation of the specific design cycles in chapter 6. The outline of the second chapter is; 2.1 Service Orientation, 2.2 Resource Management, 2.3 Digital Innovation, and 2.4 Summary of Learnings.

2.1 Service orientation

This study addresses the problem of designing digital resourcing systems. It has been conducted together with practitioners (see chapter 4) active within a context that is highly characterized by digital resources *and* a contemporary service perspective. The context referred to is the field, generally known as IT Service Management[20] (ITSM).

The 'S' in 'ITSM' indicates that a service perspective is adopted and that digital resources are bundled and provided as a digital service (c.f., Pollard and Cater-Steel 2009; Winniford et al. 2009; Cannon et al. 2011; Göbel and Cronholm 2016a; Jouravlev et al. 2019). ITSM organizations often manage the whole lifecycle of digital services; starting with the identification of business problems and needs, through to the innovative *design* of new or changed digital services, and finally, delivery and continuous improvement of the digital service in use (e.g., Cannon et al. 2011; Karu et al. 2016; Jouravlev et al. 2019). That is, the aim of ITSM is to design, implement, and manage quality digital services that meet the needs of businesses (e.g., Cannon et al. 2011). Another argument to embrace a service perspective during this research effort is derived from literature. Recent and extensive research reviews show that a contemporary service perspective introduces new or alternative approaches to digital innovation (e.g., Lusch and Nambisan 2015; Barrett et al. 2015; Snyder et al.

[20] ITSM is relevant for both research and practice since a full 95% of U.S. companies have budgeted for specific ITSM processes (Lynch 2006). Furthermore, Galup et al. (2009) stress that there is an increasing need for awareness of ITSM because of the obvious importance of this approach in practice. Ongoing discussions in the association itSMF concern if the prefix 'IT' is necessary, which implies that the term 'ITSM' can be reduced to 'SM' in the future.

2016). They also show that researchers, regardless of their field, have started to focus on innovation from a *service* perspective (c.f., Droege et al. 2009; Wittern and Zirpins 2010; Carlborg et al. 2014; Durst et al. 2015; Snyder et al. 2016; Witell et al. 2016; 2017). Some scholars even argue that innovation *should* be studied by using a service-oriented perspective as a lens, since such a perspective can foster better results for both research and practice (e.g., Barrett et al. 2015; Tsou et al. 2014). A final argument for embracing a service perspective is that the practitioners in the study required that a service perspective should be taken into account during the system design (see artifact goals in section 5.2).

A popular and contemporary service perspective adopted in this study is *Service-Dominant Logic* (S-D Logic) (c.f., Vargo and Lusch 2004a; 2008; 2016). There were several arguments for the adoption of S-D Logic instead of other service perspectives (e.g., Service Logic (e.g., Grönroos 2008)). First, S-D logic provides theoretical statements that are relevant to digital innovation and could support the design of the digital resourcing system (c.f., Lusch and Nambisan 2015). Second, S-D Logic describes a perspective that corresponds well with, and is applicable to, the whole IT sector (e.g., Arnould 2006; Wittern and Zirpins 2010; Lusch and Nambisan 2015; Göbel and Cronholm 2016a). A third argument was that S-D Logic is well known, well-cited, and consists of several clearly articulated foundational premises[21], which could support the design of digital resourcing systems. Another argument was that most scholars agree that "*service is the heart of value-creation, exchange, market, as well as [having] considerable implications for research, practice, societal well-being, and public policy*" (Vargo and Lusch 2008 p.21). Finally, the practitioners in the project (see chapter 4) argued that S-D logic is a widely accepted perspective within their contexts. For example, the new version of the ITSM best practice ITIL (Edition 4) is based on S-D Logic (Jouravlev et al. 2019).

According to Vargo and Lusch, the overall narrative of S-D Logic, *"…becomes one of (generic) actors co-creating value through the integration of resources and exchange of service, coordinated through actor-engendered institutions in nested and overlapping service ecosystems*" (Vargo and Lusch 2014, p.241). When Vargo and Lusch (2004a), presented S-D Logic, the distinct line that

[21] Theories inspiring S-D Logic are, according to Vargo and Lusch (2009), for example, resource based theory (Barney 1991; 2001); core competency theory (e.g., Prahalad and Hamel 1990; Day 1994); relationship marketing (e.g., Shostack. 1977; Berry 1983; Gummesson 1994; 2006; Grönroos 1994); theory of the firm (e.g., Penrose 1959); network theory (e.g., Håkansson and Snehota 1995); practice and context theory (e.g., Schatzki 2002; Nicolini 2012); interpretive research and consumer culture theory (e.g., Arnould and Thompson 2005); and, experience marketing (e.g., Prahalad and Ramaswamy 2000).

traditionally had been used to separate tangible goods from intangible services[22] began to fade. Thus, S-D Logic could be viewed as a reaction to the traditional *product-oriented perspective*, or *Goods Dominant (G-D) Logic*, a logic that has dominated the view of economic exchange since the industrial revolution (c.f., Smith 1776). As the name indicates, G-D Logic emphasizes goods. Exporting goods was previously considered to constitute the primary source of wealth. In order to maximize profit, the manufacturing process should be made as efficient and effective as possible. In G-D Logic, goods are seen as units of output that *embed* value and that are often produced in *separation* from customers. Services, which also exist in this product-oriented perspective, are viewed as a specific type of good. From a G-D Logic viewpoint, services have been claimed to be *intangible*, *heterogeneous*, *produced and consumed simultaneously (i.e., inseparability), and non-storable (i.e., perishability)* (e.g., Zeithaml et al. 1985; 1988). This implies that if someone applies a G-D logic perspective, that someone also focuses on a *division* between services and goods, as well as on *differences* between services and goods. G-D Logic also provides a view that services are '*add-ons*' to a product (e.g., adding a digital service to a car). Such services (i.e., extra features to a product) could enhance the *embedded* value of that product (Vargo and Lusch 2009). This perspective of service obviously reduces the value of the service *per se*. It simply suggests that a service is not regarded equally as important as goods, which in turn should be regarded as the basis of economic exchange. To sum up, from a G-D Logic point of view, the purpose of the service provider is to produce units of output embedding value, often in isolation from the customer, while the customer purchases, consumes, and destroys the value of these units (ibid).

However, the fundamental problem with G-D Logic is that it is not goods or products that customers buy (Vargo and Lusch 2004a). Instead, customers buy *value propositions* consisting of resources, presented as a service that tentatively enables them to create value for themselves. This means that service providers can only *offer* value propositions and that they sometimes also have the opportunity to influence their customers' value creation process (e.g., Grönroos and Voima 2013; Skålén et al. 2015). In this way, products, in their tangible shape, mask or hide, the real value, which consists of value-in-use or value-in-context. Another problem with G-D Logic is that customer orientation is not mandatory and that it assumes that a service provider can *decide* what the customer thinks is valuable. In Table 2.1, the differences between the goods and service perspectives are restated.

[22] Plural services in the dissertation implies a G-D logic view while service(s) implies a contemporary service perspective.

Table 2.1. Differences between S-D Logic and G-D Logic (e.g., Vargo and Lusch 2004a; 2004b; 2008; Skålén and Edvardsson 2015).

Goods-dominant logic	Service-Dominant Logic
Producing something tangible	Service
Value-added or created	Value as co-created
Value is objective	Value is subjective to the user
Value delivery	Value in use or value in context
Customers as targets	Customers as resources
Resource as operand	Resources as operant (intangible, e.g., knowledge and skills) and operand (tangible, e.g., hardware)
Supply chain	Service Ecosystem
Price	Value Propositions
Competition	Collaboration
Isolated customers	Co-creation in Service Ecosystem

As an alternative to the G-D logic, Vargo and Lusch (2004a) suggested S-D Logic. According to this perspective, service providers always offer *value propositions*, and value is co-created by resource integrating actors in service ecosystems. Value propositions are defined as *invitations to engage with an actor* (e.g., the service provider or other actors) as a means of enabling value (c.f., Lusch and Vargo 2014a; Åkesson et al. 2016). An important contribution by Skålén et al. (2015) enriches the description of the value proposition, which claims that a value proposition is not only about *what*, but also about *how* the actors co-create value. More specifically, *what* is usually something physical, i.e., the hardware and software that is being provided to the customer. The *what* is referred to as, e.g., *operand resource* (e.g., physical products). *How* usually refers to resources related to the delivery of the service (i.e., processes). The how is referred to as an *operant resource* and includes knowledge and skills. Knowledge, in this case, is referred to as the state of knowing about or being familiar with something while skills are the ability to use one's knowledge effectively and readily (Cambridge Dictionaries 2018). Both the *what* and *how* support the generation of new or changed value propositions, i.e., an innovation (Skålén et al. 2015). In the realms of this dissertation, the *how* means that a new or changed process (outcome) supporting a software application (e.g., incident management process[23]) or a new digital errand system supporting the service will qualify as *digital innovation*. This view of service provides a link between *processes* and *outcomes* (ibid). It implies that processes and hardware are important to consider during the design of novel digital service, which is important knowledge to consider during the design of the digital resourcing system. That is, a new combination of digital resources could leverage both the *what* and the *how* of a value proposition that enables *value* for someone[24]. Grönroos and Voima (2013) argue that the value part of a value proposition entails a process that increases the customer's well-being; that the customer becomes *better off* in some respect[25]. More specifically, scholars define value as value-in-use or value-in-context. This implies that value is created by the user of the service, individually and socially meaning that service customers and providers are both important in the value creation process. This implies that actors can co-create value, and Lusch and Nambisan (2015, p.162) defined value co-creation as the "*...processes and activities that underlie resource integration and incorporate different actor roles in the service ecosystem*." In this dissertation, the term co-creation is broadened to include both co-creation of the value in use *and* co-creation of the value proposition (i.e., a digital service). In contrast to G-D Logic, S-D Logic super-ordinates service (singular) to products and services (plural) (Vargo and Lusch 2009). This means that the S-D Logic perspective does not reduce the importance of tangible resources (e.g., digital technology, goods), nor does it make service(s) more important than goods. Whether the bearer of value is tangible or intangible is not important; "*regardless of whether service is provided directly or indirectly, through a good, it is the knowledge and skills (competences – operant resources) of the providers and beneficiaries that represent the essential source of value creation, not goods.*" (Vargo and Lusch 2009a, p.221).

The definition of service[26] in this dissertation is the "*process of using one's resources (e.g., knowledge) for someone's (self or other) benefit*" (Barrett et al. 2015, p.138). Such a service *enables* value but recognizes that physical products (e.g., hardware and software) *often* are an important part of the service. Figure 2.1 illustrates a simplified service perspective (neither in this case

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[23] Incident management process is one of several standardized ITSM processes.

[24] 'Someone' refers to actors; e.g., providers, customers, employees, business owners, alliance partners, and communities (Ostrom et al. 2010; Lusch and Nambisan 2015).

[25] This claim also implies that a firm's actions may also make a customer worse off (Echeverri and Skålén 2011).

[26] The definition made by Barrett et al. (2015) is similar to the one presented in the seminal paper by Vargo and Lusch: i.e., "*Service* is *the application of specialized competences (knowledge and skills) through deeds, processes, and performances for the benefit of another entity or the entity itself*" (2004 p.2).

is the intention to frame the entire S-D Logic in one figure). The figure shows that service may constitute an indirect or a direct service type. The indirect service type may consist of goods (products), which constitute tangible *operand* resources (e.g., physical products), while the direct type often constitutes more intangible *operant* resources (i.e., knowledge and skills).

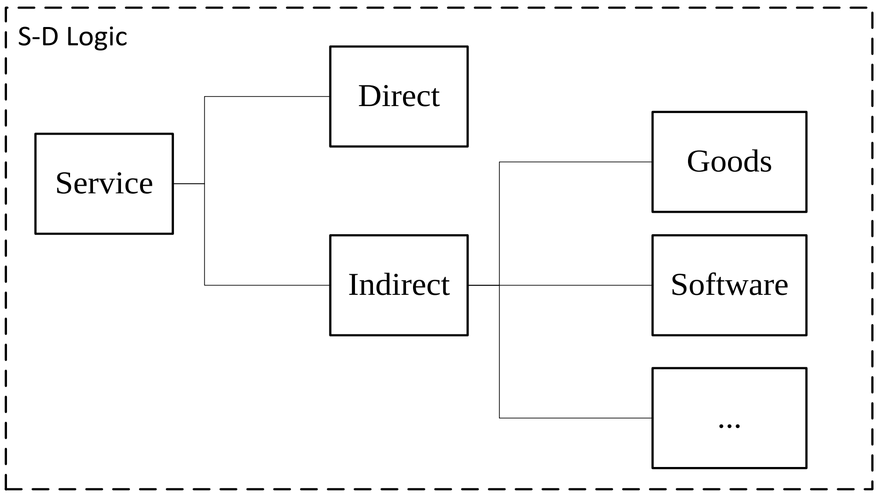

Figure 2.1. Simplified conceptual service model inspired by Vargo and Lusch (2005).

In an attempt to summarize the essence of S-D Logic, and establish a framework for a service-centered mindset, eleven normative Foundational Premises (FPs) have been proposed (Vargo and Lusch 2004a; 2008; 2016). A premise is defined as a "*…statement that is assumed to be true and upon which further theory is built…one should expect that if the premises are sufficiently rich, they should provide the foundation upon which to derive propositions that can then undergo scientific investigation and empirical testing*" (Vargo and Lusch 2009a, p. 223). Examples of foundational premises are; "Service is the fundamental basis of exchange", "Value is co-created by multiple actors, always including the beneficiary", "All social and economic actors are resource integrators", "Value is always uniquely and phenomenologically determined by the beneficiary", and "Value co-creation is coordinated through actor-generated institutions and institutional arrangements". The FPs of S-D logic has influenced the design of the digital resourcing system, and it helped to clarify the context. The latest revision of all the FPs is summarized in Appendix 2.

Although S-D logic promises to provide benefits, it is possible to criticize the perspective (e.g., Kristensson 2009; Grönroos 2011; Campbell et al. 2012). O'Shaughnessy and O'Shaughnessy (2009) have presented sharp criticism. The scholars argue that S-D Logic constitutes a backward step since it seeks to displace other marketing theories and to become an all-encompassing paradigm. Moreover, they argue that S-D Logic is not "*logically sound nor a perspective to displace others in marketing*" (ibid, p.784). However, in a response issued by Lusch and Vargo (2011), the scholars effectively point out fundamental errors in the critique. One mistake made by O'Shaughnessy and O'Shaughnessy (2009), was that they did not consider other S-D Logic knowledge contributions that were presented in other journals. Thus, they missed new knowledge on the (still) emerging logic. In their response to the critique, Lusch and Vargo (2011) demonstrate that S-D Logic is neither regressive nor intended to displace all other marketing perspectives and that S-D Logic is not advocating technology at the expense of explanatory theory. This means that, since Vargo and Lusch (2004a; 2004b) introduced S-D Logic, a large portion of knowledge has been identified and added to the service-marketing and service-science knowledge base, which means that S-D Logic is improving over time. They also emphasize that S-D Logic is pre-theoretical and intended to be soundly grounded in a manner to assist theory construction (ibid).

Another critique has been voiced by Grönroos (2011, p.279) who observed that "*some of the 10 foundational premises of the so-called service-dominant logic do not fully support an understanding of value creation and co-creation in a way that is meaningful for theoretical development and decision making in business and marketing practice*". He points out that it is the customers who are in charge of their own value creation process, meaning that the service provider can only be invited to join that process (as a co-creator) (ibid). However, S-D Logic was probably never intended to be understood in the way Grönroos interpreted the logic, but, at the time, Grönroos was accurate in his critique. In effect, the customer (or beneficiary) is indeed the ultimate value-creator also from an S-D Logic perspective. The foundational premises of S-D Logic have been refined by Vargo and Lusch (2016) and thus answer better to the critique presented by the scholar. Furthermore, Campbell et al. (2012) criticized the view of service in S-D Logic, and they argue that the logic does not recognize operands: "*while value derives from the service that goods render, this service is always materially embodied, thus materiality precedes service*" (p.14). The authors have probably misunderstood the service view provided in S-D Logic, which actually *unites* goods and traditional services (plural) as *service* (singular). Consequently, S-D Logic also recognizes operands as a very important component of the service and its value proposition. Kristensson (2009) also presents a critique of S-D Logic. He argues that the ability of S-D Logic to actually aid companies in their effort to provide opportunities for value creation is not sufficient. He stresses that the lack of specific guidelines is a reason why managers do *not* adopt S-D Logic premises. Kristensson (2009) uses the example of the “4P model” (c.f., Kotler 2000) as a contrast to S-D Logic since the 4P model was extremely successful in respect of applicability. He argues that that S-D Logic does not yet have similar guidelines, which implies that better principles are required for different contexts and purposes. This claim strengthens the need for this study, i.e., to generate prescriptive design knowledge for digital resourcing from a service perspective.

During this initial review, I have learned that there is no doubt, that the transition to a contemporary service perspective has had a positive impact on the sustainable competitive advantages of organizations (e.g., Chen et al. 2009; Ojiako 2012; Tsou et al. 2012; 2014; Verma and Jayashima 2014; Beloglazov et al. 2015; Chen 2017; Jouravlev et al. 2019). For example, previous research has found that an S-D Logic promises to provide strengthened customer relationships, enhanced innovation capabilities, and improved access to resources (Vargo and Lusch 2004a; 2008; 2016). Since both researchers and practitioners appreciate the perspective, I can conclude that there is a need to embrace S-D Logic and consider it during the design of the digital resourcing system. However, I have also learned that there is a lack of prescriptive guidelines and that there is a need for better reflection on the existing premises in order to use them in practice, during the design (e.g., Vargo and Lusch 2017; Kristensson 2009). This points to, and strengthens, one of the underlying departure points of this dissertation; i.e., existing innovation management systems do not recognize a contemporary service perspective. An innovation management system is a formal infrastructure encompassing strategies and processes by which an organization administers innovation (CEN/TS 2013). Moreover, I can conclude that S-D Logic considers that resource management is essential i.e., it is a central part of the definition of service. This assertion also corresponds well with the ITSM literature, which describes, “*the act of transforming capabilities and resources into valuable [digital] services is at the core of [IT] service management*” (Cannon et al. 2011, p.15). The authors also claim that “*ITSM means thinking of IT as a cohesive set of business resources…managed through processes and ultimately represented as services*” (Cannon et al. 2011, p.75). Consequently, contemporary service perspectives and digital resource management are tightly coupled, which has caused me to continue to elaborate on resource management.

2.2 RESOURCE MANAGEMENT

Although S-D Logic is well-grounded in theory, it is not intended to constitute a *theory* of its own (e.g., Vargo and Lusch 2015). It is rather pre-theoretic and intended to be soundly grounded in a manner to *assist* theory development (Vargo 2008; Lusch et al. 2011). Nevertheless, S-D Logic '*stands on the shoulders of giants,*' which means relying on a great pedigree of theories from diverse academic fields. One of the most influential theories for S-D Logic has been the Resource-Based Theory (RBT[27]) (Wernerfelt 1984; 1989; Peteraf 1993; Barney 1991; 2001). Since S-D Logic is grounded on theoretical statements in RBT, I decided to go deeper into the RBT literature in order to understand how S-D logic extends it and to learn and reflect more about resources.

I first learned that RBT had become one of the most influential and cited theories in the history of management[28] in Kraaijenbrink et al. (2010). It is widely accepted, and it should be considered as well-grounded in both practice and research. Moreover, RBT has had important implications for IT (Barney et al. 2001). For example, Wade and Hulland (2004) found that RBT is useful to IS/IT research and that the theory provides a valuable way for IS researchers to think about how IS relates to the strategy and performance of *service providers*. Finally, RBT has also been mentioned for its positive role in innovation and its possibility to create sustained competitive advantages for service providers (e.g., Clemons 1986; 1991; Clemons and Kimbrough 1986; Clemons and Row 1987; 1991; Feeny 1988; Feeny and Ives 1990; Barney 1991a; Bharadwaj 2000; Tarafdar and Gordon 2007; Chen et al. 2009; Tsou et al. 2014; Nylén and Holmström 2015; Lusch and Nambisan 2015; Holmström 2018).

As is to be expected, RBT puts emphasis on *resources* as a driver for the performance, especially for a single firm, such as a service provider. Barney et al. (2001, p.642) argue that resources "*can be viewed as bundles of tangible and intangible assets, including a service provider's management skills, its organizational processes and routines, and the information and knowledge it controls*." Resources are also considered crucial to innovation. This assertion is strengthened by Arvidsson and Mønsted (2018, p.369), who argue that organizations "*...recognize the need to provide employees with the freedom to identify opportunities and pursue them by combining resources in novel ways*." RBT holds that resources could create a Sustained Competitive Advantage (SCA). An SCA is achieved when a service provider creates more *economic* value than the marginal service provider in an industry (c.f., Barney and Clark

[27] Someone might know RBT as Resource Based View (RBV).

[28] Management corresponds well with the ITSM context and the purpose of the IT-artifact.

2007). As previously insinuated, the central proposition in RBT is that if a single *service provider* wants to achieve *SCA*, it must possess and control valuable, rare, inimitable resources, and have the organizational processes to manage and exploit them (Barney 1991; 2001; Wade and Hulland 2004). Thus, RBT intends to explain the *internal resources* of a *service provider's* SCA (ibid). According to Barney and Clark (2007), the four attributes, known as the *VRIO framework*, can be thought of as indicators of how useful resources are for generating SCA. The valuable (V) attribute means that a resource is *valuable* only when it enables a service provider to utilize strategies that improve its efficiency and effectiveness. A rare(R) resource is a valuable resource that is not owned by multiple service providers. If a large number of service providers possess a valuable resource, then each of these service providers can exploit the resource in the same way, which will not give service providers a competitive advantage (ibid). If a service provider possesses an inimitable (I) and valuable resource, it can only be a source of SCA (Barney and Clark 2007). Finally, the service provider needs to be organized (O) to exploit valuable, rare, and inimitable resources, because then the resource can be a source of SCA (ibid). Consequently, organizational processes are essential components in RBT, and they constitute the fourth RBT condition necessary for the realization of SCA. Such processes can enable a service provider to realize the full potential of a resource and therefore support competitive advantages (Barney and Clark 2007).

In this study, however, the focus is on actions managing *digital resources*[29]. A *digital resource* is defined as digitally represented information and software that can be viewed as an integrated resource (Goldkuhl and Röstlinger 2019). An essential part of a digital resource is its functionality and the way it enables value. A digital resource holds the potential to simultaneously be part of multiple value streams offered through functionality related to information (e.g., Henfridsson et al. 2018). A functionality of this kind can consist of activities, e.g., receiving, processing, storing, selecting, transmitting, and presenting digitized information (Goldkuhl and Röstlinger 2019). A digital resource can have multiple roles, and therefore actors can use a digital resource in many ways. In this study, the designed digital resourcing system of hardware and software can be viewed as a digital resource *per se* (c.f. Goldkuhl and Röstlinger 2019). This 'technical dimension' of a digital resource supports actors so that they can

[29] Several scholars have tried to develop typologies of tangible and intangible resources, including core competencies (Prahalad and Hamel 1990), capabilities (Stalk et al. 1992), skills (Grant 1991), strategic assets (Amit and Schoemaker 1993), assets (Ross et al. 1996), and stocks (Capron and Hulland 1999). Wernerfelt (1984) and Barney (1991b) simply used the term "resources" and made no effort to divide resource into any sub-categories. However, this study uses the term digital resource, which is an *operand* resource that can be transformed into an operant resource.

fulfill a purpose (see chapters 5 and 6), and it recognizes that digital resources utilize hardware and software technologies for the processing, storage, presentation, and transport of digitized information. However, the digital resourcing system also includes functionality that supports the managing of digitized information; i.e., it receives, processes, stores, and presents information in ways that would be difficult or impossible for humans to do. According to this view, the digital resourcing system (i.e., hardware and software) also *contains* digital resources (i.e., digitized information). Goldkuhl and Röstlinger (2019) describe the latter as the 'semantic dimension' of a digital resource, which includes conveying understandable meaning to its users through concepts and terminology. In order to enable value, the digital resourcing system needs to support human actors with the management of digital resources but also to transfer those digital resources to operant resources, which could be processed by human actors. Human actors can then bundle, add and change the operant resources and, if necessary, store the newly created resources (again) in the digital resourcing system. Hence, the operant resource (knowledge and skills) becomes a digital resource by use of the digital resourcing system. In this way, the digital resourcing system could support an *interplay* between man and digital technology. It is through the interfaces of the digital resourcing system that a human actor can meet and interact with digital resources. The latter is known as the 'interactive dimension' of a digital resource (Goldkuhl and Röstlinger 2019). Finally, the digital resourcing system could also be viewed from a 'regulative dimension' because it directs and guides the way users work (c.f. ibid). Please read the excellent report by Goldkuhl and Röstlinger (2019), on in-depth elaboration on the different dimensions of digital resources.

In the context of this study, it is important to note that a *digital resource* is being viewed[30] as an *operand resource* essential to digital innovation (see chapter 1). The reason is that this study has applied S-D Logic as a lens, which describes a shift from thinking about generic resources in terms of '*operand'* resources to '*operant*' resources (Vargo and Lusch 2009a). As previously described, operant resources can generate value directly (Vargo and Lusch 2009a), while operand resources require actors to integrate and use them in order to create value (Edvardsson and Tronvall 2013). In this study, I have mainly viewed a *digital resource* as an operand resource (i.e., the semantic dimension) because it requires some action to make it valuable; i.e., a digital resource *enables* digital innovation and value creation. In contrast, operant resources (e.g., knowledge and skills) are usually intangible, non-digitized, and are capable of *creating* value by acting on other resources (such as operand

[30] Lusch and Nambisan (2015) argue that there are reasons to believe that digital technology also could constitute an operant resources but that such as role is emergent in nature and its specifics are yet to be explicated.

resources). This means that a digital resource does not have intrinsic value; it needs to be applied and integrated to be valuable (e.g., Edvardsson et al. 2011; Mele and Della Corte 2013; Edvardsson et al. 2014). According to this view, a digital resource is a dynamic feature (in contrast to a static feature), which is illustrated by Vargo and Lusch (2004a, p.2), who assert that; "*resources are not, but they become.*" Both RBT and S-D logic consider operant resources to be a major source of competitive advantages, and they are the only kind of resources capable of meeting the VRIO criteria's (e.g., Prahalad and Bettis 1986; Grant 1996; Spender and Grant 1996; Michalisin et al. 2000; Bassellie and Benbasat 2004; Vargo and Lusch 2004; Lusch and Nambisan 2015). Operant resources produce SCA, and it is the firm's ability to effectively manipulate and apply operant resources that form the basis for achieving the SCA (Alavi and Leidner 2001). That is, an operational digital resourcing system could support the actions that help transform operant resources into digital (operand) resources and back, in order to generate novel value propositions.

During the initial search for knowledge on digital resources and digital resource management, I have found that digital resources have different dimensions and that they have the potential to be part of different value streams simultaneously (e.g., Lusch and Nambisan et al. 2015; Henfridsson et al. 2018). I have also strengthened my belief that digital resources should be viewed from a service perspective, which helps to extend the view of resources (e.g., Barrett et al. 2015; Lusch and Nambisan 2015; Vargo and Lusch 2017; see also Appendix 3). Furthermore, I have learned that digital resources provide a granularity via which digital innovation can be studied (e.g., Henfridsson et al. 2018). All of these assertions strengthen the need to consider digital resources and associated actions during the design of the digital resourcing system. However, I have not found any specific guidelines for *how* organizations should combine and recombine digital resources when discovering digital innovations. This strengthens the purposefulness of this study. Finally, I have understood that digital resources are the building blocks that leverage digital innovation and that they are indeed placed at the heart of digital innovation (Yoo et al. 2010a; Garud et al. 2013; Lusch and Nambisan 2015; Nambisan et al. 2017). Consequently, I recognized a demand for myself to learn more about digital innovation.

2.3 DIGITAL INNOVATION

Digital innovation affects the way we live our lives, the way we perform our commitments, and it sometimes even forces us to reorganize entire markets (e.g., Brynjolfsson and McAfee 2012; 2014; Åkesson and Thomsen 2014; Fichman et al. 2014; Barrett et al. 2015; Nylén 2015). It is evident that organizations that fail to embrace digital innovation become outcompeted by those who do, and in this sense, digital innovation is critical to every industry and every functional unit regardless of sector (Yoo et al., 2009; 2010; Tumbas et al. 2018). This implies that the world, as we know it, has already passed a tipping point and that our society has entered 'the golden era' of digital innovation. Therefore, researchers have an obligation to redirect attention toward digital innovation and especially toward those areas that remain understudied and poorly understood.

In this dissertation, I define digital innovation as the recombination of diverse resources that create novel value propositions, which are embodied in or enabled by digital technology. The novel value proposition should ultimately be communicated as a digital service[31] enabling actors to create value. This broad definition is in line with the more outcome-oriented definition by Fichman et al. (2014, p.330) who define innovation as a "*product, process, or business model that is perceived as new requires some significant changes on the part of adopters, and is embodied in or enabled by IT.*" [32] It also corresponds to the definition by Nambisan et al. (2017, p.224), who are of the opinion that digital innovation should be considered a process; i.e., "*creation of (and consequent change in) market offerings, business processes, or models that result from the use of digital technology*." This means that digital innovation requires the use of digital resources during the innovation process or as part of the digital service (value proposition) as the outcome of innovation (c.f., Yoo et al. 2010b; 2012; Nambisan et al., 2017). Finally, the definition is similar to the service-oriented definition suggested by Lusch and Nambisan (2015), but with a more explicit emphasis on digital resources. The mentioned scholars argue that innovation is the "*rebundling of diverse resources that create novel resources that are beneficial (i.e., value experiencing) to some actors in a given context; this almost always involves a network of actors, including the beneficiary (e.g., the customer)*" (ibid, p.161).

[31] Please, recall that service could be viewed as the application of resources (specialized competences (knowledge and skills)) through deeds, processes, and performances for the benefit of another entity or the entity itself.

[32] This definition builds on the classic outcome oriented definition by Rogers (2003) who defines innovation as "*an idea, practice or object that is perceived as new by an individual or other unit of adoption*" (2003, p.11).

The definition used in this dissertation is important since it helps to focus on digital resources and associated actions instead of outcome while it manifests the idea that digital innovation should be considered as both a process and an outcome (e.g., Huang et al. 2017). Moreover, I argue that this is important since it helps merge different perspectives of innovation, i.e., a more technical perspective found in the IS research domain and a more contemporary service perspective found in the service science domain. Finally, the service-inspired definition of digital innovation used in this dissertation is also important since it redirects the attention of specific *types* of outcome, e.g., process, product, or business model toward digital resources bundled as novel *value propositions*. Moreover, the digital innovation definition implies that a novel value proposition should be communicated as a digital service. A digital service, therefore, comes with a value proposition, consisting of *what* and *how* that *enables* value for someone (see section 2.1). According to this view, and in line with S-D Logic, 'service' becomes the application of specialized resources through deeds, processes, and performances for the benefit of another entity or the entity itself (e.g., Vargo and Lusch 2004a; Barrett et al. 2015).

A service-oriented perspective in a digital age also affects the traditional view of the *digital innovation process* (c.f., Vargo and Lusch 2008; Michel et al. 2008a; 2008b). The traditional view of the innovation process has been understood as a process consisting of several stage-gated steps progressing in a sequential, linear, and highly structured way (c.f., Zaltman et al. 1973; Robertson 1974; Booz et al. 1982; Drucker 1988; Edvardsson and Tronvall 2013). Such stages include discovery, development, diffusion, and impact. Each stage includes sub-procedures supporting, e.g., idea and solution generation, concept development, design and development, prototyping/testing, evaluation, commercialization, and feedback (c.f., Baker and Mctavish 1976; Saren 1984; Bitner et al. 2008; Romain and Tourancheau 2015). Two recent studies on the digital innovation process summarize the main stages (e.g., Fichman et al. 2014; Kohli and Melville 2019). Although different labels are used, the processes roughly correspond to each other (see Table 2.2). Both scholars are using four stages, out of which three correspond to three stages of Schumpeter's (1934; 1950) classic stage model of innovation (i.e., invention (corresponds to initiating), innovation (corresponds to developing), and diffusion). The suggested innovation stages also correspond to the stages suggested by the European standard for innovation (CEN/TS 2013). Consequently, the stages are defined to be generic, meaning that they are not necessarily specific to *digital* innovation.

Table 2.2. Two similar views of a stage-gated innovation process (Kohli and Melville 2019; Fichman et al. 2014).

Kohli and Melville (2019)		**Fichman et al. (2014)**	
Stage	**Sub activities**	**Stage**	**Sub activities**
Initiate	triggers, opportunity identification, decision making	**Discovery**	*Invention* (means the creation of something new), and *selection* (finding and evaluating an innovative technology in the external environment to potentially develop or adopt)
Develop	designing, developing, adopting	**Development**	The concept is developed, configured (deciding technology features to use)
Implement	installing, maintaining, training	**Diffusion**	Deployment (Spread to users), assimilation (when individual absorbs the innovation in daily routines)
Exploit	maximizing returns, leveraging/improving existing systems/data for new purposes	**Impact**	Focus on effects (e.g., reduced cost, improved revenue), improvements

In this study, I have focused on the discovery stage of the digital innovation process. Although Fichman et al. (2014), elaborate on digital innovation as a fundamental and powerful concept in the information systems curriculum, I argue that their description of the digital innovation process aligns well with other research on innovation and that it should be regarded as fully valid. I especially find their suggestion to call the early stage of the digital innovation process 'discovery' to fit the characteristic of the stage since it implies 'a search' for something new. Consequently, I will use the term 'discovery' rather than the term 'initiate' suggested by Kohli and Melville (2019). The purpose of the discovery stage is to manage opportunity identification, to find prominent solutions, and to decide what solution to implement. This purpose description aligns well with the description by Kohli and Melville (2019). Nevertheless, in their excellent scientometric and systematic literature review, Kohli and Melville (2019) find the coverage of research streams, diversity, and diffusiveness of research in digital innovation to be vastly uneven. They have especially concluded that IS researchers have not addressed issues within the early stage (i.e., *initiate* or *discovery stage*) of the digital innovation process, and imply that there is a demand for improved knowledge of the stage.

From a service-oriented perspective, the four overall stages do not have to be present in all digital innovation efforts, and they do not necessarily need to occur in any sequential order (e.g., von Hippel and von Krogh 2016; Nambisan et al. 2017). This means that the activities might be difficult to separate in practice (e.g., Nambisan et al. 2017; Kohli and Melville 2019). Nambisan et al. (2017) argue that innovation processes have become less bound, in terms of their temporal structure and it enables ideas "*to be quickly formed, enacted, modified, and reenacted through repeated cycles of experimentation and implementation…., making it less clear as to when a particular innovation process phase starts and/or ends*" (p.225). One reason is that digital technology includes characteristics not found in analog products (see Appendix 7). That is, in contrast to stage-gated innovation procedures, there is evidence of the opposite: ad-hoc approaches (Henfridsson et al. 2018; Nambisan et al. 2018; Kohli and Melville 2019). Digital innovation could, therefore, be understood as a process of non-linear and continuous actives which emerges through negotiations, experimentation, competition, and learning integrated in the day-to-day operations (e.g., Sundbo 1997; Gallouj and Weinstein 1997; Johnson et al. 2000; Alam and Perry 2002; Koskela-Huotari et al. 2016; Nylén and Holmström 2016; Nambisan et al. 2017). In this context, digital innovation is seen as ad-hoc and not necessarily formalized (e.g., Toivonen and Touminen 2009; Hanseth and Lyytinen 2010; Lyytinen et al. 2016; Nambisan et al. 2017; Kohli and Melville 2019). To sum up, a digital innovation process can vary, and therefore, it can be planned, intentional, and unintentional, and it emerges through an interactive learning process initiated by any involved parties (Gallouj and Savona 2009). In this study, participating organizations have been calling for a more planned and structured approach to digital innovation, since it could help them to organize, systemize, and plan their business. A digital resourcing system could support such a requirement.

Moreover, the process of digital innovation is about to change because of the way human actors are seeking digital resources to utilize in the innovation process. The traditional view of innovation is to use internal resources and focus the innovation work in a specialized Research and Development (R&D) department (Chesbrough 2003; 2006; 2011; Chesbrough and Bogers 2014).

However, the transfer to a contemporary service perspective as well as the introduction of the Internet and the advancement of digital technology has caused many organizations to shift their mindset from simply being a provider to recognize that collaboration with other actors is crucial for digital innovation (e.g., Lusch and Nambisan 2015; Juell-Skielse and Hjalmarsson 2017; Suseno et al. 2018). The findings correspond well with multiple studies within service science and marketing, which have shown that customers and other stakeholders have increasingly become co-creators of value, and thus they should be part of the innovation process (Vargo and Lusch, 2004; 2008; 2016). Also, within recent IS research, the same conclusions have been drawn. For example, Kohli and Melville (2019) assert that knowledge sharing among partners, internal and external, leads to greater recognition of exploit opportunities. Consequently, other actors than the service provider (i.e., the 'firm') can be regarded as a source of resources in digital innovation because they possess vital resources needed to enable improved value (see also section 2.1). Saldanha et al. (2017) also find that IT can play a role in facilitating collaboration with customers and, in general, the broader service ecosystem of actors by enhancing the absorptive capacity of the business via proper digital infrastructure and IT-enabled capabilities. This obviously helps to separate digital innovation from the general non-analog view of innovation (see Appendix 7, for more characteristics on digital innovation). Although the literature on digital innovation appears to be divided along different disciplinary lines it is obvious that digital resources are important for digital innovation, for, digital service and digital resources are the flip sides of the same coin. That is, a contemporary service perspective is primarily driven by resources, such as knowledge or digital information, which in turn, are efficiently managed by digital resources (i.e., a technical dimension), such as a digital resourcing system (c.f., Rust 2004; Löbler and Lusch 2014).

Furthermore, recent IS research, suggests that *digital systems* supporting efficient management of innovation constitute a prominent approach in the leveraging of digital innovation; i.e., "*firms need dynamic tools to support them in managing their digital innovation efforts"* (Nylén and Holmström 2015, p.58). There are several arguments for this need. First, digital systems supporting innovation can increase the efficiency of innovation practices such as idea decision-making, and prototyping (Ciriello et al. 2019). Secondly, digital systems can enable practitioners to scale innovations through data-driven operations, instant releases, and swift transformations (Huang et al. 2017). Thirdly, purposeful digital systems can new create market opportunities, digital innovations, and they support value creation for businesses and society (Suseno et al. 2018). Other reasons to embrace digital systems are that they can facilitate communication (e.g., Ciriello et al. 2017) and improve collaboration with actors in the surrounding service ecosystem, which is a fundamental aspect of contemporary innovation practice (e.g., den Hertog et al. 2010; Mithas 2012; Lusch and Nambisan 2015; Forrester Wave 2016; Nambisan et al. 2017). Moreover, innovation researchers have recognized the importance of the digitization of innovation processes themselves, implying that digital systems are needed (von Hippel 2005; Nambisan 2013). In other words, digital systems can leverage the digital innovation process, and that is also one reason why organizations are under increasing pressure to apply such systems in the process of innovation (e.g., Kohli and Melville, 2019). Such pressure, in combination with the increased awareness of efficient management of digital resources (e.g., Henfridsson et al. 2018), has spurred organizations to seek for contextualized, easy-to-use and, easy-to-learn digital resourcing systems supporting organizations in their effort to manage digital resources efficiently (e.g., Bieler 2016).

To sum up, digital innovation is important, since it has become imperative for organizational survival *and* it will increasingly become the source of national wealth (c.f., Agarwal et al. 2010; Lee et al. 2012; Brynjolfsson and McAfee 2012; Lucas et al. 2013; Nambisan 2013; Fichman et al. 2014; Löbler and Lusch 2014; Nambisan et al. 2017; Arvidsson and Mønsted 2018). Consequently, there is a need to support organizations in order for the process of digital innovation to be conducted efficiently. However, during the initial search for knowledge, I have learned that there is a lack of research related to the early stage of digital innovation (e.g., Kohli and Melville 2019). This is problematic because the discovery stage helps practitioners to manage digital resources and transform them into novel value propositions that could finally be realized. Moreover, I have not found any contextualized existing digital resourcing systems supporting the actions of resource liquefying, resource pairing, and resource opting (see Appendix 5), which promise to leverage the discovery stage of the digital innovation process (see chapter 3). There is no doubt that digital innovation is essential for organizations and that there is a need to support practitioners in managing digital resources from a service perspective, especially in the discovery stage of the digital innovation process. This strengthens the need for and guides the design of the digital resourcing system.

2.4 SUMMARY OF LEARNINGS

During the initial search for knowledge, I gathered detailed information about a service perspective, resource management, and digital innovation. I can conclude that a service perspective on digital resources and digital innovation is essential to embrace both from research and from a practitioner's point of view. I also conclude that digital innovation is crucial to organizations and that their ability to effectively manipulate and apply digital resources forms the basis for reaching digital innovation success. Consequently, it is possible to conclude that organizations residing in a digital age need to redirect their attention toward digital resources, and especially the actions that help to process and transform those digital resources into novel value propositions. A digital resourcing system can help them in their innovation efforts. However, I have also found that there is a lack of knowledge about *how* organizations should combine and recombine digital resources in a service ecosystem. Nor do we have sufficient prescriptive knowledge (e.g., design knowledge) of how to design systems supporting actors to perform actions in the discovery stage of digital innovation. That is, I have not found any dedicated design theory that articulates how resource-related actions should be conducted in detail or how these supporting digital systems should be designed. Consequently, the initial literature review strengthens the problem addressed in this dissertation; that *there is a lack of design knowledge for digital resourcing.* This lack of design knowledge could hamper organizations in maintaining or improving their sustainable competitive advantages, and it certainly hampers developers who cannot lean on a grounded and sound design theory, when developing purposeful digital innovation management systems. Hence, there is a need to identify new design knowledge that better corresponds more favorably to contemporary theories and ideals, and that better serves the requirements of practitioners in the IT-sector. *It is here that digital resourcing has an important role to play because it promises to support practitioners during the discovery stage of digital innovation and to streamline related digital innovation actions. Consequently, there was a need to learn more about digital resourcing.*

3 DIGITAL RESOURCING

The purpose of the third chapter is to present an initial view of the concept of *Digital Resourcing*. The initial knowledge has helped to inspire and justify the design of the digital resourcing system, which, in its turn, has helped to fine-tune knowledge about the concept of digital resourcing. That is, digital resourcing has evolved in a dialectic process during the building, intervention, and evaluation of a digital resourcing system (see chapter 6). From a design perspective, the concept of digital resourcing should be viewed as a theoretically grounded *kernel theory* (see section 3.2) that complements other justificatory knowledge presented in the previous chapter. The outline of the third chapter is; 3.1 Resourcing Actions, and 3.2 Toward a Design Theory for Digital Resourcing.

3.1 RESOURCING ACTIONS

Given that digital resources are considered a natural part of digital innovation and of the research context, I experienced a compelling need to complement the knowledge presented in chapter 2, about the different aspects of the phenomenon. Such learnings, I argue, should take place before designing the first version of a digital resourcing system, since the knowledge could inspire and help to justify the initial design.

In order to build a theoretically grounded knowledge base, I searched for relevant knowledge in recent innovation literature. As described in the previous chapter, I started to learn about resources using the resource-based theory as well as about resources from an S-D Logic perspective. Although the knowledge identified provided a good foundation for the design (e.g., Table 2.4), I was not satisfied; I had not found any *synthesized* digital resource *actions,* described on a detailed level, that could easily be translated and realized into a design. Consequently, I conducted a more in-depth search in the literature on digital innovation, which resulted in additional knowledge that could be used during the initial design of the digital resourcing system.

However, I quickly realized that the work to derive actions from existing theories was a non-trivial task. On the one hand, the different actions found were located in highly fragmented innovation literature, and the actions were not interlinked. On the other hand, the actions found were never intended to be used by developers to design digital resourcing systems. Consequently, I needed to process and transform the knowledge in a creative manner in order to relate the purpose of the digital resourcing system more adequately, the importance of creativity being widely acknowledged in design-related projects (e.g., Baskerville et al. 2019). Therefore, some of the actions described in this dissertation have previously been *briefly* explored separately in the IS literature, albeit in slightly different terms.

As mentioned earlier, I have chosen to label the processed and synthesized knowledge as *digital resourcing*. Digital resourcing, as presented in this dissertation, refers to the *actions* conducted by diverse human actors seeking to manage digital resources with potential value and to turn them into novel value propositions. The goal of digital resourcing is to leverage digital innovation with a specific focus on the discovery stage of the digital innovation process. The concept should be seen as an amalgamation of three interrelated actions: *resource liquefying* (e.g., Lusch and Nambisan 2015), *resource pairing* (e.g., Nambisan et al. 2017; von Hippel and von Krogh 2016), and *resource opting* (e.g., Sandberg et al. 2014) managing *digital resources* (see chapter 2). This means that the actions have been derived from previous research on digital innovation, and they have been developed further in this study. Moreover, the three actions correspond well with the definition of digital innovation as well as with the characteristics of the context because they all aim to manage digital resources from a contemporary service perspective (see chapter 2). In order to provide a simple transition from the realm of the somewhat vague and ambiguous resourcing actions to more distinct actions, a brief description of each identified action is presented in the following sections, while elaborated actions are presented in parallel with the emerging digital resourcing system and design knowledge in chapter 6.

3.1.1 Resource Liquefying

An initial action to consider during the design of the digital resourcing system is *resource liquefying* (e.g., Lusch and Nambisan 2015; An et al. 2016; Zolnowski and Warg 2018). *Resource Liquefying*[33] is defined as the mobilization and decoupling of resources from its related physical form or device (e.g., Lusch and Nambisan 2015). Thus, the purpose of the action is to process mobilized resources by decoupling resources from their physical form (e.g., technical or humans sources) and make them available for actors to explore using the digital resourcing system. Resource liquefying is viewed as an important prerequisite of the two other digital resourcing actions; i.e., if a sound amount of digital resources could be stored in the digital resourcing system, this would offer better opportunities for digital innovations.

[33] A similar construct, 'liquefaction', has previously been shown to constitute a key element while working with innovation in service science, but the concept has not yet been studied in the domain of digital innovation and I have not found any prescriptive design oriented knowledge supporting the development of the digital resourcing system.

In order to succeed with resource liquefying, there is a need to *mobilize* resources within a service ecosystem and summon those to a specific time and space. *Boundary objects* (e.g., Carlile and Rebentisch, 2001; Carlile, 2002) could support efficient mobilization. A boundary object embodies and represents knowledge and can be shared (Hinds and Pfeffer 2003); it could also help human actors in the service ecosystem to focus on *which* resources to mobilize. This view of boundary objects differs from the view of Eaton et al. 2015 who views a boundary object as software tools. Therefore, the goal of mobilization is to identify, acquire, grant access to resources, and make resources accessible for actors to decouple. In this dissertation, mobilization is initiated when actors have decided to start a specific digital innovation initiative because of a trigger such as an organizational problem or need. Mobilization is derived from the concept of *resource acquisition in RBT* as well as *resource density* in a contemporary service perspective. On the one hand, RBT has elaborated on the idea of *resource acquisition as* primarily focused on operand resources (i.e., goods) (Barney 1997; 2001; 2007; Wernefeldt 2011). This means that a firm produces physical goods with embedded value, which is destroyed by consumers who then work to buy more goods with embedded value. However, because of the service perspective taken, also operant resources are recognized, and those should thus be considered as well. On the other hand, mobilization is derived from a central issue in S-D logic, i.e., whether resources can be quickly mobilized for any of the dimensions: time, space, or actor (Lusch and Nambisan 2015). The same scholars draw on Normann (2001), who introduced the principle of 'density' to address this issue. Resource density is defined as the best combination of resources mobilized for a particular situation in a specific context (Normann 2001). Hence, there is a need for a digital resourcing system to facilitate easy access to appropriate resource bundles (Lusch and Nambisan 2015). The "*ultimate expression of the density principle would mean that any economic actor at any time would have more or less a whole world of specialist knowledge and specialized assets at his or her disposal*" (Normann 2001, p.27). This density opportunity is primarily driven by new technology (ibid), and the underlying principle of such techniques is the same: the need to mobilize contextually relevant resources (i.e., both operand and operant) in the most effective and efficient way in order to enhance resource density. Consequently, resource mobilization allows resources to be identified and summoned effectively, taking into account heterogeneous resources from multiple sources.

Previous research shows that resource heterogeneity, as well as organizations' different forms of specialization, spurs them to find other organizations with whom they can conduct digital resourcing (c.f., Mele and Della Corte 2013). Consequently, the mobilizing of digital resources should be conducted in collaboration. This is in line with recent research on service and digital innovation that shows that both the external competitive environment and the internal organization, shapes the digital innovation (see chapter 2). One way to think of possible actors to collaborate with is to think of *service ecosystems*. The concept of service ecosystem has been used in service science, and it is defined as a "*relatively self-contained, self-adjusting system[s] of resource-integrating actors connected by shared institutional logics and mutual value creation through service exchange*" (Lusch and Vargo 2014a, p.161). That is to say that, a service ecosystem consists of any configuration of people, technology, and value propositions, i.e., different sources possessing resources, which should be identified and used in the digital resourcing initiative. However, the issue of where to search for resources in such a service ecosystem, what boundary objects to set when searching for resources, and *how* to conduct resource mobilization using a digital resourcing system is knowledge that remains to be discovered.

The second part of resource liquefying is decoupling[34]. Lusch et al. (2010) find that the ability to decouple resources is part of a "*continuing evolution over thousands of years but now has ascended to central importance and criticality because of the emergence, growth, and proliferation of digital communication and computation…*" (p.22). This means that digital technology has increased the potential for many resources to become decoupled and stored as digital resources (Lusch et al. 2010). One specific characteristic of digital technology, enabling decoupling, is homogenization (see Appendix 7). This implies that once data is digitized, data from different sources can be transformed and manipulated and further combined with yet other data (Yoo et al. 2010b). In a similar way, decoupling transforms resources into information that actors can explore, recombine, and pair and then store, as new value enabling digital resources, in the digital resourcing system. In other words, the resources mobilized in the first step, can, after they have been decoupled, be shared between human actors in the service ecosystem, and stored in the digital resourcing system. Nonaka and Takeuchi (1995) argue that knowledge (i.e., operant resources), in particular, needs to be shared in order to convert general ideas and concepts into solutions enabling value. For example, service customers and providers can supply information on a specific process that needs to be improved into a digital innovation initiative. This corresponds to the context of this study, which is also process-oriented (recall that service *is* a process (see chapter 2)). Such resources can obviously be stored in human minds as knowledge and skills, but they can also be stored in a database as digital resources. The human actors can then interact and share knowledge (operant re-

[34] Decoupling has previously been known as 'dematerialization' (e.g., Normann 2001) or 'Liquefaction' (e.g., Lusch and Nambisan 2015).

sources) concerning processes with the other human actors to leverage innovation. In order to succeed with decoupling, actors should set up a communication process that leverages a conversational dialog between actors (e.g., Gummesson and Mele 2010). One useful mechanism leveraging communication in a service ecosystem is process assessments (Getronics 2006; Shrestha 2015; Shrestha et al. 2019). I define process assessment as the disciplined examination of the processes by actors against a set of criteria/statements to determine the capability of those processes to reach the goals of the organization. According to TSO (2011), a process is defined as a structured set of activities designated to accomplish a particular objective. A process has inputs that are transformed by the set of activities, which then turn into one or more outputs, and ultimately enables value. A high number of well-defined service processes and work procedures are suggested and used in the context. Examples of such ITSM processes are the 'service portfolio management process,' 'business relationship management process,' 'availability management process,' 'change management process,' 'request fulfillment process,' and 'incident management process.' Apart from communication, process assessments in the ITSM contexts may also facilitate service improvement (Cortina et al. 2010; 2014; Shrestha 2015), as an important part of digital innovation. Consequently, decoupling could be performed by actors who jointly assess service-related processes. In this way, the processes constitute a 'communication protocol' allowing actors to communicate around contextual statements and to decouple resources (see also chapter 4, 5, and 6). In this study, I define a communication protocol as a system of rules that enable two or more human actors to transmit and exchange information.

To sum up, a digital resourcing system should provide the functionality to support actors to perform the action of *resource liquefying*. The reason is that it will make important digital resources available for different human actors to explore and to utilize in the digital innovation process. However, in line with findings in chapter 2, current research fails to offer detailed prescriptive guidelines for how human actors should execute the action in practice. Rather, the literature adopts a technical approach that is too one-sided, i.e., mainly focused on how the digitization process transfers data to bits, which then can be merged and stored in databases (e.g., Yoo et al. 2010a; 2010b; Lusch and Nambisan 2015). From a service perspective, there is a need to extend this view to including also liquefying of resources in the possession of human actors. Furthermore, current literature does not provide detailed knowledge of the actions following[35] resource liquefying, meaning that there is a lack of the whole discovery picture. Consequently, there is a noticeable lack of prescriptive knowledge supporting practitioners who are to perform resource liquefying as an integrated action when discovering digital innovations. Hence, there is a need to identify and explore additional knowledge describing how this action could be supported through a digital resourcing system. Refined statements regarding the action of resource liquefying are further elaborated on and described in chapters 5 and 6.

3.1.2 Resource Pairing

The next resourcing action identified is *resource pairing*. The action is defined as the pairing of resources related to problems and solutions forming a package of valuable enabling information for human actors in service ecosystems. The purpose of the pairing action is to identify problems and to pair them with solutions, or vice versa, enabling novel value propositions. The success of resource pairing is highly dependent on the activity of the previous resource liquefying action, which becomes an antecedent to this action. That is, when resource liquefying arises, it should be easier to recombine and pair digital resources with other operant or operand resources. Consequently, the output of resource pairing is solutions presented as new or changed value propositions and, finally, communicated to service customers as a value-enabling digital service.

The digital resource paring action originates from von Hippel and von Krogh (2016), who suggest that innovation could be conceptualized in terms of dynamic '*need–solution pairs*' which correspond to an ad-hoc innovation process (see chapter 2). In this dissertation, a solution is viewed as a way of dealing with a difficult situation, which is more elaborated on than an idea. This solution has a value proposition, which can be communicated as a digital service if it is enabled by or embodied in digital technology. The scholars propose that especially a *need* and a *solution* should be established *together* and tested for *viability* as a need–solution pair (ibid). They specify this act as *informal* problem solving since it does not start with a problem but with a solution, which then is mapped to a problem (ibid). Nambisan et al. (2017) argue that this view could help to address digital innovation issues, such as how digital innovations emerge and evolve. However, rather than discussing needs and solutions, recent scholars use the term '*problem-solution pairing'* and state that "*digital innovation can be viewed as a constant search for and identification of new or evolved problem-solution pairs*" (Nambisan et al. 2017, p.228). This action

[35] Other studies have focused on individual aspects as predecessors of resource liquefying i.e., the importance of intrinsic and extrinsic motivation for resource sharing (e.g., Osterloh and Frey 2000; Argote et al., 2001; Gaechter et al. 2004).

also gives rise to new types of IT-artifacts, such as digital resourcing systems. New features and functionalities of such IT-artifacts should convey information on the nature of the problem-solution pairs rooted in a specific context (ibid). Thus, a digital resourcing system should orchestrate a situation allowing diverse human actors to manage digital resources and manage problem-solution pairs in their digital innovation effort. The pairing action could also help to replace or merge previous predefined and stage-gated innovation processes (e.g., Table 2.4) with more fluid boundaries. I view the resource pairing action as part of a greater whole, and that other actions are needed in order to implement a novel value proposition. This means that other stages of digital innovation are still relevant.

However, Nambisan et al. (2017) provide only a little information about *how* problem-solution pairing should be performed in practice. They argue that pairing depends on the richness of design patterns that could be used by the actors conducting innovation. A design pattern is defined as "*rules of thumb that provide a plausible aid in structuring a problem at hand or in searching for a satisficing artifact design*" (Gregory and Muntermann 2014, p.639). Moreover, a design pattern serves "*as a generalized solution to a commonly occurring problem*" (Douglass 2003, p.50). Nambisan et al. (2017) provide examples of design patterns at different levels; a service layer (e.g., a cascading style sheet) and a business layer (e.g., an exchange transaction such as a currency). In this way, a design pattern can offer a relationship between a solution and a problem (ibid). Within this study, contextualized ITSM best practices (i.e., process frameworks and standards) should serve as design patterns at a service layer. Examples of best practice frameworks that could serve as a design pattern are ITIL (c.f. Cannon et al. 2011), CMMI (CMMI Product Team 2010), the ISM method (Hoving and van Bon 2012), VeriSM™ (Agutter 2017), and COBIT (ISACA 2017a), and ISO/IEC 20000-1:2011 (ISO/IEC 2011). The argument for utilizing best practices as a design pattern is that process orientation is an essential contextual characteristic identified amongst the participating organizations (see chapter 2). That is, ITSM organizations often apply a process-based approach to manage a digital service lifecycle (c.f. Cater-steel 2009; Galup et al. 2009; Cannon et al. 2011; Shrestha 2015). Another argument for utilizing ITSM best practices is that they correspond well with the former resource liquefying action (section 3.1.1), which also leans on processes but, in that case, as a 'communication protocol.'

Another element essential to the action of resource pairing is the *value proposition*. A value proposition is central since it relates to the aim of digital resourcing, i.e., to support actors when managing digital resources in order to co-create value propositions and communicate them as a digital service. In this sense, the value proposition guides the resource pairing action (see chapter 2).

Finally, resource pairing draws on previous research on *resource integration,* an essential construct in S-D Logic (see section 2.1). Resource integration views customers, not as the buyers of output, but as resource integrators working together with providers (Mele and Della Corte 2013). This collaborative view on pairing could help to address another key digital innovation question suggested by Nambisan et al. (2017), i.e., how do firms integrate internal and external parties and various communities when contributing to the digital innovation process? However, rather than supporting innovation, resource *integration* supports *value creation-in-use,* which means that it is not directly viewed as an act in the innovation process. However, since resource integration can appear in different shapes; *complementarity* (i.e., actors possess different resources valuable in different ways), *redundancy* (i.e., actors have similar resources), *mixing* (i.e., actors have similar *and* different resources asking for complementarity and redundancy resources) (Mele and Dellacorte 2013), it could contribute to an understanding of how resources should be paired and inscribed within a digital resourcing system. Furthermore, human actors constitute the engine in resource integration. The human actors decide what resources are available, and that could enable the most value (e.g., Edvardsson et al. 2011). Consequently, without actors, digital resource pairing is difficult to arrange (e.g., Lusch and Nambisan 2015; Suseno et al. 2018). To facilitate resource integration amongst diverse human actors' common organizational structures, processes, and sets of principles are important to follow (e.g., Lusch and Nambisan 2015). This is in line with Gummesson and Mele (2010), who claim that interaction between human actors is mandatory for resource integration. Such actors should set up a dialogue and exchange resources for renewal; i.e., actors interact to communicate 'needs/problems' and 'wants,' thus laying the foundation for pairing. Such knowledge is of great value to the design of the resource pairing action and strengthens the need for both communication protocols and design patterns.

Although *resource pairing* has started to become a recurring theme of digital innovation literature, I argue that the concept is elusive, and plenty of work is required to gain a full understanding of this phenomenon (see also Nambisan et al. 2017). For example, neither Nambisan et al. (2017) nor Hippel and Von Krogh (2016) discuss *how* the action of informal pairing should be conducted in practice or how it should be incorporated in a digital system. von Hippel and von Krogh (2016) state, "*we will still want to better understand how it works*" (p.215). Furthermore, previous studies on problem-solution pairing have not been contextualized, and I have not found any explicit principles that allow researchers and practitioners to design digital systems supporting explicit pairing by human actors. Finally, the concept of resource integration, and design patterns, which could inspire the design of the resource pairing action, are poorly understood (e.g., Mele and Della Corte 2013). Consequently, there is a need to explore empirically how digital resourcing systems could support human actors in service ecosystems in the performing of digital resource pairing. This exploration could increase the understanding of the resourcing action for the IS research community. Digital resource pairing will be further elaborated on and refined in chapters 5 and 6.

3.1.3 Resource Opting

The final action of digital resourcing identified and elaborated on in this dissertation is labeled *resource opting*. The action is defined as the opting of problem-solution (resource) pairs. Thus, the purpose of the resourcing action is to opt-in, or opt-out, amongst several co-created problem-solution pairs holding novel value propositions that could be realized. In digital resourcing, the problem-solution pairs created during the resource pairing action are viewed as digital options. Resource pairing, therefore, becomes an antecedent to resource opting (see 3.1.2). The argument for embracing resource opting in digital resourcing is that a human actor usually is better suited for one out of several possible courses of action (e.g., Simon 1960; Bowman and Hurry 1993). Another argument is that developments in digital technologies make it increasingly possible to support human actors to make decisions (i.e., to opt-in or out) in a better and faster way (Carlsson and El Sawy 2008).

Given that organizations seek to keep different options open in situations that involve an unforeseeable future, Bowman and Hurry (1993) suggest that researchers adopt an *option lens*. An option in this perspective is defined as having access to an opportunity for an investment choice. An option lens provides a view of an organization's digital resources (i.e., problem-solution pairs) as a bundle of digital options for future strategic choice. This means, the main reason to use an option lens in digital resourcing is that a wrong decision about a problem-solution pair could cause unwanted costs, and it could reduce the expected value (Kohli and Melville 2019; Sandberg et al. 2014). Digital options[36] have previously been studied in relation to digital technology (e.g., Sambamurthy et al. 2003; Sandberg et al. 2014), implying that an options lens is transferable to digital innovation (Hjalmarsson et al. 2017). To sum up, actors need to jointly test problem-solution pairs for viability in a grounded approach since it could support organizations to become more aggressive in growing markets as well as more resilient in downturns (e.g., Sandberg et al. 2014; Bowman and Hurry 1993). Consequently, a digital resourcing system could support organizations to build capabilities for how to evaluate or test identified problem-solution pairs as digital options (see also Sandberg et al. 2014; Kohli and Melville 2019).

[36] Fichman et al. (2014) uses the term ’selection’ which refers to finding and evaluating an innovative technology in the external environment. This view differs from my view of opting.

The concept of digital options is partly derived from Bowman and Hurry (1993), who present a *financial options chain* where options are viewed in different stages. The stages are; 1) several options in an options portfolio may await recognition as *shadow options*, 2) an organization's routines influence which shadow options are *recognized*, and 3) recognition of shadow options is the mechanism by which learning continuously translates into a *struck option*. This option chain suggests a mechanism to selecting options 'in' or 'out'; i.e., if an option has positioned the organization favorably, it should be 'selected in' while if the organization has been positioned unfavorably, the option will be 'selected out.' Bowman and Hurry (1993) do not provide normative knowledge on how selecting an option in or out should be performed. Recently, Sandberg et al. (2014) translated the financial options chain into a *digital options chain*. In contrast to *shadow, real,* and *struck* options, the scholars distinguish between options that are *available, actionable*, or *realized*. Available digital options are potential investments that lay dormant awaiting recognition from an organization, i.e., the options are unknown to the organization. Such unknown options may be identified in an innovation process, and the scholars argue that they may be systematically examined in terms of desirability and feasibility in order to recognize the most suitable as *actionable* digital options (ibid). They argue, "*Initially, the focus is on generating many desirable investment alternatives without particular concern for their practical implications, but their feasibility must eventually be accounted for by considering available resources and implementation conditions*" (ibid, p.431). *Desirability* refers to as the quality of resources as being worth having (Sandberg et al. 2014), while feasibility refers to the degree of resource investments and compatibility with infrastructure and culture; i.e., the degree of being easily done (e.g., Checkland 1981; Sandberg et al. 2014). This knowledge is also based on the work by Sambamurthy et al. (2003), who suggest managers use digital options to identify which investments could provide performance gains. If a decision is made to invest in a specific digital option, it becomes a *realized* digital option. Simply put, the problem-solution pairs could be viewed as actionable digital options, and when one of those have been opted-in, that digital option is defined as a *realized* digital option.

In this dissertation, the term resource opting is used, which especially draws on the previous options work provided by Sandberg et al. (2014). In line with previous research, the specific goal of resource opting becomes to opt-in or opt-out of one or more of several problem-solution pairs holding a novel value proposition, to be realized. Such opt-in or -out decision is referred to the human actor's evaluation of "*value in the social context, that is, the interpretation and the determination of positive or negative value*" (e.g., Carida et al. 2018, p.7). From a contemporary service perspective, such value should be jointly evaluated by customers/users of the new or changed digital resource; recall that value is unique to each actor and, therefore, must be assessed by those actors involved (e.g., Vargo and Lusch, 2016). To be able to conduct the resource opting action, the participating actors should not only reason with regard to *feasibility* and *desirability* (see Sandberg et al. 2014) but also around *uncertainty* (e.g., Daft and Lengel 1986; Lusch et al. 2008; Lusch and Webster 2010; Alfaro-Garcia et al. 2015). "*Given that the future entails uncertainty, it is reasonable to expect that uncertainty is inherent in every innovation process.*" (Lusch 2012, p.1). Uncertainty is defined as something that is not known or definite and should be diminished by the ability of actors to remove resource resistance through eliminating barriers or transforming weaknesses into opportunities (Akaka et al. 2012; Vargo and Lusch 2016; Carida et al. 2018). Evaluation of *uncertainty* should be considered during the design of the digital resourcing system since it *"…is widely accepted that the concept of innovation involves uncertainty…"* (Alfaro-Garcia et al. 2015, p.62). There is no doubt that resource opting is important. Without this resourcing action, human actors risk selecting and implementing a novel digital service that no one will use. However, even though Sandberg et al. (2014) advocate that *evaluation* of digital resources is important, they do not provide sufficient normative and prescriptive knowledge to guide practitioners regarding *how* to evaluate using feasibility and desirability. Nor do they provide guidelines for how a digital resource option should be tested for viability and selected in practice. In line with the two other actions of digital resourcing, there is a lack of design knowledge considering how digital resource opting should be performed, and how the action should be inscribed in a digital resourcing system. Consequently, there is a need for further exploration into how the action of digital resource opting should be transferred and applied to digital resourcing systems fostering the discovery of digital innovations. Digital resource opting will be additionally refined and elaborated on in chapter 5 and 6.

3.2 TOWARD A DESIGN THEORY FOR DIGITAL RESOURCING

Having highlighted the three identified resourcing actions[37], I turned my attention to forming a synthesized view of digital resourcing in service ecosystems. Informed by the literature reviewed, I could discern an initial logic between the resourcing actions, their relationship to digital resourcing systems, and to human actors in service ecosystems. The logic and relationships are summarized in a simple conceptual model[38] that aims to increase the understanding of

[37] I do not posit that the three identified actions are the *only* actions that could support the discovery stage of digital innovation. Other actions such as prioritization, voting, and knowledge management suggested by Panda (2007), could support the discovery stage or be part of the suggested resourcing actions (see further in appendix).

[38] A conceptual model is a model of an abstract idea rather than a model mirroring reality (e.g., Brown 2004; Bubenko et al., 2001; 2002).

digital resourcing (recall that it should be seen as a part of the discovery stage of digital innovation) (Figure 3.1). The conceptual model also aims to inspire the design of the first version of the digital resourcing system.

First, Figure 3.1 shows the conceptual logic connecting the three resourcing actions, i.e., *resource liquefying*, *resourcing pairing*, and *resource opting*. More specifically, it shows that resource liquefying could be summarized as consisting of two interrelated activities, i.e., resource mobilization and decoupling. Mobilization could be performed by identifying human actors (and non-human actors such as databases, etc.) that possess resources 'locked' in the physical matter. To support resource mobilization, boundary objects should be set up, which could help the actors to work together with useful resources. Such boundary objects could also help actors to ignore those resources that could possibly interfere with the resourcing work. When the right resources are mobilized to space and time, actors can decouple resources from their physical matter. This activity should be performed by using a communication protocol, e.g., by communicating about process statements related to an ITSM best practice (through assessment). The discussions around different statements should allow humans to free resources from their physical matter and make them available for utilization. The output from resource liquefying consists of decoupled digital resources stored and shared between different actors that can be acted upon. In the following *resource pairing* action, the decoupled digital resources could be more easily used in order to pair resources related to problems and solutions. Problems should inspire actors to combine and recombine resources to shape proper solutions. This action should be performed by adopting design patterns. In the case of this study, an ITSM best practice could also constitute a design pattern since it provides generic activities that could help to identify problems and to solve them. By applying the resource pairing action, the actors co-create solutions with value propositions, which in turn constitute the outcome of the liquefying action.

Finally, the actors should jointly opt-in or opt-out of one or more of the generated problem-solution pairs (i.e., a digital option) in the *resource opting* action. According to the learnings in previous sections, this action should be performed by first testing each digital option for viability through attributes such as feasibility and desirability and next by opting-in or -out of one or more prominent pairs holding value propositions with high density. Thus, the output from resource opting is a feasible and desirable value proposition that could be developed, realized, and diffused.

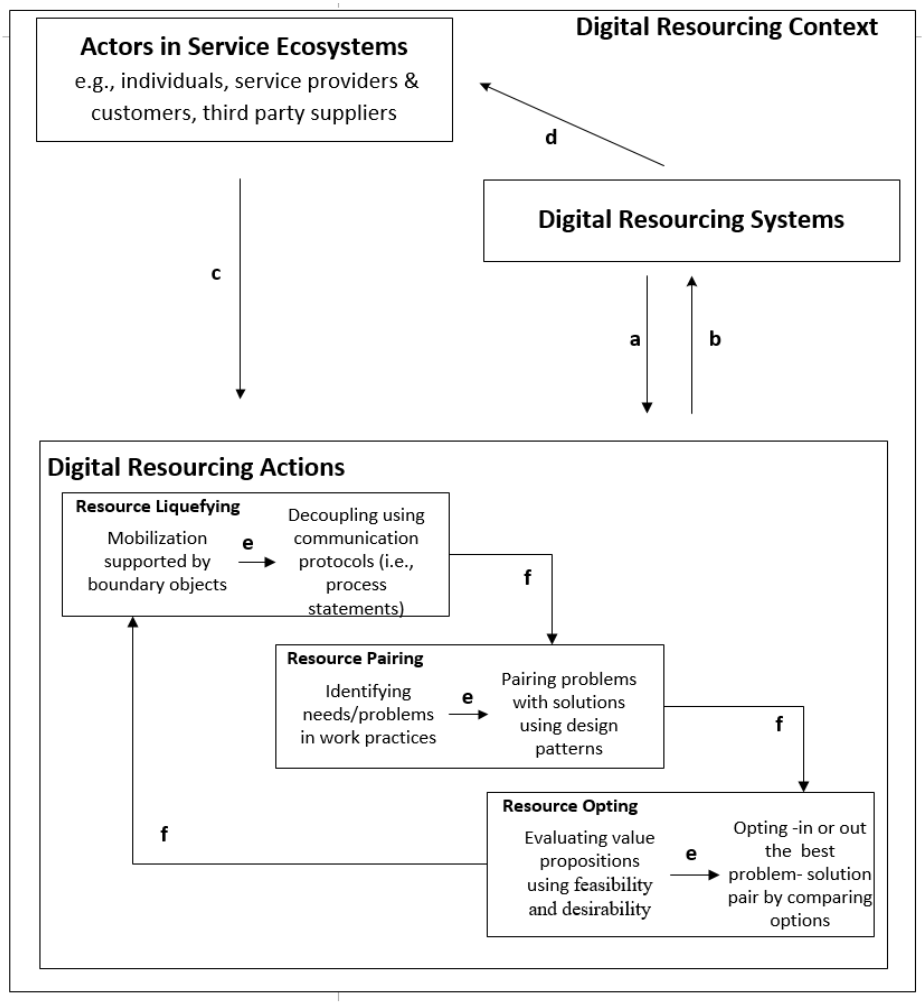

Figure 3.1. Conceptual model of the digital resourcing context in service ecosystems.

The conceptual model (Figure 3.1) shows that the three mediating resourcing actions consist of two interrelated activities each (e). Each resourcing action also serves as input or output to each other (f). Furthermore, the digital resourcing actions should be supported by a digital resourcing system (a) which embeds and facilitates the mediating resourcing actions to form institutional arrangements in the service ecosystem. The digital resourcing system could also be seen as a result of the resourcing actions taken by human actors as part of the whole service ecosystem (b). Furthermore, the digital resourcing system in action affects institutions, organizations and human actors in the service ecosystem (d). Finally, the service ecosystem enables or constrains the resourcing actions taken (c). In this way, the digital resourcing system constitutes a socio-technical ensemble IT artifact acknowledging the dual characteristics of technological embeddedness and the role of a contextual carrier (e.g., Purao et al. 2013; Orlikowski and Iacono 2001).

As previously mentioned, the synthesized components of the conceptual model should be viewed as a theoretically grounded kernel theory that helps to create a better understanding of the phenomenon of digital resourcing. A kernel theory is a term formulated by Walls et al. (1992), and it refers to "*any descriptive theory that informs artifact construction*" (Gregor and Hevner 2013, p.340). It is underlying a design theory (Markus et al. 2002), and Kuechler and Vaishnavi (2008, p.489) add that those kernel theories "*frequently are theories from other fields that intends to explain or predict a phenomena* [sic] *of interest*." The reason to include a kernel theory to complement other justificatory knowledge (see, e.g., chapters 2 and 6) was that such a theory explains, at least in part, why the designed digital resourcing system should work (e.g., Gregor and Hevner 2013). In the same manner, Goldkuhl (2004a) argues that a good kernel theory justifies, or serves as an external warrant, for the design theory. In line with the previous statements, the three identified resourcing actions, in this part of the study, are descriptive and help to explain how to design a digital resourcing system. Hence, I argue that it is reasonable to view the resourcing knowledge as a kernel theory meaning that the design of the digital resourcing system should include the three resourcing actions as initially described.

To conclude, I argue that the *synthesized* view of digital resourcing, which is summarized in the conceptual model, promises to evoke a shift from understanding the discovery stage of digital innovation as solely ad-hoc practices, to recognizing it as an approach consisting of interrelated and semi-structured resourcing actions in a service ecosystem (e.g., Hanseth and Lyytinen 2010; Lyytinen et al. 2016: Henfridsson et al. 2018; Nambisan et al. 2018; Kohli and Melville 2019). The conceptual model also evokes a shift to focus on actions associated with *digital resources* per se rather than focusing on different types of innovation outcomes. Such digital resources emanate from the utilization of, e.g., hardware, software, knowledge, and skills, and they are processed in order to co-create novel value propositions with the goal of enabling value for someone. Finally, it is important to recall that the concept of digital resourcing has not previously been studied in a synthesized approach, and it has not been materialized in a digital resourcing system. This strengthens the problem addressed, and it reinforces the necessity to refine and extend current knowledge in parallel with the design and evaluation of a digital resourcing system.

4 RESEARCH APPROACH AND RESEARCH METHOD

The purpose of the fourth chapter is to present and argue for the research approach and method that has been applied in order to answer the research question. Moreover, the purpose is to describe the research setting. The remaining part of chapter 4 continues with section 4.1 Research Approach and 4.2 The ADR method.

4.1 RESEARCH APPROACH

Epistemologists agree that a prerequisite for possessing knowledge is that someone has a belief in a relevant proposition and that this belief must be true (Pritchard 2010). The philosophical position supporting true belief in this study is *pragmatism* (c.f., Peirce 1903; 1931; James 1907; Dewey 1980; 1997). According to Dewey (1925/1988), man learns about reality, and gains knowledge of reality, through intervention in practice. Pragmatism has a clear foundation in empiricism[39], but it goes beyond a pure orientation to the observation of a given reality; "*Pragmatism means an interest for actions…. the world is changed through reason and action, and there is an inseparable link between human knowing and human action*" (Goldkuhl 2004b, p.3). That is, pragmatism suggests that the interaction between man and the environment constitutes the foundation of knowledge. From a pragmatist's point of view, either a positivist method, a method supporting interpretivism, or a mixed-method could be adopted in order to answer research questions. Pragmatism holds that the most crucial determinant of the epistemology (i.e., view of valid knowledge), ontology (i.e., nature of the world, i.e., the reality), and axiology (i.e., judgments about value) is the research question (Saunders et al. 2015). Consequently, the research question formulated in chapter 1 is of major importance due to its influence on the research design of this study.

In the study, an *ontology* similar to, but perhaps a bit more radical than the *interpretative ontology*, has been applied. This means that reality is viewed as socially constructed, i.e., it is subjective, and it can change. Klein and Myers (1999, p.67) state that "*interpretive research can help IS researchers to understand human thought and action in social and organizational contexts; it has the potential to produce deep insights into information systems phenomena including the management of information systems and information systems development*." The ontological perspective that has been taken on in this study acknowledges that multiple inter-subjective realities consist, which means that

[39] Aristotle, Francis Bacon, John Locke, George Berkley and David Hume advocate empiricism that argues that knowledge come primarily from sensory experience.

that the underlying digital resourcing system constrains or enables reality (c.f., Vaishnavi, et al. 2018). The epistemology could be summarized as *knowing through making* (ibid), and the axiological stance taken is that *value* plays an important part when interpreting results and that I, as a researcher, has a subjective point of view recognizing that I have become part of what is being researched.

Trost (1997) states that scientists who seek to understand or wish to find patterns in a phenomenon should use a qualitative research method. A qualitative researcher sees reality as something constructed by the individuals involved in the research situation (Creswell 1994). Thus, a central view of qualitative research is in line with the view of a pragmatist, a belief that people assign meaning to the objective and real-world and that their experiences are situated within a context (Tesch 1990). The connection with the real world is also the true value of qualitative research (Kemmis 1980). This view corresponds well with general research in the IS field: "*research in the information systems field examines more than just the technological system, or just the social system, or even the two side by side; in addition, it investigates the phenomena that emerge when the two interact*" (Lee 2001, p.iii). In other words, the IS discipline exists at the breaking-point where knowledge of the properties of, e.g., IT-artifacts and knowledge of human behavior, come together (Gregor 2006). This means that the natural surroundings in the research context have been crucial for me and that it has been important to understand or interpret the designed digital resourcing system from the meaning that people in the context have given them.

The purpose of this dissertation has been to design an *operational* digital resourcing system while presenting different levels of design knowledge for digital resourcing. A research approach, which contributes to design knowledge, while allowing for qualitative evaluation of novel IT-artifacts within given organizational contexts, is *Design Science Research* (DSR). This is also one reason for selecting the DSR approach for this study. Another reason is that the DSR approach is regarded as a legitimatized and important IS research paradigm within the IS discipline (e.g., Simon 1981; Walls et al. 1992; Hevner et al. 2004; Iivari 2007; Baskerville et al. 2009; Rossi et al. 2013; Gregor and Hevner 2013; Baskerville et al. 2018; 2019; vom Brocke et al. 2019).

DSR has roots in the science of the artificial and constitutes a problem-solving paradigm that seeks to create innovations (Simon 1981). The nature of design knowledge is special because it aims to support the achievement of artifact goals (e.g., Walls et al. 1992). Hence, the approach differs from social science theory, which does not aim to achieve artifact goals but rather to deal with artifact goals as the object of the study (ibid). Moreover, several IS researchers suggest that DSR is associated with pragmatism in its attempt to bridge science and practical action (e.g., March and Smith 1995; Iivari 2007; Hevner 2007; Hovorka 2009). A DSR approach emphasizes IT-artifacts as the core of IS and challenges the managerial and organizational issues that have been in focus within the IS discipline for many years (e.g., Orlikowski and Iacono 2001). This does not mean that one should *not* recognize organizational issues but that there is a need to find a balance between technology and organizational issues (e.g., Sein et al. 2011). It contributes to knowledge and generalized design theory, but it also contributes to practice with problem-solving and innovative IT-artifacts (e.g., March and Smith 1995; Gregor 2006; Gregor and Jones 2007; Kuechler and Vaishnavi 2008; Vaishnavi and Kuechler 2012). That is, DSR strives for both scientific rigor and practical relevance (e.g., Baskerville et al. 2019). Moreover, DSR incorporates creativity into the research process, meaning that the analytical processes supporting rigor and practicality should not impede the novelty of the solutions (ibid). Consequently, DSR corresponds well with the philosophical orientation of this study.

Since the popularity of DSR in IS is increasing, several specific DSR approaches[40] have been suggested. Examples of familiar DSR approaches are; Design Science Research in Information Systems Research (DSRISR) (Hevner et al. 2004; Hevner 2007); Design Science Research Methods and Patterns (DSRMP) (Vaishnavi and Kuechler 2015); Soft Design Science Methodology (SDSM) (Baskerville et al. 2007; Baskerville et al. 2009; Pries-Heje et al. 2014); Design Science Research Methodology (DSRM) (Peffers et al. 2008); and Action Design Research (ADR) (Sein et al. 2011). In this study, the research question, ontology, and epistemology have determined the specific choice of research approach, research method, *and* the research setting (c.f., Baskerville 2012; Patton 2015). Those aspects have led to the ADR method being selected to support knowledge generation (see Sein et al. 2011). The arguments for the choice of ADR and the description of the ADR method are elaborated in the following sections.

[40] e.g., a methodology outlining the principles that guide research practices or methods comprising tools, strategies or techniques that are used in research (Venable et al. 2017).

4.2 THE ADR METHOD

ADR is a research method supporting the design and evaluation of ensemble IT-artifacts in an organizational environment. ADR deals with two seemingly disparate challenges: 1) addressing a problem situation encountered in a specific organizational setting by intervening and evaluating, and, 2) constructing and evaluating an IT-artifact that addresses the class of problems typified by the encountered situation (Sein et al. 2011). There were several arguments that motivated the specific choice of ADR for this study. An essential one was that ADR supports the build and evaluation of an IT-artefact, such as a digital resourcing system, which is an integral part of the research effort of this study (see chapter 1). Furthermore, ADR supports knowledge generation as design knowledge, which corresponds well with the anticipated type of knowledge contributions of this study. Although ADR does not provide explicit support for IS Design Theory generation, several scholars have shown that it is possible to apply ADR for that purpose (e.g., Kuechler and Vaishnavi 2012; Venable et al. 2017; Haj-Bolouri et al. 2016; 2017). Simply put, presenting a design theory provides more elaborated knowledge than solely a set of design principles, and it makes the knowledge more usable for practitioners. Moreover, ADR supports researchers in responding to the dual mission of IS research; make theoretical contributions to the research domain, and assist in solving problems for the practice (Sein et al. 2011). Another motive for selecting ADR was that it provides excellent support for how to orchestrate collaboration between researchers and practitioners, i.e., an ADR-team[41]. Thus, ADR supports a team to design and evaluate a digital resourcing system in real contexts, with real users (e.g., Sun and Kantor 2006). A final argument for selecting ADR was that the method supports creativity (e.g., Baskerville et al. 2019) and explicitly helps to recognize the digital resourcing system as shaped by a wide variety of stakeholders, in a context such as developers, service providers, service customers, and IT managers. To conclude, ADR corresponded well with the research question, the dual purpose of the study, as well as the philosophical stance taken in this study.

[41] I have participated in the ADR-team, whose members have contributed with knowledge for the research project. However, I am solely responsible for the conceptualization of digital resourcing and the design knowledge presented in this dissertation. That is to say, in line with the role of an action design researcher, I have been deeply engaged in the search journey and I am responsible for the end of this journey presented in this dissertation. Since I have collaborated with others during the research effort, references will be made to the entire ADR-team and not to individuals through the course of this text. Other members of the ADR-team have been researchers from diverse fields and different representatives (e.g., managers, service managers, developers, process owners) residing at both service customers and service providers.

In the execution of this study, the phases and principles of ADR have been adhered to. The four ADR phases are; 'problem formulation' (see 4.2.1), 'building, intervention, and evaluation' (BIE) (see 4.2.2), 'reflection and learning' (see 4.2.3), and 'formalization of learning' (see 4.2.4). In addition to the four phases, ADR proposes a set of guidelines, formulated as principles. The principles assist researchers and practitioners in their efforts to balance practical problem solving and scientific knowledge production. All of the principles have been followed accordingly during the research process, and the specific steps of the approach are presented and explained throughout this chapter as well as chapter 6, and 7. The ADR principles are:

1. *Practice-inspired research:* The principle emphasizes field problems such as knowledge-creation opportunities. This research effort has included identifying field problems and collaborating with practitioners in the practice along the whole research process (e.g., chapters 1-3 and Appendix 1).
2. *Theory-ingrained artifacts:* The principle emphasizes that created IT-artifacts should be informed by theories. The design of the digital resourcing system has been informed by justificatory knowledge, including a kernel theory (e.g., chapters 2, 3, and 6).
3. *Reciprocal shaping:* The principle emphasizes inseparable influences mutually exerted by an IT-artifact and the organizational context. The digital resourcing system in this research effort has been designed and evaluated in multiple organizational contexts (see chapters 6 and 7). Moreover, contextual characteristics have influenced the design (e.g., chapter 2).
4. *Mutually influential roles:* The principle points to the importance of mutual learning among different project participants. This research effort has included routines to support mutual learnings (e.g., chapter 6).
5. *Authentic and concurrent evaluation*: The principle emphasizes that evaluation is not a separate stage of the research process. This research effort has been interwoven into the design and evaluation of the digital resourcing system in BIE cycles (e.g., chapter 6)
6. *Guided emergence*[42]: The principle emphasizes the interplay between intentional intervention and organic evolution. "*It emphasizes that the ensemble artifact will reflect not only the preliminary design (see Principle 2) created by the researchers but also its ongoing shaping by organizational use, perspectives, and participants*" (Sein et al. 2011, p.44). The design knowledge in the research effort has emerged during the intervention in practice (e.g., chapters 3 and 6).

[42] Emergence is defined as "*the fact of something becoming known or starting to exist*" (Cambridge Dictionaries 2018).

7. *Generalized outcomes*: The principle transfers from the specific-and-unique to generic-and-abstract. This research effort has generated three levels of design knowledge at different levels of abstraction (e.g., chapters 5, 6, and 7).

The ADR phases and principles (summarized in Figure 4.1) have had an important role in guiding this research effort. However, during the course of this study, I realized that ADR does not provide explicit guidelines that support the specific purpose of creating and presenting a design theory[43]. To gain a better correspondence with the purpose, I decided to complement ADR by consulting Gregor and Jones (2007), who have elaborated on the different components of a design theory. Moreover, I found inspiration in Gregor and Hevner (2013), who offer a description of how to position design science research in an excellent manner. I also realized that ADR does not suggest specific guidelines for *how* to select and create an evaluation strategy or for *how* to evaluate an IT-artifact such as the digital resourcing system in practice. Hence, there was a need to search for explicit evaluation guidelines elsewhere. Fortunately, complementary design evaluation solutions exist. In order to support design researchers to create and select evaluation strategies effectively, Pries-Heje et al. (2008) presented different *evaluation strategies* for design research projects. The strategies have later been extended in Venable et al. (2012) and, finally, presented as a "*Framework for Evaluation in Design Science*" (FEDS) (Venable et al. 2016). FEDS is elaborated in section 4.2.2. I also leaned on different grounding processes suggested by Goldkuhl (2004a) (e.g., section 4.2.2.3.3). Finally, I used Grounded Theory (GT) Corbin and Strauss (2008) in order to search for a research opportunity and to ensure that the problem addressed was generic. No doubt, the ADR phases have been followed during the knowledge development in this study. However, the aforementioned activities that aimed to complement ADR have affected the structure of and terms used in this dissertation. The complementary activities pointed in a direction away from the (perhaps obvious) structure of a dissertation following ADR, i.e., to organize the different chapters strictly according to the four ADR phases. Instead, I have chosen to structure this dissertation in relation to design contributions (chapters 5, 6 and 7). Moreover, it affected the terms used, which may not be mentioned explicitly in ADR (e.g., the design theory terms used). I argue that this approach has not affected the outcomes negatively because all ADR phases, principles, and tasks have been followed accordingly. To conclude, I argue that complementing knowledge has reinforced ADR so that it fits better with the purpose of this study.

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[43] My view is that since ADR is categorized within DSR it could implicitly support design theory generation.

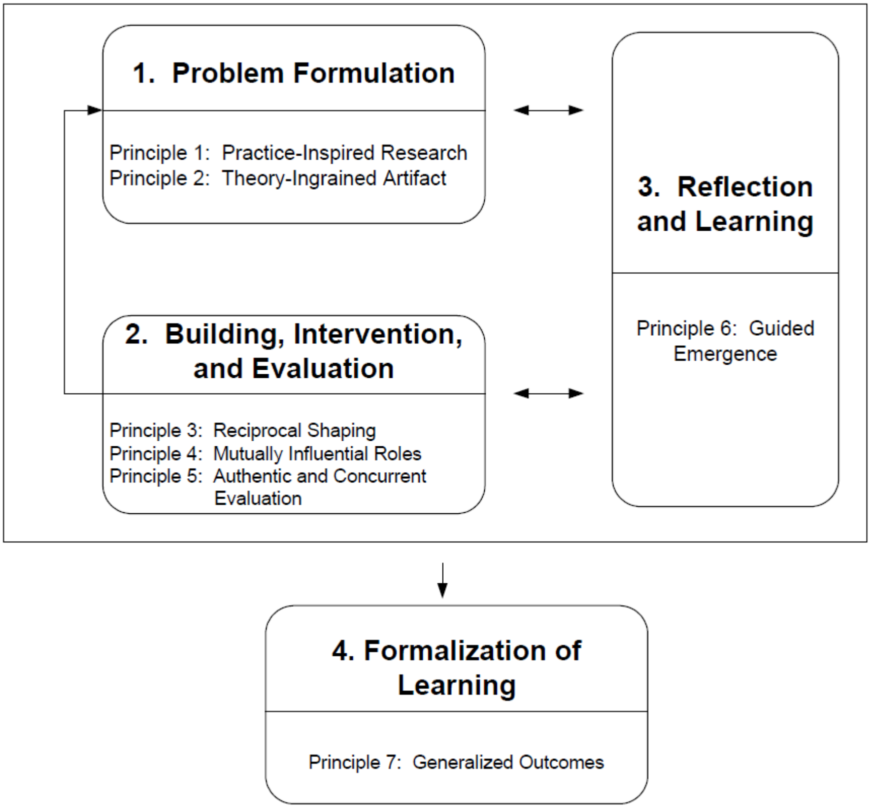

Figure 4.1. The relationship between ADR phases and principles.

In the following sections, the different ADR phases for this study are described. Although the different phases of ADR were carried out as cycles[44], this chapter describes the phases sequentially, starting with *problem formulation*.

4.2.1 Problem Formulation

The first ADR phase included articulating the research approach by identifying problems perceived in practice and/or anticipated by researchers (Sein et al. 2011). The problem formulation phase is the entry point of an ADR project (Sein and Rossi 2019). The problem in this dissertation is grounded in both theory and practice (see chapter 1-3). The different activities in the problem formulation phase followed the suggested ADR tasks: to 'Identify and conceptualize the research opportunity' (section 4.2.1.1), 'Formulate initial research questions' (section 4.2.1.2), 'Cast the problem as an instance of a class of prob-

[44] Iteration is synonymously used with the term cycle in this dissertation.

lems' (section 4.2.1.3), 'Identify contributing theoretical bases and prior technology advances' (section 4.2.1.4), 'Secure long-term organizational commitment' (section 4.2.1.5), and 'Set up roles and responsibilities' (section 4.2.1.6). In the problem formulation phase, I have also included specifying the artifact goals for the digital resourcing system, an activity that is only insinuated in Sein et al. (2011) (who prefer using the terms 'scope' and 'goals'). The reason for including artifact goals is to strengthen the link between the problem and to *documented* goals agreed by practitioners and researchers in order to know when the digital resourcing system is finished. The findings from the problem formulation ADR phase have been presented in the first three chapters of this dissertation, while the particular activities to reach the findings are described in the following sections.

4.2.1.1 Identify and Conceptualize the Research Opportunity

In order to identify problems and shape them into a research opportunity, interviews with the participating organizations (see Table 4.1) were conducted. The interviews were semi-structured (e.g., Patton 2015), which means that if necessary, supplementary questions could be asked during the interview sessions. The reason for that was that I wanted to increase the possibilities of identifying 'real' problems that were interesting for theory *as well as* practice. The questions asked related to organizational challenges and strengths. Different role-keepers at service providers and their customers were interviewed (e.g., service managers, process owners, developers, team managers, etc.). The initial results were presented in Göbel (2014), where seven organizations were interviewed. Building further on these results, 11 new group interviews with several representatives from other organizations were conducted. Each interview took approximately eight hours to complete, including pre- and post-actions. The interviews were recorded and transcribed. The analysis of the experienced problems identified followed GT (Strauss and Corbin 1990; Corbin and Strauss 2008). The argument for using GT for analysis was to identify problem patterns that could be transformed into a research opportunity. Another argument was that ADR did not provide any specific technique for analyzing such data. The benefit of the GT approach was that it helped to form a *generic* problem, which was *significant* to all organizations in the research project and not only for one single organization. In this way, the ADR-team could avoid the 'consultant trap,' i.e., solving a problem for practice irrelevant for research. In the first GT step (*open coding*), problems were identified, categorized, and named using the collected material from the interviews. Next, in the *axial coding* phase, relationships between the categories were drawn using boxes and arrows (see example in Appendix 1). Finally, using *selective coding*, a core problem was identified, which summarized the problem to address in the study. The results of the analysis were presented, discussed, and agreed upon in a workshop, including 16 participants from 11 organizations (section

4.2.1.6). That is, the purpose of the workshop was to verify and ensure that the problem was also valid for their organizations. In addition to identifying problems anticipated in practice, literature, which could confirm that the core problem was true and interesting for the research community, was scanned (see chapters 1, 2, 3, and Appendix 1). The activities resulted in a defined problem (see chapter 1) as well as the initial conceptualization of digital resourcing (see chapter 3), which were refined in subsequent BIE-cycles (see chapter 6).

4.2.1.2 Formulate Initial Research Questions

During this ADR task, researchers and practitioners were collaboratively reflecting on the problems identified and on the associated research opportunities. The output from reflection and associated discussions led to this very research undertaking and the research question. Following the discussions, I finally formulated a fine-tuned research question that should help to answer the problem addressed, and that corresponded well with the DSR community. The question was communicated to, and accepted by, the ADR-team.

4.2.1.3 Cast the Problem as an Instance of a Class of Problems

The work in the two previous tasks laid the basis for addressing the tension between solving the problem as encountered and dealing with a class of problems and solutions related to digital resourcing systems (e.g., Sein et al. 2011). Sein et al. (2011) argue that the knowledge should be generated, which could be applied to a class of problems of which the specified problem is an example. Moreover, Van Aken (2004, p.2009) argues that a solution "*is typically not totally general, but applicable to a certain application-domain, a class of problems*." The class of problems in focus in this dissertation, i.e., lack of design knowledge for digital resourcing systems enabling discovery of digital innovations, is described in chapters 1-3. This class is regarded as a sub-class of the innovation management systems class (see also chapter 5). This ADR activity was conducted using the generic problem collected from the multiple organizations, the research opportunity, artifact goals, and justificatory knowledge collected, which were then mapped to a class. Consequently, the casting was reflected upon continuously during the research project, and the aforementioned information made it possible to cast the digital resourcing system as a sub-class of the innovation management systems class.

4.2.1.4 Identify Contributing Theoretical Bases and Prior Technology Advances

When developing new knowledge, awareness of prior knowledge and contributions are essential since such knowledge"…*facilitates theory development, closes areas where a plethora of research exists and uncovers areas where research is needed*" (Webster and Watson 2002, p.13). Therefore, it was necessary to identify justificatory knowledge; i.e., the underlying knowledge or theory from the natural or social or design sciences that gives a basis and explanation of the design. This kind of knowledge could have the potential to create a foundation for advancing knowledge regarding digital resourcing. In this study, the artifact goals (chapter 5), the definition of digital innovation (chapter 2), contextual characteristics (chapter 2), and underlying problems (chapter 1, 2, and 3) support the search for justificatory knowledge. The justificatory knowledge later helped to form the theoretically grounded kernel theory of digital resourcing (see chapter 3). This corresponds well with ADR and especially the principle 'theory ingrained artifact,' meaning that researchers inscribe theoretical elements in an artifact, and by doing so, they manifest the theory "*in a socially recognizable form*" (Orlikowski and Iacono 2001, p. 121).

In order to identify justificatory knowledge, journal articles, conference proceedings, and other forms of literature have been identified and analyzed. In generic DSR terminology, this action correlates to finding constructs of interest in the theory (Gregor and Jones 2007). More specifically, a search for information in the eight top IS journals, according to the AIS Senior Scholar's Basket of Journals have been conducted. The journals are: European Journal of Information Systems (EJIS), Information Systems Journal (ISJ), Information Systems Research (ISR), Journal of Association of Information Systems (JAIS), Journal of Information Technology (JIT), Journal of Management Information Systems (JMIS), Journal of Strategic Information Systems (JSIS) and, Management Information Systems Quarterly (MISQ) (including special editions on digital innovation and service innovation). Moreover, relevant articles that are cited in these journals have been made used of. Furthermore, I have searched for justificatory knowledge in journals related to resource management and service management such as: "*Academy of Management Review*," "*Journal of Management Journal of Service Research," "European Journal of Marketing,"* and, *"Journal of the Academy of Marketing Science."* I could only find a few studies that reported results related to digital resources in a digital innovation context and even fewer provided reflections on resourcing. Therefore, I decided to expand the search to include some leading conference proceedings. I fully realized that conference proceedings do not usually hold the same scientific status as journals, yet, the chosen proceedings have been peer-reviewed and selected from proceedings with a normal acceptance rate of less than 50%. The conference proceedings searched for were; International Conference on Design Science Research in Information Systems and Technology (DESRIST); Australasian Conference on Information Systems (ACIS); International Conference on Information Systems (ICIS); Australian and New Zeeland Marketing Academy (ANZMAC); Naples forum on Service; and, European Conference on Information Systems (ECIS). The terms used to search for relevant knowledge were 'Digital Innovation,' 'Digital Resource,' 'Digital Resourcing,' 'Resource-Based View/Theory,' 'Service Innovation,' 'Digital

Service,' and 'Service-Dominant Logic.' On finding articles related to the constructs, a 'backward search' has been conducted by reviewing the citations for the articles identified. The latter was done in order to determine prior relevant articles. A 'forward search,' using Google Scholar, has been conducted in order to identify articles citing the articles previously identified, as a first step. By following these steps, sufficient existing knowledge related to the subject has been identified, described, and reflected upon. Finally, a search for variants of terms such as 'resourcing,' 'resource liquefying,' 'resource pairing,' and 'resource opting' was conducted. The results have mainly been presented in chapters 2 and 3. However, since the design-knowledge has emerged along with the design, intervention, and evaluation of the digital resourcing system in practice, additional justificatory knowledge has been identified and presented in relation to the communication of the specific BIE cycles in chapter 6.

Since digital innovation, service-orientation, and especially digital resourcing are emerging research areas built on a plethora of underlying theories (see chapters 1, 2, and 3), a vast amount of related papers is constantly being published, and new knowledge is constantly added to an existing knowledge base. Thus, there was a risk that information concerning prior knowledge might have been overlooked. Hence, I do not claim that my literature review is exhaustive. However, the outcome of the literature review was considered sufficient in order to define state of the art concerning digital resourcing (in respect of the research purpose of the dissertation). In order to reduce the risk of leaning on insufficient prior knowledge, searches for additional theoretical knowledge were performed along with the emergence of the design knowledge (see chapter 6). As previously explained, the criteria for selecting the justificatory knowledge were derived from the contextual characteristics of ITSM, the definition of digital resourcing, and artifact goals (chapters 1, 2, and 3). A potential risk with such an approach was that the chosen theories and perspectives *leave* other perspectives and theories out (c.f., Alajoutsijärvi et al. 2001). Another anticipated risk identified was being caught in the zoom-out position, i.e., to view digital resourcing as a black box (c.f., Leroy et al. 2013). A black box is, according to Leroy et al. (2013, p.1102), "*a scientific statement that is treated as fact and is exempted from close examination – despite this never having been the authors' intent*." Such a risk has the potential to unbalance the way researchers zoom in and out when studying a subject (ibid). This zoom in and zoom out balance is known as the 'zizo' movement, a term coined by van Mele (2006). *Zooming out* from a phenomenon means to focus on essential points rather than on the finer details (c.f., Leroy, et al. 2013). To *zoom in* examines "*more closely, or in greater detail; the focus is on the specifics of a phenomenon*" (Leroy et al. 2013, p.1102). In order to avoid 'zooming out' and 'black-boxing,' this research effort switches between a focus on the individual level and organizational levels[45] of observation as well as a detailed observation of the digital resourcing system in action. This has mainly been done in 'reflection and learning.' This is also in line with the view of the context of this dissertation (see chapters 2 and 4). Switching between the different levels has been continuous and seamless while working with designing and evaluating the digital resourcing system. Researchers and practitioners have not always been operating with a preconceived and fixed definition of when the different levels have been in focus. An advantage of this position has been that the design of the digital resourcing system has not been impaired by a single focus.

In relation to this ADR task, I also learned more about the context of ITSM. The reason was that knowledge about the context aligns itself well with my view of research, as well as with ADR. According to a widespread definition, context is "*any information that can be used to characterize the situation of an entity. An entity is a person, place, or object that is considered relevant to the interaction between a user and an application, including the user and applications themselves*" (Dey 2001, p.5). It can be seen as webs "*of intelligibility, activities, events, specific individuals, histories, and 'obviousnesses' […] in which intelligibility is articulated or words are meaningful*" (Schatzki 2002, p.63). Consequently, it is plausible to put decisions about what characteristics are essential to consider in the designer's hands (e.g., Dey 2001). In order to support context awareness, contextual characteristics were identified initially through interviews in the underlying research project (see chapter 2). Another reason to learn about the context is that dominant approaches of design have often taken a technological-oriented view of the designed IT-artifact. This means that they have paid scant attention to its shaping by the organizational context, which is confirmed by ADR (Sein et al. 2011). This is problematic because an excessively technological-oriented design approach will affect the organizational relevance of the artifact negatively. Better awareness of the context supports researchers to adhere to a socio-technical view of the world

[45] According to Leroy et al. (2013), there are five different levels to use when observing and conceptualizing reality. The first is the macro level: institutions, cultures, generations, genres, social classes and lifestyles. Since institutions (see chapter 2) are an important component of digital resourcing, the research effort has been partly related to this level. The second observational level is the meso level. The meso level deals with action systems such as organizations as a whole, or power structures (in power struggles in industry standards). The meso level is also linked to inter-organizational interactions. Since multiple organizations participated in the study, the research effort has also partly been positioned on that level. The micro level deals with small groups and the micro-decisions they make. It also deals with the interactions that take place between members of the group. The micro level has been the main focus in the study. The individual level focuses on a single actor; i.e., his/her cognition and motivations. The individual level has also been taken into account in this research. Finally, the biological level deals with the brain and its activities. This level has not been in focus in this study.

(Doherty and King 2005). A socio-technical view refers to the dual characteristics of technological embeddedness and the role of the digital resourcing system as a contextual carrier (e.g., Mumford 1981; Orlikowski and Iacono 2001; Purao et al. 2013). Moreover, contextual characteristics affect and influence the design of the digital resourcing system, while it obviously affects the selection of the underlying theories that influence the design. This implies that there is a need to identify and be aware of the characteristics of the research context during the design. To this end, the digital resourcing system designed in this dissertation has emerged from interaction with the organizational context. To conclude, the contextual characteristics have been important in order to support the search for constructs in the underlying theories (see chapters 2 and 3) that could support the design of the digital resourcing system. In order to identify the characteristics of the context, 11 interviews were conducted with the participating organizations. Moreover, related literature was reviewed. Again, the collected material was analyzed inspired by the steps in GT, and core categories were identified. Those categories constitute the contextual ITSM characteristics such as resource and service and their underlying elements (see chapter 2).

In this ADR task, also possible existing solutions were also identified and analyzed. This specific activity was conducted in order to reduce the risk that a solution to the problem addressed could not be found. This search was conducted using Summon[46], a search engine utilizing the majority of established academic databases (e.g., Web of Science). Keywords used when searching for solutions were variants of 'innovation tools,' 'Digital Innovation solutions/tools/IT-artifacts,' 'digital resourcing systems', 'online tools for digital innovation,' 'digital resourcing,' 'resourcing systems,' 'IT-artifacts/digital systems/frameworks for ITSM,' 'best practices solutions/tools.' However, these keywords (and source of knowledge) did not result in multiple 'hits.' In order to find additional solutions, a search of the web (www.google.com) for context-related IT-artifacts was conducted. In addition, recent reports (i.e., white papers and surveys) that could point out relevant tools/systems were identified. Moreover, multiple academic conferences and industry conferences have been visited to identify knowledge about existing digital resourcing tools (and related theories). Finally, the practitioners in the research project provided information about various existing solutions. The result, presented in Appendix 5, shows that no digital resourcing system similar to the one presented in this dissertation has been identified. Nevertheless, the result was considered to be a valuable input to the design of the digital resourcing system.

[46] http://www.hb.se/biblioteket/.

Finally, high-level artifact goals were defined during the work related to this ADR task. Identifying artifact goals was considered crucial because it could help researchers and practitioners to know when the designed digital resourcing system had reached saturation. The artifact goals were implicitly identified by establishing the problem, which could then be transferred to goals. The artifact goals were jointly agreed upon among researchers and practitioners. The argument to identify and determine the artifact goals in collaboration with all practitioners was to ensure that also practical purposes were also taken into account. In other words, the importance and validity of the artifact goals have been confirmed in both theory and practice. The results of identifying artifact goals are presented in chapters 1 and 5.

4.2.1.5 Secure Long-term Organizational Commitment

My dissertation has been based on the results from research efforts conducted between 2010 and 2016. During this period, I have presented a licentiate dissertation (Göbel 2014) and additional conference papers, which have contributed to the justificatory knowledge of this dissertation. In this way, it is possible to view the research undertaking as a longitudinal six-year effort where I have searched for an IT-artifact emerging from design, use, and ongoing refinement in context. This emergence is specially described in chapter 6. It corresponds well to ADR, and also to the DSR approach with typically longitudinal streams of research (e.g., Baskerville et al. 2018). A challenging task in this research effort, as well as a critical element in ADR, was to secure a long-term commitment from the participating organizations. Agreements regarding collaboration and letter-of-intent were to be signed with all partners. However, two organizations (id 16 and 17, in Table 4.1) lacked the staff to participate over the full period, and therefore those organizations only joined two of the three BIE cycles. Yet, the two organizations have participated in the design and evaluation of essential components (see chapters 4, 5, and 6) and have therefore contributed to the generalized knowledge identified. Since the majority of the organizations stayed with the research-project until a sufficient digital resourcing system had been designed and evaluated, good conditions to reach the utility, quality, and efficacy of the digital resourcing system have been ensured.

4.2.1.6 Set up Roles and Responsibilities

The organizations approached in this study belonged to different sectors (i.e., had different core business models), were of different sizes (small, medium, and large)[47], and they were classified as either a service provider or customer. Although ADR does not explicitly provide support for managing several organizations, multiple and diverse organizational partners were included. The argument for this was that researchers wanted to ensure the existence of a generic problem *and* a generic solution to the problem addressed. According to Mayring (2007), generalization is seen as a central aim of science and as a process of theory formulation for further applications. The first tentative and weakest form of generalization would be to analyze the context of a *single* organization and then to generalize the results to similar contexts (ibid). To reach general conclusions, researchers need to widen the basis and to work with three to ten organizations (e.g., Mayring 2007; Yin 2009). This means that evaluating the digital resourcing system in several different service ecosystems and several different organizational contexts should deliver research generalizability, rigor, and trustworthiness in the results of this study. Another argument for involving both service providers and service customers was to respond to the construct of the contemporary view of digital innovation and a contemporary service perspective (see chapters 1 and 2). To create even better conditions to produce generalized design knowledge, the ADR-team also selected organizational partners from both the public *and* private sectors. Finally, additional organizations in other contexts were approached, in order to evaluate the theory further as well as to evaluate the specific design theory component, *artifact mutability* (see Table 4.2 and chapter 7).

22 organizations (11 service providers and 11 service customers) have been involved in the design and/or the evaluation of the digital resourcing system (see Table 4.1). Within the 22 organizations, there were several dyadic service provider-customer relationships (i.e., Business-to-Business (B2B)). Existing relationships were of importance since it corresponded to the contemporary service view of contexts (see chapters 1 and 2). Table 4.1 shows the different organizations participating and their relationships. The responsible evaluator of the design knowledge has been the author of this dissertation.

[47] In this dissertation, the European Union's (2003) definition of small and medium-sized enterprises is adhered to, which means that a company is defined as small if it 1) employs fewer than 50 people and 2) its annual turnover does not exceed EUR 10 million (ibid). A company is defined as a medium sized company if it 1) employs fewer than 250 people, and 2) its annual turnover does not exceed EUR 50 million or the company's annual balance sheet total does not exceed EUR 43 million. The difference between the categories is that there are fewer employed people in small and medium-sized enterprises than in large companies.

Table 4.1. Participating organizations of the three-year research project.

Org. id	Existing relation to org.id	Core Business (supported by ITSM)	Provider (P)/ Customer (C)	Size (S/M/L)
Public sector (small and large)				
1	2	Municipality	P	S
2	1	Municipality	C	S
3	4	Municipality	P	L
4	3	Municipality	C	L
5	8	Municipality	C	L
Private sector (small, medium, and large)				
6	7 and 8	IT- infrastructure and application	P	M
7	6	Energy	C	S
8	6	Banking	C	S
9	5	IT-consultancy	P	S
10	11	IT- consultancy	P	L
11	10	Compressed air dynamics	C	M
12	13	Data service(s)	P	S
13	12	Data service(s)	C	S
14	15	Telecom	P	L
15	14	Telecom	C	L
16	17	Banking	C	M
17	16	Banking	C	M
18	19	IT- consultancy	P	S
19	18	Outdoor power products	C	L
20	-	Automotive	P	L
21	-	IT- consultancy	P	L
22	-	IT- consultancy	P	S

One argument in favor of including an organization in the project was that they shared the same problem (see chapter 1) and that they had the same needs: they required a digital resourcing system supporting them in order to manage digital resources and to leverage digital innovation. A common denominator that united the organizations was that they all worked with digital service(s) and best practices related to the field of ITSM (e.g., frameworks such as ITIL and processes such as change management, incident management). Moreover, the organizations experienced problems regarding existing contextualized digital and non-digital IT-artifacts (see Appendix 1). That is, in total, the participating organizations provided researchers with excellent opportunities for solving a generic problem within context.

Finally, 4 additional organizations (i.e., a total of 26 organizations) were involved in order to evaluate the mutability of the design theory. As explained in chapter 1, artifact mutability is defined as the changes in the state of the artifact anticipated in theory, i.e., that the degree to which artifact change is encompassed by design theory. Gregor and Iivari (2007) introduced the term 'semizoa' to refer to IS/IT artifacts as mutable systems that exhibit some of the characteristics of living creatures. In other words, artifacts exhibit adaptive behavior. In this dissertation, artifact mutability is analyzed via three different mutability aspects, 1) the degree to which an artifact can be adapted in order to be applied in different sectorial contexts, 2) the possibility to adapt the artifact to the situation in a context, and 3) the degree to which an artifact has the potential to modify, transform and/or constrain their surrounding environment. Mutability aspects 2 and 3 were evaluated in parallel with the evaluation of the digital resourcing system (described in chapters 6 and 7). Four organizational settings/contexts were explicitly selected for evaluation of mutability aspect 1. None of these had a business model that corresponded directly to IT. Table 4.2 shows the four additional organizations (i.e., not included in the original ADR project) where mutability was conducted. The argument for selecting those organizations was that they represented contexts with similar characteristics (such as the ITSM context); e.g., resource-oriented, service-oriented, and managing processes utilizing different best practices.

Table 4.2. Additional organizations selected for evaluating Artifact Mutability.

Public/ Private	Core Business	Provider (P)/ Customer (C)	Size (S/M/L)
Public	Municipality	P and C	M
Private	Research of new medicine	P	L
N.G.O	Oil	P	L
Private	Retail	C	S

Finally, and in line with ADR, I was deeply involved in the project, intervening in the design, and in the evaluation of the digital resourcing system, as well as in reflection and learning. This means that I have made multiple decisions about how to understand the collected data (e.g., Walsham 1995). This obviously comes with a risk of misinterpretation due to, e.g., bias. Such a risk can be reduced by involving two or more researchers when analyzing the data (Seuring and Müller 2008). In this study, the result of analyses was discussed in workshops consisting of practitioners and researchers who agreed on the results in consensus (e.g., DeGroot 1974). Moreover, several developers were engaged in the project in order to program the digital resourcing system based on the specific requirements identified by researchers and practitioners. These developers also inspired the design through their experiences and knowledge and technical know-how.

4.2.2 Building, Intervention, and Evaluation

The second ADR phase, BIE, used the problem framing and justificatory knowledge identified in the first phase in order to create an initial design for the digital resourcing system. The tasks involved corresponded to the tasks suggested by Sein et al. (2011); 'Discover initial knowledge-creation target' (section 4.2.2.1), 'Select or customize BIE form' (section 4.2.2.2), 'Execute BIE cycle(s)' (section 4.2.2.3), and 'Assess the need for additional cycles' (section 4.2.2.4). In other words, in ADR, the BIE phase interweaves building, intervening in organizations, and evaluation (Sein et al. 2011).

4.2.2.1 Discovering Initial Knowledge-Creation Targets

As mentioned in chapter 1, the purpose of the designed digital resourcing system has been two-fold; it has supported practitioners when creating novel value propositions communicated as digital service, and it has constituted the means to identify, evaluate and visualize new design knowledge. The dual-purpose corresponds to the ADR task of discovering the initial knowledge-creation target.

The problem framing and justificatory knowledge identified in the first ADR phase formed a platform for generating the initial design of the digital resourcing system. In order to search for further knowledge, an essential activity in the initial build phase was to identify a set of meta-requirements[48] complementing the artifact goals. These were regarded as refinements of the high-level artifact goals. The meta-requirements were derived from justificatory knowledge, contextual characteristics, artifact goals, and interviews with practitioners. The artifact goals and meta-requirements also fine-tuned the 'purpose and scope' of the digital resourcing system to which the theory was applied

[48] Walls et al. (1992) uses the modifier 'meta' to describe the specific requirements that address a class of problems, rather than requirements of a single problem.

(e.g., Gregor and Jones 2007). The meta-requirements not only covered the digital resourcing system (e.g., the content of the digital resourcing system), physical setting, functionality, and steps inscribed in the digital resourcing system but also considered characteristics and constructs in the context. For each meta-requirement, the justification was given by means of referencing artifact goals. Meta-requirements and artifact goals are presented in chapter 5. In addition to meta-requirements, specific requirement-specifications (e.g., technical requirements or requirements regarding fields or location of fields, etc.) were created along with interventions in contexts and workshops. When a specific requirement was established, the matter was discussed in a workshop with all the project participants present. By doing so, specific requirements were agreed upon. If new or altered specific requirements were identified, the detailed requirement specification was modified by consensus. Specific requirements are described in chapter 6. In similar workshops, *mock-ups* (rough sketches of a specific digital resourcing system version), created by researchers and developers, were presented and discussed. The mock-ups leveraged the discussions and ideas for new specific requirements, and thus this activity recurred in later workshops as well.

Related to meta-requirements is the *meta-design* (Walls et al. 1992). Inserting a meta-design is important and should be understood as a re-conceptualization of the digital resourcing system into a class of solutions. This is an integral part of the study; since it is directly related to one of the anticipated contributions (see chapter 1). Furthermore, the class of solutions is vital since it ensures that the IS design theory, design principles, and the digital resourcing system do not only address a specific solution in a specific environment (e.g., a time reporting system for a single corporation). It also addresses a class of IT-artifacts, e.g., a digital resourcing system as a subclass of the innovation management systems class (see also section 4.2.1.3). The initial design of the digital resourcing system constituted the initial knowledge-creation target, which was further shaped by organizational use and subsequent ADR design cycles.

4.2.2.2 Select or Customize BIE form

As insinuated in the previous sections, researchers and practitioners adopted an organization-dominant BIE form throughout the project. One reason for this was that the ADR-team started this undertaking from scratch, i.e., with no digital resourcing system available together with practitioners. This meant that the primary context for innovation was naturalistic because the research was conducted using organizational intervention. The selection of an organization-dominant BIE form does not mean excluding innovative technological design in the developed digital resourcing system.

4.2.2.3 Execute BIE cycles

Although the BIE phase was iterative and intertwined, the three activities, building, intervention, and evaluation, are described separately in the following subsections.

4.2.2.3.1 Building

When all organizations had agreed[49] on the meta-requirements, the meta-design, the specific requirements, and the mock-ups, a developer-team built a version of the digital resourcing system. Although the build-step was a continuous activity, this very section focuses on the *initial* build. The argument for this decision is that this step formed a solid base, which was later refined in parallel with new specific requirements identified during interventions in practice (see chapter 6). This meant that after the initial build, the work continued throughout the cyclic ADR approach. During the building phase, design knowledge also started to emerge. Design knowledge was first identified by studying the constructs identified in justificatory knowledge, including the kernel theory (chapters 2 and 3), the artifact goals, and the meta-requirements. When the initial version of the digital resourcing system was deployed, it was also possible to visualize early versions of the design knowledge. Such visualization is presented in chapter 6 using screenshots of the digital resourcing system, and each 'step' in the digital resourcing system corresponded to the different design knowledge components (see chapter 6). Finally, by studying the emerging digital resourcing system in contextual settings, it was possible to revise the design knowledge and finally to formalize it.

The building activity also included populating the digital resourcing system with rich information and contextualized *content* (e.g., ITSM frameworks, design patterns or communication protocols, etc.). An important part of the content was to identify core processes in the context, which could support actors to lean on processes forming communication protocols *and* design patterns when using the digital resourcing system (see chapters 3 and 6). Another reason was to adhere to the practitioners who stated that best practices are too comprehensive and complex (see also Appendix 1 and 5). When core IT processes were identified, the processes also had to be modified. The reason for modifying the processes was that existing processes were not completely contextualized, and thus, they did not sufficiently fulfill the needs derived from the practitioners in the context (see chapter 2). The specific steps to identify and contextualize processes and process statements were:

1) Analysis of popular best practices and supporting IT-artifacts

2a) Identification of core processes in previous work

[49] Since multiple actors participated in the project, a consensus strategy was used throughout the project.

2b) Identification of core processes in the research context
3) Contextualization of identified core processes

The results of the activity are rendered in Appendix 5. The reason for utilizing Appendix 5 is that although the population of the digital resourcing system is relevant to the dissertation (i.e., it constitutes communication protocols and design patterns), it is regarded as non-essential to explaining the design theory. The core processes identified and modified should rather be viewed as examples that support resourcing actions.

1. Analysis of Popular Best Practices and Supporting IT-artifacts

The purpose of this activity was to get a general understanding of how successful ITSM best practices correspond to a contemporary perspective of the market (i.e., service and resource), and to find areas where improvements could be made. The activity was conducted using S-D Logic and RBT as a lens and was partly presented in Göbel and Cronholm (2015). However, the result was further elaborated on and extended in this study. The best practices analyzed were ITIL, COBIT, CMMI, VeriSM, and ISO/IEC 20000 (see Appendix 5). The argument for selecting these best practices was that they were considered to be amongst the most used ITSM best practices, according to practitioners and itSMF International (2013). By analyzing the *purpose* and the *activities* of the specific processes, it was possible to group processes, regardless of their best practice origin.

2a. Identification of Core Processes in Previous Work

In the second activity, researchers and practitioners jointly identified core ITSM processes pinpointed in prior studies. The purpose of this activity was to review the service perspective on resources in existing studies while getting a base for the next activity. The 11 FPs of S-D Logic was used to understand the perspective in identified processes (see Appendix 5).

2b. Identification of Core Processes in the Research Context

In this activity, both service providers and customers (i.e., participants in this study) collaborated to identify core processes in the ITSM context. This work was based on the outputs from the first and second activities. Core ITSM processes were identified by practitioners in a workshop where they selected the most frequent ITSM processes in their organization. The result was also mapped to contemporary service practices. The latter was done in order to ensure that processes were also related to innovation. Next, and in order to confirm the selection of processes, the ADR-team discussed the processes with different representatives/roles in the participating organizations. Participating roles were service managers, process managers, developers, team leaders, IT-managers, testers, and process owners. The results were compared with the general results from the first and second activity. In this way, it was possible to advance existing knowledge concerning core ITSM processes. The aforementioned approach can be considered cumulative: researchers and practitioners collaboratively built the proposal of core ITSM processes on other scholars' findings and formed them into a communication protocol (see Appendix 5).

3. Contextualization of Core Processes
In the third activity, the knowledge gained from the first and second activities was used as a base for inscribing a contemporary service perspective on resources into the proposed core processes. Next, the ADR-team developed functionality and implemented the modified and core ITSM processes as essential components of a communication protocol and design pattern in the digital resourcing system. The selected ITSM processes were later refined through interventions in context (see Appendix 5).

4.2.2.3.2 Intervention

Researchers and practitioners jointly designed and evaluated the digital resourcing system and underlying design knowledge in a cyclic (or iterative) approach. Each BIE cycle included multiple interventions in real contexts. The outcome from one cycle contributed input to the next one. The arguments for not conducting more than three BIE cycles were that each cycle was exhaustive, and more importantly, after the third cycle, the digital resourcing system was regarded as fit-for-purpose and had reached the artifact goals. That is, after the third cycle, saturation was reached.

One purpose of the BIE cycles was to intervene in practice and evaluate new versions of the emerging design knowledge in parallel with the digital resourcing system. Another purpose was to introduce new specific requirements for improvement (i.e., formative evaluation) and for the inscribed design knowledge. In this way, the interventions supported the generation of design alternatives and the evaluation of such alternatives against different requirements and artifact goals, until a satisfactory design was achieved. Consequently, the full BIE phase was regarded as the heart of the ADR project.

Before each BIE cycle and associated interventions were initiated, the digital resourcing system was presented to practitioners in workshops. The purpose of such workshops was to present a new version of the digital resourcing system and to agree on changes that had been made, and if necessary, fine-tune and reconfigure the artifact before evaluating it in practice. When all organizations had agreed on and accepted the new version, researchers and practitioners started the different interventions of that BIE cycle. Next, and within the cycle, multiple interventions in practice were conducted. The reason was to ensure that new emerging design knowledge was relevant to all organizational contexts and met with a high degree of generality. In each cycle, 11 interventions in dyadic organizational ecosystems of service customers and providers (see Table 4.1) were carried out.

Two different types of interventions were conducted. The first type of intervention comprised organizations presented in pairs; i.e., a service provider and customer in a dyadic relationship. The two organizations arranged so that employees with different roles (from both organizations) could meet to use (and evaluate) the digital resourcing system within their contexts. The second type of intervention took place when one single organization evaluated the digital resourcing system (i.e., not in a dyadic relationship). The latter was mainly conducted in the first cycle since practitioners initially did not want to conduct digital resourcing across organizational borders. This is elaborated on in chapter 6. However, both types of intervention took place in real contexts with real practitioners.

Each specific intervention involved 4 to 10 human actors (individual employees) with various organizational roles. The number of participants and roles varied depending on the context and situation within organizations - examples of participating roles were managers, developers, and process owners related to service customers, providers, and researchers. A facilitator (usually the author of this dissertation but sometimes also a practitioner) was always present to lead the discussions, ask critical questions, keep track of time and of administrative tasks. Examples of service customer and provider representatives using the digital resourcing system were service managers, incident managers, change managers, developers, testers, team leaders, IT-managers, end-users, and process owners. Such representatives sometimes belonged to two different organizations and sometimes to two different departments within the same organization, but always to the same service ecosystem (business-to-business settings (B2B)). This dyadic approach (see also Figure 4.2), corresponds well to a contemporary service perspective since it recognizes that value and value propositions *can* be co-created by *two* or more actors in the service ecosystem managing resources (e.g., Mele and Della Corte 2013; Vargo and Lusch 2016; Saldanha 2017). Furthermore, the choice to focus on two (dyadic) actors was supported by the practitioners participating in the project. They argued that it would be too much of an effort concerning people, time, and cost, to manage digital resourcing with more than two actors at once (see also artifact goals in chapter 5). After each intervention, the ADR-team reflected on and discussed the results. After all dyadic interventions in one BIE cycle were finished, all participating organizations met in workshops in order to reflect, discuss, agree, learn from each other, and take action on the bases of the result.

Figure 4.2. An anonymized, but authentic picture of service providers and service customers using the digital resourcing system in practice (the digital resourcing system is visualized through the use of a projector screen).

4.2.2.3.3 Evaluation

As described above, a purpose for each BIE cycle was to evaluate the design knowledge. Evaluation is a key activity in this research effort because "*it provides feedback for further development and (if done correctly) assures the rigor of the research*" (Venable et al. 2016, p.77). The dominant evaluation approach in DSR has traditionally been to separate the build and evaluation phase; i.e., *first,* the build phase is conducted and *then* the evaluation phase (e.g., March and Smith 1995; Hevner et al. 2004; Sein et al. 2011). This way of evaluating is insufficient because the context is not fully recognized (Sein et al. 2011). Sein et al. (2011) present the principle of 'authentic and concurrent evaluation,' meaning that evaluation in ADR is "*not a separate stage of the research process that follows building*" (ibid, p.43). Accordingly, decisions concerning building have been interwoven with *ongoing* evaluation in practice. This corresponds well with Gregor (2009), who argue that researchers in the design disciplines must use both induction and abduction while using his/her creativity and imagination. As previously stated, ADR does not provide specific guidelines for how to select and create an evaluation strategy as well as guidelines for how to conduct an evaluation of an IT-artifact in practice.

Consequently, I turned to FEDS (Venable et al. 2016) for support. Although the formalized FEDS did not yet exist when this study was started, it is used to describe the evaluation strategies of this dissertation. The argument for that is that FEDS was shaped by strategies already presented in previous papers that existed when this study was initiated (e.g., Pries-Heje et al. 2008; Venable et al. 2012). Moreover, FEDS corresponds in an excellent way to the ADR method applied in the study. Finally, FEDS provides terms and concepts that are common in traditional evaluation theories (e.g., Smithson and Hirschheim 1998; Remenyi 1999; Stufflebeam 2003).

The foundation for a FEDS evaluation strategy is a mix of two different dimensions. The first dimension concerns the functional purpose of the evaluation; i.e., *formative* or *summative* evaluation. According to Venable et al. (2016, p.80), "*the purpose of formative evaluation episodes is to improve the outcomes of the process under evaluation*." The purpose of summative evaluation is to judge the extent that the outcomes of intervention match expectations (i.e., *utility* and *artifact goals*) (ibid). Formative evaluation episodes are often regarded as iterative in order to conduce improvement as development progresses, while summative evaluation episodes are often used to measure the results of a completed design (ibid). This means that there should be summative evaluation episodes to assess the utility of the outcomes towards the end of the project (Rossi et al. 2013). Both formative and summative evaluation corresponds with ADR. For example, Sein et al. (2011) argue that the specific evaluation format in ADR may vary, and the authors provide an illustration of ADR in use, which is presenting a combination of formative and summative evaluation.

The second dimension of an evaluation strategy concerns the selection of a 'paradigm,' i.e., either *artificial* evaluation or *naturalistic* evaluation. Naturalistic evaluations "*offer the possibility to evaluate the real artifact in use by real users solving real problems*" (Venable et al. 2016, p 81). Thus, it explores the performance of an artifact in its real environment (ibid). This evaluation paradigm corresponds well with ADR´s recommendation to intervene in contexts. Artificial evaluation, on the other hand, is considered unrealistic in this study since it fails to adhere to either real users, real systems, or real problems (c.f., Sun and Kantor 2006; Venable et al. 2016). Since three different levels of design knowledge have been identified and evaluated in the study: i.e., the digital resourcing system, the design principles, and the design theory, three different evaluation strategies have been applied. The three evaluation strategies were intertwined and built on each other, which is in line with the contributions of the study. That is, the three evaluation strategies have formed a dialectic process (e.g., Spencer and Krauze 1996) where the different cycles and evaluation strategies feed into each other in order to improve and identify new design knowledge. This approach harmonizes with Venable et al. (2016), who claim that when "*an artifact is evaluated for its utility in achieving its purpose, one is also evaluating a design theory that the design artifact has utility to achieve that purpose*" (p.425). Thus, the second purpose of evaluation in DSR is to confirm, improve, or disprove design knowledge and to collect different requirements supporting refinements of the digital resourcing system. The result of the evaluation is mainly presented in chapter 6, but the results from the evaluation are also presented in chapter 7. Figure 4.3 shows how different evaluation strategies relate to the different levels of design knowledge.

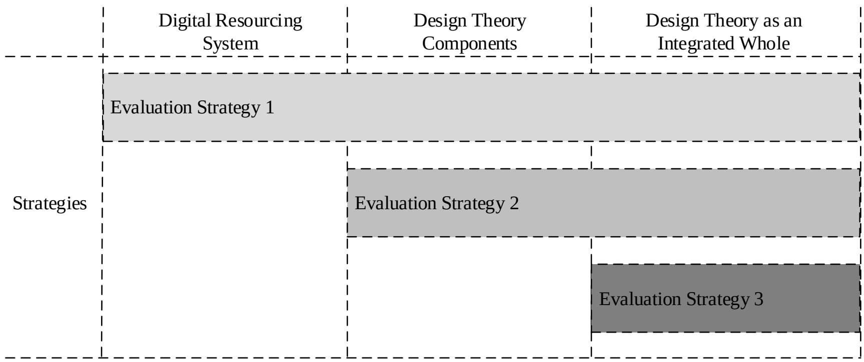

Figure 4.3. Three Evaluation Strategies spanning over different evaluands or abstraction levels of design knowledge.

As previously stated, three intertwined evaluation strategies were formulated, which were adhered to during the three BIE cycles. All evaluation strategies included answering why, when, how, and what to evaluate. *What* referred to the three different evaluands: i.e., the digital resourcing system, design principles, and the complete IS design theory. As part of the evaluation strategies, *evaluation episode(s)* were designed. An episode is defined as a situation that is integral to, but *separable from*, a continuous narrative (c.f., Merriam-Webster 2018). Furthermore, each evaluation episode consisted of multiple interventions in practice. In other words, each of the three cycles contained all evaluation strategies holding evaluation episodes that, in turn, holds the different interventions in practice.

The purpose of the first evaluation strategy was to evaluate all levels of design knowledge with a specific focus on the *utility* of the digital resourcing system. This strategy was needed because the digital resourcing system is only *hypothesized* to provide utility unless it is evaluated, which implies that evaluation constitutes the science part of design-related projects (c.f., Venable et al.

2016). In order to equip the research with rigor (reliability and validity[50]), researchers need to present *evidence* that:

- The IT-artifact, design principles, and design theory *work*
- The IT-artifact, design principles and design theory have *utility for their purpose*
- Use of the IT-artifact, design principles and design theory helps to *solve the problem* and/or *provides the benefit* or improvement expected
- The IS design theory *is correct* (ibid).

Other scholars fully agree that rigor should be demonstrated throughout evaluation and more specifically suggest that rigor can be demonstrated through evaluating the utility, novelty, quality, completeness, ease of use, effectiveness, and efficacy of the IT-artifact (e.g., March and Smith 1994; Hevner et al. 2004; Gregor 2006; 2009). Although several of the suggested evaluation properties (also known as evaluation indicators) were used in this study, they should be seen as examples since they are commonly "*necessarily unique to the artifact, its purpose(s), and its situation during evaluation*" (Venable et al. 2016, p.84). Consequently, specific evaluation properties were identified to correspond to the underlying research study in a better way. Those properties are described in chapters 5 and 6 in relation to emerging design knowledge. The first evaluation strategy and specific evaluation episodes are described in detail in chapter 6.

The purpose of the second evaluation strategy was to evaluate design knowledge related to different design theory components. The components explicitly evaluated were artifact mutability, testable propositions, principles of implementations, and design principles. Other design theory components implicitly evaluated were 'purpose and scope,' constructs, justificatory knowledge, and the expository instance (i.e., the digital resourcing system). Although the first evaluation strategy supported the evaluation of design knowledge, a more summative evaluation was conducted to further ensure the validity. This was done by following the four grounding processes for practical knowledge suggested by Goldkuhl (2004a); i.e., value grounding (i.e., description of artifact goals and values), conceptual grounding (i.e., description of constructs and their relationships), explanatory grounding (i.e., description in relation to theory), and empirical grounding (i.e., evaluation in practice). According to Goldkuhl (2004a), these grounding processes relate to the three

[50] Reliability can be defined as "*the consistency of a measuring instrument*" (LoBiondo-Wood and Haber 1998, p. 558). Hammersley (1992, p.69) defines validity as: "*an account is valid or true if it represents accurately those features of the phenomena that it is intended to describe, explain or theorise.*"

main categories of grounding processes, i.e., internal, theoretical, and empirical grounding. The specific groundings are elaborated in chapter 6. The argument for including the four grounding processes was that they should help to reflect on and explain certain aspects of design knowledge that the digital resourcing system could not but also to summarize the design knowledge. Moreover, they supported the link between the identified constructs of digital resourcing, the digital resourcing system, and design principles. The second evaluation strategy is also described in detail (as a complement to the first strategy) in chapter 6.

The purpose of the third evaluation strategy was to evaluate, the *mutability*, *structure*, and *generalization* of the design theory as *a whole, in a simple manner*. As previously described, while evaluating the digital resourcing system (evaluation strategy 1) and design knowledge (evaluation strategy 1 and 2), also parts of the design theory as a whole were evaluated. However, in order to ensure rigor, the third evaluation strategy included additional evaluation episodes. The purpose of those episodes was to evaluate the components as a whole to ensure that they were *formalized* in a contemporary way and that they worked for other contexts. This evaluation strategy was artificial and summative. A further description of the third strategy will follow in chapter 7.

4.2.2.4 Assess the Need for Additional BIE cycles

In line with ADR, Venable, et al. (2016) state that design researchers can carry out more than one intervention in order to evaluate an IT-artifact such as the digital resourcing system. That is, evaluation strategies should operate progressively where it often proceeds from formative evaluation to at least one final summative evaluation that concludes the research effort (ibid). Consequently, the selection of evaluation strategies and its cyclic format corresponds well to the fourth task in the BIE phase, which is to assess the demand for additional cycles. In this study, the need has depended on *how* the artifact goals have been fulfilled and whether or not the evaluation of design knowledge has been regarded as sufficient (i.e., if the digital resourcing systems works and provide utility). That is, if saturation is reached, no more BIE cycles are necessary. In the current study, the ADR-team reached saturation after the third BIE cycle (see chapter 6).

4.2.3 Reflection and Learning

The purpose of the third ADR phase, *Reflection, and Learning,* is to move conceptually from building a solution for a particular instance to applying that learning to higher abstraction levels (e.g., Sein, et al. 2011). Since *Reflection and Learning* have been a continuous activity conducted in parallel with the BIE phase in ADR, all information has not been described as a separate part under the ADR-label ‘reflection and learning’ in this dissertation. By contrast, much information associated with 'reflection and learning' has been presented within the description of the BIE cycles (see chapter 6). Therefore, 'reflection and learning' has been performed and described as part of the BIE phase. However, in order to visualize adherence to the ADR phase more lucidly, a summary of 'reflection and learning' is described in relation to each BIE cycle in chapter 6. The reason for this structure is that since they are interlinked, it is difficult to separate the two ADR phases. The specific tasks in this ADR phase corresponded to the ADR tasks suggested by the scholars: i.e., 'Reflect on the design and redesign during the project' (section 4.2.3.1), 'Evaluate adherence to principles' (section 4.2.3.2), and 'Analyze intervention results according to stated goals' (section 4.2.3.3).

4.2.3.1 Reflect on the Design and Redesign During the Project

The 'Reflection and learning' phase was continuous, and it included searching for signals in the environment, reflecting on the problem framing, on the theories that were chosen, and the emerging design knowledge and digital resourcing system. The signals identified during the evaluation episodes offered opportunities for the author of this dissertation to reflect on the digital resourcing system. The material (e.g., recordings, notes, memories, etc.) collected during previous BIE cycles constituted the input to the reflection and learning. In order to verify, change, or reject the design knowledge, all collected material was analyzed and reflected upon by the author and later discussed with the whole ADR-team, which helped to confirm, reject, or revise design knowledge. Moreover, justificatory knowledge was used, e.g., the concept of digital resourcing and the VRIO framework. The result from the reflection constituted a basis for discussions and further analysis in following group workshops where all participating organizations were involved. That is, all practitioners and researchers met to reflect on, learning, verifying, and/or disproving results in project workshops in order to evaluate adherence to design knowledge and stated goals.

4.2.3.2 Evaluate Adherence to Principles

In parallel with the reflection on design knowledge, adherence to all components in the design theory was evaluated. This reflection was mainly conducted by the author of this dissertation, and the result is presented in chapter 6. To confirm the result of my individual reflection, workshops were arranged. Over the years, at least 18 'reflection and learning' workshops with practitioners in the ADR-team were conducted. A positive effect of the workshops was that knowledge was shared amongst all participants concerning results from the realized evaluation strategies. Moreover, researchers and practitioners got an opportunity to jointly discuss and agree upon the fulfillment of the artifact goals. As described in section 4.2.3.1, the output from reflection and learning workshops was new or changed the requirements serving as input to the development and, more importantly, the refinements of the different abstraction levels of design knowledge, i.e., digital resourcing system, design principles, and design theory. This action helped to ensure that design knowledge contributions were generic, new, true, and interesting for different organizations (c.f., Ramirez 2015; Tellis 2017).

4.2.3.3 Analyze Intervention Results According to Stated Goals

In parallel with previous ADR tasks, empirical experiences, and signals collected from intervention in practice were structured according to the predefined evaluation properties (see chapter 6). This move helped to sort and categorize the material collected but also to form relationships between different categories. The collected material was then analyzed in relation to evaluation properties, artifact goals, constructs identified in justificatory knowledge, meta-requirements inscribed in the digital resourcing system, and effects on the context. This helped to refine the three levels of design knowledge even further.

4.2.4 Formalization of Learning

In the final ADR phase, *Formalization of Learning*, results from previous phases and cycles were formalized, finalized, and packaged into different levels of design knowledge. More specifically, the five tasks suggested in ADR were followed in this phase: i.e., 'Abstract the learning into concepts for a class of field problems' (section 4.2.4.1), 'Share outcomes and assessment with practitioners' (section 4.2.4.2), 'Articulate outcomes as design principles' (section 4.2.4.3), 'Articulate learning in light of theories selected' (section 4.2.4.4), and, 'Formalize results for dissemination' (section 4.2.4.5).

4.2.4.1 Abstract the Learning into Concepts for a Class of Field Problems

The design knowledge was presented as a class of field problems (i.e., lack of design knowledge for the digital resourcing systems class). The concept of digital resourcing was presented as a design theory related to the class of digital resourcing systems. Design theory is generally considered as the highest abstraction level of design knowledge.

4.2.4.2 Share Outcomes and Assessment with Practitioners

Outcomes and results from evaluation and intervention have been shared with practitioners throughout this project. The outcome of this study has also been shared with multiple practitioners in various ways. For example, the final version of the digital resourcing system was published on the web while the software (code) was being packaged and distributed to the practitioners who were interested in having it. As previously described, the digital resourcing system was regarded as a contribution since it both constitutes aid to practitioners solving practical problems and also since it represents design knowledge (e.g., Baskerville et al. 2018). Emerging results were also presented at several IS research conferences and practitioner conferences (e.g., Göbel 2014; Göbel et al. 2013; 2014a; 2014b; 2016a; 2016b; 2016c; Pilerot and Göbel 2016; Göbel and Cronholm 2015; 2016a; 2016b; 2017; Cronholm et al. 2017a; 2017b; Cronholm and Göbel 2018; 2019a; 2019b; 2019c).

4.2.4.3 Articulate Outcomes as Design Principles

In this dissertation, I have articulated three design principles, which correlate well with ADR. However, since the purpose has also been to look beyond design principles, I have articulated additional components to form a design theory. According to Gregor and Jones (2007), any design theory should include as a minimum: the 'purpose and scope,' the constructs, the 'principles of form and function' (i.e., design principles), artifact mutability, testable propositions, and justificatory knowledge. Those six components are sufficient to give the idea of an IT artifact. However, in order to provide detailed knowledge about the design theory considering how to put it into practice, two additional components have been described in this dissertation, i.e., 'principles of implementation' and the digital resourcing system. The principles of implementation are important because they provide knowledge regarding the development process of the design. The materialized digital resourcing system is vital because it supports practitioners while it also constitutes an example of the realized design knowledge.

In order to support the articulation of design principles Walls et al. (1992, p.41) suggest a formula which reads: "*If you want to achieve goal X, then make Y happen*" while van Aken (2004, p.227) proposes: "*If you want to achieve Y in situation Z, then something like action X will help*". According to Van Aken (2004), the part of the principle claiming 'something like action X' means that the prescription is to be used as an example of the design. Van den Akker (1999, p.9) offers an extended structure of a design principle; i.e., "*If you want to design intervention X (for the purpose/function Y in context Z), then you are best advised to give that intervention the characteristics A, B, and C (substantive emphasis), and to do that via procedures K, L, and M (procedural emphasis), because of arguments P, Q, and R.*". Finally, Chandra et al. (2016a) suggest the following formula of a design principle (p.4045): "*Provide the* [*digital resourcing*] *system with [material property—in terms of form and function] in order for users to [activity of user/group of users—in terms of action], given that [boundary conditions—user group's characteristics or implementation settings].*" The formulas by Van den Akker and Chandra relate to other components in a design theory, such as a testable proposition. In this dissertation, the suggestion by van Aken (2004) inspired the formulation of design principles as well as principles of implementation. The argument for that was that the formula is easy to read and understand while Gregor and Jones (2007) pointed it out. The design principles were expressed as general principles, and their formulation was based on the practitioner's and researcher's empirical experiences of using the digital resourcing system in real contexts in relation to the underlying justificatory knowledge and artifact goals. It was possible to identify three design principles early in the DSR project, which emerged during the design and evaluation of the digital resourcing system (see chapter 6).

4.2.4.4 Articulate Learning in Light of Theories Selected

During the course of his study, all knowledge has been articulated in relation to both theory and practice. These learnings are presented in this dissertation. This means that theory, as ingrained in the digital resourcing system, is described (see chapters 1-3, 6, and 7). Moreover, the summarized learnings have been articulated in relation to theory in chapters 7 and 8.

4.2.4.5 Formalize Results for Dissemination

All three abstraction-levels of design knowledge have been packaged for dissemination. First, design knowledge has been formalized in this dissertation. Second, the digital resourcing system (the first level of design knowledge) has been packaged in order to be easy to install for organizations. The results from formalization and learning related to design theory are presented in chapters 7 and 8.

5 THE DIGITAL RESOURCING SYSTEM

The purpose of chapter 5 is to present the *final* version of the digital resourcing system. One reason for presenting the final version in a separate chapter, *before* describing how it has evolved during different BIE cycles is that it will increase the readability and the understanding of the forthcoming chapters in this dissertation. It is important to note that this presentation order (i.e., presenting the final resourcing system before the emerging design knowledge) does not reflect the research process (see chapter 4). Another reason for presenting the digital resourcing system first, is that the digital resourcing system *per se* contributes to the *first* abstraction level of design knowledge; i.e., "*an instantiation such as a prototype can be seen as serving a communicative purpose in illustrating the design principles that are embodied within it*" (Gregor and Jones 2007, p.330). To be clear, the purpose of this chapter is *not* to present evidence for the utility of the digital resourcing system, or how the knowledge has emerged along with the various BIE cycles; that result is presented in chapters 6 and 7. The structure of the contents of the fifth chapter is; 5.1 Meta-Design, 5.2 Purpose and Scope of the Digital Resourcing System, and 5.3 Description of the Instance.

5.1 META-DESIGN

A meta-design describes a class of IT-artifacts hypothesized to meet the artifact goals and meta-requirements of the digital resourcing system (c.f., Walls et al. 1992; Gregor and Jones 2007). Hence, those aspects should be acknowledged during the design of the digital resourcing system (Sein et al. 2011). Laudon and Laudon (2014) describe traditional system classes[51], i.e., different types of meta-designs. A familiar class of IT-systems that share the same goal as digital resourcing systems is the Innovation Management Systems class. The purpose of such IT-artifacts is to support the innovation process. Implementing an innovation management system adds several benefits to an organization. The European standard for innovation management systems (CEN/TS 2013, p.4) has found that such systems…:

- …enhance growth, revenues, and profit from innovations.
- …bring fresh thinking and new value to the organization.

[51] Examples of traditional IT-artifact classes suggested by Laudon and Laudon (2014) are; e.g., Transaction Processing Systems (TPS); supporting operational management by keeping track of the elementary activities and transactions of the organization (e.g. orders, receipts, etc.), Management Information Systems (MIS); serving middle management with reports to manage organizations efficiently and effectively, Decision Support Systems (DSS); focusing on problems that are unique and rapidly changing, Supply Chain Management systems (SCM); managing relationships with providers, Project and Portfolio Management systems (PPM); supporting organizations to manage projects and portfolios of projects.

- …proactively capture value from a better understanding of future market needs and possibilities.
- …help identify and mitigate risks.
- …tap into the collective creativity and intelligence of the organization.
- …capture value from the collaboration with partners for innovation.
- …motivate employee involvement in the organization and fosters teamwork and collaboration.

As described in chapter 1, Bieler (2016) has found that several organizations are looking for Innovation Management Systems as a way to address the highly prioritized and somewhat challenging area of innovation. That is, the market for Innovation Management Systems is growing (ibid). Moreover, the authors recently evaluated 15 of the most well-known Innovation Management Systems on the market and found that existing instances provide a continuum of different types of functionality (ibid). Such systems range from team communication tools, crowd-funding/crowd-collaboration tools, idea generation tools, and innovation consulting tools (i.e., practical advice and innovation strategy). As described in the research method, I have also conducted complementary searches in literature and on the web for existing innovation systems. The result is presented in Appendix 5 and aligns well with Bieler's (2016) conclusion, i.e., that the Innovation Management Systems class includes a diverse range of different digital and non-digital innovation systems that focus on different parts of the innovation process. I have not found any Innovation Management System that is dedicated to supporting digital resourcing at the discovery stage of the digital innovation process. Consequently, the sub-class of *digital resourcing systems* is added to the range of existing innovation management systems in this dissertation. This promises to extend the Innovation Management System class. I also found universal principles that should be considered during the design of an Innovation Management System. They are; design to take the company's resources into account, design to determine the goals for the innovation process, design to manage and control the different phases of the innovation process (Toivonen and Tuominen 2009). More specifically, Panda (2007), found that innovation systems should be developed by following design principles such as; design for transparency of ideas, design for collaboration of employees, design for iterative work, design for prioritization of ideas, design for the voting of ideas, and design for knowledge management. Those principles are also in line with Sandström and Björk (2010). Figure 5.1 shows the digital resourcing systems sub-class, and existing principles suggested in the literature on innovation management systems classes. However, in order to fully support digital resourcing in the IT sector (i.e., artifact goals and meta-requirements in this study), the digital resourcing systems class initially needed to be extended with additional design knowledge related to digital resourcing systems. As previously stated, the digital resourcing systems class is related to the discovery stage of the innovation initiative. However, development literature on the subject of the innovation management class has not focused specifically on *digital* innovation, and the principles in existing literature are not especially focused on digital resources; i.e., they fail to provide clear guidelines to developers about digital resourcing. Moreover, recent best practices for innovation systems (e.g., CEN/TS 2013) do not provide any design knowledge directed towards digital resourcing systems. Simply put, existing design principles are either located on a too advanced level of abstraction or do not manage digital resources from a contemporary service perspective. Consequently, they do not adequately serve the meta-requirements (see Table 5.1) or artefact goals (see Figure 5.2) of digital resourcing systems. In order to support the artifact goals and meta-requirements, the designed digital resourcing system needed to be instantiated according to the specific requirements of practitioners.

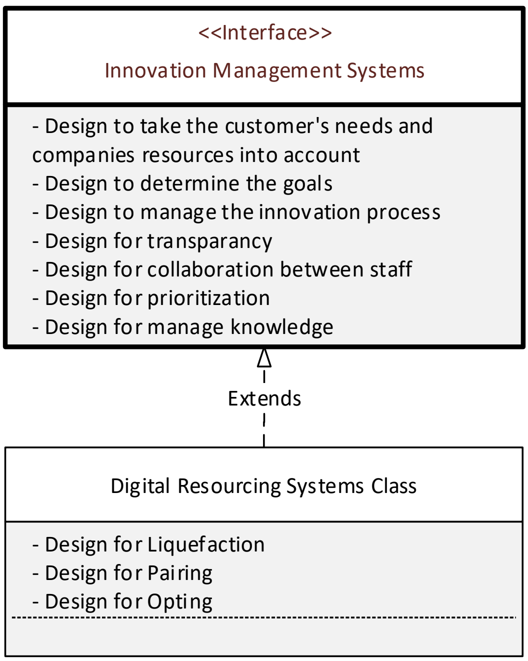

Figure 5.1. The initial digital resourcing systems class extends to the Innovation Management Systems class.

5.2 Purpose and Scope of the Digital Resourcing System

In order to support practitioners and researches and set a direction for the design effort, and to understand when the digital resourcing system has reached a sufficient design, a '*purpose and a scope'* was set. Simply put, the purpose of any IT-artifact is about *what the system is for* (Gregor and Jones 2007). The overall 'purpose and scope' is to develop a contextualized and easy-to-use digital resourcing system supporting service customers and providers to co-create novel value propositions when discovering digital innovations. The digital resourcing system should reach this overall purpose and scope by inscribing digital resourcing actions managing digital resources (see chapter 3).

The digital resourcing system has been designed to be used in a situation where a group of diverse roles, from a service provider and a service customer, are able to meet and use the digital resourcing system in order to manage digital resources, co-create novel value propositions, and finally, communicate the outcome as a digital service. In this way, the digital resourcing system should orchestrate an efficient approach to the discovery stage of the digital innovation process; it should improve the situation of the practitioners and foster sustainable competitive advantages. Although it is possible to view the digital resourcing system as a way to support also the *development* stage of the digital innovation process, I argue that the development stage is more focused on configuring the solution opted-in (e.g., Kohli and Melville 2019). Anticipated benefits enabled by the digital resourcing system are; e.g., to strengthening the relationship amongst providers and customers, enabling efficient resource sharing, supporting the identification of rare, unique, and value-enabling digital resources and to encourage the creation of new digital resources and store them into the digital resourcing system. The digital resourcing system should also support actors to utilize such resources as building blocks in order to co-create novel value propositions. Moreover, the digital resourcing system should support resource liquefying, resource pairing, and resource opting, which could improve the efficiency of digital innovation. Consequently, the digital resourcing system should organize and facilitate a situation, which practitioners have previously struggled to arrange.

The overall purpose presented is substantiated by a set of defined artifact goals that specify the type of IT-artifact to which the theory applies (i.e., digital resourcing system). In this way, the artifact goals also define the scope, or boundaries, of the design knowledge (ibid). Consequently, researchers and practitioners, initially, formulated artifact goals that described the overall requirements of the whole socio-technical digital resourcing system. The artifact goals emerged along with the BIE cycles. One example of emergence was artifact goal number 2, which changed from focusing on one service provider to dyadic actors, i.e., service providers, and service customers, in the second BIE cycle (see chapter 6).

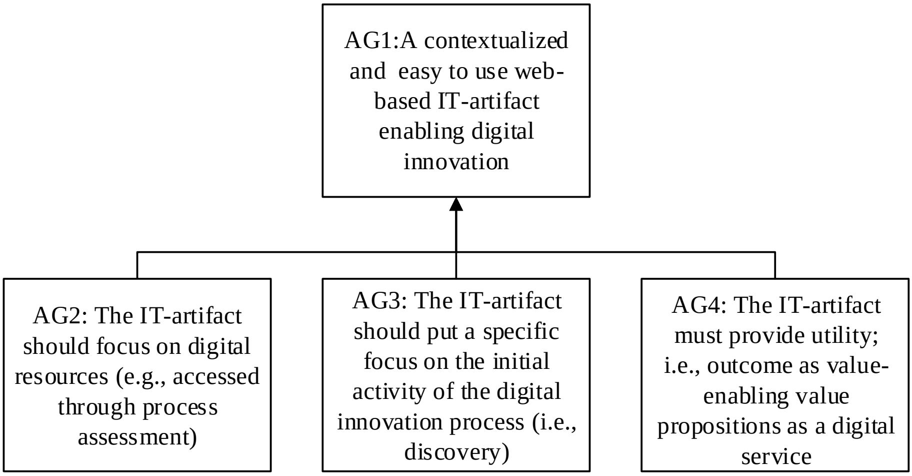

Figure 5.2. A brief overview of the relationships between artifact goals of the Digital Resourcing System.

The first artifact goal advocated that the solution should constitute a contextualized, easy-to-use web-based IT-artifact (i.e., digital resourcing system) enabling digital innovation (see Figure 5.2). In other words, the design knowledge should have a physical existence, represented by an IT-artifact, in the real world (e.g., Walls et al. 1992; Gregor and Jones 2007; Sein et al. 2011). Contextualization implies that the digital resourcing system should consider the specific organizational characteristics and available digital resources at hand. This also motivated several of the evaluation properties, such as *fit-for-context* and *utility* elaborated in section 6.1. To support the overall artifact goal, three additional and more detailed (sub) artifact goals were defined.

The second artifact goal reads; "*The IT-artifact should focus on digital resources (e.g., accessed through process assessment).*" This artifact goal required a focus on digital resources and on the fact that they were considered as essential by practitioners in the context. This does not mean that non-digitized resources were considered unimportant. Since another contextual characteristic for ITSM is 'a contemporary service perspective,' practitioners in the underlying project argued that digital innovation should be based on core processes, i.e., the *how's* of a value proposition of service (see chapter 2). Another reason to focus on processes was that the ADR-team argued that processes could constitute a communication protocol and design pattern, to support mobilization and decoupling, and to find problem-solution pairs. However, since the practitioners relied on a large number of comprehensive processes in their day-to-day practice, they wanted to focus on only generic, existing, and core ITSM processes. Consequently, the second artifact goal also supported the overall artifact goal since it helped to streamline the digital resourcing work (i.e., easy-to-use system). Promoting an IT-artifact that focused on core ITSM processes, implied that focusing on operand resources (hardware and software) was a secondary issue. Thus, this artifact goal sets a noteworthy scope of the design because it puts a focus on the *how* part (i.e., processes) of digital service, rather than the *what* (e.g., a digital technology, or other digital systems used by practitioners) of the digital service. In other words, this instance of a digital resourcing system should primarily focus on process improvements. However, this did not mean that operand resources were not important to consider during the design. On the contrary, practitioners and researchers argued that such operand resources often constituted the *core* of the service. Finally, the second artifact goal implied that evaluation properties related to completeness and process efficiency were important to consider during the evaluation of the artifact (see section 6.1).

The third artifact goal that was agreed upon reads: *the IT-artifact must include a specific focus on the initial phase (i.e., discovery) of digital innovation* (see also Figure 5.2). In the initial interviews of practitioners, I learned that ITSM organizations do not always have formal routines for working with digital innovation from a contemporary service perspective. Nor do practitioners always possess the time or staff to manage processes effectively according to the dominant best practices (Göbel 2014). One practitioner quote supporting this claim was, "*It's hard to continuously improve and innovate ITSM work practices*" (i.e., to design and deliver novel value-enabling digital services). This is in line with the findings in the study by Bieler (2016), which showed that 35% of 6000 decision-makers have a need to formalize their innovation processes. It also corresponds with Kohli and Melville (2019), who have found that the initial stage of digital innovation is understudied. According to practitioners, such an innovation initiative should start with identifying a problem in practice that needed to be solved. It is a well-known management adage that 'understanding the problem is half of the solution' (c.f., Jonassen 2000). Further, Lloyd et al. (2011) claim that an assessment of the current situation is crucial to identify the scope of the solution. Hence, assessment of the current practices was an essential part of the initiative (see also chapter 2 and 3). Another argument uttered by practitioners in the research project was that "*almost all of our solutions come from an experienced problem in practice*." This view is in line with recent research into digital innovation, which suggests that the innovation process should focus on the *problem–solution pairs* (c.f., von Hippel and von Krogh 2016; Nambisan et al. 2017). The main argument underlying this artifact goal was again that the time available for innovation work was often scarce (c.f., Göbel 2014), and thus practitioners could not afford to work in the wrong direction and solve a problem that did not enable value for a customer or provider. Consequently, the third artifact goal leads to evaluation properties related to completeness and process efficiency.

The last artifact goal reads: *the IT-artifact should provide explicit utility, i.e., enabling value propositions communicated as a digital service*. Thus, this artifact goal points towards a sufficient quality of the *outcome* obtained while using the digital resourcing system (see chapter 2). This is a critical artifact goal because, if the digital resourcing system did not enable *utility*, it would be useless. The artifact goal corresponds to the definition of digital resourcing since it ensures that intended outcomes were focused on value. As previously explained, such an outcome could, on the one hand, consist of new or changed digital technology, improving the value proposition (e.g., a traditional product). An example of that type of outcome could be a new digital errand system or new functionality (e.g., search functionality) in an existing digital service. On the other hand, the outcome could consist of altered or new IT-related processes that increased the possibility for users to create value when using a digital service. An example of such an outcome is an improved incident management process or change management process or a new routine, improving a service desk. The last artifact goal implies that evaluation properties related to utility are important to consider during the evaluation of the digital resourcing system (see chapter 3).

Next, the ADR-team created meta-requirements. According to Gregor and Jones (2007), meta-requirements relate to the 'purpose and scope' of the artifact. Meta-requirements also constitute refinements of the artifact goals. All meta-requirements in Table 5.1 were explicitly derived from the justificatory knowledge presented in chapter 2 and 3, and the practitioners' experiences. Since the digital resourcing system is viewed as a sub-class of the innovation management system, it should also draw on requirements in that class. The main characteristics that this class of IT-artifacts share is that they manage an innovation process consisting of discovery, development, implementation, and exploration (Shneiderman 2007; CEN/TS 2013; Fichman et al. 2014; Kohli and Melville 2019). Moreover, such systems should enable collaboration (Shneiderman 2007; CEN/TS 2013), creativity (Austin et al. 2012) and, problem- solution generation (von Hippel and von Krogh 2016; Toivonen and Tuominen 2009; Tsou et al. 2014; 2015). Properly executed, such systems enable actors to utilize digital resources efficiently in order to create value-enabling digital service(s).

The meta-requirements evolved in parallel with the design of the digital resourcing system, and Table 5.1 presents the final meta-requirements. The table shows an id and a description of the meta-requirement. It also shows how the meta-requirement related to one or more of the artifact goals. That is, for each meta-requirement, the justification was given by means of referencing artifact goals.

Table 5.1. Meta-requirements and relation to artifact goals.

ID	Meta-requirement	Relation to Artifact Goal (AG)
1	The digital resourcing system should focus on "resourcing" using a contemporary service perspective	AG1:A contextualized and easy-to-use web-based IT artifact enabling digital innovation, AG2: The IT-artifact should focus on digital resources (e.g., accessed and stored through process assessment), and AG3: The IT-artifact should put a specific focus on the initial activity of the digital innovation process (i.e., discovery)
2	The digital resourcing system should foster creative resource pairing using digital resources from collaborating actors in the ecosystem (internal and external)	AG2: The IT-artifact should focus on digital resources (e.g., accessed through process assessment), and AG3: The IT-artifact should put a specific focus on the initial activity of the digital innovation process (i.e., discovery)
3	The digital resourcing system should support problem solving.	AG1: A contextualized and easy to use web-based IT artefact enabling digital innovation, AG3: The IT-artifact should put a specific focus on the initial activity of the digital innovation process (i.e., discovery), and AG4: The IT-artifact must provide utility; i.e., outcome as value-enabling value propositions as a digital service.
4	The digital resourcing system should foster the mobilization and decoupling of digital resources.	AG1: A contextualized and easy to use web-based IT artifact enabling digital innovation, AG2: The IT-artifact should focus on digital resources (e.g., accessed and stored through process assessment), and AG3: The IT-artifact should put a specific focus on the initial activity of the digital innovation process (i.e., discovery)
5	The digital resourcing system should focus	AG1: A contextualized and easy to use web-based IT artifact enabling digital innovation,

	on core ITSM processes.	and AG2: The IT-artifact should focus on digital resources (e.g., accessed and stored through process assessment)
6	The digital resourcing system should allow for iterative innovation (e.g., incremental improvements).	AG1: A contextualized and easy to use web-based IT artifact enabling digital innovation, AG3: The IT-artifact should put a specific focus on the initial activity of the digital innovation process (i.e., discovery) and AG4: The IT-artifact must provide utility; i.e., the outcome of using it should be value-enabling value propositions.
7	The digital resourcing system should allow for the prioritization of problems and solutions.	AG1: A contextualized and easy to use web-based IT artifact enabling digital innovation, and AG3: The IT-artifact should put a specific focus on the initial activity of the digital innovation process (i.e., discovery).
8	The digital resourcing system should allow for the evaluation of novel value propositions and joint decision making of what to realize into practice (i.e., opting).	AG3: The IT-artifact should put a specific focus on the initial activity of the digital innovation process (i.e., discovery) and AG4: The IT-artifact must provide utility; i.e., the outcome as value-enabling value propositions as a digital service.

Meta-requirement number 1 (table 5.1) was derived from RBT and the FPs of S-D Logic, while numbers 2-4 and 8 were derived from the theoretical foundations that are especially relevant to digital resourcing. As part of the justificatory knowledge, they constituted essential constructs for the study, which are dwelt on further in chapters 2, and 3. The fifth meta-requirement was provided to ensure that both operand resources and operant resources related to core ITSM processes were considered. That is, processes were also an essential characteristic of the context. Meta-requirement number 6 referred to the whole digital resourcing process, which meant that the incremental nature of the innovation process should be recognized (see chapter 2). It also implied that resources generated by actors should be stored in the digital resourcing system. The term 'iteration' in number 6 means that functionality supporting novel digital services should be developed. Meta-requirement number 7 calls for prioritization of the underlying problems (i.e., to ensure that one did not solve the wrong problem). The practitioners also required that human actors should be able to prioritize quickly among identified problem-solution pairs. The argument in favor of this was that the practitioners are often short of both time and staff. As a final step, it was necessary to opt-in or opt-out for which viable problem-solution that could nurture the most value for the beneficiaries. Hence, meta-requirement number eight stated that actors should evaluate tentative novel resources before selecting them, developing them, and putting them into practice.

5.3 DESCRIPTION OF THE INSTANCE

Several scholars do not show or describe *how* actors might use IT-artifacts when they propose a design. Showing or describing an IT-artifact is crucial since it provides an increased understanding of how design knowledge can be operationalized in a specific context. To this end, a brief overview of the final version of the web-based digital resourcing system will be illustrated and described in the following sections, while the technical architecture is described in Appendix 4. However, first, it is reasonable to provide an example of how practitioners worked *before* the introduction of the digital resourcing system in the context. Traditionally, only one manager from a service provider and one individual from the customer met in order to discuss the weaknesses and strengths of relevant digital service(s) in order to improve the situation. To their support, they usually brought a physical contract or a service level agreement (Cannon et al. 2011). When the meeting was held, the manager from the service provider presented pre-defined metrics in order to visualize the status of the ongoing activities related to the digital service. The result was compared to the statements in the contracts. These meetings were routinely held, usually one to four times each year, and the structure of the meeting had ‘always’ been the same. Although one purpose of the meeting was to innovate and improve digital services (and the relationship between customers and supplier), it seldom led to any concrete changes, improvements, or novel service(s). Moreover, there were seldom any other routines or digital systems supporting innovation initiatives at the service provider or the customer. Finally, there was no support for involving several actors in the service ecosystem. Simply put, no meetings, specific practices, or digital systems were used to support structured discovery of digital innovations. However, the practitioners understood that digital innovation was *essential* and they argued that they had a need to structure their innovation work in a better way. Consequently, they were in need of a digital resourcing system (see also chapter 1).

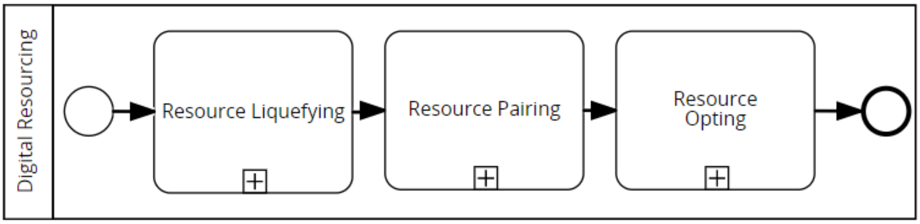

Figure 5.3. Three digital resourcing actions forming the digital resourcing system. The activities are here illustrated as sub-processes using by BPMN notation (BPMN 2019).

In contrast to the traditional way of working with improvements, a group of diverse roles from the service provider and service customer jointly used the digital resourcing system, which guided their innovation initiative. More specifically, the final version of the digital resourcing system was designed according to meta-requirements and specific requirements, but especially it comprised the three digital resourcing actions: i.e., resource liquefying, resource paring, and resource opting (chapter 3). Although Figure 5.3 illustrates a sequential and non-iterative order, the resourcing actions did not necessarily need to be followed in a specific order, and they were iterative; i.e., together they constituted a 'digital resourcing cycle' that was held together in the digital resourcing system by a 'round.' A round should be viewed as a container for all generated digital resources related to the initiative. The digital resources gathered and/or generated in a single round were stored in the database of the digital resourcing system. Those digital resources could then be used and reused as a base for future digital innovation initiatives (i.e., a new round could be generated based on stored digital resources).

In order to use the digital resourcing system in practice, at least three different actors needed to be involved in the work; apart from relevant roles representing the service customer and the provider, a facilitator needed to participate (see Table 5.2). The facilitator could come from either the customer or the provider or from an external actor (e.g., consultant). The digital resourcing system was designed to be used one to four times each year. However, no barriers were built into the digital resourcing system that hindered organizations from using it in their digital innovation initiatives more often. Thus, the design corresponds to the iterative nature of innovation (e.g., Kohli and Melville 2019) while it supports the organizations struggling with sparse time and money.

Table 5.2. Roles included in using the digital resourcing system.

Actor	Description	Main responsibilities
Service Customer	Could consist of different roles depending on the selected scope (e.g., process/service) of the digital resourcing initiative.	To collaborate with service providers and actively manage digital resources from the service customer perspective.
Service Provider	Could consist of different roles depending on the selected scope (e.g., process/service) of the digital resourcing initiative.	To collaborate with service customers and actively manage digital resources from the service provider perspective.
Facilitator	Could come from the customer, provider, or external partner.	To facilitate resourcing actions (see chapter 3), i.e., lead discussions, administrate the content of the digital resourcing system, and keep track of time, etc.

5.3.1 Inscribed Action 1: Resource Liquefying

The purpose of the first action inscribed in the digital resourcing system was to mobilize and decouple resources in order to store them into the digital resourcing system. A simple overview of the specific steps of the resourcing action is given in Figure 5.4.

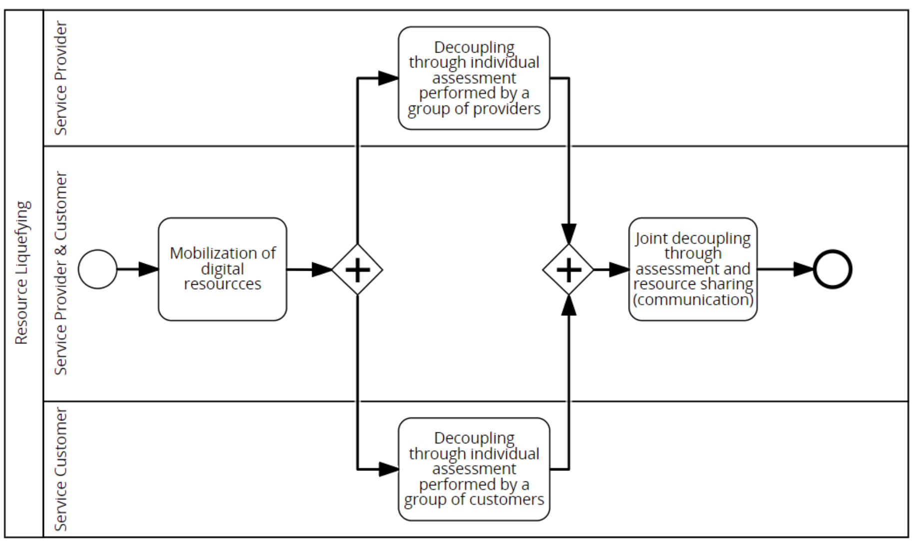

Figure 5.4. Resource liquefying process illustrated by BPMN notation (BPMN 2019).

First, human actors (see Table 5.2) selected boundary objects that supported them when mobilizing the right resources to space and time. This was partly done by registering different role-representatives from the service provider, and the service customer, into the digital resourcing system. The human actors also (jointly) described a digital service (operand resource) to be in focus during the whole innovation work, and they selected a best practice (a contextualized ITSM framework or standard). Next, they selected one or more core IT processes from the already installed set of processes in the digital resourcing system (see Figure 5.5). In line with the description in chapter 3, the digital resourcing system included a set of contextualized ITSM core processes, which could be used as a communication protocol when mobilizing and decoupling resources as well as a design pattern when pairing problems and solutions. However, if necessary, practitioners had the possibility to change the content and purpose of processes to fit better with the contextual needs in their service ecosystem. Accordingly, and if the actors found it necessary, they changed content of this kind. In this way, the digital resourcing system was considered mutable because it could be adapted to fit different contextual needs. Finally, the actors added information about the digital service, roles, best practices, and underlying IT processes. The information added formed a 'round' (see section 5.3). When a 'round' had been prepared (i.e., when a digital service, best practice or standard (i.e., communication protocol)), specific processes, and roles had been selected and saved (Figure 5.5), a text and a URL was sent by email (a built-in functionality in the digital resourcing system) to the participating roles at the service providers and customers. When receivers of the email followed the URL, the actors, wherever they were physically located, were directed to the next activity, decoupling.

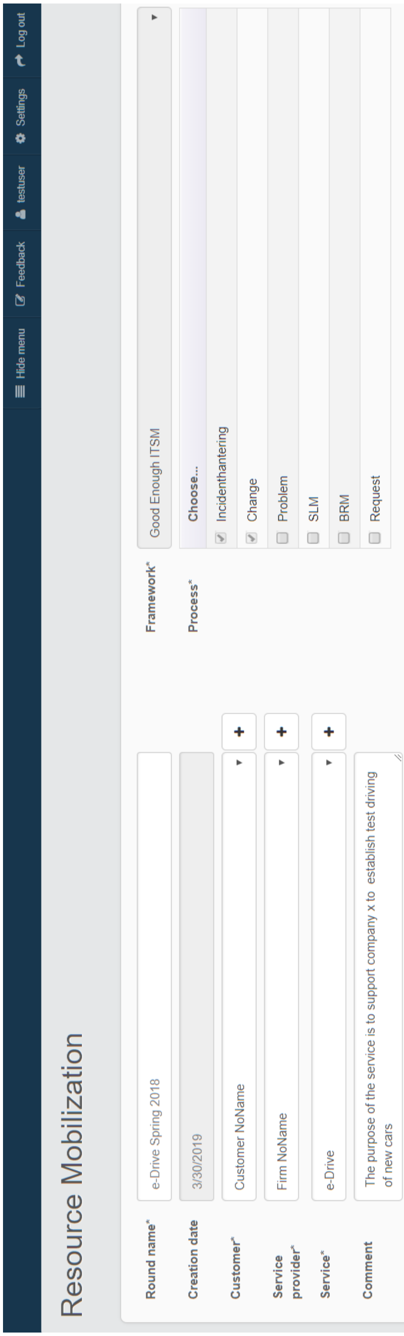

Figure 5.5. Functionality supporting practitioners when mobilizing resources and preparing a new round.

When resources were mobilized, they should be decoupled and stored as *digital* resources in the system to leverage the possibility to create novel value propositions (i.e., digital innovations). More specifically, resource decoupling was performed using a communication protocol, including assessment of the selected ITSM processes. First, the individual groups of service customers and providers followed the URL sent and conducted an organization-specific process assessment (Figure 5.6). In this activity, the group of customers and providers separately communicated and discussed their own specific organizational view on the selected processes statements. Each group of the two organizations conducted this activity in separate physical locations. To support communication and assessment, five different grading levels were inscribed in the digital resourcing system. The ratings were inspired by a 5-point Likert scale (see Figure 5.6). A Likert scale indicates levels of agreement with a declarative statement (c.f., Albaum 1997). More specifically, the inscribed Likert scale 'asked' practitioners to indicate their levels of agreement with a statement related to an ITSM process. For the 5-point Likert scale inscribed in the digital resourcing system, each scale-point was labeled according to an 'agreement-level': 1) fully agree; 2) mostly agree; 3) partly agree; 4) do not agree; and, 5) does not apply. If needed, comments from discussions could be added to each rating explaining why the specific rating was chosen in relation to a statement. Each process took approximately 20 minutes (+- 5 minutes) to assess. If necessary, the actors also used data in external databases or data from digital documents to complement knowledge possessed by the group of human actors. To sum up, the first decoupling activity did not span over organizational borders; i.e., it only focused on decoupling resources from a single service provider or a single service customer and to store such resources in the digital resourcing system.

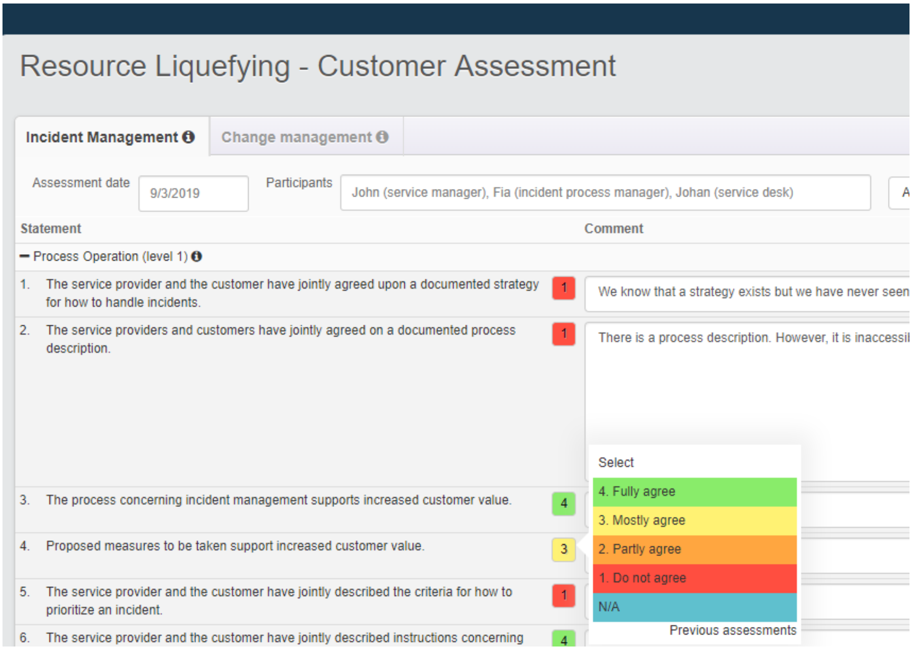

Figure 5.6. Organization-specific decoupling (part of liquefaction) performed by a service customer.

In the next decoupling activity, all relevant role-representatives from both the service customer and the service provider met physically to communicate and discuss the results of the different organizational views *together*. The organizations met in a meeting room using the digital resourcing system (i.e., they gathered around a projector screen showing the result). The whole group of service providers and customers then compared and communicated around differences and similarities from the two organization-specific assessment/decoupling actions. To support this activity, the digital resourcing systems visualized the results from the two organizational-specific assessments (Figure 5.7). Consequently, service providers and customers, in collaboration, could communicate around similarities and differences between their different views. Through their discussions, the actors shared knowledge, but they also created new knowledge together, which thus were decoupled from the human brain (or digital systems) and stored as digital resources in the digital resourcing system.

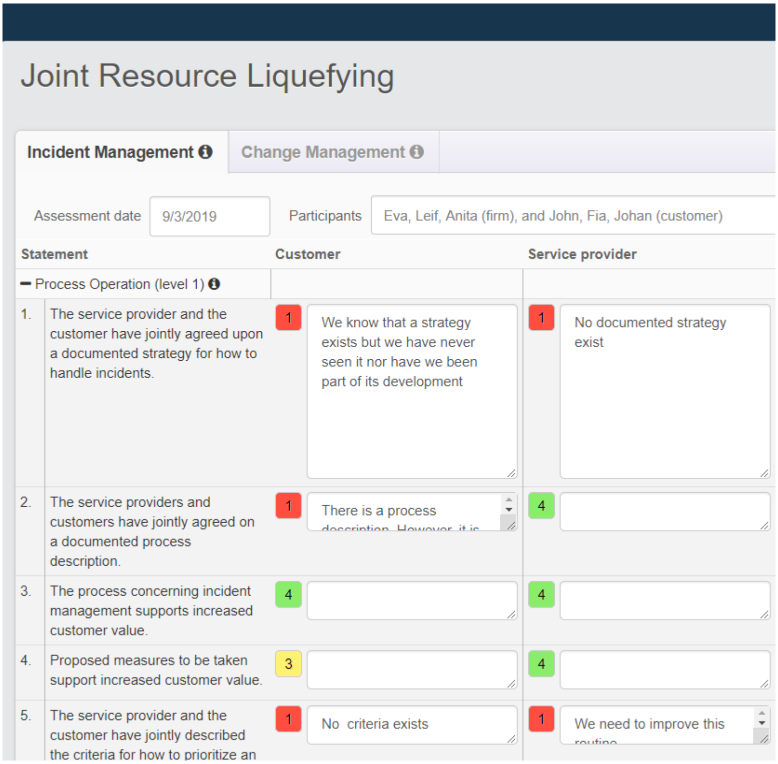

Figure 5.7. Joint Resource Liquefying by service customers and providers.

The communication around different organizational views between service providers and customers could result in four types of results (Table 5.3). The first type of result shows that both the customer and the service provider agreed that a specific process statement/activity was sufficiently performed in the context (i.e., they have both rated it 'fully agree'). The second result shows that the practitioners do not agree that a statement/activity is sufficiently performed (it does not enable sufficient value for actors). The third result state that the customer had a less positive view of the activity while the service provider had a great experience. The fourth possible result shows how the service provider had a bad experience of the processes statement/activity while the customer had a good experience. If any of the two actors wanted to change their rating during the discussions (since new resources were shared during the decoupling session), the digital resourcing system allowed them to alter the result ad-hoc. The two group of actors also had the opportunity to store shared comments (as digital resources) together with the ones already registered during the organization-specific assessment.

Table 5.3. Possible results of discussions around the communication protocol.

	Customer	Provider
Type of result 1	Agree	Agree
Type of result 2	Do not agree	Do not agree
Type of result 3	Agree	Do not agree
Type of result 4	Do not agree	Agree

5.3.2 Inscribed Action 2: Resource Pairing

In the resource pairing action, roles from both the service provider and the customer used the result created in the resource liquefying action as a foundation to identify and share problems, to co-create solutions holding novel value propositions and pair solutions with problems. Since new solutions were directly related to a problem or vice versa, they formed 'problem-solution' pairs (e.g., von Hippel and von Krogh 2016).

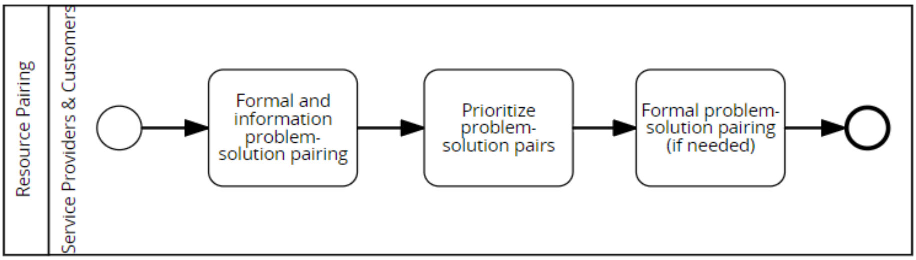

Figure 5.8. Activities of the digital pairing action illustrated by BPMN notation (BPMN 2019).

Resource pairing consists of few, sometimes parallel, steps. First, the service provider and customer jointly used formal and informal problem-solution functionality by using the process statements in the digital resourcing system as a *design pattern* (Figure 5.9). The design pattern supported the actors in their comparing of the *as-is* situation with a *to-be* situation regarding the digital service, which could result in problem-solution pairs. On the one hand, problems/gaps between the two views of service providers and customers were identified, which was compared to the design pattern. Since the design pattern holds a general solution, the comparing activity often resulted in a solution to the problem identified (i.e., called formal pairing). On the other hand, actors were sometimes inspired by design patterns and created a solution first and then mapped the solution to a problem, which was added in the digital resourcing system (i.e., called informal pairing). That is, the resource pairing action supported both information and formal pairing. When problem-solution pairs had been co-created, the human actors jointly prioritized the problem-solution pairs that were most important to take care of, i.e., although multiple problems and solutions could be identified during this activity, not all problem-solution pairs were significant enough to prioritize.

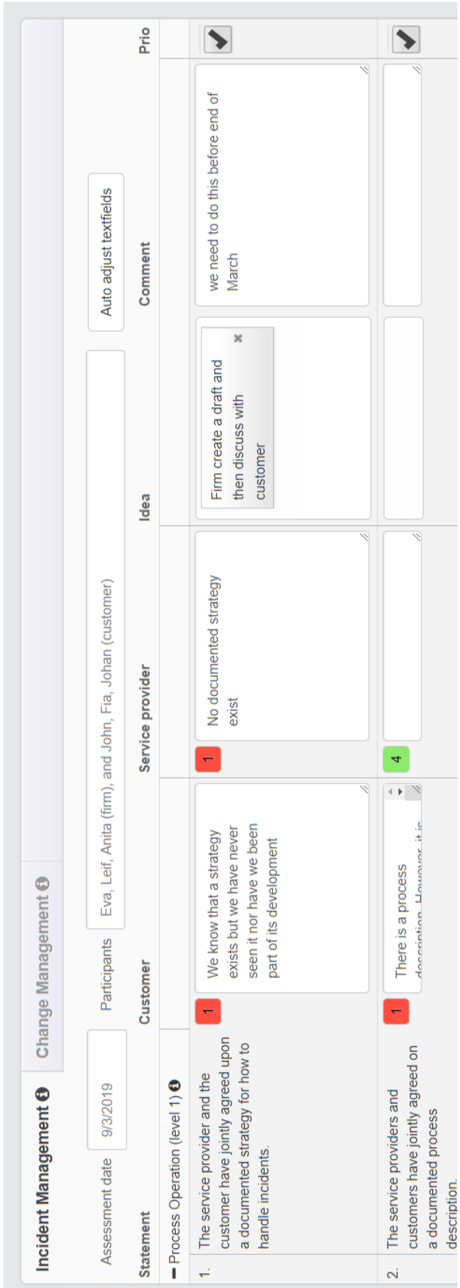

Figure 5.9. Formal and Informal Problem-solution Resource Pairing.

To support problem-solution prioritization, simple checkboxes were implemented (right-hand side of Figure 5.9). The practitioners simply ticked the checkbox in order to prioritize an identified problem-solution pair. This selection did not mean that the problem-solution pairs not prioritized were unimportant, only that they were postponed for future use. However, the result from the previous pairing step could sometimes result in identified problems with no solutions. To leverage the possibility to identify solutions in the case only problems had been identified, and to *visualize* problem-solution pairs, the digital resourcing system included a dedicated *formal* problem-solution paring view. The view fostered a tighter coupling between an identified problem and a solution, and the view supported even further problem-solution pairs to evolve. In this view of the digital resourcing system, one of the identified problems prioritized in the previous view was chosen using a radio button (see Figure 5.10). The information of the selected problem was then visualized in the digital resourcing system (e.g., comments and/or solutions (if existing) from the previous step). Next, the service provider and customer, in collaboration, used their collected operant resources (i.e., visualized in the digital resourcing system) to merge, recombine, and fork digital resources in order to co-create and suggest even more solutions that could solve the identified problem. A short description of each solution holding a value proposition was added to the digital resourcing system. The problem-solution pairs were finally saved in the database.

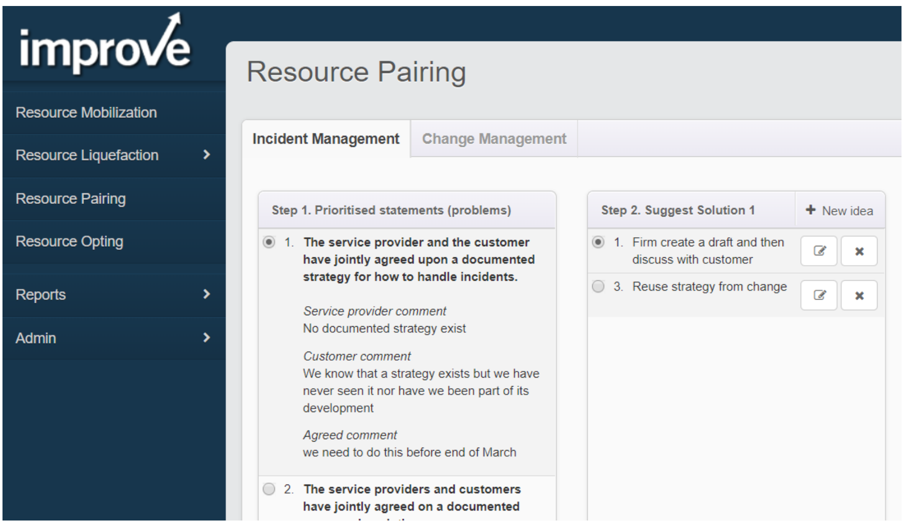

Figure 5.10. Resource Pairing showing problem-solution pairs.

5.3.3 Inscribed Action 3: Resource Opting

The purpose of the third action, resource opting, was to opt-in or opt-out feasible and desirable problem-solution pairs with low uncertainty/risk that could be developed and realized. That is, this action also supported the actors when testing a solution for viability. Figure 5.11 shows the steps in this activity.

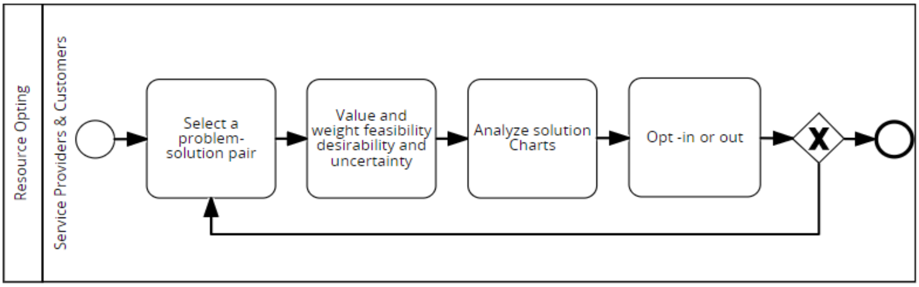

Figure 5.11. Activities of digital resource opting illustrated by BPMN notation (BPMN 2019).

First, each of the co-created problem-solution pairs added during the resource pairing action were jointly evaluated according to contextualized criteria (see Figure 5.12). These criteria were jointly added into the digital resourcing system by the actors. Each criterion related to one of three criteria categories, i.e., feasibility, desirability, and uncertainty/risk. Once again, a scale (1-5; i.e., 1 = low, 5 = high) were used in order to evaluate each criterion of a specific solution using 'sliders' (Figure 5.12). In this step, the practitioners also weighed the importance of each criterion. This was done according to a simple fuzzy set (c.f., Zadeh 1965; Zimmermann 1983; 1987; 1996), and thus it was possible to calculate a total sum for each set of criteria (feasibility, desirability or risk/uncertainty) (see Figure 5.12). The final sum was later used as input to the last activity in the resource opting action.

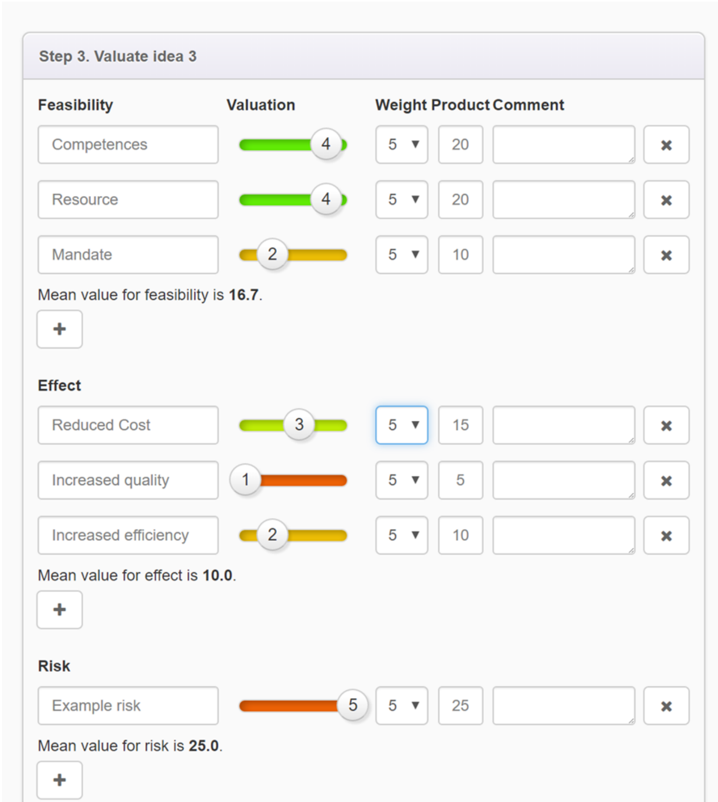

Figure 5.12. Evaluation of problem-solution pairs (i.e., digital options) generated during resource pairing.

Finally, the practitioners jointly opted in or out of a problem-solution pair, with the support of three different charts visualizing the evaluated problem-solutions in relation to desirability/feasibility, desirability/risk, and feasibility/risk. In Figure 5.13, three different charts are shown as visualized in the digital resourcing system. In the example, two identified problem-solution pairs are shown in each chart. The charts were based on the data/information (digital resources) stored in the previous evaluation step. By clicking on one problem-solution-box in a chart, a 'context area' was visualized as a pop-up. The pop-up shows all the information related to the problem-solution pair. By discussing the different pairs in relation to each other (based on the charts), the actors had all the information needed to jointly opt-in or opt-out the most desirable and feasible pair to realize into practice. When the actors had decided which pair holding a valuable solution should be developed and realized, they clicked on it and saved the information to the database to be used for follow-up and history.

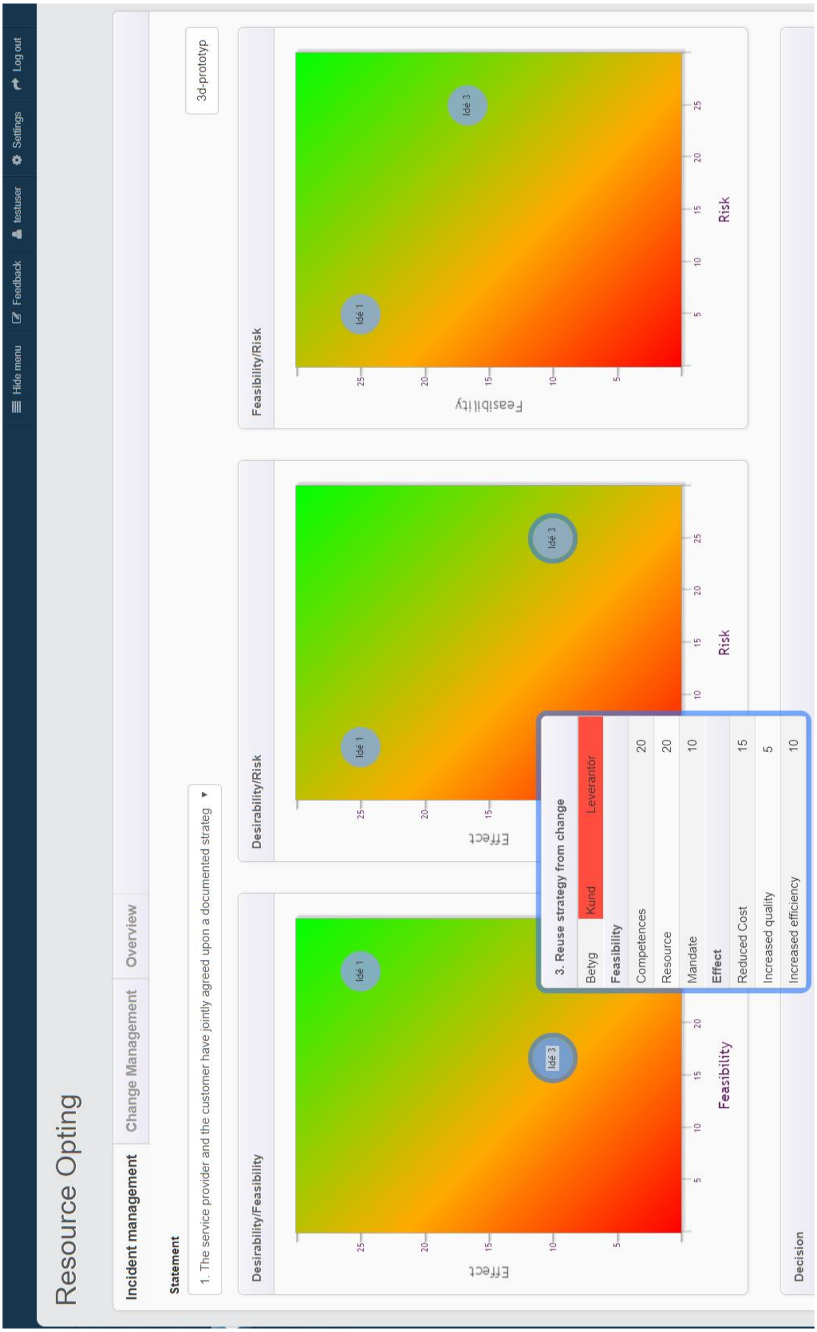

Figure 5.13. Three different charts are showing two solutions in order to support resource opting.

As previously described, the development part concerning, e.g., software coding or process modeling was not specific activities supported by the digital resourcing system. The argument for that was that organizations already had their own development or project management systems, and thus, they were not in need of an additional one. Another argument was that the digital resourcing system aimed to support the discovery stage of digital innovation. However, since there was a need to follow-up on realized problem-solution pairs, a simple functionality was designed supporting practitioners to add basic information about the digital innovation to realize (Figure 5.14).

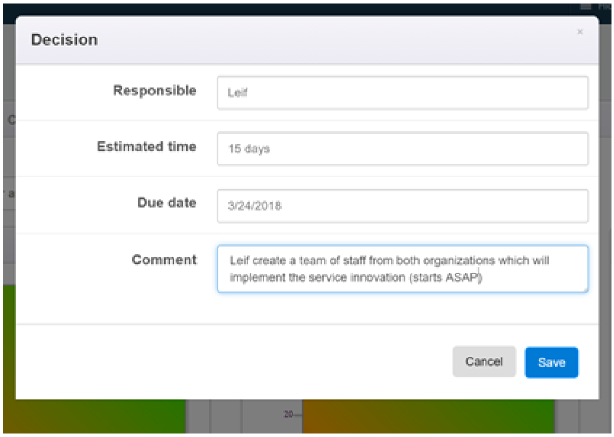

Figure 5.14. Adding information about the opted solution.

In summary, the digital resourcing system supported multiple service providers and customers towards efficient management of digital resources when discovering digital innovations in a more structured and focused approach than before the system was used. It enabled efficient mobilization and decoupling of digital resources, and it allowed the dyadic actors to co-create and pair digital resources related to problems and solutions as building blocks in digital innovation. Finally, the digital resourcing system supported the actors' choices to opt-in on one or more viable value propositions. Consequently, the digital resourcing system organized and facilitated a situation, which practitioners had previously struggled to arrange, which meant, in effect, that the introduction of the digital resourcing system improved the context and provided utility.

6 EMERGING DESIGN KNOWLEDGE

In contrast to the previous chapter, which was aimed to describe the final digital resourcing system[52], the purpose of this chapter is to describe *how* design knowledge has emerged. This corresponds well with design science research asserting that a description of design knowledge should include a narrative of the interventions in practice, which increases the transparency of the design choices made, as well as the reliability of the results. In this chapter, I have used screenshots and textual descriptions to illustrate the emerging design knowledge, and I have chosen to structure the description around the three digital resourcing actions (see chapter 3). The reason is to increase the readability, i.e., to offer a coherent text for each digital resourcing action. Moreover, the description in this chapter correlates to the two ADR phases, 'Building Intervention, and Evaluation' and 'Reflection and learning.' More specifically, 'Building,' 'Evaluation,' and 'Reflection and learning' is gone into detail while the part 'Intervention' is only briefly described since detailed information is available in chapter 4. The contents of this chapter continuous with 6.1 Evaluation Strategy, 6.2 Design for Liquefying, 6.3 Design for Pairing, 6.4 Design for Opting, and 6.5 Summary of Evaluation.

6.1 EVALUATION STRATEGY

It is important to recall that when evaluating the digital resourcing system, the researcher also evaluates the utility of the design principles and design theory (e.g., Venable et al. 2016). Thus, the different abstraction levels of design knowledge i.e., 1) digital resourcing system, 2) design principles, and 3) design theory) have emerged in parallel during the research process.

The aim of the evaluation strategy corresponding to the first abstraction level of design knowledge was to provide a sound and well-grounded evaluation approach that ensured the *utility* of the digital resourcing system. There is a consensus that *utility* is the ultimate evaluation property of an IT-artifact, but also other generic evaluation properties have been suggested by several scholars (e.g., Hevner et al. 2004; Gregor and Hevner 2013; Venable et al. 2016). Such generic evaluation properties have been described in chapter 4. However, since not all IT-artifacts have the same purpose, a set of specific evaluation properties, unique to the digital resourcing system, was co-created with practitioners in this study. Those were derived from the artifact goals (see chapter 5), contextual characteristics (chapters 2 and 3), and justificatory knowledge

[52] Please recall that the presentation order of chapter 5 and 6 is intended to increase readability and that the order does not reflect the research process; i.e., the final digital resourcing system presented in chapter 5 is rather a result of the ADR cycles described in this chapter.

(chapters 2 and 3). Eight specific evaluation properties were finally identified and agreed upon (see Figure 6.1 and Table 6.1)

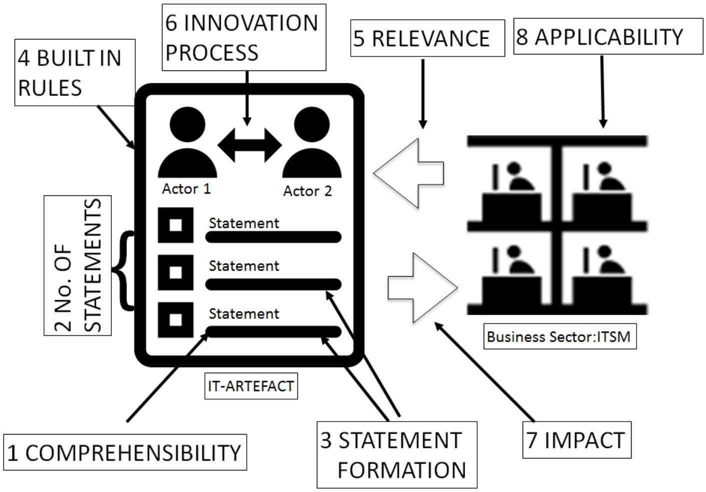

Figure 6.1. Specific evaluation properties (‘Business sector’ equals ‘context’).

The specific evaluation properties of the digital resourcing system were also mapped to the *generic* evaluation properties suggested by other scholars (information on these is available in chapter 4). This mapping was conducted in order to ensure that important aspects of the evaluand were taken into account in the study. The evaluation properties identified and mapped were agreed upon amongst all researchers and practitioners; i.e., the properties were based in both research and practice.

Table 6.1. Evaluation properties for the digital resourcing system.

ID	Property Name	Property Description	Relation to Generic property
1	Compre-hensibility	Comprehensibility (under-standability) of the content of the digital resourcing system (i.e., labels, ease-of-use, core processes/commu-nication protocol, etc.)	*Completeness* (relates to quality) (Hevner et al. 2004)
2	No. of statements	The number of built-in process statements (i.e., the content of core processes).	*Fit with the organizational context* (relates to the quality of the artifact) (Hevner et al. 2004)
3	Statement formation	Grouping of the content/formation of statements (i.e., in the communication protocol).	*Fit with the organizational context* (relates to the quality of the artifact) (Hevner et al. 2004)

4	Built-in rules	The built-in rules setting borders of the digital resourcing system.	*Flexibility* and *Mutability* (Gregor and Iivari 2007)
5	Relevance	The relevance of the digital resourcing system in relation to the organization's purpose and context.	*Fit with the organizational context* (relates to the quality of the artifact) (Hevner et al. 2004), *Mutability* (Gregor and Iivari 2007), and *utility*.
6	Innovation Process	Quality of the built-in digital resourcing actions.	*Process* (StuffleBeam 2003)
7	Impact	Impact and utility of the digital resourcing system in action.	*Utility,* e.g., the quality of results obtained through the use of the artifact (Hevner et al. 2004). *Resource utilization* (Smithson and Hirschheim, 1998). *Efficacy* (that the utility/benefits derived from the use of the Artifact are due to the artifact, not due to other factors.) (Venable et al. 2016) *Effectiveness* (i.e., the degree to which the artifact meets its higher-level purpose or goal and achieve its desired benefit in practice) (Checkland and Scholes 2011)
8	Applicability	The applicability of the digital resourcing system in the context.	*Fit with the organizational context/fit-for -context* (i.e., quality of the artifact) (Hevner et al. 2004)

In line with the naturalistic approach of this study, the properties were evaluated in a qualitative fashion. This meant that subjective data rather than quantitative data were collected. Data was collected through intervention in practice but also through semi-structural interviews that were conducted after each intervention with all participating organizations (e.g., Patton 2015). When evaluating the utility of an IT-artifact, the evaluator should ask, "*Does the design artifact improve the environment [i.e., context], and how can this improvement be measured*?" (Hevner et al. 2007, p.89). Examples of other questions asked, and their relations to evaluation properties were:

- "*Are all statements understandable for all actors?*" (i.e., comprehensibility in Figure 6.1)
- "*Are there too many or too few statements included in the artifact?*" (i.e., no of statements in Figure 6.1)

- “*Are the formation of service statements good enough?*” (i.e., statement formation in Figure 6.1)
- “*Are the internal rules of the IT-principles of forms and function/internal rules of the artifact easy to understand (i.e., the way you grade statements, etc.)*?” (i.e., built-in rules in Figure 6.1)
- “*Is the* digital resourcing system *relevant to your context?*” (i.e., relevance in Figure 6.1)
- “*Is the* digital resourcing system *easy enough to use in your context?*” (i.e., innovation procedure in figure 6.1)
- “*What are the effects of using the* digital resourcing system*?*” (i.e., effects in Figure 6.1)
- “*What is the impact on the relationship between service customer and provider?*” (i.e., impact in Figure 6.1)”
- “*Is the* digital resourcing system *applicable in practice, and will you continue to use it as an innovation routine?*” (i.e., applicability in Figure 6.1)

If necessary, supplementary questions in relation to each property were asked. Finally, a workshop with results from the evaluation was held. In this workshop, practitioners and researchers discussed and agreed on the result. By following this evaluation strategy, sufficient conditions to demonstrate the *utility* and quality, etc. of the digital resourcing system were created.

Moreover, the evaluation strategy consisted of several evaluation episodes (see also chapter 4). Each evaluation episode included multiple interventions in real contexts. Each intervention often engaged multiple employees from service providers and customers who used and interacted with and around the digital resourcing system. Each intervention was planned in detail, and all participants were identified and informed about the evaluation process before each intervention. The evaluation episodes holding the multiple interventions are illustrated in Figure 6.2. The figure shows a trajectory where different evaluation episodes (as part of the three major BIE cycles) proceeded from formative evaluation to a summative evaluation concluding the research effort. The outcome from one evaluation episode constituted the input to the next. Consequently, three major evaluation episodes were planned and performed. That is, each evaluation episode shown in Figure 6.2 holds multiple interventions that are related to one of the three BIE cycles.

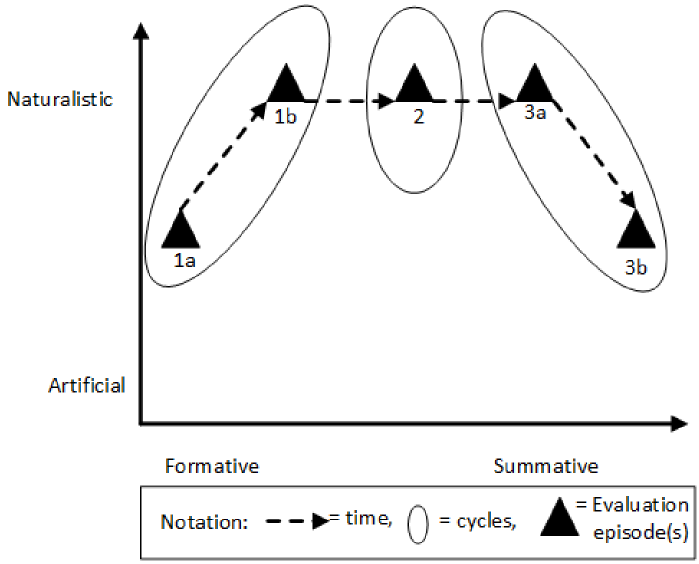

Figure 6.2. A trajectory of the different evaluation episodes included in the three cycles.

Furthermore, Figure 6.2 shows that the first part of the initial evaluation episode (i.e., number 1a) was *semi-naturalistic* because early versions of the digital resourcing system were demonstrated and discussed in workshops with practitioners. However, since practitioners from all different contexts (see chapter 4) participated in the discussions and evaluated the digital resourcing system, the part of the evaluation episode (i.e., number 1a) was not an entirely artificial evaluation episode conducted by researchers alone. The evaluation episode was considered formative since the results were used to improve the digital resourcing system before the second part of that evaluation episode could start. The second part of the evaluation episode (i.e., number 1b) was purely naturalistic. 11 interventions took place in different ITSM contexts, and real users used and evaluated the digital resourcing system together. Evaluation episode 1b was also formative because the results supported improvements of the digital resourcing system (and design knowledge). The formative and naturalistic dimensions were also applied to the two following evaluation episodes (i.e., number 2, and 3a (Figure 6.2)).

The final episode (i.e., number 3b in Figure 6.2) was summative and *semi-naturalistic*. This is in line with FEDS (Venable et al. 2016), which states that summative evaluation provides the highest rigor when evaluating IT-artifacts and usually occurs at the end of an evaluation trajectory (Venable et al. 2016). In this episode, all practitioners met in a workshop to discuss, agree on, and summarize their experience of using the digital resourcing system. All quotes were collected in an excel sheet, related to evaluation properties, and agreed upon by all organizations and researchers (see chapter 4). The quotes have been translated from Swedish to English. Examples of these quotes are presented in the current chapter and chapter 7.

The evaluation episodes were filmed and photographed. Ethical principles such as 'informed consent' (e.g., Myers and Venable 2014) were also discussed in the ADR-team. All companies agreed to participate in the different ADR phases, and they were ready to allow researchers to intervene in their organizations. Recall that there was also an overall contract between researchers and practitioners (see chapter 4)). In addition, the researchers also created field notes and reflected over the digital resourcing system in use during the interventions. The collected material was later used in the ADR 'Reflection and learning' phase. After the interventions were completed, the participating actors responded to the questions related to evaluation properties described above

The description above corresponds to the first of the three intertwined evaluation strategies mentioned in Figure 4.3 (i.e., digital resourcing system), while the following description corresponds to the second evaluation strategy, i.e., different components[53] of design knowledge constituting a design theory. In order to learn about the evolving design knowledge, a search for signals in the authentic contexts was constantly ongoing. To support the search for signals in context, the ADR principle of *Guided Emergence* has been considered (Sein et al. 2011). Guided emergence emphasizes that the designed artifact should reflect both the preliminary artifact design and its refinement through organizational use while considering different perspectives, theories, and roles (e.g., Iivari 2003; Garud et al. 2008; Sein et al. 2011) (see also chapter 4). Accordingly, the description in this chapter includes empirical learnings, justificatory knowledge, anticipated[54] and unanticipated[55] consequences of different design alternatives. Such consequences have been a result of the outcomes of authentic, concurrent evaluation in context, which in turn has *guided* the *emergence* of the digital resourcing system and design knowledge. In other words, such consequences have led to refinements that included not only trivial fixes but also substantial changes made to the design. The descriptions of anticipated and unanticipated consequences will be described in sections called 'Reflection and learning' and are summarized in tables. In order to increase the transparency and readability of the unanticipated consequences transferred to the

[53] The components explicitly evaluated were 'artifact mutability', 'testable propositions', 'principles of implementations' with a specific focus on 'design principles', which constitute important components of a design theory.

[54] Something that is regarded as probable or expected.

[55] Something that is regarded as improbable or not expected.

next BIE cycle, ‘ids’ have been used in the different tables (e.g., Table 6.2, 6.3, and 6.4).

In addition to this formative evaluation, a *complementary* and more summative evaluation strategy was created (see also chapter 4). The argument for that was to reflect on and explain certain aspects of design knowledge that the digital resourcing system could not directly support (e.g., Goldkuhl 2004a). Since this evaluation is related to reflection and learning, the description is located under the final ‘*reflection and learning’* phase for each resourcing action. As described in chapter 4, the complementary evaluation strategy was based on the four grounding processes of design suggested by Goldkuhl (2004a). Grounding means justifying knowledge by claiming its validities (ibid). This means that an argumentative relationship between knowledge and some other part of knowledge should exist (ibid). The four grounding processes used were; *value grounding* (goals and values), *conceptual grounding* (constructs and relationships), *explanatory grounding* (description in relation to theory), and *empirical grounding* (evaluation in practice) (Figure 6.3). These grounding processes correspond to the more well-known terms; i.e., internal[56] grounding (i.e., conceptual/value), empirical grounding (i.e., application), and theoretical grounding (i.e., explanatory/conceptual/value) (Goldkuhl 2004a). The motive for these choices was that the different grounding approaches and the description of the emerging knowledge together form a coherent approach to justify the design knowledge (c.f., Cronholm and Goldkuhl 2003; Cronholm 2004; Heinrich and Schwabe 2014). Moreover, the grounding processes help to specify and explain certain aspects of design knowledge that the digital resourcing system in chapter 5 could not.

[56] Grounding a design theory in its own background knowledge; “*means how the different knowledge parts are related to each other and that there is a meaningful and logical consistency*” (Goldkuhl 2004a, p.66).

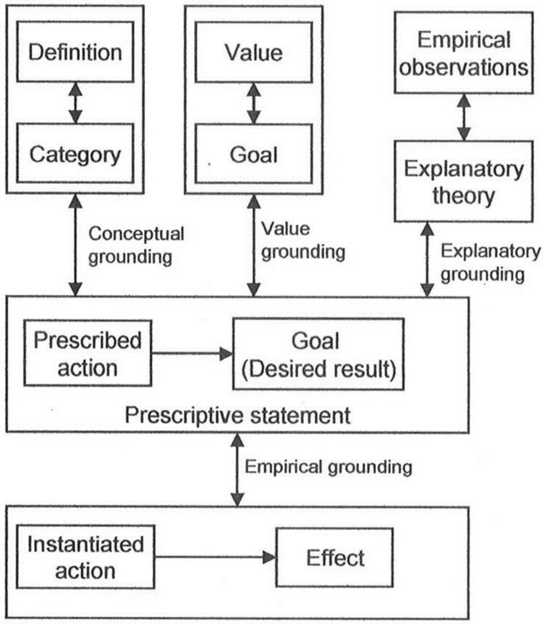

Figure 6.3. Different forms of grounding and their relationships (Goldkuhl 2004a).

In *value grounding* the goals and values that the design knowledge should help to fulfill was described (c.f., Goldkuhl 2004a; Gregor and Jones 2007). Value grounding is interconnected to *conceptual grounding* since values, and goals include the use of words or constructs; "*grounding of practical knowledge cannot be done without an analysis of the concepts used*" (Goldkuhl 2004a, p.66). Thus, conceptual grounding has included a reference to the existing and possible definitions of constructs in the kernel theory and their relationships. The third type, *explanatory* grounding means, "*that action rules and other practical knowledge are given justification in general explanatory theories*" (Goldkuhl 2004a, p.66). This study used the different constructs initially explained in chapter 3 (e.g., resource liquefying, resource pairing, and resource opting). This type of grounding shows a clear epistemological relationship between normative, prescriptive and explanatory statements; i.e., such statements can be grounded in explanations of a theoretical nature (c.f., Walls et al. 1992; Goldkuhl 2004a). Finally, *empirical grounding* was conducted to evaluate the application of the distinct suggested design knowledge in context. Eisenhardt and Graebner (2007) support the importance of empirical grounding and claim that it supports transparency of the analysis to readers. This grounding-type especially correlates to the evaluation episodes described above. However, in order to identify relevant empirical evidence (e.g., practitioner quotes) for specific design knowledge, a mapping between a quote and the design theory components was conducted. Thus, quotes related to a specific design theory component and its corresponding functionality in the digital resourcing system were selected from a list of all generic empirical quotes collected. By doing so, empirical quotes could provide evidence of and help to investigate whether (or not) the prescribed action worked in practice (Goldkuhl 2004a). Therefore, the result from the empirical grounding was aimed to summarize the verification of the utility, quality, and efficacy of the digital resourcing system and the different components of a design theory.

6.2 DESIGN FOR LIQUEFYING

As described in chapter 3, an essential and theoretical resourcing action inspiring the design of the digital resourcing system was *resource liquefying*. The purpose of the resourcing liquefying action is to support developers to design functionality that help actors to mobilize and decouple resources in order to make them available for actors to utilize through the digital resourcing system. The following sections describe how this initial design knowledge has evolved.

6.2.1 The First BIE Cycle

In the following sections, the first BIE cycle related to resource liquefying is described, meaning that knowledge related to the other resourcing actions; i.e., resource pairing and resource opting are not described here. The different steps in the BIE cycle are presented in sequential order. In reality, however, the design knowledge related to the different resourcing actions emerged in parallel, and the steps in the BIE cycle were overlapping. The decision to separate the descriptions in this dissertation has been to increase the readability.

6.2.1.1 Building

Human actors need to have access to digital resources in order to utilize them. Consequently, the digital resourcing system needs to be designed with features supporting the service providers *first* to mobilize resources and *then* to leverage the willingness of actors to decouple, share, and store them as digital resources. Based on the knowledge identified and described in chapters 2 and 3, the ADR-team could start to design a first version of the digital resourcing system. However, in the first BIE cycle, I also extended the search for justificatory knowledge related to the specific action.

I learned that knowledge (i.e., operant resources) could be distinguished for having both *tacit* and *explicit* dimensions (Polanyi 1966; 1983). On the one hand, explicit knowledge can easily be communicated because it consists of facts, rules, and policies, which can be articulated and codified in writing or symbols (e.g., Zander and Kogut 1995). On the other hand, tacit knowledge is embodied in practice and/or routines, which are not always easy to discuss and teach (Nelson and Winter 1982). Since tacit knowledge does not reside at a conscious level of human minds, it is difficult to decouple, articulate, communicate, and share it with others. In other words, tacit knowledge is 'non-codifiable' (Matzler et al. 2008; Hinds and Pfeffers 2003). Operant resources *always* consist of tacit and explicit dimensions, while operand resources are easier to share because they are more related to explicit knowledge (e.g., Polanyi 1966; Orlikowski 2002; Matzler et al. 2008). Previous research has shown that a digital system (a generic system-level) can facilitate the development of interpersonal connections regarding topics of interest, and by doing so, they are able to support the decoupling and sharing of both explicit and tacit knowledge (Hinds and Pfeffer 2003; Hooff and Ridder 2004). Moreover, it has been realized that a digital system could facilitate forms of social interaction that sharply differ from communication without system support, and this could lead to more personal communication, to a stronger identification with a group, and to more collective behavior (Hooff and Ridder 2004). Simply put, previous research into digital systems has shown that they can offer unique opportunities to overcome barriers of *space* and *time*, but more importantly, they can increase the *willingness* to share different forms of resources (Hammer and Mangurian 1997; Dimmick et al. 2000). These are all conditions that could positively influence the possibility to mobilize and decouple resources, and also the willingness to donate, receive, and store (digital) resources amongst actors in the service ecosystem (e.g., can den Hooff and Ridder 2004; Lusch and Vargo 2014b). However, Lusch and Vargo (2014b) argue that many organizations get sidetracked when they are building up explicit knowledge using for example technical-oriented data-warehousing systems. The reason is that they, by doing so, are ignoring tacit knowledge owned by their employees. The scholars also find that tacit knowledge should be shared by using communication (ibid). This means that the belief of the ADR-team that resource liquefying supported by the digital resourcing system could support human actors codifying and make both operand and operant resources explicit and sharable was strengthened by this extended justificatory knowledge search.

On the contrary, I learned that digital systems offer only limited opportunities for truly social communication because the richness of the resources shared is deeply connected to digitized technology and explicit knowledge (Hinds and Pfeffer 2003; Matzler et al. 2008). In accordance with this view, digital technology is not perceived as a very useful alternative to face-to-face communication and conversations (Flaherty et al. 1998). To reduce this possible barrier and to support service providers with decoupling of mobilized resources (e.g. tacit knowledge) better for a specific time and space, the ADR-team decided to implement functionality in the digital resourcing system supporting face-to-face communication and dialog between a group of individuals (residing at a service provider). This move was strengthened by Hinds and Pfeffer (2003), who found that people who regularly interact through meeting face-to-face *and* who are supported by technology to facilitate the situation show an increased willingness to share their expertise with others; i.e., all parties benefit from the exchange. To conclude, the ADR-team agreed that a face-to-face meeting supported by functionality in the digital resourcing system could support human actors to mobilize and decouple resources, thereby increasing the richness of the resources shared. Such functionality could give strength to service providers facing a known barrier, i.e., the experts' limited ability to explicate and share their operant resources (such as tacit knowledge).

As described in chapter 3, I also had found evidence that if one wants to succeed with resource sharing through communication, developers should set up a communication protocol levering the dialog between actors and therefore supporting them to decouple resources and to make them available to act upon (see also Gummesson and Mele 2010). I had also found that one useful mechanism to leverage communication in a service ecosystem is to conduct process assessment[57] (Getronics 2006; Shrestha 2015). Accordingly, the ADR-team decided that the decoupling activity should be supported by a communication protocol inscribed in the digital resourcing system. The communication protocol should contain process statements (related to ITSM) that should be assessed jointly by the group of service providers.

Against this background, the digital resourcing system was developed to include ITSM best practices and associated process activities presented as *statements* (see examples in Appendix 5). To focus on processes was also a specific requirement from the organizations in the research project, as they referred to the service-oriented characteristic of the context. In point of fact, focusing on processes corresponded well with research describing that processes constitute a crucial part of a digital service and that decisions related to resources are best examined in relation to processes (Davenport 1993; Barua et al. 1995; Davenport and Short 1990; 2003; Ray et al. 2004; Pavlou and El Sawy 2006; Vargo and Lusch 2004; 2008; 2016). Moreover, practitioners argued that it was appropriate to utilize the *current* best practice of the context, i.e., ITIL in the first BIE cycle (e.g., Cannon 2011). They also argued that the statements inscribed in ITIL focusing on certain activities should remain *as-is (*i.e., no changes in this BIE cycle).

[57] Mainville (2014) adds that organizations prefer a light-weighted (less costly and less time consuming) process assessment method.

Apart from designing a communication protocol regarding process statements, the ADR-team agreed that there was a need to build system support for resource mobilization by implementing *boundary objects* (e.g., Carlile and Rebentisch 2001; Carlile 2002). A boundary object embodies and represents knowledge and can be shared (Hinds and Pfeffer 2003). The organizations argued that this design decision could help to draw attention to certain aspects of the digital resourcing initiative and make the mobilization activity more efficient compared to not using boundary objects (i.e., no boundary objects risked to foster too unfocused and inefficient discussions). Moreover, Finke et al. (1992) had shown that individuals are more creative when given operating limits. The communication protocol per se helped to set such boundaries since it directed the communication around process statements relevant to the situation. However, the ADR-team also implemented functionality related to the boundary object of the ITSM best practices. More specifically, that functionality should support a group of service providers and make them want to decouple resources (by communicating) about the statements for a specific process. Another boundary object implemented in the digital resourcing system supported a specific focus on *service providers* (alone) possessing *operant resources*. That is, both practitioners and researchers considered that it was sufficient to develop functionality by supporting the mobilization of *operant resources* possessed by the *service provider*.

The argument in favor of focusing on operant resources was that they were considered to be the most valuable resources from a service perspective (Vargo and Lusch 2004a; 2008; 2016). The argument to focus on resources from *service providers* was that RBT (see chapter 2) suggests a focus on internal resources owned by individuals in the firm. Moreover, the service providers participating in the project often worked in conjunction with many of their customers; i.e., they claimed that they had access to enough resources related to customers' needs. Furthermore, a majority of the current best practices in the context of ITSM are solely directed towards service providers, and therefore organizations argued that it would be enough if the digital resourcing system were directed to that specific actor. The service providers also argued that they already had a good idea of what the customer valued. Practitioner quotes strengthening this assertion were expressed on several occasions during the BIE cycle: e.g., "*We know what our customers value!*", "*Our customers often do not know what they need.*", and "*We often have a better understanding of what our customers need than the customers do themselves.*" In addition, service customers agreed with the specific requirement; they argued: "*We buy a digital service from expert service providers and we expect that the provider to deliver according to an agreement.*" That is, although customers participated in the *design* of the digital resourcing system, the ADR-team agreed that the service providers should have sufficient operant resources available in order to work with digital resourcing. Therefore, the digital resourcing system was initially designed with a focus to extract and use operant resources from service providers as boundary objects.

Against this background, Figure 6.4, and Figure 6.5 illustrates a first version of the digital resourcing system supporting human actors to mobilize and decouple operant resources from the service provider alone. Specifically, Figure 6.4 shows the first version of the functionality supporting a group of service providers to define identified boundary objects supporting the activity of mobilization. Dashed rectangle #1 and #2 in Figure 6.4 shows how the service provider has selected processes from an ITSM best practice (i.e., a boundary object) related to an undefined digital service (i.e., not included in this version). Finally, dashed rectangle #3 shows that the digital resourcing system only took resources from the service provider (another boundary object) into account.

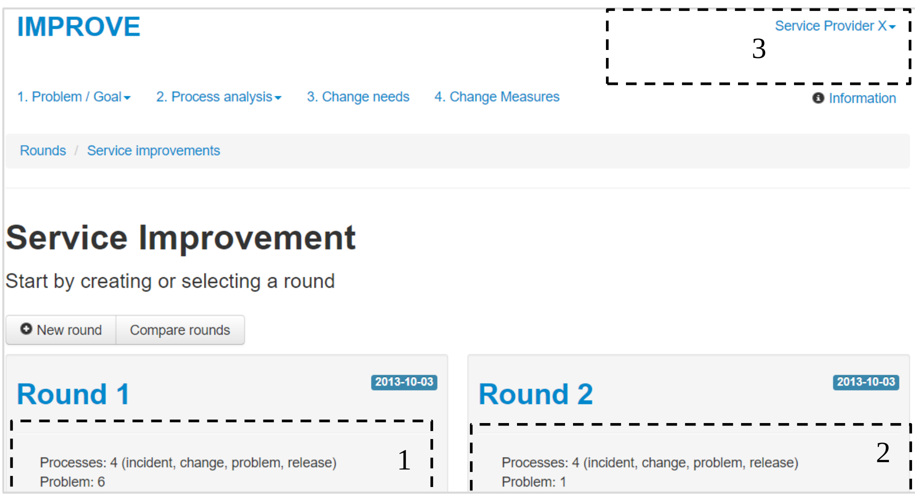

Figure 6.4. Boundary object supporting mobilization (and decoupling) of resources.

Furthermore, Figure 6.5 shows how functionality supporting decoupling was implemented in this version of the digital resourcing system. It illustrates the built-in feature allowing a group of service providers to decouple and share resources by communicating on the subject of the process statements (i.e., a communication protocol). Dashed rectangle #1 and #2 show examples of process statements in the communication protocol supporting decoupling. As previously explained, the process statements were derived from existing processes in practice, e.g., incident and problem management (dashed rectangle #3).

Figure 6.5. Functionality supporting decoupling by using a communication protocol (i.e., statements related to processes).

6.2.1.2 Intervention

When the new design was developed, the ADR-team followed the organization-dominant BIE to intervene in practice. As previously described, the reason was that the BIE form correlated well with the purpose of generating design knowledge, where the primary source of innovation was interventions in organizations. This BIE-form also helped the ADR-team to conduct a comprehensive intervention that involved evaluating the artifact in *multiple* contextual settings. Figure 6.2 shows the different evaluation episodes, while chapter 4 includes a description of the different organizations.

6.2.1.3 Evaluation

The interventions and evaluation in practice revealed both anticipated and unanticipated consequences. First, the face-to-face meetings facilitated by the digital resourcing system, including the communication protocol, encouraged the group of service providers to discuss, and decouple operant resources for the right space and time. That is, as anticipated, the digital resourcing system helped the group of service providers to overcome the barrier related to the explication and sharing of operant resources (such as tacit knowledge). It is difficult to point out exactly what tacit knowledge shared was, but it was clear that knowledge previously hidden was being shared. Practitioners argued; "*the statements of each process make us think and talk about aspects of the digital service that we usually do not talk about.*" Hence, the ADR-team could conclude that process statements constituted a sufficient communication protocol and that it worked as a feasible boundary object supporting practitioners to mobilize and decouple operant resources related to a specific work area. Second, the ADR-team recognized that it was plausible to focus on operant resources owned by humans. The reason for this was that such knowledge and skills related to experiences that individual co-workers had stored in their memory, and as practitioners in the participating organizations put it, "*the system supported us to share knowledge and experiences.*"

Third, the ADR-team could conclude that the digital resourcing system did indeed facilitated resource decoupling, *especially* when the group of service providers met face-to-face to communicate with one another about the process statements (i.e., supported by the communication protocol). This meant, different individuals at the service provider met and discussed separate process statements, which encouraged them to decouple and share resources previously hidden to the *whole* group. The ADR-team also realized that the practitioners referred to experiences from previous work situations, from other colleagues, or customers that were not present in the room. This was interesting because it meant that people who had not been present could share their operant resources through *others* and thereby affect the result. However, during the interventions, the ADR-team also noticed that the service providers referred to facts stored in digital documents, IT-systems, and other technical databases during the conversations. This implied that also, digital resources (i.e., operand resources) were pointed out, decoupled and shared in the group. In this way, a greater stock of digital resources was decoupled and stored and shared amongst all individuals in the group. A quote strengthening the claim that resource liquefying provided utility was; "*We are sharing the knowledge that we otherwise would not share, and the tool [digital resourcing system] provides new insights around our IT processes.* Consequently, the new features supported service providers to share valuable, rare, and inimitable resources, which would be difficult to mobilize and decouple without the digital resourcing system. Although it is difficult to claim that the digital resourcing system directly supported tacit knowledge transfer, the ADR-team argued that the digital resourcing system indirectly supported organizations to put words on the knowledge that had previously been hidden. This could be viewed as a move from tacit knowledge to explicit knowledge that could more easily be communicated and utilized by the whole group of service providers.

Nevertheless, the evaluation episodes (see Figure 6.2 (1a and 1b)) also showed that the design of the digital resourcing system needed to be improved. Practitioners argued that the theoretical and empirical specific requirements that had been implemented simply had not yet resulted in sufficient *utility*, and they did not match all of the artifact goals (see chapter 5). An unanticipated consequence was that the service providers argued that although the operant resources mobilized through the digital resourcing system were promising, they were in no way sufficient. The built-in features simply provided access to too *unilateral* and *biased* digital resources since it was only derived from knowledge owned by service providers. During evaluation, the practitioners had realized that they needed to mobilize and decouple resources from service customers since they possessed valuable resources that could support organizations to create even better value propositions. A quote from a service provider who reinforced this claim reads, *"...our new solutions are only based on qualified guesses around our own [service providers] view*". Another statement uttered was, "*We should bring someone to work together with us, someone who knows the customer*." A rhetorical question asked was, "*Who would be better to collaborate with than the customer?*" This practitioner revelation was vital because it showed that there was ongoing learning in practice, and it finally led to a new specific requirement stating that resources related to other actors (i.e., service customers) should be supported by new functionality in the next version of the digital resourcing system. To sum up, the organizations had, through the digital resourcing system, access to digital resources in the possession of service providers alone (which corresponded well to RBT (Barney et al. 2001)). Now they dismissed this narrow view in favor of more recent research in digital innovation and service science; i.e., research claiming that collaboration between several human actors in a service ecosystem highlights the benefits over 'silo thinking' (e.g., Kappelman et al. 2014; Lusch and Nambisan 2015; Vargo and Lusch 2004; 2008; 2016). Such collaboration "*occurs when a group of autonomous stakeholders of a problem domain engage in an interactive process, to use shared rules, norms, and structures, to act or decide on issues related to that domain*" (Wood and Gray 1992, p.146).

Another unanticipated consequence was that inscribed ITIL process statements were considered as too fixed since they could not be adapted to the context by the organizations. This meant that there was a risk that the wrong themes being discussed, which in turn could lead to the wrong resources being mobilized, decoupled, and stored in the digital resourcing system. Similarly, the ADR-team learned that existing ITIL statements implemented in the digital resourcing system needed to be improved because they were based on a product-oriented perspective (see Appendix 5 for the verifying analysis). This means that the statements were directed solely to the service provider and not to other actors (e.g., service customers) in the service ecosystem. This strengthened the finding that not all necessary resources were decoupled and stored in the digital resourcing system. Consequently, new functionality in the digital resourcing system was needed.

6.2.2 First Reflection and Learning

As described above, the ADR-team had found evidence that the resource liquefying functionality provided benefits already in this early BIE cycle. According to the participating organizations, the functionality provided valuable, rare, and inimitable resources for the *service providers'* organization since resources that were previously hidden in people's memories became decoupled from physical matter, stored in the digital resourcing system, and could be shared amongst the group of service providers.

Based on the knowledge acquired, I formulated a design principle; "*Design for resource liquefying by communication protocols and defined boundary objects*." The findings also supported me to formulate early testable propositions for the design theory; i.e., "*design for resource liquefying fosters improved capability to mobilize resources*," and "*design for resource liquefying fosters improved capability to decouple operant resources from physical matter and transform them into digital resources*." Furthermore, I learned that the mutability of the artifact (see chapter 1) was not satisfactory; it had a low degree of mutability. That is, the possibilities to adapt the digital resourcing system to the situation in a context were not very favorable, since the built-in functionality with regard to statements was too fixed. Moreover, there was too much focus on service providers. However, in relation to artifact mutability, I also realized that the digital resourcing system had the potential to modify and transform their surrounding environment since practitioners using the digital resourcing system got access to resources that had previously been inaccessible. Finally, it was too early to draw any conclusions regarding 'principles of implementation' (see chapter 1), but new knowledge had started to emerge that was directly formulated with an aim to identify contextual characteristics. The emerging knowledge encompassed a belief that the approach to identify and define contextual characteristics at an early stage of a development project could influence developers to make better design decisions, e.g., by identifying boundary objects and the type of communication protocol.

Table 6.2. Summary of consequences related to the first BIE cycle.

Anticipated consequences	Unanticipated Consequences	Comment
Functionality supporting a focus on operant resources should be sufficient. (id 1a)	-	No unanticipated consequence, i.e., in this cycle - operant resources seemed to be sufficient.
Functionality supporting mobilizing and decoupling of resources from *service providers* should be enough.	A need to mobilize and decouple operant resources from complementary sources (i.e., service customers) was recognized. (id 1b)	Became input for the next BIE cycle.
Functionality supporting an existing best practice (i.e., fixed ITIL statements) should support service providers to decouple resources.	Support for contextualized and service-oriented best practices was needed in order to gather digital resources with higher quality. (id 1c)	Became input for the next BIE cycle.
A feature including a communication protocol supporting organization-specific assessment and face-face-communication should leverage resource decoupling.	Communication regarding process statements supported decoupling. However, complementary decoupled resources were needed in order to provide an improved resource base for digital innovation (i.e., the organization-specific assessment was not enough). (id 1d)	Became input for the next BIE cycle.

6.2.3 The Second BIE Cycle

In the following sections, the second BIE cycle related to resource liquefying is described. The different steps in the BIE cycle in the research project tended to overlap. However, in order to facilitate readability, the steps are presented in sequential order, starting with the building part.

6.2.3.1 Building

The ADR-team started the second BIE cycle by returning to theory in order to strengthen previous design decisions and to stimulate inspiration for improvement of design. We started to learn more about (and improve) the existing functionality to identify more resources in the possession of other actors than service providers (see first BIE cycle). For example, we found assertions in theory that strengthened the learnings of the first BIE cycle. Peters et al. (2014) had found that people possessing relevant knowledge are usually recognized as *service customers* (in addition to service providers). The ADR-team also learned that service *must* be conducted through *collaboration* among service providers and customers in a service ecosystem (e.g., Lush and Nambisan 2015). This also strengthened the belief that we should build new functionalities, also supporting service customers to mobilize and decouple digital resources. Although all actors in a service ecosystem are potential resource integrators and innovators (e.g., Lusch and Nambisan 2015), the ADR-team decided to limit the design to support a group of service providers *and* service customers (in dyadic pairs). Practitioners in the ADR-team argued that it would be too inefficient, as well as hard to arrange a situation where more actors than a group of service providers and customers used the digital resourcing system. Hence, a dyadic setting of service providers and customers should be sufficient.

Next, a new, improved version of the digital resourcing system was built. First, the ADR-team improved the process assessment functionality by dividing it into two steps. In the first step, customers and providers used the 'communication protocol' separately to discuss and assess process statements. One reason for this was that the practitioners argued that the human actors would be more open to one another if they discussed process statements in 'their' individual group before sharing results with others. Another reason for the first organization-specific step was that service providers and service customers could perform this action without meeting each other face-to-face, which could save valuable time. Thus, functionality supporting each individual group of service providers and customers was called for.

In the second step, the service customers and service providers should *meet* face-to-face to use the digital resourcing system together. The service customers and providers should use the communication protocol and discuss the results of the individual process assessment activity, and together they compared the result against the process statements (i.e., the communication protocol). The reason to keep functionality supporting face-to-face interaction was that previous research had shown that it would provide better utility than the functionality supporting *non*-face-to-face interaction (e.g., Matzler et al. 2008;

Hinds and Pfeffer 2003). The ADR-team also improved the detailed assessment functionality by adding two new comment fields in the digital resourcing system. These simple fields should allow service customers and service providers to store co-created knowledge (i.e., digital resources) around a process statement. They could also store the reason for why a specific rating of a process statement had been selected (the ratings also fostered fruitful discussions). Another argument for adding comment fields was that they should help practitioners to remember previous discussions over space and time (i.e., the next time they used the digital resourcing system). Finally, and in order to solve the issue regarding process statements that were too fixed, the ADR-team added features suggesting for practitioners to add contextualized best practices, including tailored processes and process statements. The ADR-team also developed a contextualized best practice (holding the processes and statements) inspired by the FPs of S-D Logic (see Appendix 2 and Appendix 5).

Furthermore, the ADR-team had learned that organizations wanted access to resources from *other* sources than the service provider and the service customer (e.g., experiences, data in databases, etc.). In the second BIE cycle, the ADR-team found a need to understand more precisely, from where such resources really resided. This was regarded as relevant knowledge because it could help to ensure that the ADR-team utilized resources from various, useful sources that could fulfill the VRIO framework. I once again started to scan the literature in order to gain a better understanding of the sources and found the concept of *presentification* (Benoit-Barné and Cooren 2009). The scholars claim that presentification "*signify those ways of speaking and acting that are involved in making present things and beings that, although not physically present, can influence the unfolding of a situation*" (ibid, p.10). However, since the act of presentification reflects an *intentional* activity (c.f., Pilerot and Göbel 2016), which is conducted or followed consciously similar to a method, the construct of 'present absence' has been given precedence in this dissertation. 'Present absence' refers to someone or something not being immediately and physically present but still being able to make itself known, i.e., present as part of the resource liquefying action. By doing so, operant resources could be shared from others through the medium of present actors. This term then becomes the opposite of the concept of 'absent presence' (Gergen 2002), where humans *are* present physically but simultaneously rendered absent because they are not wanted to acknowledge in the room (i.e., someone is listening to music on their phones with headphones on and are elsewhere in their minds). The construct of the 'absent present' has previously been theorized with regard to IT (e.g., Pilerot and Göbel 2016), where the emphasis has been on technology's ability to mediate print, speech, images, and sound, thereby fostering time and space-transgressing connections between people. That is, this phenomenon aided the ADR-team in gaining a better understanding of the fact that resources were solely restricted to practitioners or physical databases present in a physical location or if the digital resourcing system could also bring about additional resources from other sources through the discussions supported by the digital resourcing system.

The need for changes was finally transformed and manifested in a new version of the digital resourcing system. Dashed rectangle #1 and #2 in Figure 6.6 show the straightforward functionality allowing practitioners to add a service provider *and* a service customer into the digital resourcing system. This simple improvement could contribute to making practitioners to be aware of other actors and to mobilize and decouple resources from further sources (i.e., service customers). The feature should also support a collaborative approach to digital resourcing, where customers and providers collaborated better in innovation initiatives than before.

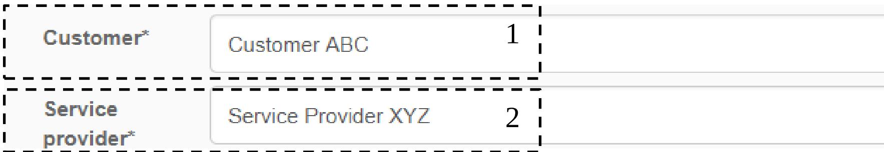

Figure 6.6. Both customers and providers were acknowledged by the new version.

Figure 6.7 illustrates how newly implemented features allowed practitioners to add and contextualize best practices (i.e., processes). The example shows a contextualized framework called ‘Good Enough ITSM’ designed within the research project (dashed rectangle #1). Dashed rectangle #2 shows how processes could be added in the digital resourcing system when necessary, while rectangle #3 and #4 show that it was possible to tailor the content of each process statement, i.e., to create new or to change statements. This feature should also be of assistance to practitioners when adding new process statements that better-acknowledged service customers (illustrated in the dashed rectangle #5).

Figure 6.7. Features allow for contextualized frameworks, processes, and process statements.

Finally, Figure 6.8 shows the new functionality for resource liquefying (#1), which enabled both service customers and service providers to decouple resources based on the communication protocol (i.e., best practice processes and process statements). Dashed rectangle (#2) and (#3) illustrates how the digital resourcing system supported the dyadic actors (a group of service customers and providers) to assess processes. Dashed rectangle (#4) shows statements in a communication protocol related to a process (#7), which had been assessed and rated by the practitioners with comments (#5 and #6).

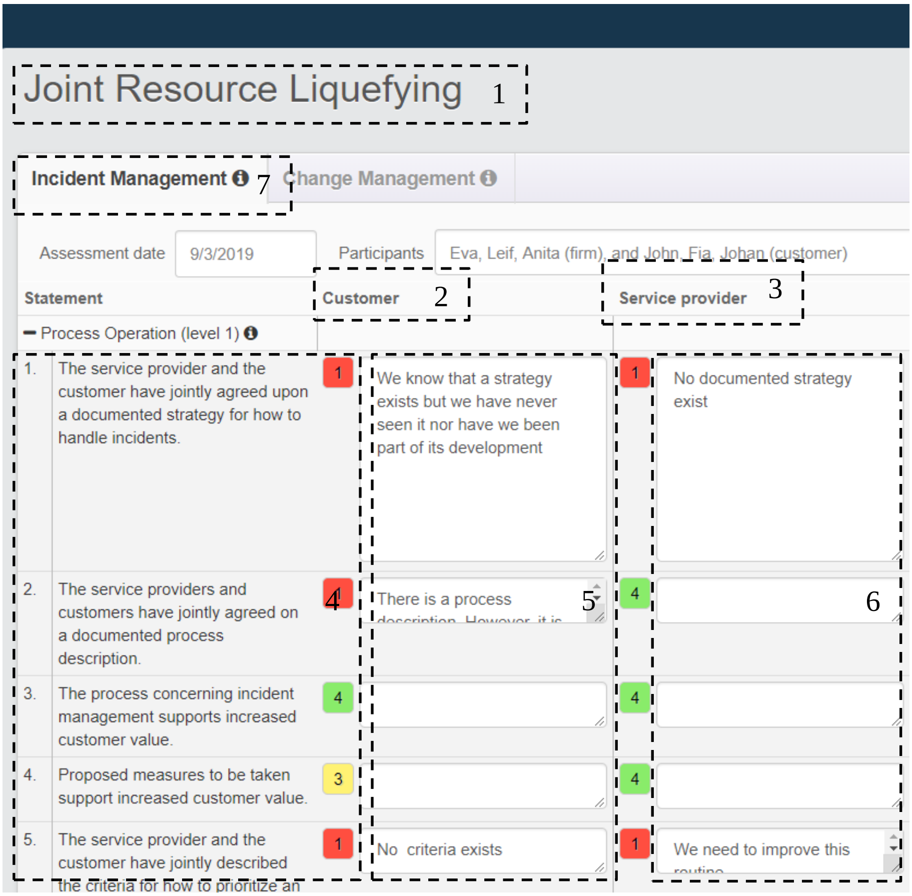

Figure 6.8. An improved digital resource liquefying functionality, supporting service providers, *and* customers.

6.2.3.1 Intervention

The ADR-team followed an organization-dominant BIE to intervene in practice. Figure 6.2 shows the different evaluation episodes, while chapter 4 includes a description of the different organizations.

6.2.3.2 Evaluation

The evaluation episodes of the second BIE cycle revealed that the functionality supporting resource liquefying had been considerably improved in comparison to the previous version of the digital resourcing system. First, the new features allowing contextualized frameworks, processes, and process statements were much appreciated by all practitioners. It enabled them to mobilize and decouple more resources than by using the previous version of the digital resourcing system. The reason was that the new processes and statements (i.e., communication protocol) could support an improved dialog focusing on the right things in the context. One quote strengthening this conclusion was: "*it is terrific that we can add our own frameworks and statements because now we can tailor them to our situation*." Consequently, the ADR-team learned that digital resource liquefying should support service providers and customers in order to mobilize and decouple resources by setting a boundary object and defining *contextualized* processes and process statements.

Second, the new feature allowing an additional actor to participate in the work, i.e., service customers, was successful. It helped to decouple more resources from an increased number of sources. To collaborate over resources correspond well with a contemporary digital innovation view as well as with the S-D Logic perspective (i.e., Lusch and Nambisan 2015; Vargo and Lusch 2008; 2016). A practitioner quote supporting this claim reads, "*we [service providers] appreciate that the tool [digital resourcing system] supports collaboration with the customers now; it provides more knowledge when discussing the service.*" That is, the ADR-team verified that the action to decouple resources should be performed in collaboration between a dyadic constellation of service providers and customers.

Thirdly, the design choice to inscribe a two-step assessment functionality, i.e., to first assess process statements within each group of providers/customers, and then assemble, was recognized as successful. The first individual assessment helped the group of employees from one single organization to agree upon their 'official' organizational view of the situation before the joint discussion. Because of this built-in rating feature, it was difficult for one group to 'hide' and/or 'adapt' ratings and answers to fit in with what the other organization claimed. The functionality therefore increased the practitioners' trust in the digital resourcing system as well as the digital resources identified and stored. One quote supporting this statement was, "*when we didn't use the* [digital resourcing] *system, we could adapt our answers to what we thought the customers wanted to hear. Because of the* [digital resourcing] *system, we cannot 'hide' anymore*". Similar quotes were identified amongst several of the interventions during the second BIE cycle. Thus, the ADR-team concluded that the digital resourcing system fostered honesty and trust amongst the service providers and customers.

Furthermore, the ADR-team could conclude that the built-in communication protocol provided utility (i.e., it helped to mobilize, decouple, and store digital resources). The conclusion also supported the belief that a digital resourcing system fosters a better digital resource foundation for digital innovation than when there is no support of a similar system. A practitioner quote supporting this assertion was, "*The discussions created by the tool [digital resourcing system] are excellent and bring about new information. This information supports us [customers and providers] to identify multiple problems [i.e., knowledge] that we did not know existed*." Since knowledge is mainly tacit and embedded in the context in which it is being used (e.g., Polyani 1983; Hinds and Pfeffers 2003), this was considered an important finding. That is, digital resource liquefying using a communication protocol *forced* the practitioners to discuss different aspects and different experiences that had previously been difficult to talk about, and that had been *unknown* to the whole group. In this way, knowledge was made explicit. Another practitioner quote supporting this assertion was: "*we claim that this joint process assessment feature is the real USP [unique selling point] for this tool [digital resourcing system], and that is also why the tool [digital resourcing system] is so powerful*."

Finally, the ADR-team could *verify* that the group of service providers and service customers referred to digital documents as well as data stored on computers and in various databases, strategies, and policies as well as other human actors not present in the room (i.e., present absence). The practitioners referred to the fact that those non-present humans and non-human sources were in possession of knowledge and skills (resources), and service providers and customers tended to discuss those resources from the perspectives of 'present absent'. That is, the service providers and customers talked about the sources and the knowledge they represented. An example of this situation occurred when practitioners discussed an improved service that the customers' organization had experienced; i.e., better maintenance of a server park. The practitioners focused on issues related to the habits, knowledge, and preferences (operant resources) that were derived from their colleagues who were not present. An utterance supporting this claim was, "*They [the colleagues not present] are always oriented towards the solution that causes the least problems."* Similarly, the practitioners commented on their own respective organization and existing routines and habits; they talked about the "people at the IT department." They asserted, "*Some of our staff contact the helpdesk twice a year whereas others are calling them on a weekly basis*" and "*the IT-department always needs the errand number.*" This is referencing to non-present actors was also manifested in frequent questions brought up during the interventions in practice: "*Is the* *consultant supposed to participate?*" That is, even though the actors' colleagues and other distant practitioners were physically absent, they regularly appeared in the conversations about a process statement. In such a way, they also contributed with knowledge that helped to decouple resources and identify common problems and solution. In effect, resource liquefying helps actors to gather and share operant resources through the present absence. In contrast to previous research (e.g., Gergen 2002), this act seems not to be restricted to technologies such as digitized documents because the ADR-team´s findings show that the digital resourcing system can also bring about experiences from other human actors in conversations, thus evoking present absence. Consequently, this allowed non-present actors to contribute to their resources, which were then shared and used among the present actors (e.g., Pilerot and Göbel 2016).

Although the digital resourcing system performed better in the second BIE cycle, the ADR-team found that further improvements were required. An unanticipated consequence motivating improvements was the fact that that there was too much focus on operant resources (e.g., knowledge, skills, and experiences possessed by humans). This made the discussions amongst service providers and customers too vague, practitioners argued. That is, the risk for misunderstandings between service customers and providers was significant. A practitioner quote confirming this assertion was, "*When using the tool [digital resourcing system], we [service providers and customers] often misunderstood each other. We later realized that we had two different underlying digital services [operand resources] on our minds during the conversations [fostered by the digital resourcing system]*." As a solution to this issue, the practitioners required an additional boundary object since this could sharpen the focus in the dialog between service providers and customers. The idea was to build support to define the *underlying digital service* (i.e., operand resource). This specific requirement corresponds well with a modern service-oriented perspective (see chapter 2).

Finally, the ADR-team found that there was a need to ensure that *all* necessary resources were mobilized. The practitioners argued that there was a risk that actors possessing important digital resources might be omitted in the current version. Omitting resources could hamper the digital resourcing process since there was a risk that omitted resources might have positive effects on the value proposition. A possible solution was to allow practitioners to specify the work-related *roles* (as participants) included in the groups of service providers and customers. The argument was that such a feature could help the practitioners to identify other human actors of the service provider or customer with access to different value enabling resources.

6.2.4 Second Reflection and Learning

The ADR-team had learned that the digital resourcing system incorporating the new features of resource liquefying had improved since the first version. It seemed like the move to allow dyadic actors (i.e., service providers and service customers) to follow the communication protocol together improved the mobilization and decoupling activity, thus providing access to more digital resources than in the previous version of the digital resourcing system. Another reason was that the process statements were contextualized, which encouraged practitioners to direct their attention towards the right aspects of the digital service and context, and thereby transforming tacit knowledge to sharable explicit knowledge more efficiently. The ADR-team also learned that the digital resourcing system allowed for *present absence*. That is, it helped the actors to decouple resources from human actors or other sources not present in the room. This is also a reason why the digital resourcing system leveraged the possibility for human actors to utilize valuable, rare, and inimitable resources, i.e., resources that without the action of resource liquefying would be hard or even impossible to access. Consequently, the digital resourcing system had the potential to leverage competitive advantages through resource liquefying.

Based on the learnings, I could revise the title of the design principle into "*Design for resource liquefying through contextualized communication protocols and defined boundary objects.*" That is, the term *service-oriented* and *contextualized* were added to the title of the principle. There was also a need to revise the description of the design principle to clarify and unfold how the principle could be fulfilled (see chapter 7). The findings in the second BIE cycle strengthened the testable propositions formulated in the first BIE cycle; i.e., *"Design for resource liquefying fosters improved capability to mobilize resources*," and "*Design for resource liquefying fosters improved capability to decouple operant resources from physical matter and transform them into digital resources.*" However, it also supported me to create a new testable proposition; "*Design for resource liquefying fosters improved capability to transfer tacit knowledge to explicit knowledge derived from far-flung sources (e.g., present absence)*." Since the functionality improved the possibility to adapt the digital resourcing system to the context, the degree of artifact mutability was better than before. Therefore, I considered artifact mutability to be of *medium* level. In relation to the design-theory component 'principles of implementation,' I strengthened my belief that developers should identify and reflect upon contextual characteristics in order to create a digital resourcing system (in this case, boundary objects and communication protocols). The 'principle of implementation' was formulated as; "*Design by identifying contextual characteristics*." This principle increases the efficiency of the digital resourcing process because it encourages practitioners to focus on the right aspects of the environment. In a similar way, I learned that developers should recognize and involve multiple actors from various contexts and evaluate the digital resourcing system in those contexts. The reason for this is that the digital resourcing system will be better aligned with the traditions within the context and, therefore, increase the efficiency of the work. The second 'principle of implementation' was labeled; "*Design by recognizing and involving multiple actors from various contexts.*"

Table 6.3. Summary of the consequences from the second BIE cycle.

Anticipated consequences	**Unanticipated Consequences**	**Comment**
Functionality supporting a focus on operant resources should be sufficient. *It is transferred from BIE cycle 1. See id 1a in Table 6.2.*	A need to recognize additional resources was recognized (i.e., operand resources) (id 2a)	Became input for the next BIE cycle.
A need to mobilize and decouple operant resources from complementary sources (i.e., service customers) was recognized. *Transferred from BIE cycle 1. See id 1b in Table 6.2.*	-	Saturation reached
Support for contextualized and service-oriented best practices was needed in order to gather digital resources with higher quality. *Transferred from BIE cycle 1. See id 1c in Table 6.2.*	-	Saturation reached
Complementary decoupled resources were needed in order to provide an improved resource base for digital innovation (i.e., the organization-specific assessment was not enough). *Transferred from BIE cycle 1. See id 1d in Table 6.2*	-	Saturation reached since both organization-specific and joint assessments provided sufficient resources.

	Support to explicate different roles (i.e., sources of knowledge) possessing digital resourcing was needed in order to ensure improved mobilization. (id 2b)	Became input to the next BIE cycle.
	A need to learn more about the concept of present absence that had started to unfold. (id 2c)	To be further investigated.
	Better support to store co-created digital resources (id 2d)	A new field should be implemented.

6.2.5 The Third BIE Cycle

In the following sections, the third BIE cycle related to the resource liquefying action will be described. This constitutes the last BIE cycle. Although the different steps in the BIE cycle overlapped in the research project, they are presented in a sequential order to increase readability.

6.2.5.1 Building

In order to meet the new specific requirement allowing practitioners to specify *roles* from each actor, the ADR-team added a straightforward text field called 'participants.' This field should help the practitioners reflect on what *roles* could contribute operant resources to the digital resourcing work. In order to meet the new specific requirements supporting practitioners to specify and visualize a digital service, the ADR-team added a simple field called 'service.' This was considered a new boundary object since it could help practitioners to improve focus in their discussions and to avoid misunderstanding. The aim was to support practitioners when defining the underlying digital service, e.g., an operand resource as an IT-system or digital infrastructure. The term 'service' was used rather than 'operand resource' since the ADR-team realized that most practitioners recognized the service term when referring to digital technology (please recall that the service term from a service-oriented perspective on resources is more sophisticated than just pointing toward digital technology (see chapter 2)). Finally, the ADR-team developed a simple feature allowing the service providers and customers to add descriptions and comments in the digital resourcing system. The reason was that practitioners believed that extracted resources should be stored in the digital resourcing system for future purposes since there was a risk that they otherwise could forget them and not bring them to forthcoming digital resourcing initiatives.

Figure 6.9 shows how the practitioners defined a digital service (i.e., operand resource), which, in this example, is called ‘e-Drive.’ The field should help practitioners to avoid misunderstandings identified during the second BIE cycle. The figure also shows a new field where multiple participants (roles and names of individuals) could be added to the digital resourcing system. That is, the field allowed practitioners to specify different roles that possessed or had access to additional operant resources related to the specific digital service selected. Roles from both the service provider and service customer should be added in the participant field.

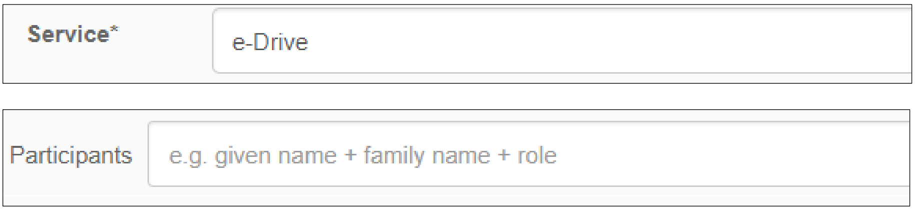

Figure 6.9. The new fields were supporting an underlying digital service and roles.

Furthermore, Figure 6.10 shows a screenshot of the final version of the digital resourcing system inscribing the action of resource liquefying. Dashed rectangle #1 illustrates how service providers and service customers worked together to communicate about statements and to add information as digital resources in the digital resourcing system. The recently developed comment field contains digital resources co-created during the activity (dashed rectangles 1# and #2).

Figure 6.10. Final changes leveraging the resource liquefying action.

6.2.5.2 Intervention

The third BIE cycle was also conducted following the organizational-dominant BIE form. Figure 6.2 shows the different evaluation episodes, while chapter 4 includes a description of the different organizations.

6.2.5.3 Evaluation

The result of the evaluation episodes of the third BIE cycle showed that the functionality of the digital resourcing system, and its associated design knowledge, were sufficient, correct, helped to solve a problem, provided utility, and worked in practice. All participating actors argued that it fulfilled the purpose of mobilizing relevant resources, which could be decoupled and stored jointly by service providers and customers in an efficient way. In other words, resource liquefying was sufficiently inscribed into the digital resourcing system.

One feature that helped to finalize the resource liquefying action was the newly added possibilities to define and focus on both operant *and* operand resources; i.e., making the digital service explicit allowed the practitioners to focus and narrow the dialogs regarding the statements in the communication protocol. Moreover, the result showed that the new functionality, which supported the definition of roles, also improved the mobilization, i.e., attracted the right human actors as members of the work team. A quote strengthening these claims was, "*our discussions have become better because diverse roles participate and focus on the processes of the specific IT-service [i.e., operand resources] defined in the tool [digital resourcing system]*." Finally, the trivial comment field improved the full resource liquefying action. It aided practitioners when defining and storing their shared understandings of specific problems or solutions as well as of knowledge that could be valuable in the future digital resourcing actions. In this way, operant resources that had previously been stored in human brains were mobilized, decoupled, and digitized and saved in the digital resourcing system. In a similar way, resources stored in external digital systems were transferred into the digital resourcing system. Such digital resources were later shown to be useful in the creative resource pairing activity (section 6.3).

6.2.6 Third Reflection and Learning

As described above, the functionality related to resource liquefying provided utility, and both practitioners and researchers were satisfied with the result. No anticipated consequences had been identified during the third BIE cycle (see Table 6.4).

Table 6.4. Anticipated and unanticipated consequences.

Anticipated consequences	Unanticipated Consequences	Comment
A need to recognize additional resources was recognized (i.e., operand resources). *Transferred from BIE cycle 2. See id 2a in Table 6.3.*	None	Saturation reached
Support to explicate different roles (i.e., sources of knowledge) possessing digital resourcing was needed in order to ensure improved mobilization. *Transferred from BIE cycle 2. See id 2b in Table 6.3.*	None	Saturation reached
A need to learn more about the concept of present absence that had started to unfold. *Transferred from BIE cycle 2. See id 2c in Table 6.3.*	None	Saturation reached
Better support to store co-created digital resources. *Transferred from BIE cycle 2. See id 2d in Table 6.3.*	None	Saturation reached

Both operant and operand resources stemming from diverse present and non-present human actors in the service ecosystem, as well as digital resources stored in technical data sources, could be mobilized, decoupled, and shared amongst multiple human actors in the service ecosystem. Tacit knowledge was transformed into explicit knowledge, and a sufficient base of digital resources was stored in the digital resourcing system. Consequently, researchers and practitioners agreed that saturation was reached and that no further BIE cycles were needed in order to verify the design knowledge related to the resourcing action.

Based on the learnings, I did not need to revise the title of the design principle, i.e., "*Design for resource liquefying through contextualized communication protocols and defined boundary objects*" was kept. However, there was a need to change the detailed description of the principle to improve the description of how the principle could be implemented in practice; the full description is provided in chapter 7. Furthermore, there was no need for changes in testable propositions. The formulation of testable propositions from the second BIE cycle were adhered to; 1) *Design for resource liquefying fosters improved capability to mobilize resources, 2) Design for resource liquefying fosters improved capability to decouple operant resources from physical matter and transform them into digital resources, and 3) Design for resource liquefying fosters improved capability to transfer tacit knowledge to explicit knowledge derived from far-flung sources (e.g., present absence)*. In the same manner, the principles of implementation formulated in the second BIE cycle were kept as follows; 1) *Design by identifying contextual characteristics* and 2) *Design by recognizing and involving multiple actors from various contexts*. However, the medium degree of artifact mutability identified during the second BIE cycle had been improved during the final BIE cycle. The reason for this was that the changes in the digital resourcing system allowed for better contextualization (e.g., digital service and roles could be contextualized). Consequently, I learned that the degree of artifact mutability in relation to the action of resources liquefying was *high*. Table 6.5 summarizes the emerging design knowledge related to resource liquefying.

Table 6.5. Summary of emerging design knowledge related to resource liquefying.

Design knowledge/ BIE cycle	Formulation (changes in italic)
Design Principle	
BIE cycle 1	Design for resource liquefying by communication protocols and defined boundary objects
BIE cycle 2	Design for resource liquefying through *contextualized* communication protocols and defined boundary objects
BIE cycle 3	No further changes
Testable Proposition	
BIE cycle 1	1) *Design for resource liquefying fosters improved capability to mobilize resources* 2) *Design for resource liquefying fosters improved capability to decouple operant resources from physical matter and transform them into digital resources.*
BIE cycle 2	1) Design for resource liquefying fosters improved capability to mobilize resources 2) Design for resource liquefying fosters improved capability to decouple operant resources from physical matter and transform them into digital resources.

	3) Design for resource liquefying fosters improved capability to transfer tacit knowledge to explicit knowledge derived from far-flung sources (present absence)
BIE cycle 3	No further changes
Artifact Mutability	
BIE cycle 1	Low degree of mutability
BIE cycle 2	*Medium* degree of mutability
BIE cycle 3	*High* degree of mutability
Principles of Implementation	
BIE cycle 1	Design by identifying contextual characteristics
BIE cycle 2	1) Design by identifying contextual characteristics *2) Design by recognizing and involving multiple actors from various contexts*
BIE cycle 3	No further changes

To summarize the 'reflection and learning' in the third BIE cycle, the four grounding processes; i.e., value-, explanatory-, conceptual-, and empirical grounding, were used (see sections to follow).

6.2.6.1.1 Value Grounding

An evaluation of the design knowledge justifies the claim that the resource liquefying action enables value for organizations. It enables value since it adds knowledge about *how resource liquefying* could be performed in practice and how it could be implemented in a digital resourcing system. The design knowledge identified differs from previous suggestions concerning digital systems that utilize only operand resources stored in technical databases (e.g., Lusch and Vargo 2014b, Yoo et al. 2010b). In contrast, this design knowledge supports mobilization and decoupling of both operand (digitized) resources stored in databases *and* operant resources owned by human actors, which implies a wider perspective of the resources to utilize in the digital innovation process. In a similar way, this design knowledge is valuable since it has shown that resources can be mobilized and decoupled from actors that are *present absent* and then stored in the digital resourcing system. All of these resources decoupled from various, and sometimes, far-flung locales in the service ecosystem add knowledge to the digital resource base and support forthcoming digital resourcing actions. This means that a group of human actors from service providers and customers can mobilize and decouple more high-quality resources than previously expected.

Moreover, the design knowledge supports actors to transfer tacit knowledge to explicit knowledge, *and* it shows how a service-oriented perspective can be supported by a digital resourcing system. Consequently, resource liquefying supports the identification of valuable, rare, and inimitable resources, which can increase the competitive advantages of organizations in the service ecosystems.

In addition, the design knowledge is valuable because it helps to fulfill all artifact goals (see chapter 5.2). It meets the first artifact goal (i.e., a contextualized and easy to use web-based IT artifact enabling digital innovation). The reason is that the design knowledge constitutes an important action in digital resourcing while it considers characteristics in the context, i.e., it is *contextualized*. Moreover, the knowledge directly contributes by meeting the second artifact goal (i.e., focus on digital resources through process assessment). The argument is that the knowledge emphasis developers to use communication protocols through process assessment, supporting mobilization, decoupling, and storing of digital resources. The design knowledge also corresponds well with the third artifact goal (i.e., it puts a specific focus on the initial activity of the digital innovation process). The reason for this is that it aims to fulfill an essential part of the digital innovation process; i.e., to build a sufficient digital resource base, which can leverage forthcoming actions within the digital innovation process. Finally, it supports the fourth artifact goal (i.e., to provide utility). The reason is that evidence has shown that it helps to mobilize and decouple resources, which can be stored in the digital resourcing system.

6.2.6.1.2 Conceptual grounding

Figure 6.11 illustrates a model aiming to visualize and further explain the relationship between different constructs related to digital resource liquefying. These constructs are mobilization, decoupling, operant and operand resources, communication protocols, and human actors (including present absent actors) in service ecosystems. The figure shows how dyadic actors (i.e., a group of service customers and providers) mobilizes relevant operant and operand resources within selected confines (i.e., boundary objects). Such resources include tacit knowledge, which can be stored in the digital resourcing system but also already digitized resources stored in databases. With the support of dynamic communication protocols, the actors can decouple and share digital resources. Through the construct of *present absence*, the actors could identify even more digital resources within the confines set. Consequently, via the actors who were present, absent human actors could also share knowledge and experiences in the digital resourcing action. These constructs have been presented and described in more detail in previous sections, as well as in the second and third chapters.

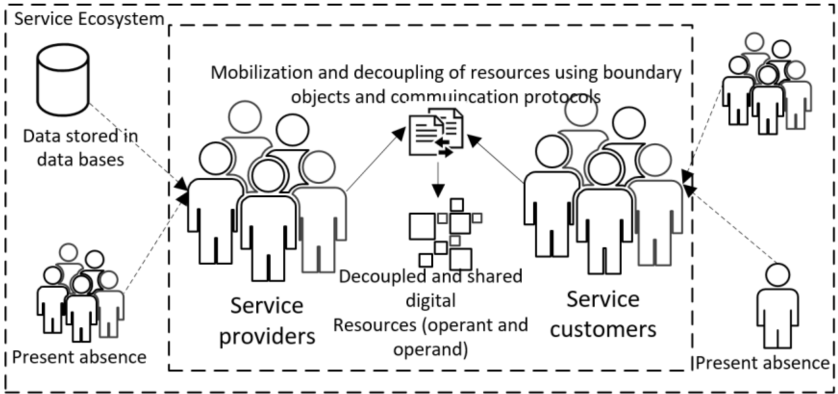

Figure 6.11. Model of resource liquefying.

6.2.6.1.3 Explanatory grounding

In order to leverage the discovery stage of digital innovation, there is a need for several human actors in the service ecosystem to pair digital resources related to problems and novel solutions (see section 6.3). A prerequisite for that is digital resource liquefying. It helps to mobilize both operant and operand resources for a specific space and time and then to decouple such resources from their physical matter and store these in a digital resourcing system. The co-created digital resource base could then leverage the more creative digital resourcing actions (chapter 3). The design knowledge related to resource liquefying supports diverse actors originating from the service provider and service customer to mobilize resources from various data sources (i.e., human actors and technical sources). Moreover, it helps human actors to decouple the mobilized resources from their physical matter (e.g., human brains or databases) and to store those as digital resources in the digital resourcing system. In other words, resources will be decoupled or unbundled from a material object, and it will be available for actors to act upon (e.g., Normann 2001).

An issue identified has been that operant resources (e.g., knowledge and skills) vary in their transferability (e.g., Grant, 2001). The critical distinction is between ‘explicit knowledge,’ which can be articulated (and hence transferable at a low cost), and ‘tacit knowledge,’ which is manifested in its application and is transferable at a high cost (ibid). By assessing specific processes statements using communication protocols that are inscribed in the digital resourcing system, tacit knowledge is transferred to explicit knowledge, which is easier to store and share. The explanation is that the digital resourcing system facilitates focused interactions and communication between human actors, and it is through the interactions leveraged by communication protocols that previously hidden operant resources are brought to light and finally stored in the digital resourcing system (e.g., chapter 2 and 3 or Lusch and Nambisan 2015).

Although the digital resourcing system mainly focuses on the operant resources possessed by the dyadic human actors working with the digital resourcing system, it also acknowledges existing digital resources in technical databases, digital documents, and resources possessed by actors who are not physically present. That is, digital resources stored in the digital resourcing system with origins from various data sources. First, resources are extracted from the present actors (i.e., service customers and providers) with the support of a contextualized communication protocol. Second, digital resources may originate from technical sources such as databases or digital documents. Third, resources may originate from other human actors, not physically present in the room. The latter refers to the construct of *present absence*. In this way, the dyadic human actors of service customers and providers physically present could be looked upon as carriers of operant resources from other parts of the service ecosystem. Those resources are shared and stored (digitized) because of the discussions facilitated by the digital resourcing system. In this way, the digital resourcing system can *evoke* other actors who have not been present when the digital innovation initiative was taken (c.f., Pilerot and Göbel 2016). This is in line with Lusch and Nambisan (2015), who argue that for most form of human civilization, knowledge and information has been embedded in physical matter (e.g., human minds, technical devices, writings, or even drawings on stone and paper). This study shows that for that matter to be useful, it must be mobilized, decoupled and shared with others. Resource liquefying, as part of a digital resourcing system, enables these activities.

To sum up, the design knowledge related to digital resourcing creates benefits to the practitioners in the digital resourcing initiative because it mobilizes and decouples operant and operand resources from various sources. It stores those (digital) resources in the digital resourcing system, which constitute the building blocks used in the forthcoming resourcing activities. This means that resource liquefying is crucial for the discovery stage of the digital innovation process.

6.2.6.1.4 Empirical Grounding

During the description of the three BIE cycles above, empirical evidence extracted from the formative evaluation episodes has been presented. In this section, a selection of quotes from the summative evaluation episodes are restated. The argument for this procedure is to provide further evidence that reinforces the utility of the identified design knowledge and of the digital resourcing system. The benefits of implemented design knowledge have shown to be that it supported a better mobilization and decoupling of resources than without the design knowledge inscribed in a digital resourcing system. A reason for this was that human actors using the digital resourcing system were guided to talk about important matters, which they did not do when not having access to a digital resourcing system. The focus on communications and debates also helped to make tacit knowledge explicit. Quotes supporting this assertion are; *"The* [digital resourcing] *system supports us to identify knowledge that we would not otherwise have discovered," and "we get access to valuable resources that we did not know existed*." Moreover, practitioners claimed, *"The discussion around statements is more rewarding than if we were not supported by a digital [resourcing] system."*

A positive effect of the implemented design knowledge was that it provided a shared view on the current practice (what and how of value proposition). This was achieved through digital resource liquefying; i.e., mobilization and decoupling of resources. The practitioners stated the following: "*We now understand that we [service customer and provider] are both needed to fulfill the service proposition and that we need to work together*." Other quotes strengthening the significance of the design knowledge for resource liquefying are:

- "*The [digital resourcing] system forces us to learn from each other [i.e., customers and service providers]*"
- *"Communication [through communication protocol] is better when focusing on certain aspects [i.e., boundary objects]"*
- *"The built-in focus [i.e., boundary object] supports clarity."*
- *"The IT-system supports the service customer and provider to share and discuss important matters that never would have been discussed without the tool [digital resourcing system]."*

Another positive benefit of the implemented design knowledge was that the service providers and customers could *trust* the digital resources that had been mobilized, decoupled, and generated using the digital resourcing system. This was an immediate effect of the assessment in the communication protocol. Examples of quotes supporting this claim are;

- "*Because of the IT-system, one cannot change information to better fit a response of the other actor. i.e., we get access to true information".*
- *"One cannot hide [cannot avoid discussing certain aspects that they could without the digital resourcing system]."*

Quotes providing evidence that the boundary objects worked were:

- *"It [The digital resourcing system] support us to focus better than before."*
- *"It [The digital resourcing system] supports us in setting the most important boundaries."*
- *"It is easy [to work with resourcing] when focusing on processes."*

- *"It is good that we [service customer and provider] set boundaries together."*
- *"We [service customer and service provider] rapidly found the right service to focus on."*
- *"The boundaries help to identify where to direct our resources."*
- *"The boundaries form a foundation for a focused innovation discussion."*

Moreover, the empirical material showed that the dyadic actors of service providers and customers were referring to other people, e.g., customers, providers, and colleagues, who were not present in the actual room using the digital resourcing system, but who related to the selected boundaries. Consequently, the design knowledge supported actors to gather and decouple operant resources from human actors who were present using the digital resourcing system *and* human actors who were absent. The practitioners referred to the fact that they had different sets of competencies, which comprised of different discourses and different work experiences. They tended to discuss the activities from their perspectives of the two organizations that they represented. An example of this situation was when the practitioners who discussed a potentially urging need that the customer's organization experienced (i.e., maintenance of a server park related to a specific digital service and process). The actors concentrated on issues related to the habits and preferences that were derived from their colleagues, who were not present. A quote supporting this claim was, "*They [i.e., colleagues] are always oriented towards the solution that causes the least effort.*" Similarly, the service provider and customer referring to their own respective organizations and existing routines and habits; they talked about their "*existing processes*" and the "*people at the IT department*." They asserted that "*some of our staff contact the helpdesk twice a year whereas others are calling them on a weekly basis*." Evidently, even though the actors' colleagues and other distant actors were physically absent, they appeared in the conversations about the boundary objects and in that way they, contributed with resources that helped to identify, formulate and share resources as well as *increasing* the resource base (operant resources), providing an excellent and focused foundation for digital innovation. Finally, the human actors who were present referred to digital documents or data in databases, which could be stored as digital resources in the digital resourcing system. This was also manifested in the frequent dialogs that took place during the interventions in practice.

6.3 DESIGN FOR PAIRING

The overall purpose of the second resourcing action, *resource pairing*, is to encourage human actors to jointly pair, combine, and recombine digital resources in order to co-create solutions holding a novel value proposition. This should be carried out by service providers and customers who pair resources related to problems with co-creative solutions or vice versa (see chapter 3). These activities correspond well with the theoretical definition of digital innovation that implies that different actors in service ecosystems should recombine digital resources in order to create novel resources (i.e., 'innovations') and present those as a value-enabling digital service (e.g., Lusch and Nambisan et al. 2015; Henfridsson et al. 2018). The resource pairing action should utilize digital resources from the previous resourcing liquefying action (section 6.2). In the following sections, the emergence of design knowledge, related to resourcing pairing, is further described.

6.3.1 The First BIE Cycle

The first BIE cycle related to resource pairing is presented in the sections to follow. This means that the emergence of design knowledge related to the other resourcing actions, i.e., resource liquefying and resource opting (see chapter 3), will not be described in the following sections. Moreover, the different steps in the BIE cycle are presented in sequential order. In reality, however, the design knowledge related to the different resourcing actions emerged in parallel, and the steps in the BIE cycle were overlapping. The reason to separate the descriptions in this dissertation is to increase readability.

6.3.1.1 Building

Based on the initial justificatory knowledge identified and described in chapters 2 and 3, the ADR-team started to construct measures in support of problem identification. A strong reason for building support for problem identification was that it constitutes an opportunity for digital innovation and that it is a well-known management adage that "*understanding the problem is half of the solution"* (c.f., Jonassen 2000; von Hippel 2005; Lloyd et al. 2011; von Hippel and von Krogh 2016). Another reason to build support for problem identification was that a *problem* could be viewed as part of a problem-solution pair (Nambisan et al. 2017). Moreover, the organizations in the project argued that they were used to starting innovation initiatives by first identifying and defining a problem that needed to be solved.

I had previously noted that the communication protocol used in the resource liquefying action could constitute an excellent approach to the identification of problems; i.e., the ADR-team already had built-in functionality supporting an assessment approach, which boosted debates where problems related to process statements were identified and discussed. More specifically, the ADR-team argued that service providers could draw on the assessment results and compare their current situation against the process statements in the implemented best practice. In this way, an implemented best practice (e.g., ITIL) constituted a '*design pattern*' that could be used to benchmark a situation of *as-is* with a situation *to-be* (e.g., Nambisan et al. 2017). A design pattern conveys knowledge about how something ultimately should work in practice, which in turn could constitute a resource base for how digital resources should be combined in order to form a solution that enables improved value (e.g., Nambisan et al. 2017). In other words, a design pattern inscribed in the digital resourcing systems could potentially help human actors to find problems *and* solutions. Another argument for utilizing a process assessment feature in the digital resourcing system was that *assessment* had previously been found to support problem identification in similar ITSM contexts (e.g., van Loon 2007; CMMI Product Team 2010; Göbel 2014; Shrestha 2015). This shows that assessment has a dual purpose, i.e., to foster communication when mobilizing and decoupling resources (section 6.2) and to support the identification of problems and solutions in combination with a design pattern.

Next, the ADR-team built a rating functionality, by allowing service providers who communicated over and assessed statements, to agree on and to put real numbers on a statement (see chapter 5 and section 6.2). That is, if the service providers thought that they worked according to a defined process statement, they put a high number in a dropdown box, otherwise a low number. The ratings were inspired by a Likert scale (c.f., Albaum 1997). For the 5-point Likert scale inscribed in the digital resourcing system, each scale-point was labeled according to an 'agreement-level': 1) fully agree; 2) mostly agree; 3) partly agree; 4) do not agree; and, 5) does not apply. According to Li (2013), the Likert scale labels may be worded differently depending on what is being measured, but the ADR-team found no argument for using another scale. If required, the service providers could also add a comment in accordance with each rating explaining why the specific rating number had been chosen in relation to a statement. The fact was, the service providers alone were supposed to identify and agree on existing problems that needed solving by assessing and rating statements (and in parallel decoupling and sharing knowledge). This gave rise to the designing of this feature (see Figure 6.12).

In effect, the ADR-team was inspired by the construct of *resource integration*, as a means to support the creation of novel solutions (see also chapters 2 and 3). Resource integration represents a continuous process defined as a series of activities performed by an actor for the benefit of another party (Payne et al. 2008; Peters et al. 2014). Current theorizing on resource integration supported the ADR-team with valuable information for a novel design. For example, previous research has shown that resource integration should be conducted by common organizational *structures, processes, and sets* of principles (e.g., Lusch and Nambisan 2015). Although this information is helpful, no examples of such structures, processes, or principles are provided by the scholars. Moreover, the ADR-team found that the *interaction between actors* is mandatory for resource integration (Gummesson and Mele, 2010). Such interaction should be conducted through a *dialogue* where knowledge and other resources could be transferred; i.e., actors can interact to communicate *needs* and wants as possible solutions (ibid). This knowledge aligned well with the knowledge found in relation to resource liquefying (see section 6.2), and the ADR-team argued that solutions discussed during resource liquefying could also support the resourcing pairing action. Consequently, effective integration becomes a matter of resource matching; *"...resource integration is characterized by the 'configurational fit' of the resources, activities, processes that see the matching both in terms of internal configuration - within an actor - and external configuration for the whole network or a subgroup within it*" (ibid, p.193). However, as indicated above, an initial challenge met within the first BIE cycle was that existing studies mainly focuses on actions related to value-in-use and not on prescriptive guidelines supporting *how* to co-create novel value propositions as a digital service. Consequently, the ADR-team needed to adapt the knowledge of resource integration to make it comply better with the purpose of digital resourcing.

Based on the knowledge acquired, functionality supporting service providers on their own to match resources centering on identified problems with process statements, and goals[58] were developed. This functionality should support the actors in co-creating grounded *needs*. Identified needs should then provide a base for creating new solutions holding value propositions. In this sense, the resourcing action of pairing could be regarded as the matching of solutions fulfilling a real problem/need that resulted in a new or changed value proposition. This form of pairing, where problems are identified first and then paired with solutions, is known as a *formal* problem and solution pairing (von Hippel and von Krogh 2016). All, activities above were designed to be based on the available digital resources stored in the digital resourcing system (see section 6.2).

Figure 6.12 shows how service providers assessed and agreed on a rating (dashed rectangle #4-6) for each statement (dashed rectangle #1-3). Figure 6.13 shows how actors could match/pair resources (dashed rectangle #4-6), which were then used to define and describe a specific need (not visible).

[58] According to Jung (2012, p.209) "*The importance of effective goal setting is old news to scholars in the fields of public administration, political science, and management, as well as practitioners in both the public and private sectors.*"

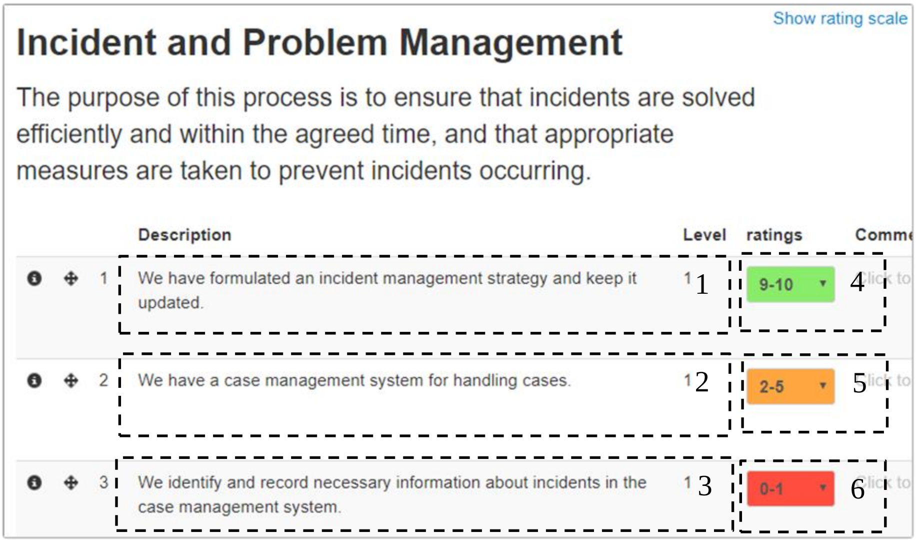

Figure 6.12. Process assessment and the rating functionality.

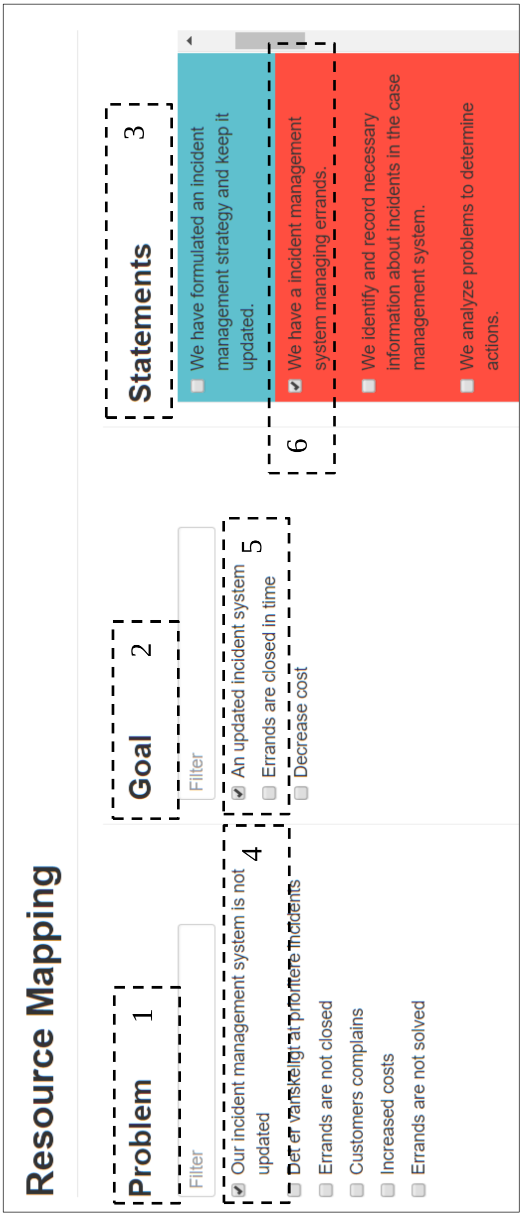

Figure 6.13. Mapping or resources supporting pairing.

Finally, Figure 6.14 illustrates how the group of service providers could co-create and add new solutions (dashed rectangle #1). The solutions were based on identified resources related to needs (dashed rectangle #2) and problems (opens as a popup (i.e., dashed rectangle #3)) and visualized in a simple table. Each of the created solutions had a description, a responsible person (i.e., who was to make sure it was implemented), and information about the estimated work effort to implement it in practice.

Figure 6.14. The first version of digital resource pairing.

6.3.1.2 Intervention

As previously described, the first BIE cycle was conducted following the organizational-dominant BIE form. Figure 6.2 shows the different evaluation episodes, while chapter 4 includes a description of the different organizations.

6.3.1.3 Evaluation

During the evaluation episodes, the ADR-team detected anticipated as well as unanticipated consequences. An anticipated consequence was that the design pattern was inspiring service providers to compare their current situation (*as-is*) to a best practice (*to-be*). This helped them to identify problems with the practice, but it also pointed them toward solutions. All organizations agreed that; "*It [the digital resourcing system] supports us to identify and agree on problems.*" Another anticipated consequence was that the functionality related to resource pairing aided service providers to generate novel value propositions. A service provider quote supporting this claim was "*we are generating innovations [i.e., solutions with value propositions] in a structured approach.*" That is, during the evaluation, every intervention in practice resulted in several improvements in practices or in digital service(s). Examples of improvements identified were new routines, new activities in the incident management process, and a decision taken for a new version of an existing errand system.

However, we also acknowledged a need for improvements in the digital resourcing system. First, and in a similar way as for the resource liquefying (see section 6.2), the practitioners argued that customers should be co-producers of the novel value proposition, which also corresponded to justificatory knowledge previously identified. A quote from a service provider reinforcing that assertion was, "*We [service providers] are merely guessing what the customer really needs and wants, it would be better if the customers join us.*" Consequently, there was a need to include more human actors (i.e., different roles from those of the service customers) also in the resource pairing action. Another unanticipated consequence identified was that the service providers argued that the functionality of resource pairing was too ambiguous, complex, and ineffective. Instead of directing attention to the creative pairing activity, practitioners were asking questions about how they should use the digital resourcing system and how the pairing functionality actually worked. They also argued that this pairing functionality, where problems, goals, process statements, and solutions, should be matched with each other, was an inefficient step and that they did not need any support for all mapping steps. Quotes confirming this claim was "*We don't need this functionality [resource pairing] because we already know the relationships between needs, goals, and the problems we identified. You know, we just participated in the previous conversations [resource liquefying], and therefore there is no need to transfer problems to goals*". A similar quote was "*It is enough to generate innovations based on* *the shared problems, not goals and needs which are basically the same as the problems.*" Consequently, there was a need to improve the pairing functionality in the digital resourcing system of the second BIE cycle.

A similar unanticipated consequence identified during evaluation in practice was that all actors, without exception, started to discuss solutions in parallel with the problems identified. Although the ADR-team had designed the digital resourcing system to support actors *first* in identifying problems and *then* focusing on solutions (i.e., formal pairing), they often discussed novel value propositions first (i.e., a solution to *non-identified* problems). This was carried out despite the fact that the ADR-team had carefully instructed the actors not to discuss solutions before problems. Accordingly, researchers and practitioners agreed that there was a need to embrace this very innovation-oriented culture found in the context and to build support to store the solution popping up as digital resources. That is, the concept of problem and solution pairing started to evolve because the borders between problems and solutions had been blurred. Thus, the ADR-team agreed that there was a need to improve the digital resourcing system in order to cope better with contextual requirements identified in the second BIE cycle.

A final unanticipated consequence was that there was an increasing need to develop support for *prioritization* of the different problems (gaps between the design pattern and contextual situation) and for solutions identified. The argument was that practitioners could not risk or afford to work with *all* the identified problems or solutions but only with the ones that were crucial and important to solve for both practitioners and customers. The practitioners did not mean that the other problems/solutions identified were unimportant, but that they could be on hold and stored in the digital resourcing system for the future. Hence, the ADR-team needed to refine the digital resourcing system to support also this specific requirement during the next BIE cycle.

6.3.2 First Reflection and Learning

In the first BIE cycle, the ADR-team learned that we had taken a step in the right direction but that the design had not yet been accomplished. First, we had learned that the digital resourcing system could be used by the service providers to identify and agree on problems. One reason for this was that the conversations directed towards statements of a *to-be* situation (i.e., certain aspects of the practice) allowed the service providers to discuss aspects that they otherwise did not discuss in a structured way. Another reason was that the rating system helped them to decide whether something should be classified as a problem or not. However, we had also learned that *too many* problems were identified and that practitioners argued that it was impossible for them to deal with all of them in parallel.

Furthermore, the ADR-team learned that service providers successfully utilized the decoupled digital resources from the previous liquefying action successfully and integrated them through the resource pairing functionality. By using the design pattern, they were able to generate novel solutions to a problem while affecting the value proposition positively. Consequently, there was no need to build other explicit functionality supporting actors for the creative activities. That is, the discussions fostered by the current functionality were significant enough to co-create novel value propositions. In this way, innovations were based on rare resources because decoupled resources were paired, continuously, and reorganized, fostering even rarer, and harder-to-imitate, digital resources. From this perspective, the initial resource pairing functionality enabled the service providers to integrate resources in an organized and unique way, which corresponded well to the VRIO framework (Barney and Clark 2007). Evidence of this statement is the fact that novel solutions were generated and finally implemented in practice. A simple example of such a change was that one of the organizations realized that they needed to improve their release process and decided to add a new activity in the process. The activity included sending out emails notifying all users of the digital service before *and* after the deployment of the new version. Practitioners argued that the change of the service enhanced value since customers were 'better off' and that the customer complaints had decreased. However, as stated above, the practitioners were not satisfied with the functionality since pairing functionality was still regarded as ineffective. Consequently, the ADR-team agreed that we had to continue improving the design in the next BIE cycle.

Finally, I formulated an initial design principle from the learnings in the first BIE cycle. The design principle was formulated as "*design for resource pairing by formal problem-solution pairing supported by design patterns*." This implied that resourcing starts with a list of identified and formulated problems, which then could then be used as a basis for the creation of solutions. Because of the findings and evidence available in the BIE cycle, an initial testable proposition could also be formulated in the reflection and learning phase: "*formal resource pairing leverage novel value propositions*." In this first BIE cycle, artifact mutability was considered to have a low degree of mutability since there was only one structured and strict pairing approach to support the action. No additional principles of implementation were identified during the BIE cycle (apart from the one explained in relation to resource liquefying in section 6.2).

Table 6.6. Summary of anticipated and unanticipated consequences from the first BIE cycle.

Anticipated consequences	Unanticipated Consequences	Comment
Pairing by service providers is sufficient.	Support for more actors in the service ecosystem (i.e., service customers) was needed. (id 1a)	Became input for the next BIE cycle.
Resource matching between statements, goals, needs, and problems will support the action	Resource pairing and matching of statements, goals, needs, and problems reduced the efficiency in the resource innovation process. A need for easier paring was needed. (id 1b)	Became input for the next BIE cycle.
It is sufficient to focus on problems and then solely on solutions.	It was not possible to discuss problems and then solutions alone (formal problem-solution pairing). Functionality supporting formal *and* informal pairing was requested. (id 1c)	Became input for the next BIE cycle.
	There was a need for problem/Gap prioritization since there were too many problems identified. (id 1d)	Became input for the next BIE cycle.

6.3.3 The Second BIE Cycle

In the following sections, the second BIE cycle related to resource pairing will be described. In the same manner, as in the previous BIE cycle, the different BIE steps follow the organization-dominant BIE form, and they are presented in a sequential order to increase readability.

6.3.3.1 Building

Based on the unanticipated consequences and specific requirements identified in the first BIE cycle, the ADR-team rebuilt the digital resourcing system to give better support to resource pairing. The ADR-team started to discuss how the digital resourcing system could include considering the service customer in the resource pairing action. After joint reflection and discussion workshops, we decided that we did not need to build a *specific* functionality to consider customers' views in the resource pairing action. The argument was that it should be sufficient to bring the customers to the face-to-face meetings with service providers, thus joining the resource pairing action. In this way, the pairing functionality should become generic and suit any actor or role in the service ecosystem, which was likely also to increase the degree of artifact mutability.

However, the ADR-team still needed to redesign the pairing functionality because it was considered to be comprehensive and complicated, meaning that it was ineffective. Although all practitioners agreed that *goals* were relevant (which is very much in line with the literature, (e.g., Locke and Latham 1990; Locke 2000)), they argued that they already were aware of the overarching goal and purpose with the digital resourcing initiative and their own organization, and that therefore there was no need to restate it in the digital resourcing system. Hence, the ADR-team simply removed the developed feature related to goals[59]. In a similar way, the practitioners argued *needs* correlated largely with *problems,* and therefore the 'needs' feature was removed, while the problem feature was kept. The reason was that the ADR-team had learned that the practitioners (both service customers and providers) preferred discussing problems and relating them to solutions (or vice versa).

In the first BIE cycle, the ADR-team had also learned that practitioners were extremely solution-oriented, and that they often, by using the design pattern, instantly came up with new solutions to identified and shared problems. More importantly, we had also noticed that practitioners using the digital resourcing system identified solutions without having identified a problem. This was obviously a positive effect of the discussions, but to provide even better support for this contextual characteristic, the ADR-team decided to develop a *solution/idea-capturing* feature. The new functionality was to support the need of practitioners first to add *solution*s and *then* to define the corresponding problem if necessary. In this way, a complementary approach to *formal* problem-solution pairing was designed, i.e., informal pairing. Although this new feature was seen as part of resource pairing activity, it was implemented as a list-box in the previous action (i.e., resource liquefying). As previously explained, the reason was that we had noticed that many solutions were discussed already during the resource liquefying action. The ADR-team also found support for this solution-capturing functionality in existing idea management solutions (see Appendix 5) and in the literature; i.e., solutions created during brainstorming sessions should be captured in some acceptable manner so that it can be communicated to others and developed further into a more elaborated concept (Gaynor 2002; Du Preez and Louw 2008; Fichman et al. 2014; Kohli and Melville 2019). These findings, emanating from both practice and theory, strengthened the belief that the new functionality should be implemented within the

[59] As previously mentioned, the ADR-team also removed the cause-effect functionality for problems and goals.

digital resourcing system. Finally, the ADR-team developed a simple problem-solution prioritization feature. That feature was intended to help increase the efficiency in the innovation work since it would force the actors to jointly select one or several of the identified problems and solutions, which would be in focus during the forthcoming resourcing action (see section 6.4).

Dashed rectangle #1 in Figure 6.15 illustrates the functionality of *solution*/*idea capturing*. In this case, service providers and customers (dashed rectangle #2) jointly paired solutions (i.e., dashed rectangle #1) to a problem gap between service customers and providers. Trivial checkboxes (i.e., dashed rectangle #3) were added to support actors to pinpoint the most critical resource problems.

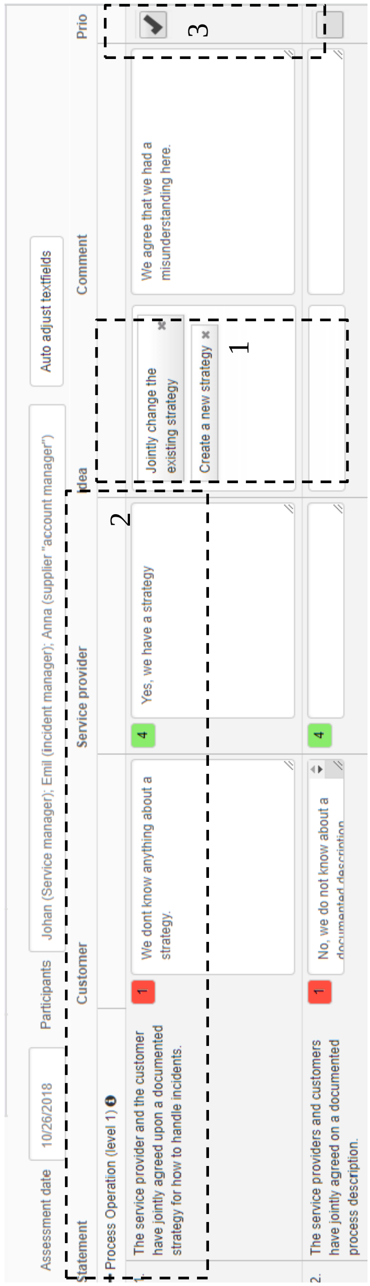

Figure 6.15 Second version of resource pairing; solutions (#1) could be paired with problems (#2).

6.3.3.2 Intervention

The second BIE cycle was also conducted following the organizational-dominant BIE form. Figure 6.2 shows the different evaluation episodes, while chapter 4 includes a description of the different organizations.

6.3.3.3 Evaluation

The outcome of the evaluation episodes showed that the resource pairing functionality worked better compared to the latest version of the functionality. First, the simple problem-solution prioritization functionality was considered easy to use, and it supported the organizations in the selection and pinpointing of problem-solution pairs related to practices. A quote supporting this statement was, "*the problem filtering functionality helps us to prioritize gaps and find solutions*." Second, more digital resources with higher quality could be identified, stored, and utilized, because of that service customers joined the resource pairing work; i.e., customers extended the creative capability. Service customers also supplied additional operant resources through their presence. Again, the organizations generated novel solutions affecting value propositions positively. To their support, they used the design pattern (best practice statements), identified problems, comments, and solutions captured.

The simple trick to include a solution capturing functionality in the resource liquefying action was also considered a successful move. We could conclude that this activity contributed an additional approach to the *formal* problem-solution pairing because it supported practitioners in the process of generating novel solutions that did not have to be based on an already identified problem. Instead, the practitioners could use the solution and map it to a problem in a later step (i.e., what problem does this solution solve?). This form of innovation is called *informal* problem solving, and it refers to when a problem and a solution are discovered and tested for viability *together* (von Hippel and von Krogh, 2016; Nambisan et al. 2017). A significant advantage of these problem-solution pairs is that the potentially relevant innovation (i.e., novel value proposition) come packaged together and that the digital resourcing system could store those pairs for future utilization. Consequently, the ADR-team concluded that functionality supporting problem-solution pairing with a *dual* approach to pairing, *informal and formal* problem-solution pairs were feasible. A quote strengthening the utility of the implemented functionality was, "*The tool [digital resourcing system] supports us when creating innovations [novel value propositions] together with customers that we could not create by ourselves.*" We also found that the combined informal and formal approach to resource pairing often led to a set of novel solutions affecting value propositions in different ways but solving the same problem (i.e., rather than a single solution to a single problem).

Although the ADR-team recognized that the digital resourcing system and design knowledge had matured and improved during the second BIE cycle, the ADR-team found needs for further improvements. One unanticipated consequence identified was that the practitioners were still not completely satisfied with the *visualization* of the formal and informal resource pairing. They especially argued that the digital resource pairing should be conducted using the same system view/screen since it might otherwise reduce creativity. That is, in the current version, resource pairing was conducted in separate views, meaning that the relationship between problems and solutions was not always clear. To visualize the problems and solutions in the same view could leverage transparency, creativity, and collaboration, the practitioners argued. As previously explained, we had also noted that the result could sometimes result in problems but no solutions. A new view supporting visualization could also help actors to form new solutions, again through a formal problem-solution approach. Another unanticipated consequence was that both customers and providers wanted access to comments stored in the digital resourcing system during the whole process. Such comments, they argued, should inspire service providers and customers to create better solutions. Hence, the ADR-team needed to fine-tune the resource pairing action also in the next BIE cycle.

6.3.4 Second Reflection and Learning

In the second BIE cycle, the ADR-team had learned that service customers and providers should create a novel problem-solution pair through *informal and formal resource pairing* using a design pattern. The service customer and provider brought different and complementary resources to the resource pairing action, and the customer 'ensured' that the novel solution could enable value. Thus, the inscribed features strengthened the support of practitioners to organize and generate valuable, rare, and inimitable resources; i.e., it was difficult for others, not participating in the initiative, to generate the same value proposition. The ADR-team further learned that there was room for minor improvements of the digital resourcing system (i.e., tighter visualization of resource pairing and an improved way to create solutions).

Finally, I reflected upon the formulation of the design principle, which was revised into "*design for resource pairing by formal and informal problem-solution pairing supported by design patterns."* The initial testable proposition was changed to "*formal and informal resource pairing fosters new or improved value propositions*." Another testable proposition added was, "*Resource pairing fosters improved capability to identify, discuss, and share problems*." The artifact mutability was considered to be of a higher degree in this version since it was possible to adapt process statements to the context (see 6.2 and Appendix 5). Also, since the functionality of pairing had been increased to include *informal* pairing, which extended the possibility to innovate for practitioners.

Hence, artifact mutability was upgraded to a *high* degree. In the same manner as explained in section 6.2, I strengthened the belief that developers should identify and reflect upon contextual characteristics in order to create a digital resourcing system. The principle of implementation was therefore formulated as "*Design by identifying contextual characteristics*." In a similar way, I learned that developers should recognize and involve multiple actors from various contexts and evaluate the digital resourcing system in those contexts. The reason for this is that the digital resourcing system will be better aligned to the traditions within the context and, therefore, increase the efficiency of the undertaking. The principle for implementation was labeled; "*Design by recognizing and involving multiple actors from various contexts.*"

Table 6.7. Anticipated and unanticipated consequences.

Anticipated consequences	Unanticipated Consequences	Comment
Support for more actors in the service ecosystem (i.e., service customers) was needed. *Transferred from BIE cycle 1. See id 1a in Table 6.6.*	-	Saturation reached.
Resource pairing and matching of statements, goals, needs, and problems reduced the efficiency in the resource innovation process. A need for easier paring was needed. *Transferred from BIE cycle 1. See id 1b in Table 6.6.*	Need to show/visualize customer and provider comments (i.e., knowledge) in the pairing functionality. (id 2a)	Became input to the next BIE cycle.
It was not possible to discuss problems and then solutions alone (formal problem-solution pairing). Functionality supporting formal *and* informal pairing was requested. *Transferred from BIE cycle 1. See id 1c in Table 6.6.*		Functionality for formal and informal pairing provided utility. Saturation reached
There was a need for problem/Gap prioritization since there were too many problems identified. *Transferred from BIE cycle 1. See id 1d in Table 6.6.*	-	Saturation reached

	Tighter/visualized link between problems and solutions was requested. (id 2b)	Became input to the next BIE cycle.

6.3.5 The Third BIE Cycle

In the following sections, the third BIE cycle related to resource pairing is described. Although the different steps in the BIE cycle were overlapping in the research project, they are presented in a sequential order in order to increase the readability in the following sections.

6.3.5.1 Building

Since the ADR-team had found that the functionality related to *informal* pairing was sufficient and provided utility, we decided to keep it as it was. In contrast, the ADR-team fine-tuned the *formal* pairing functionality to promote creativity further and to visualize the problem-solution pairs better. The reason to make this decision was that it could make it easier to understand the whole 'package' of problem-solution pairs for service customers and providers. Furthermore, the ADR-team built functionality supporting visualization of the comments from the organization-specific service customer and service provider assessment of process statements. In addition, the ADR-team visualized the result of the shared/collaborative assessment, and the solutions captured (section 6.2). Figure 6.16 illustrates a screenshot of the final *formal* resource pairing activity. The prioritized problem (dashed rectangle #1) is connected to two new ideas/solutions (dashed rectangle #2). The functionality allowed service providers and customers to add new solutions if necessary (e.g., if only a problem with no solutions existed).

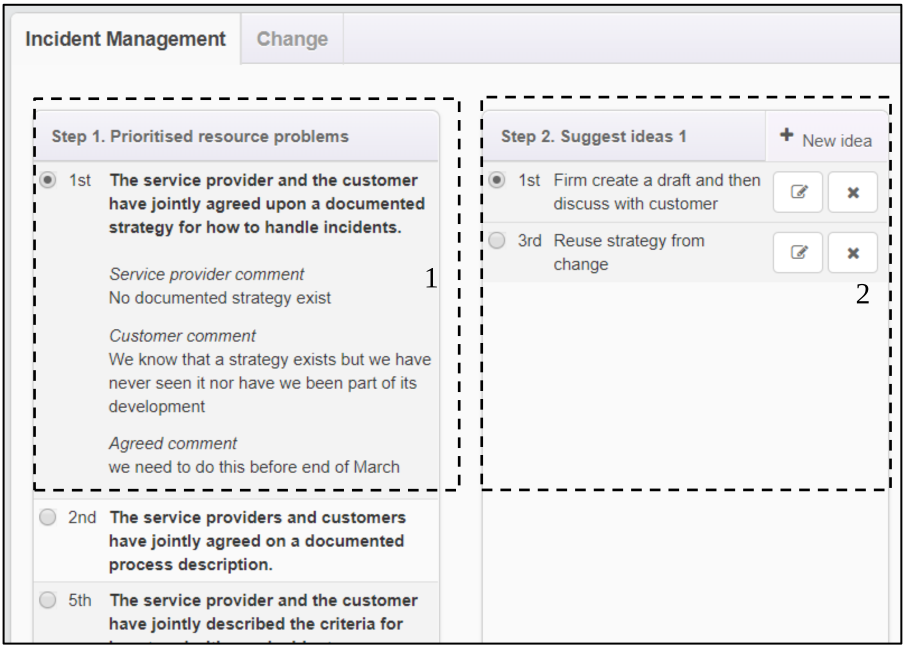

Figure 6.16. Formal resource pairing visualizing a tighter coupling between problem and solution/ideas.

6.3.5.2 Intervention

Again, the ADR-team followed the organizational-dominant BIE form. Figure 6.2 shows the different evaluation episodes, while chapter 4 includes a description of the different organizations.

6.3.5.3 Evaluation

The evaluation episodes showed that the newly created and dedicated *formal* resource pairing feature improved the situation; i.e., it provided utility, and the practitioners were satisfied with the functionality. This meant, instead of moving back and forth amongst the different system views, the practitioners had all the information they needed from one single view. Moreover, the functionality helped to co-create solutions in cases where nothing but problems had been identified. That is, the simple features supported service providers and customers when using the digital resourcing system more efficiently than the previous version. A quote strengthening this claim was; "*The [digital resourcing] system* support us to *generate solutions and relate them to problems*", and "*It [the digital resourcing system] is more easy to use now because we can read the different comments from different actors while discussing problems and solutions without having to keep that information in our minds.*"

6.3.6 Third Reflection and Learning

During the BIE cycle, no unanticipated consequences had been detected (see Table 6.9), and based on the positive evaluation result, the ADR-team learned that the digital resource pairing action was sufficient. The ADR-team also considered that if the design knowledge were not inscribed in a digital resourcing system, there would be a risk that the value of a generated problem-solution would not be sufficient. Effectively, the features supporting informal and formal resource pairing unleashed the potential for service customers and providers to utilize digital resources in a structured approach and to co-create novel problem-solution pairs enabling value. Such problem-solutions were usually hard to replicate because the operant and operand resources used in the resource pairing action had emerged through sophisticated activities bound to the specific context. That is, the digital resources were available to the actors using the digital resourcing system and *not* to other actors in other service ecosystems. A practitioner quote supporting this assertion was "*the tool [the digital resourcing system] supports us to structure our innovation process and to co-create [by resource pairing] new digital services.*" As with the resource liquefying action, the design knowledge related to the resource pairing action emerged through the three BIE cycles. It has evolved from something that barely worked in the first BIE cycle to something that both service customers and service providers argue provides utility in the form of valuable, rare, and inimitable digital resources formed as problem-solution pairs holding value. Consequently, it is possible to conclude that also the resource pairing action supported to fulfill the VRIO framework and enabled competitive advantages.

To sum up, I had learned that the design principle formulated in the previous cycle, *design for resource pairing by formal and informal problem-solution pairing supported by design patterns*, was sufficient and that no more BIE cycles would be necessary. Similarly, no changes were needed in the previous suggested testable proposition. The formulation of *formal and informal resource pairing leverages new or improved value propositions* were kept. Furthermore, no changes had been made that changed the view of artifact mutability; it was still considered to have a *high* level. Finally, no further changes regarding the ‘principles of implementation’ were identified during the third BIE cycle. A summary of the emerging design knowledge is presented in Table 6.8.

Table 6.8. Summary of emerging design knowledge related to resource pairing.

Design knowledge/ BIE cycle	Formulation (changes in italic)
Design Principle	
BIE cycle 1	*Design for resource pairing by formal problem-solution pairing supported by design patterns*
BIE cycle 2	Design for resource pairing by *formal and informal* problem-solution *pairing supported by design patterns*
BIE cycle 3	Design for resource pairing by formal and informal problem-solution *pairing supported by design patterns*
Testable Proposition	
BIE cycle 1	*Formal resource pairing leverages novel value propositions*
BIE cycle 2	Formal *and informal* resource pairing leverage *new or improved* value propositions. *Resource pairing fosters improved capability to identify and discuss problems*
BIE cycle 3	*Formal and informal resource pairing leverage new or improved value propositions.* *Resource pairing fosters improved capability to identify, discuss, and share problems*
Artifact Mutability	
BIE cycle 1	Low degree of mutability
BIE cycle 2	*High* level of mutability
BIE cycle 3	High level of mutability
Principles of Implementation	
BIE cycle 1	Design by identifying contextual characteristics
BIE cycle 2	1) Design by identifying contextual characteristics *2) Design by recognizing and involving multiple actors from various contexts*
BIE cycle 3	No further changes

Table 6.9. Anticipated and unanticipated consequences.

Anticipated consequences	Unanticipated Consequences	Comment
Need to show/visualize customer and provider comments (i.e., knowledge) in the pairing functionality. *Transferred from BIE cycle 2. See id 2a in Table 6.7.*	-	Saturation reached.
Tighter/visualized link between problems and solutions was requested. *Transferred from BIE cycle 2. See id 2b in Table 6.7.*	-	Saturation reached.

Finally, the four grounding processes: i.e., value-, explanatory-, conceptual-, and empirical grounding, are used to summarize the learnings accrued in the third BIE cycle.

6.3.6.1.1 Value Grounding

The design knowledge related to the resource pairing action is valuable, since it, encourages practitioners to co-*create* new or improved problem-solution pairs holding novel value propositions in an efficient approach. It supports diverse human actors (groups of service providers and service customers) in the service ecosystem in identifying problems and then co-creating solutions to those problems - but not necessarily in that order. That is, the design knowledge supports *both* informal and formal problem-solution pairing.

Solution-problem pairs are valuable since they come as a whole, which explains why a specific solution works in a specific context. Moreover, a problem-solution pair of this kind could be saved as a digital resource for future use in other situations. The contextualized design pattern implemented in the digital resourcing system also provides value because it supports discussions where actors jointly identify problems and co-creates solutions that are better fit-for context than without such discussions (i.e., through the use of design patterns). Furthermore, this design knowledge is valuable since it shows how a service-oriented perspective could be applied in practice. Finally, it shows how digital resourcing could help to reach the VRIO framework, which in turn, fosters sustainable competitive advantages. Consequently, the design knowledge of resource pairing should be regarded as essential or even as the *core* action of digital resourcing. The design knowledge of resource pairing corresponded to the four artifact-goals. It was considered especially important to implement in order to reach artifact goals 1, 3, and 4 (see chapter 5). The argument was that resource pairing knowledge is directly related to the creative activity of resourcing, and thus, the process *and* outcomes of the discovery stage of digital innovation. Moreover, the design knowledge contributes by meeting the second artifact goal because it regards digital resources as essential to this creative activity. Finally, the design knowledge could be seen as subsequent knowledge of resource liquefying, since it pairs and recombines the digital resources mobilized and decoupled in the previous stage.

6.3.6.1.2 Conceptual Grounding

The main construct emphasized is obviously digital resource pairing. However, digital resources, and dyadic human actors in service ecosystems are important constructs to consider, also. These constructs are defined in chapters 2 and 3. Digital resource pairing means that the dyadic human actors utilize the digital resource base (i.e., mobilized and decoupled digital resources stored in the digital resourcing system) and pair those digital resources to co-create novel solutions holding viable value propositions. This corresponds well with Arthur (2009), who has found that all innovation is a result of recombining different resources. In the case of digital resourcing, the actors co-create solutions that are paired with problems or vice versa. Hence, a mix of formal and informal problem-solution resource pairs leverage this resourcing action. In this way, the human actors jointly compose different digital resources as building blocks. Since solutions are *co-created* by actors from service customers and providers, they often enable higher value than if a single actor (e.g., a service provider) performed this activity alone. Figure 6.17 shows how dyadic actors of service customers and providers (as part of a service ecosystem) co-create innovations through both formal and informal resource pairing.

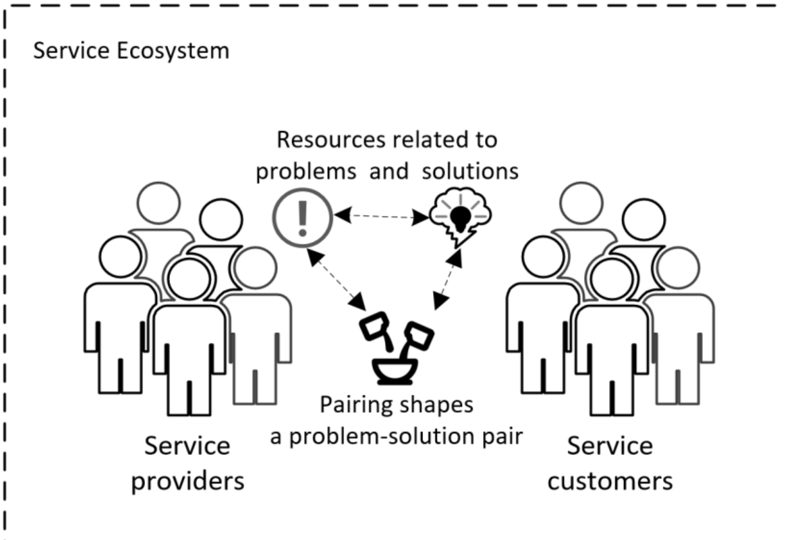

Figure 6.17. Model of digital resource pairing.

6.3.6.1.3 Explanatory Grounding

I have only found a few studies showing digital innovation as a (re)combinative pairing activity and which focuses on digital resources as building blocks (e.g., Lusch and Nambisan 2015; Nambisan et al. 2017; Henfridsson et al. 2018; Holmström 2018). Scholars who have touched on the subject have focused on already digitized operand resources rather than *how* to utilize also *operant and operand* resources supported by a digital system (Lusch and Vargo 2014b). To that end, the design knowledge of resource pairing suggests how diverse human actors in a service ecosystem can pair digital resources related to problems and solutions that are supported by a digital resourcing system.

The design knowledge related to digital resource pairing is based in Nambisan et al. (2017) and von Hippel and von Krogh's (2016) concept of problem-solution design pairs. Nambisan et al. (2017) argue that the unbounded nature of digital innovation implies that there is a need to shift from a focus on rigid innovation processes and specific outcomes to a focus on dynamic problems that, later, could be linked to a solution. As mentioned in chapters 2 and 3, the scholars call this phenomenon problem-solution pairing (c.f., Nambisan et al. 2017). The elaborated design knowledge suggested in this dissertation extends this view and supports both informal and formal problem-solution pairing of operant *and* operand resources underpinned by contextualized design patterns. A contextualized design pattern support the actors when finding solutions and then identifying a problem, or vice versa. This formal or informal pairing action lays the groundwork to identify novel solutions with good value propositions presented as a new digital service (i.e., digital innovation). The action of resource pairing also draws on recent research that has shown that innovation should be conducted together by several actors in the ecosystem (see chapter 2). This "*…implies that the core service provider has to co-design and co-produce a service innovation with other providers and manage the accompanying alliance…, [and] they must be able to manage and orchestrate these various coalitions*" (Teece 2007, p.1320). However, the current study has extended this view to including service customers and sometimes resources stored in other sources. Consequently, the design knowledge of resource pairing reinforces that individuals in organizations are the primary actors of knowledge creation (e.g., Grant 2001) and that the digital resourcing process is dependent on such actors. To conclude, this design knowledge is not entirely novel since it draws on existing knowledge. However, it extends the knowledge acquired recently, because it shows *how* a co-creative pairing action can be conducted through a *combination* of informal and formal resource pairing, it shows how organizations utilize *digital resources* owned by human actors, and it shows how a *design pattern* could be utilized and inscribed into a digital resourcing system. At the same time, the design knowledge creates a balance between an overly unstructured and an overly ad-hoc approach to digital innovation. This wide and balanced scope constitutes a benefit for practitioners because it leverages the possibilities for actors when discovering digital innovations. Consequently, this resourcing action, supported by the digital resourcing system, helps to structure and organize the digital innovation work, which recently has been regarded as ad-hoc and difficult to organize in a structured way (e.g., Henfridsson et al. 2018; Nambisan et al. 2018; Kohli and Melville 2019).

6.3.6.1.4 Empirical Grounding

The formative empirical grounding, conducted through the evaluation episodes, showed that the design knowledge related to resource pairing worked and that it was essential to take into account when designing digital resourcing systems. Empirical quotes expressed during the summative evaluation, strengthening that resource pairing supports actors to co-create solutions were:

- *"The IT-system helps us to improve the service [e.g., novel value propositions had been synthesized and merged with existing service]."*
- *"It [the digital resourcing system] creates an opportunity to develop innovative ideas further. "*

Quotes providing evidence that resource pairing helped to identify real problems:

- *"Problems are clarified and agreed upon."*

- *"Somethings that has disturbed us but that we could not really identify before was now identified because of the IT-system."*
- *"Previously, we thought that we knew something - now we get a system that spurs us to understand [new knowledge and skills] what the customer really thinks and values."*
- *"Issues that are sometimes easy to solve are identified."*

Furthermore, the evaluation episodes illustrated that the design knowledge fostered co-creation. The practitioners agreed that:

- *"We do not have to guess [what service to create] anymore because the customer has contributed to the innovation. "*
- "*It [the digital resourcing system] provides a feeling that we [providers and customers] own the new service together.* "

6.4 Design For Opting

The purpose of the third resourcing action, *resource opting*, is to support organizations when they jointly evaluate and opt-in or opt-out of one or more novel problem-solution pairs co-created. Under these circumstances, a viable, opt-in solution holding a value proposition with good density could be realized. The following sections will offer a detailed description of how this design knowledge has emerged.

6.4.1 The First BIE Cycle

6.4.1.1 Building

In the first BIE cycle, the practitioners did not expect that the outcome from digital resource pairing to be a set of solutions to the same problem. Therefore, during specific requirement discussions, the practitioners argued that in the unlikely event that several solutions should present themselves, it would be enough to opt-in or opt-out without digital support by using the resources from previous actions. That is, the actors could *discuss* e.g., desirability and then select an option. Consequently, no specific functionality or features supporting resource opting were developed in the digital resourcing system in this BIE cycle. Since no specific functionality was designed to support a selection of novel value propositions, no screenshots from early versions of the digital resourcing system could be presented in this section.

6.4.1.2 Intervention

As described previously, researchers and practitioners adopted an organization-dominant BIE form. The focus was to evaluate the other resourcing actions while a secondary purpose was to evaluate if there was a need for specific functionality related to resource opting.

6.4.1.3 Evaluation

The *need* for new functionality supporting digital resource opting was obviously regarded as an unanticipated consequence for the ADR-team when we realized it during evaluation episodes. During the first BIE cycle, the ADR-team learned that the resource pairing action often resulted in several solutions to the same problem rather than a single solution. A solution in relation to this aspect is also referred to in the literature on the topic as a digital option (e.g., Sandberg et al. 2014), and there is no doubt that different digital options could affect a value proposition in different ways. During the evaluation episodes, the organizations recognized that the lack of digital support for opting reduced the possibility for practitioners to agree upon which solution to realize. Since these findings gave rise to design knowledge related to digital resource opting, the learnings are presented in this section rather than in relation to digital resource pairing, where they were identified from the beginning (section 6.3).

The lack of system-support for resource opting led to long discussions among the practitioners when they used the digital resourcing system. The discussions held concerned how to opt-in or opt-out the best alternative to be put into practice. Selecting an option without digital support was therefore regarded as inefficient; i.e., "*we need a better way to select amongst the solutions*," the group of practitioners from all organizations asserted. Moreover, practitioners found a need to store information about *why* a specific option was opted-in or -out. They argued that it could leverage the organizational memory, support communication, as well as increase the transparency of a specific decision. That is, the ADR-team realized that the digital resourcing system should support practitioners to opt, trace, remember, and increase continuous learning over time while it could support communication with other actors in the service ecosystem.

Moreover, the practitioners argued that there was a higher risk of making the wrong decisions without explicit support for opting. Such incorrect decisions could affect the dyadic relationship between service customers and providers in terms of economic losses, reduced value of the digital service, or reduced trust in the digital resourcing system. The findings during evaluation corresponded well with the findings by Chorus (2010), who showed that practitioners have a desire to avoid a situation where an opted alternative is outperformed by a non-opted alternative. To reduce such risks, a digital resourcing system should be able to provide structured support for how to efficiently evaluate and test different options for viability. An example of a practitioner quote that strengthened the need for a new opting action was; "*In our company, we are used to evaluating different alternatives carefully, and therefore it would be great if the tool [the digital resourcing system] supported us when doing that in this case as well. We believe that there will be a better result if we could* *carry out the selection of new solutions together with the customer*." To include the customer in such a decision process was also a way to reduce uncertainty since customers should possess valuable knowledge to utilize in the resource opting action. This collaborative approach is in line with a service perspective, as well as with previous findings of digital opting (see chapter 2).

6.4.2 First Reflection and Learning

In summary, the ADR-team learned that there was a need for new and explicit functionality in the digital resourcing system supporting resource opting. The ADR-team also learned that opting must be addressed by providing useful tools for the analysis and treatment of various criteria related to uncertainty (Alfaro-Garcia et al. 2015). Uncertainty is often caused by an absence of information (Funtowicz and Ravetz 1990). To this end, the ADR-team argued that a digital resourcing system should support uncertainty reduction during the opting action by utilizing the digital resources possessed in previous resourcing actions. Moreover, we had learned that service customers should join the resource opting action (see section 6.2 and 6.3). Against this background, the ADR-team decided to build new opting functionality in order to reduce uncertainty in the second BIE cycle. A result from the 'reflection and learning' was a tentative design principle, *design for resource opting*. Since no boundaries were set related to evaluation criteria of different options, the artifact mutability was regarded as a *high* level. The principle of implementation labeled "*Design by identifying contextual characteristics*" was strengthened since I had learned that I had to learn about the contextual characteristics in order to build a digital resourcing system. Finally, I formulated an initial testable proposition, i.e., "*Digital resource opting reduces the uncertainty of which novel value propositions to realize*."

Table 6.10. Anticipated and unanticipated consequences.

Anticipated consequences	Unanticipated Consequences	Comment
No functionality supporting opting for different alternatives was needed in the digital resourcing system.	Opting functionality supporting the evaluation/filtering of different options was needed. (id 1a)	Became input to the next BIE cycle.
-	Customers should take part in the resource opting action (id 1b)	Became input to the next BIE cycle.

6.4.3 The Second BIE Cycle

In the following sections, the second BIE cycle related to resource opting will be elaborated upon. In this part of the study, two minor and interrelated BIE iterations took place. I call them BIE cycle 2a and 2b in order to increase the readability. Consequently, the structure of the following sections will follow this logic. Although the different steps in the BIE cycle were overlapped during the research project, they are presented in a sequential order to increase readability.

6.4.3.1 Building (2a)

Based on the justificatory knowledge (see chapters 2 and 3) and the learnings identified in the first BIE cycle, the ADR-team extended the knowledge search in order to learn more about how to opt one or more solutions from the set of problem-solution pairs. We found that systems supporting the evaluation of different innovation alternatives have shown to be an efficient approach towards selecting one good option and realizing it (e.g., Preez and Louw 2008; Wycoff 2003). Such systems could also enhance the value proposition of the digital service presented to customers while reducing the risk (e.g., Chou et al. 2008). That is, the research that had been carried out by other scholars had strengthened the need for a new design of the digital resourcing system. Furthermore, the ADR-team found that digital resource opting could be viewed in the light of previous work by Sambamurthy et al. (2003). As mentioned in chapter 3, the scholars suggested that IT practitioners should think of the selection of digital investment choices as 'digital options.' In the context of this study, the term 'digital resource option' has been preferred. A digital resource option is defined as access to digital resources providing an investment choice, a definition inspired by Sambamurthy (2003) and Sandberg et al. (2014).

In order to get a deeper understanding of resource opting, I turned to various research within decision-making. For example, I turned to the literature related to the field of discrete choice (e.g., Baltas 2001; Train 2009). The reason was that discrete choice could be used to describe, explain, and predict choices between two or more discrete alternatives, which stands in contrast to quantity oriented models. This view correlated well with the qualitative nature of innovation in this research context. However, I learned that methods of discrete choice are usually used to *simulate* human behavior, and since the human actors (practitioners) were simultaneously present in space and time, the team started to search for alternative decision-making theories within the literature of innovation. Within the innovation literature, I found further information about *uncertainty reduction*. Already in the mid-eighties, Daft and Lengel implied that the innovation process is related to a high level of uncertainty (e.g., Daft and Lengel 1986). Today, however, it "*... is widely accepted that the concept of innovation involves uncertainty, imprecision, and imperfect or vague* *information*" (Alfaro-Garcia et al. 2015, p.62). Any innovation process, including the one implemented in the digital resourcing system, is inherently coupled with uncertainty because the process and especially the outcome cannot be predicted in advance (e.g., Castellacci et al. 2005; Foster 2010; Jalonen 2012; Tidd and Bessant 2013). In other words, the findings in literature corresponded well with the need to develop new functionality, and it further strengthened the need for new features supporting uncertainty reduction.

Apart from *uncertainty reduction,* Preez and Louw (2008) found that careful thinking should go into developing filtering criteria to be able to opt for the most *desirable* alternative. Desirability refers to the quality of resources being worth having (Sandberg et al. 2014). Inspired by this knowledge, the ADR-team argued that there was a need to develop functionality to support actors with the filtering of options competently through a set of criteria leveraging the probability of selecting a desirable option. Hence, the new version of the digital resourcing system was developed to support both *uncertainty reduction* and *desirability*. Unfortunately, the ADR-team did not find any existing literature that specified which filtering criteria relating to desirability and uncertainty should be implemented. Consequently, the ADR-team relied on creative thinking[60], the contextual characteristics identified (see chapters 2 and 3), and previous experience of practitioners at this stage in the development process.

Finally, the ADR-team started by developing a simple resource opting functionality supporting filtering of different digital options. The feature consisted of three fields, 1) a field with a set of *newly created* solutions, 2) a field containing *highly prioritized* solutions, and 3) a field containing solutions with *low priority*. Although it was not explicitly visualized in the redesign, the functionality supported resource opting since it allowed practitioners to select solutions by communicating around uncertainty and desirability and to put the different solutions into either of the two categories. In that way, various criteria could be discussed ad-hoc. Figure 6.18 shows how a generated solution (dashed rectangle #1) from the resource pairing action could be filtered by dragging and dropping the solution either into the highly prioritized area (dashed rectangle #2) or to the low prioritized area (dashed rectangle #3). The *highly* prioritized solutions should then be implemented in practice, while the other solutions were stored for future needs. As described above, no specific filtering criteria

[60] I view creative thinking as a way of looking at situations from different perspectives where one suggests solutions. It can be stimulated by an unstructured process such as brainstorming (often used here), and by a structured process such as lateral thinking (e.g., bypass problems by new ways). Both ways were used in the project. Creativity is widely acknowledged and it also corresponds well with the design science research used in this study (Baskerville et al. 2019).

were inscribed in the digital resourcing system at this point. Instead, the practitioners needed to decide ad-hoc, which criteria were important to discuss and use.

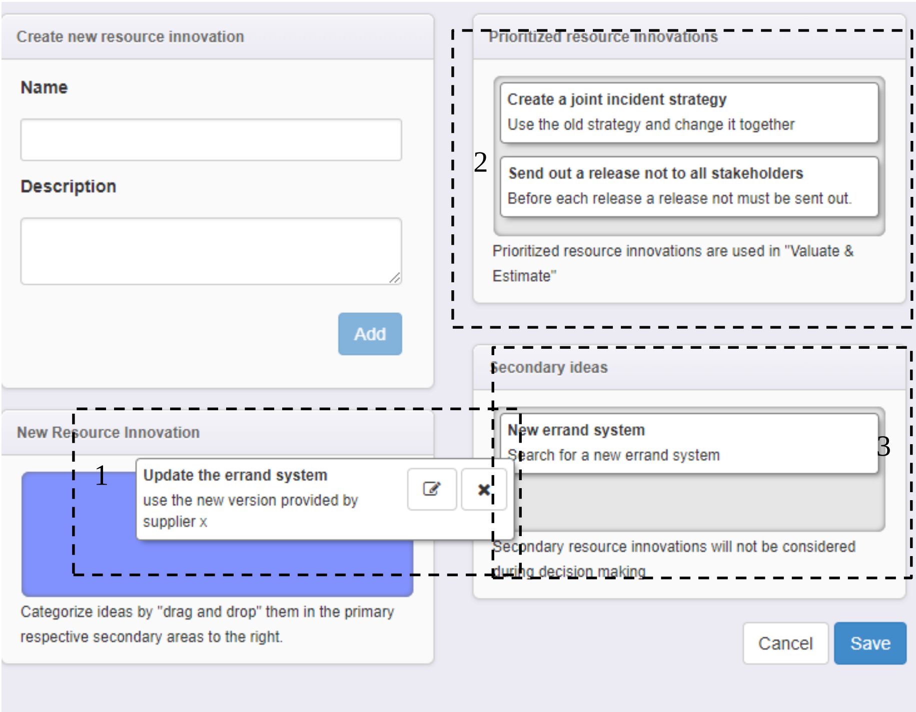

Figure 6.18. A simple filtering functionality is supporting joint resource opting.

6.4.3.2 Intervention (2a)

An organization-dominant BIE form was conducted. In contrast to the former intervention in BIE cycle 1, there was functionality to use and evaluate in connection with this intervention.

6.4.3.3 Evaluation (2a)

The result of the evaluation episodes showed that the new design was a support to practitioners to opt a solution in or out in an efficient approach. The practitioners argued that the new functionality was easy-to-use and that it *forced* the group of service providers *and* customers to think and motivate a specific choice before they 'dragged' the solution into either of the two areas (see dashed rectangle #2 and #3 in Figure 6.18). However, the interventions and evaluations quickly revealed that there was a need for an extended refinement of the functionality. The practitioners argued, "*It's good that the feature [drag and drop] support us to reflect and it is easy to use, but instead of categorizing* *innovations into two groups by solely discussing ad hoc criteria, we would like to evaluate solutions in a more detailed and structured level.*" Based on these kind of assertions, the ADR-team decided to redesign the functionality, already in the second part of the BIE cycle (e.g., 2b section 6.4.3.4). Therefore, the team once again had to go back to the 'drawing board,' and since there was time left in the second BIE cycle, the ADR-team started on this immediately.

6.4.3.4 Building (2b)

For the second time in the first BIE cycle, I consulted the literature and expert competence of practitioners in the research project. I found that problems related to decisions *"...usually are too complex and ill-structured to be considered through the examination of a single criterion, attribute, or point of view that will lead to the optimum decision. Such a unidimensional approach is merely an oversimplification of the actual nature of the problem at hand, and it can lead to unrealistic decisions*" (Psarras and Zopounidis 2010, p.1). Hence, the ADR-team decided to implement support for *multiple* criteria for the evaluation of different possible options. Next, practitioners and researchers discussed specific filtering criteria relevant to the context. Practitioners argued that relevant criteria that could be used in the digital resourcing system were the following: the estimated *cost* to develop and implement the solution, the estimated *time reduction* of realizing the solution, the work *effort* to implement the solution (i.e., time and money), the *necessity* of the solution, and the estimated *value*. The criteria identified also corresponded well with common attributes in management, meaning that they had some form of theoretical grounding (Chapman and Ward 2002; 2003; Barney et al. 2011). Consequently, the ADR-team decided to redesign the resource opting functionality based on the new specific requirements.

To increase the possibility for practitioners to evaluate and finally opt-in or opt-out amongst different solutions[61] to an even higher degree, new 'drop down-,' and 'slide'-features supporting rating were developed. The rating sliders included a numbered scale from one and ten. The number 10 was considered good (e.g., low cost or high value). The practitioners could use the drop-down- and slide-features to evaluate the different and fixed criteria for a specified solution. This specific requirement corresponded well to the analytical hierarchy process suggested by Saaty (2008) who argues that to make comparisons, practitioners "*need a scale of numbers that indicate how many times more important or dominant one element is over another element with respect to the criterion or property with respect to which they are compared.*" (ibid,

[61] Although problem-solutions pairs were used the opting action were more focused on the solution part since it constitutes the digital innovation per se and it might enable most value for customers.

p.85). However, the drop-down boxes contained rating alternatives such as 'high' or 'low' instead of numbers.

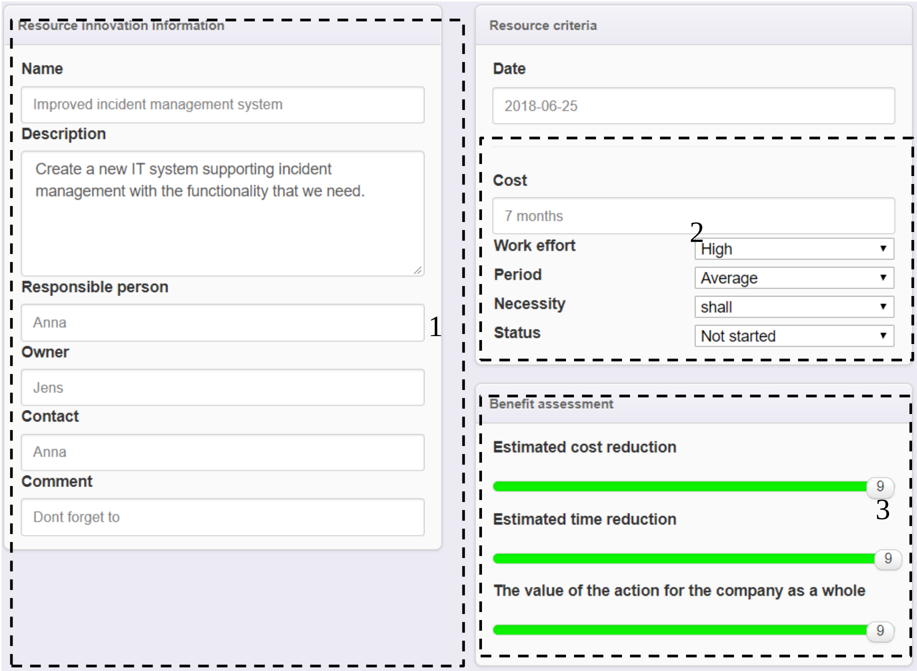

Figure 6.19. New evaluation features developed in the second BIE cycle.

The new design, supporting the filtering of different solutions and using the identified set of criteria is illustrated in Figure 6.19. The dashed rectangle (#1) shows one (of many) solution(s) that practitioners had to evaluate during the resource opting action. The next dashed rectangle (#2) shows the filtering criteria, including the rating sliders (dashed rectangle #3). In the example, the practitioners have decided that the solution could provide a high degree of cost and time reduction, and enable a high value (improved value proposition); therefore, they have selected rating 9 for all of these criteria.

6.4.3.5 Intervention (2b)
In the following interventions, the new digital resource opting features were evaluated. An organization-dominant BIE form was selected.

6.4.3.6 Evaluation (2b)
The ADR-team quickly realized that the design had been improved compared to previous versions of the digital resourcing system. The new filtering functionality using quantitative ratings supported a better discussion regarding which (problem-) solution (i.e., digital option) should be put into practice. That

is, the service providers and customers got an opportunity to test a digital option for viability. Moreover, the new design supported the practitioners when seeking a consensus regarding a rating. A practitioner quote supporting this statement was, "*it's good that we finally can analyze innovations using different criteria. It supported us to reflect on the solution and its value. The functionality better maps the way we usually work in our company*." The ratings were based on practitioners' subjective experiences. This finding corresponded with the result presented by Alfaro-Garcia et al. (2015), who argues, "*much of the information needed for an accurate evaluation tends to be qualitative or subjective*" (p.62). However, the inscribed rating functionality supported practitioners when transferring subjective experiences into quantitative measurements, which then became easier to visualize, discuss, and understand.

To summarize, sophisticated design for resource opting had started to emerge, but an unanticipated consequence was that the practitioners argued that the functionality could be improved even further. Especially, they claimed that there was a need for a more efficient and effective way to *compare* the rated and evaluated solutions. That is, in the current version of the digital resourcing system, it was difficult to compare the co-created solutions, and practitioners had to click back and forth amongst the views in the digital resourcing system in order to succeed. Hence, the practitioners required a new functionality to support the comparison and visualization of evaluated solutions. Another unanticipated consequence was that practitioners were not fully satisfied with the *fixed* set of built-in filtering criteria. Since each context often had its own[62] specific criteria to evaluate solutions, there was a need to allow for a contextualized set of criteria in the next version of the digital resourcing system. However, the ADR-team decided that the existing criteria already developed should be maintained in the digital resourcing system as examples or inspiration, meaning that practitioners could use them or exchange them. A third unanticipated consequence was that not all criteria were of equal worth within the same context; i.e., some criteria were more critical than others and should, therefore, should have a higher value in the evaluation scheme than other criteria. Consequently, the team also needed to consider and develop functionality to support *weighting* in the next BIE cycle (see Table 6.11).

6.4.4 Second Reflection and Learning

The ADR-team learned that both anticipated and anticipated consequences of the design had also occurred in this BIE cycle (Table 6.11). Based on the evaluation result, I revised the design principle from; "*Design for digital resource opting*" to "*Design for collaborative digital resource opting by evaluation of*

[62] Yet, everyone agreed on that customer value was necessary, as well as the desirability and risk/uncertainty and value.

contextualized criteria." The reason was that I had learned that fixed criteria did not work and that customers ought to participate in the action. The testable proposition defined in the first BIE cycle was revised to "*Digital resource opting reduces the uncertainty, and it increases the desirability of the value propositions to be realized*." Since the ADR-team had learned, but not implemented functionality supporting contextualized criteria yet, the artifact mutability was reduced from medium to low; i.e., a fixed set of criteria was not sufficient. Finally, the principles of implementation, i.e., "*Design by identifying contextual characteristics*" and "*Design by recognizing and involving multiple actors from various contexts,*" were strengthened.

Table 6.11. Anticipated and unanticipated consequences.

Anticipated consequences	Unanticipated Consequences	Comment
Opting functionality supporting the evaluation/filtering of different options was needed. *Transferred from BIE cycle 1. See id 1a in Table 6.10.*	Drag n drop functionality (see Figure 6.18) was not sufficient. A need for opting by a generic and fixed set of criteria should provide sufficient support to evaluate both desirability and uncertainty.(id 2a)	Changed and evaluated already within this BIE cycle. (see)
Customers should take part in the resource opting action. *Transferred from BIE cycle 1. See id 1b in Table 6.10.*	-	Saturation reached
Drag n drop functionality (see Figure 6.18) was not sufficient. A need for Opting by a generic set of criteria should provide sufficient support to evaluate both desirability and uncertainty (identified in this BIE Cycle). *Transferred from this BIE cycle. See id 2a above.*	Need for adaptable, contextualized set of evaluation criteria related to uncertainty and desirability. (id 2b)	Became input to the next BIE cycle.

-	Need for weighting of criteria. (id 2c)	Became input to the next BIE cycle.
-	Need for a composite opting view supporting comparison of evaluated options. (id 2d)	Became input to the next BIE cycle.

6.4.5 The Third BIE Cycle

In the following sections, the third BIE cycle related to resource opting is described. Although the different steps in the BIE cycle overlapped in the research project, they are presented in a sequential order to increase readability.

6.4.5.1 Building

In previous BIE cycles, the ADR-team had learned that the digital resourcing system facilitated the creation of multiple available solutions through digital resource pairing. In the third BIE cycle, we needed to develop improved functionality in order to support actors to opt-in an *actionable* solution that could be put into practice (see chapter 3). Hence, I deepened my knowledge regarding option theory and especially around different *generic* criteria that could support practitioners to select one of several options (e.g., Bowman and Hurry 1993; Luehrman 1998, Sambamurthy 2003; Sandberg et al. 2014). I learned that during recent years, Sandberg et al. (2014) had developed the work by Sambamurhty (2003) by utilizing theories on information management (i.e., Mathiassen and Sørensen 2008) and ubiquitous computing (i.e., Evans and Wurster 2000; Fleisch and Tellkamp 2006). I had already learned that the digital resource options should be systematically examined in terms of *uncertainty* and *desirability*. Now the ADR-team decided to add *feasibility* (i.e., the degree of being easily carried out), which was suggested by Sandberg et al. (2014). Given this decision, the most *desirable* and *feasible* digital resource option with a low degree of *uncertainty* should be considered an *actionable* digital resource option. However, although Sandberg et al. (2014) persuasively position digital options theory, they do not adequately explain how the evaluation of desirability and feasibility using multiple criteria should be performed in practice; they even claim that it is difficult to do that and their most concrete advice is vague. The scholars claim that "*future research could develop methods for assessing the value of actionable digital options and for bundling them in order to better guide investment decisions*" (ibid, p.449). Stated differently, no particular evaluation guidelines for how to apply *desirability* and *feasibility* in practice are provided by identified theory. In order to solve this issue, the ADR-team designed functionality using desirability, feasibility, and uncertainty as *criteria categories*, which could then be populated by contextualized criteria made by practitioners. In order to increase the efficiency of the functionality, the ADR-team added initial criteria serving as inspiration for practitioners. Such suggestions were derived from the previously fixed criteria (see BIE cycle 2) and discussed in workshops. Suggestions for criteria are visible in Figure 6.20.

Next, the ADR-team searched for a solution to fulfill the specific requirement of *weighting* the criteria selected. Again, we conducted a more in-depth search into the decision-making literature. The team found that Multiple-Criteria-Decision-Analysis[63] (MCDA) is a widely accepted and recognized research field addressing decisions using multi-criteria (c.f., Fishburn 1967; Triantaphyllou 2000). As such, it allows for consideration of all aspects that are related to an evaluand. Consequently, MSDA was a relevant theory to draw on in order to find a solution to the weighting requirement. A prominent approach to MCDA is '*Fuzzy Logic,'* a term coined by Zadeh (1965). 'Fuzzy Logic' addresses problems involving fuzzy phenomena, which correspond well with the subjective criteria categories of desirability and feasibility (Zadeh 1965; 1988; 1989; 2006). In this dissertation, the term fuzzy determines that "*something is lacking in clarity or definition*" and that this something cannot be defined as either true or false (Merriam-Webster 2018). That is, this 'something' is often regarded as subjective to the actors involved, which corresponds well to how value propositions which usually are qualitative or subjective. In other words, the practitioners in the study had a need to define criteria under each category of criteria in a fuzzy manner.

The 'fuzzy logic' (which is not fuzzy per se) simplifies a context based on degrees of truth, rather than Boolean logic. By doing so, it provides an approach to managing the fuzziness identified in the project. Alfaro-Garcia (2015, p.3) argues, "*Fuzzy Logic stands as a viable way to adopt decision-making due to its capacity of dealing with uncertain and subjective conditions."* Moreover, "*fuzzy logic has given an edge to deal with uncertainty and vagueness because it reflects how people think. It attempts to model our sense of words, our decision-making, and our common sense. As a result, it is leading to new, more human intelligent systems*" (Husain et al. 2017, p.19). Alfaro-Garcia et al. (2015) argue that Fuzzy Logic is encouraged when evaluating qualitative and subjective criteria in innovation measurement; they use the term *defuzzification* to describe the process of producing a quantifiable result

[63] The term criteria is mainly used in this dissertation because of the use of the term in the MCDA field. However, sometimes also the term factor is used as a synonym to criteria. That is, no difference is made between the two in this context. MCDA is also sometimes referred to as Multiple-Criteria Decision-Making (MCDM).

out of vague information (ibid). Consequently, researchers and practitioners (i.e., the ADR-team) decided to implement a new feature based on an algorithm supporting defuzzification of the evaluation criteria selected by the organizations. Consequently, the team needed to specify an appropriate defuzzification method. Several of the established defuzzification methods have been summarized, analyzed, and compared by Husain (2017). The result shows that the *fuzzy-weighted average method* (e.g., Saneifard 2010; Saneifard and Ezzati 2010) is better to use in a defuzzification compared to other algorithms such as the Mean of Maximum (e.g., Harris et al. 1993), Centroid of Area (e.g., Wang et al. 2006) or Bisector (e.g., Harris et al. 1993). The scholar argues that there is simply more consistency in the results using a fuzzy-weighted average method (Husain 2017). While the weighted average is a variant of an average measuring the center of a data set, the fuzzy-weighted average takes into account that some criteria 'count more' than others do, which corresponded excellently with the specific requirements of the practitioners in the study. The ADR-team finally defined the fuzzy-weighted average (U) consisting of the numbers $u_1, u_2, \ldots, u_m$. The formula must contain non-negative fuzzy weights; $w_1, w_2, \ldots, w_m$. Based on Dong and Wong (1987), the formula of the fuzzy-weighted average is then defined as:

$$u = \frac{\sum_{i=1}^{m} w_i * u_i}{\sum_{i=1}^{m} w_i}$$

$(i = 1, 2, \ldots m, \text{ and } w_i \neq 0.)$

According to Pavlacka and Talasova (2006), the algorithm used when to calculate the fuzzy-weighted averaged then could be described as:

$$u = \frac{w1u1 + w2u2 + \ldots + w\mathrm{m}u\mathrm{m}}{w1 + w2 + \ldots w\mathrm{m}}$$

A very simple example from using the digital resourcing system (see Figure 6.20) was that actors created three criteria under the criteria category *Feasibility* (i.e., competence, resources, and mandate). The actors rated all criteria with number 5, meaning that they considered the feasibility of the digital option to be optimal. They also weighted each criterion high (i.e., 5). Logically, the result should be 5. The calculation is:

$$5 = \frac{(5 * 5) + (5 * 5) + (5 * 5)}{5 + 5 + 5}$$

Accordingly, researchers and practitioners implemented the simple algorithm based on a fuzzy- weighted average, including possibilities to add multiple contextualized criteria where the actors of service customers and providers jointly decided which criteria were relevant for the categories' desirability, feasibility, and uncertainty. Please note that the ADR-team used the term 'value' instead of 'desirability' and 'risk' instead of 'uncertainty,' since it corresponded better to ITSM practitioners.

Finally, and in order to answer the call from the organizations who argued that there was a need for a better approach to be able to *compare* the evaluated digital resource options (set of problem-solution pairs) to each other, the ADR-team built a feature that supported *visualization* of a total score for each digital resource option. The idea of this feature was suggested by one of the participating organizations that had good experiences from using benefit-cost ratio matrixes (e.g., Porter et al. 2009; Zangeneh et al. 2010). The designed feature consisted of three simple charts showing each digital option in relation to the values set for feasibility, desirability, and uncertainty. The idea was discussed amongst all practitioners who agreed that it was a good solution and that it should be implemented in the digital resourcing system. Figure 6.21 shows the result of this resource opting comparison feature. The overall purpose of the three charts was to assist the actors when conducting the final step of resource opting, i.e., to identify an *actionable* resource option and *realize* it.

Figure 6.20 shows the new features in the digital resourcing system. A selected solution (i.e., digital option) (#1) was evaluated by multiple criteria (#5-7) related to feasibility (#2), desirability (#3), and uncertainty (#4) (called risk in the figure). Rating sliders (#8) were implemented to calculate the fuzzy-weighted (#9) average.

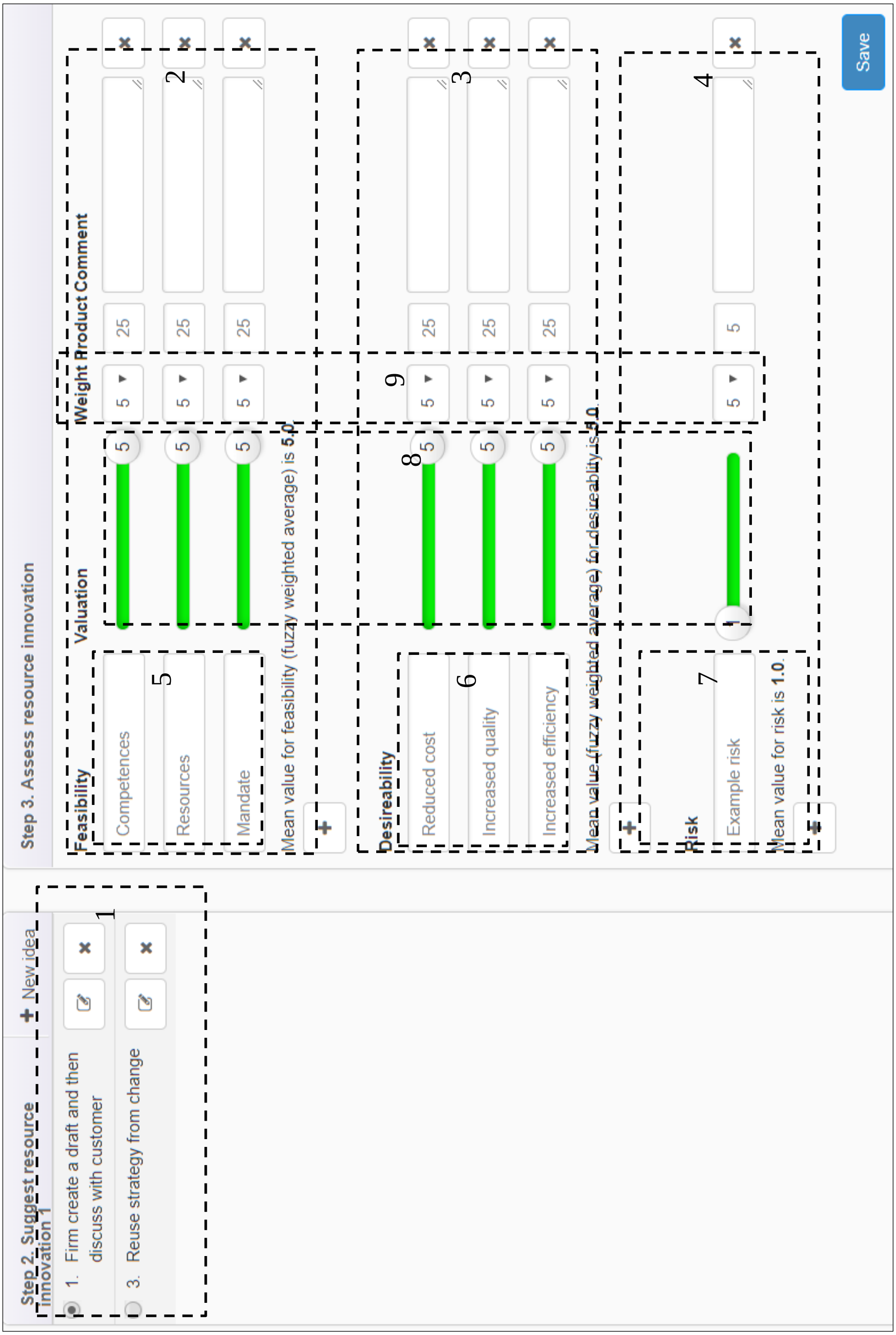

Figure 6.20. The final version of digital resourcing opting as visualized in the digital resourcing system.

Finally, Figure 6.21 shows the new features supporting the practitioners when deciding on an actionable option to realize jointly.

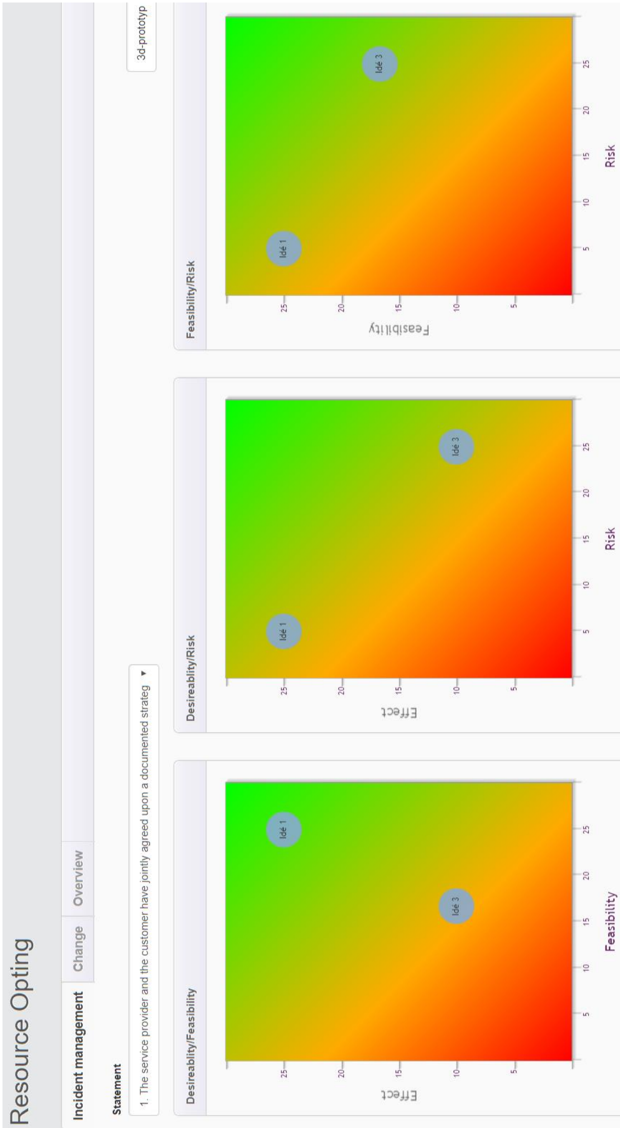

Figure 6.21. Charts are supporting the comparison of different digital options (i.e. a problem-solution pair is called idea in the Figure). Each circle corresponds to one option. In the example, the solution located in the green area of the chart should be opted-in.

6.4.5.2 Intervention

In the following interventions, the new digital resource opting features were evaluated. Again, an organization-dominant BIE form was used.

6.4.5.3 Evaluation

The nature of decisions related to strategic importance to organizations is usually complex and unstructured, and the stakes are often high (De Boer et al. 1998; Alanazi et al. 2013). To opt for the most desirable and feasible solution of several possible alternatives is undoubtedly such a strategic decision, and that is one of the reasons why practitioners needed the new feature. Fortunately, the findings from the evaluation episodes and interventions in practice showed that digital resource opting worked and provided utility. The inscribed 'fuzzy-weighted average' algorithm for resource opting made it easier for actors to opt-in or opt-out of a solution from within a set of solutions in order to realize it. They also argued that they had confidence in that they had made the correct choice. This means that defuzzification of the criteria related to the categories of desirability, uncertainty, and feasibility worked and provided utility. The practitioners argued: "*the new opting feature using weighting made it easier to identify the best innovation together with customers*." Moreover, the new feature that allowed for *contextualized* criteria worked. A quote from a customer was, "*Because of the weighting of our own criteria, we can trust that the innovation is good enough*." Finally, the ADR-team could conclude that the way actionable digital resource options were evaluated and opted was improved because of the visualized charts supporting comparison in an efficient approach. "*The charts make it easier to identify the best viable option,*" practitioners argued. That is, the digital resourcing system helped the practitioners select an actionable option with the highest density, i.e., with the best combination of digital resources regarding feasibility, desirability and uncertainty and that could be mobilized for a particular situation in a particular context (see also chapter 2 and 3). This means that the ADR-team could conclude that digital resource opting was satisfactory and no more BIE cycles were needed.

6.4.6 Third Reflection and Learning

The ADR-team learned that we had reached saturation since the new digital resource opting feature supported practitioners to opt-in or opt-out of the most desirable and feasible innovation with a low degree of uncertainty. By doing so, the actors could be confident that they had opted for a viable problem-solution pair affecting the value proposition in a good manner. That is to say, if this design knowledge is inscribed in a digital resourcing system, it will enable human actors to maximize density while also supporting human actors utilizing rare digital resources that are hard to imitate. Finally, and based on the learnings in the third BIE cycle, I could determine the design principle as being

"*Design for collaborative digital resource opting by defuzzification of contextualized criteria related to desirability, feasibility, and uncertainty*." The testable propositions from previous BIE cycles were strengthened; "*Digital resource opting reduces the uncertainty, and it increases the feasibility and desirability of the value propositions to realize*." As described in the sections above, the artifact mutability was affected in the final cycle since the digital resourcing system now included *contextualized* criteria. That is, the contextualized criteria affected the degree of artifact mutability in a positive manner; it was considered to be of a *high* degree. Principles of implementation were not affected in the last BIE cycle. Table 6.12 summarized the emergence of design knowledge components related to digital resourcing opting.

Table 6.12. Summary of emerging design knowledge related to resource opting.

Design knowledge/ BIE cycle	**Formulation (changes in italic)**
Design Principle	
BIE cycle 1	*Design for resource opting*
BIE cycle 2	*Design for collaborative digital resource opting by evaluation of contextualized criteria*.
BIE cycle 3	*Design for collaborative digital resource opting by defuzzification of contextualized criteria related to desirability, feasibility, and uncertainty*.
Testable Proposition	
BIE cycle 1	*Digital resource opting reduces the uncertainty of which novel value propositions to realize*
BIE cycle 2	-Digital resource opting reduces the uncertainty, *and it increases the desirability* of which novel value propositions to realize.
BIE cycle 3	- Digital resource opting reduces the uncertainty, and it increases the *feasibility* and desirability of the value propositions to realize
Artifact Mutability	
BIE cycle 1	High level of mutability
BIE cycle 2	Low level of mutability
BIE cycle 3	High level of mutability
Principles of Implementation	
BIE cycle 1	Design by identifying contextual characteristics
BIE cycle 2	-Design by identifying contextual characteristics

	-*Design by recognizing and involving multiple actors from various contexts.*
BIE cycle 3	-Design by identifying contextual characteristics -Design by recognizing and involving multiple actors from various contexts.

Table 6.13. Anticipated and unanticipated consequences.

Anticipated consequences	Unanticipated Consequences	Comment
Need for adaptable, contextualized set of evaluation criteria related to uncertainty and desirability. *Transferred from BIE cycle 2. See id 2b in Table 6.11.*	-	Saturation reached
Need for weighting of criteria. *Transferred from BIE cycle 2. See id 2c in Table 6.11.*	-	Saturation reached
Need for a composite opting view supporting comparison of evaluated option. *Transferred from BIE cycle 2. See id 2d in Table 6.11.*	-	Saturation reached

Finally, the four grounding processes, i.e., value-, explanatory-, conceptual-, and empirical grounding, are reinforced to summarize the learnings.

6.4.6.1.1 Value Grounding

Making viable opt-in or opt-out decisions concerning digital innovations have been seen as a difficult activity in practice and theory. Consequently, the design knowledge related to the resource opting action is valuable because it enables practitioners to conduct resource opting using digital resources in a structured and efficient manner. This means that the design knowledge inscribed in a digital resourcing system helps practitioners to make good decisions, which could be relied upon. Moreover, the design knowledge supports the VRIO framework because it utilizes hard to imitate digital resources in the process. Furthermore, this design knowledge helps to fulfill all artifact goals. First, it helped to reach artifact goal 1; (easy to use web-based IT artifact enabling digital innovation) and objective 4 (the artifact must provide utility) since the design knowledge constitutes another essential action supporting digital innovation. That is, without this knowledge inscribed into a digital resourcing system, there would be a high risk that the wrong solution with a reduced value proposition might be put into practice. This knowledge also supports artifact goal 3; put a specific focus on the initial activity of the digital innovation process (i.e., discovery) and artifact goal 2; focus on digital resources (e.g., accessed through process assessment). The argument for the latter is that the knowledge correlates well to the discovery stage of digital innovation and since it helps to focus on digital resources.

6.4.6.1.2 Conceptual Grounding

The essential construct related to the design knowledge was digital resource opting. Other constructs are, service providers and customers (actors in service ecosystems), as well as defuzzification of criteria related to feasibility, desirability, and uncertainty, are other constructs that relate to digital resource opting. The constructs are defined in chapter 2, and 3, and in previous sections. Figure 6.22 illustrates a simple model showing how dyadic human actors jointly evaluate available digital resource options for viability by defuzzification of contextualized multi-criteria related to feasibility, desirability, and uncertainty. It also shows that, together, the actors select a viable digital option with the highest density affecting the value proposition in a positive way. The selected actionable digital option should then be put into practice: i.e., a realized option.

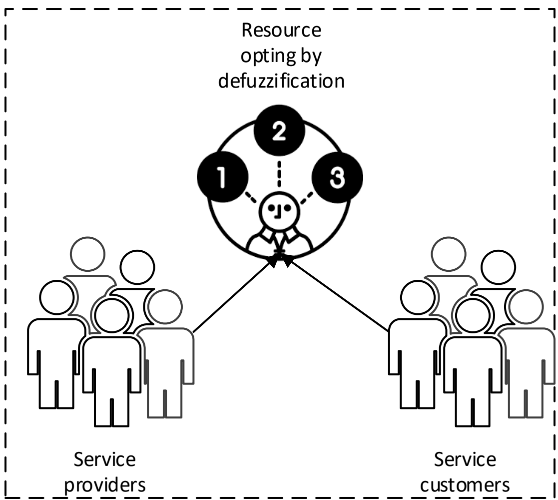

Figure 6.22. A model illustrating dyadic actors who jointly opt-in or out digital resource options (solutions or value propositions) created during digital resource pairing.

6.4.6.1.3 Explanatory Grounding

Digital resource opting, should be performed in a structured approach by evaluating each digital resource option (problem-solution pair), from a set of digital options, using criteria categorized under categories of desirability, feasibility, and uncertainty. This will help the actors in service ecosystem to jointly utilize operant resources, store them as digital resources, and use them to test each option for viability and finally select the digital option with a high density, i.e., with a sound value proposition. To solve the problem where different evaluation criteria are not of equal worth, *defuzzification* should be used because it helps to make vague information more clear. When each digital resource option is evaluated, the digital options should be compared against each other (Saaty 2008; Sandberg et al. 2014; Venable et al. 2016), and the result should be visualized in charts. This will help the actors to jointly analyze and select an actionable and viable digital option with the best value proposition, i.e., it possesses a high resource density (e.g., Lusch and Nambisan 2015). Furthermore, the resource opting action should be conducted in collaboration by service customers and providers with good knowledge of the digital service in context and its value proposition. This correlates with previous research that has shown that operative decisions, which require detailed knowledge of the actors involved, are at their best when decentralized (Grant 2001). The design knowledge therefore corresponds to S-D Logic as well as to the VRIO framework; i.e., a digital resource should possess and control *valuable, rare, inimitable* resources, and have the *organizational* processes to manage and exploit such resources (Barney 1991; 2001; 2011; Wade and Hulland 2004). The reason is that inscribed design knowledge supports the generation of rare digital resources supporting the option activity while it allows actors to *organize* their evaluation of digital options together with customers and providers.

6.4.6.1.4 Empirical Grounding

The empirical grounding of the design knowledge showed that it worked in practice and that it provided utility for practitioners. Quotes agreed on by all practitioners in the project were:

- *"Through the [digital resourcing] system, it is easy to make decisions about what solution to implement in our organization."*
- *"The identified solutions are better [novel value propositions with high density presented as a digital service] than if we are not using the IT system."*
- *"It is easy to understand which innovation that could enable most value for customers."*
- *"The tool [digital resourcing system] enables a better understanding of value."*
- *"The [digital resourcing] system makes it easy to select and prioritize innovations to implement."*

6.5 SUMMARY OF EVALUATION

In the description of the aforementioned BIE cycles, evidence of an emerging design knowledge for digital resourcing has been provided. In order to verify the knowledge, the digital resourcing system has been evaluated in a final and explicit summative approach in order to demonstrate its *utility* with evidence addressing specific evaluation properties (see section 6.1). Extractions of additional empirical evidence are, therefore, in focus in this section. The empirical evidence consists of statements and claims, quoted by practitioners using the digital resourcing system. The empirical quotes presented in Table 6.14 were agreed upon by all organizations in workshops; i.e., the quotes should be considered as generalized. Consequently, the quotes provided in Table 6.14 demonstrate that the different evaluation properties, e.g., utility, quality, etc., (see chapter 4) of the proposed design knowledge, are correct. Finally, as part of the ADR-team, I have participated in all BIE cycles, and my own experience from intervention and evaluation in real contexts confirms that the design knowledge is correct and that the digital resourcing system provides utility.

Table 6.14. Summative evaluation results presented as quotes from practitioners.

Evaluation properties	Empirical Evidence (quotes)	Relation to generic evaluation properties
Impact	*The digital resourcing system supports improved communication and resource transfer between customer and provider.*	Resource utilization/ Utility
Impact	*The digital resourcing system creates a mutual learning situation between customers and providers.*	Resource utilization/utility
Impact	*The digital resourcing system strengthens the relationship and hence, the integration between customer and provider.*	Resource utilization/Utility
Innovation Process/Effectiveness	*The digital resourcing system provides an efficient digital resourcing process.*	Process, Utility, Completeness, Effectiveness
Innovation Process/Applicability/Impact	*The digital resourcing system supports improved visualization and*	Process, Utility

	traceability of problems and solutions.	
Innovation Process	*The digital resourcing system makes IT processes 'visible' for both customers and providers.*	Process, Impact, Utility
Effectiveness	*The digital resourcing system allows customers and providers to co-create innovation based on resources.* *When everything is gathered in the same place [i.e., in a digital resourcing system], a more structured innovation process is enabled compared to if we were not using the tool [digital resourcing system].*	Process, Utility
Innovation Process/Effectiveness	*The digital resourcing system enables a common understanding of problems.*	Process, Utility
Impact	*The digital resourcing system enables increased value [innovations] for both service customers and providers.*	Utility, Efficacy
Relevance/Applicability/Build In Rules/No of statements/Comprehensibility	*The digital resourcing system clarifies that processes are jointly owned by the service customer and provider.*	Fit for context
Relevance/Applicability/Build In Rules/No of statements/Comprehensibility	*The digital resourcing system provides a common language.*	Fit for context
Relevance/Applicability/Build In Rules/No of statements/Comprehensibility	*The digital resourcing system is easy to learn and use.*	Fit for context
Relevance/Applicability/Build In Rules/No of statements/Comprehensibility	*The digital resourcing system allows for a greater understanding of the service in focus.*	Fit for context

Relevance/applicability/Build In Rules/No of statements/Comprehensibility	*The digital resourcing system is flexible and adaptable, which makes the area of use broad.*	Flexible

Practitioners in all participating organizations reflected on the specific evaluation properties (see section 6.1). The result was that all organizations agreed that the digital resourcing system was 'easy-to-learn,' 'easy-to-use' and that it provided 'utility.' Easy-to-use and easy-to-learn meant that practitioners did not need to spend time learning the digital resourcing system or even to prepare before using the digital resourcing system. This, in turn, means that the design is self-explanatory and includes affordance. Affordance refers to those things that provide the user with a clue to functionality (c.f., Gibson 1986) and, such things are afforded to specific user groups by technical objects (Markus and Silver 2008). Such affordance was also embedded through colors, buttons, sliders, tables, charts, menus, texts, the built-in digital resourcing actions, etc.

Furthermore, the digital resourcing system was considered *efficient* since the built-in actions supported the practitioners' to discover digital innovations. The digital resourcing system also provided a common language amongst practitioners, which affected the efficiency in communication in a positive way. The practitioners also agreed that the 'number of statements' for each process was sufficient and that the process statements were formulated and structured in an understandable way. This meant that the contextualized communication protocol worked and was fit for purpose (i.e., to mobilize and decouple resources). The 'built-in rules' were also regarded as sufficient because the structure and logic in the digital resourcing system were easy to understand and it enabled a balance between a too rigid structure and too much freedom in the innovation process. One of the most significant challenges for any innovation method is to find a sufficient balance between stringent and unstructured innovation procedures; the former could hamper the generation of ideas while the latter could lead to many ideas being lost and never executed (Span 2016). The digital resourcing system was designed to provide a sufficient balance between a structured and unstructured ad-hoc innovation process to reduce such risks. In other words, while mutability was inscribed in the digital resourcing system, the three actions provided an easy to follow structure acknowledged by practitioners. Accordingly, the evaluation episodes showed that digital resourcing actions balance creative disorder and formal routines. Practitioners and researchers also argued that the digital resourcing system allowed for 'flexibility' (i.e., contextualization in this context), meaning that it was possible to contextualize and add new best practices processes, digital services, process statements, and roles, etc. The 'relevance' of the digital resourcing system was according to the practitioner's excellent, since digital innovation work is considered crucial (see chapters 1, 2, and 3). Therefore, the digital resourcing system was highly 'applicable to the context.' In other words, both the content (e.g., in the communication protocol, design pattern, etc.) and the inscribed resourcing actions took into account characteristics that were related to the context (see chapter 2). Furthermore, the evaluation episodes showed that the specific evaluation property labeled 'impact' (i.e., related to the generic property: *utility*) of the digital resourcing system was sufficient. This means that the digital resourcing system organized a situation supporting the actors to pair digital resources related to problem and solutions and to co-create novel value propositions. Such digital resources should be considered hard to *imitate* since they were related to specific actors in a specific context, which meant that they were *rare*. Consequently, the digital resourcing system supported practitioners when managing digital resources that corresponded to the VRIO framework (c.f., Barney 2001).

In order to understand whether the digital resourcing system would be sufficient as 'a whole,' it was also evaluated against the four artifact goals. The first artifact goal, i.e., to design a contextualized and easy-to-use web-based digital resourcing system enabling digital innovation, was fulfilled. The ADR-team concluded that the digital resourcing system *works*, that it has *utility for its purpose,* it helps to *solve a problem*, it *provides benefits* as expected, and it is *correct* (e.g., Venable et al. 2016). The digital resourcing system was contextualized as belonging to the realm of ITSM, but it was also possible to adapt it to other contexts with similar characteristics. The second artifact goal implies that the digital resourcing system should focus on and emphasize digital resources. The evaluation showed that digital resources were being managed during the digital resourcing process. Hence, this artifact goal was also regarded as fulfilled. The third artifact goal stated that the IT artifact should put a specific focus on the discovery stage of the digital innovation process (e.g., Graham and Bachmann 2004; Fichman et al. 2014; Kohli and Melville 2019). The three built-in digital resourcing actions constituted a continuous balanced and synthesized approach to digital innovation, and it supported the discovery stage of the digital innovation process. Consequently, also, the third artifact goal was considered to be fulfilled. The fourth artifact goal stated that the digital resourcing system must provide utility; i.e., it should leverage innovation outcome as novel value propositions presented as a digital service. Finally, the evaluation episodes showed that the digital resourcing system reached the anticipated benefits stated in chapter 5. The digital resourcing system strengthens the relationship amongst service providers and customers, it enables efficient digital resource sharing between actors, and it supports the identification of rare, unique and value-enabling digital resources while it supports the co-creation of new digital resources stored in the digital resourcing system.

To sum up, in this chapter, a description of the emerging digital resourcing system and associated design knowledge has been presented. The design knowledge has been improved ultimately by answering the question, "*Does the design artifact improve the environment…?*" (Hevner et al. 2007, p.89). Evidence has been brought to light, which shows that the digital resourcing system indeed orchestrates an efficient approach when discovering digital innovations. It supports digital resource liquefying, resource pairing, and resource opting, which improves the efficiency of the discovery stage of the digital innovation process. In other words, it supports actors so they can to manage and utilize digital resources as building blocks in order to co-create novel value propositions and present them as a digital service. Moreover, the digital resourcing system supports actors in service ecosystems who are in command of rare, unique, and value-enabling digital resources. It also supports increased communication amongst actors, and it enables efficient digital resource sharing amongst several actors in a service ecosystem. Simply put, I have shown that the digital resourcing system worked, that it provided utility for its purpose, that it improved the environment, and that it helped to reduce the problems introduced in chapters 1 and 2. In this way, the digital resourcing system can organize and facilitate a situation, which practitioners have previously struggled to control. Therefore, it is also possible to conclude that the design knowledge presented in this chapter is trustworthy.

7 IS Design Theory for Digital Resourcing

The purpose of chapter 7 is to summarize the IS design theory for digital resourcing. As previously described, an IS design theory consists of multiple components, of which several have already been presented in the previous chapters. To avoid too much repetition, references to those components are used in this chapter. Another purpose of this chapter is to offer a summary of additional evaluations made. This chapter is divided into section 7.1 Evaluation Strategy, 7.2 The IS Design Theory, and 7.3 Summary of Evaluation.

7.1 Evaluation Strategy

An IS design theory should be evaluated *through* an IT-artifact that demonstrates its worth with evidence addressing specific criteria such as *utility*. This means that the design theory for digital resourcing has been evaluated when the digital resourcing system was evaluated for its utility in achieving its purpose (e.g., Venable et al. 2012; 2016; Gregor and Hevner 2013; Walls et al. 1992). Consequently, the evaluation strategy of the design theory is tightly integrated with the three BIE cycles visualized in Figure 6.2. However, in order to ensure that the design theory for digital resourcing worked and was correct, I decided to extend the evaluation of the design knowledge through a summative approach. A summative approach to evaluation corresponds well with design science research (e.g., Rossi et al. 2013; Venable et al. 2016)

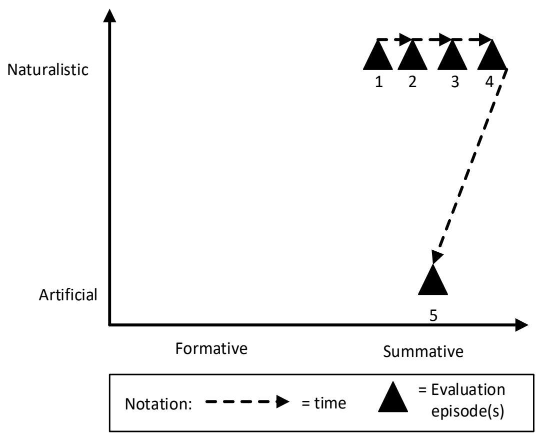

Figure 7.1. The final summative evaluation episodes for the IS design theory.

Figure 7.1 shows that evaluation episodes 1 to 4 were specially conducted in order to evaluate the design knowledge in *other* contexts than the one of ITSM, while evaluation episode 5 was artificial and summative. The purpose of evaluating the design knowledge in other contexts was to strengthen its generalizability.

The first four evaluation episodes were conducted in organizations residing in a public context (a Swedish municipality), in a pharmaceutical context, in the petroleum sector, and in the retail sector. These organizations had not been involved in the design of the digital resourcing system. One argument for selecting organizations from the specified contexts above was that they had needs and characteristics similar to those of other organizations participating in the research project, even though they resided in other contexts (see chapter 2). Another argument was that they approached the ADR-team; i.e., they were in need of a digital system supporting the discovery stage of the digital innovation process. This meant they were highly accessible and responsive in meeting the evaluation interest. In order to evaluate the design knowledge, contextualized processes and process statements were created to form new communication protocols and design patterns. This was to help to test the built-in mutability aspects and generalizability of the digital resourcing system.

As a final step in the evaluation strategy for the design theory, one concluding evaluation episode was carried out (see no. 5 in Figure 7.1). It was completely artificial and summative, and the purpose was to ensure that all the components of the design theory had been *formalized* in a correct way (e.g., Gregor and Jones 2007; Gregor and Hevner 2014; Cronholm and Göbel 2018). Consequently, a comparison or benchmark analysis of the content of each component of the complete design theory for digital resourcing and contemporary IS design theories was conducted. The result is presented in section 7.2 and Appendix 6. In the contents of this section, the third evaluation strategy is summarized in relation to each design theory component.

The first design theory component, '**purpose and scope**,' was formulated by practitioners and researchers together. The 'purpose and scope' was based on practitioners' needs and the identified class of problems (i.e., *lack of design knowledge for digital resourcing systems*). Furthermore, it was based on theoretical statements, and it was matched with a systems class; i.e., Innovation Management Systems. Consequently, the 'purpose and scope' was grounded and evaluated in both theory and practice. The component is presented in chapters 1 and 2, while the result of the evaluation of this design theory component is elaborated on in section 5.2.

The design theory component entitled '**constructs**' was inscribed in the digital resourcing system as fine-tuned meta-requirements. Rather than being evaluated *per se,* this knowledge has been looked upon as representations of constructs of particular interest as part of the '**justificatory knowledge**'; i.e., the knowledge that has inspired the design. The main constructs of interest in this dissertation are obviously the three digital resourcing actions; resource liquefying, resource pairing, and resource opting. The constructs form the concept of digital resourcing, which has been viewed as a kernel theory in this dissertation (see chapter 3). The constructs in justificatory knowledge have provided a basis as well as an explanation of the digital resourcing system design. However, by applying the knowledge in the digital resourcing system, the constructs in the justificatory knowledge have also been evaluated, and new knowledge has evolved during the BIE cycles. The constructs and other entities of justificatory knowledge have been evaluated and reflected upon during the evaluation episodes and interventions. The result is presented in chapter 6 and chapter 7 (see section 7.2.2 and 7.2.6).

The design theory component called '**design principles**' (i.e., principles of form and function) has been evaluated through the different BIE cycles presented in chapter 6, which were complemented with the four grounding processes suggested by Goldkuhl (2004a). In order to ensure a contemporary *format* of the design principles, three meta-design principles related to content, structure, and level of abstraction of a specific principle have been used (e.g., Cronholm and Göbel 2018). The design principles, as well as the result of the evaluation, is presented in chapter 6 and chapter 7 (see section 7.2.3).

The evaluation of '**artifact mutability**' was also carried out in parallel with the digital resourcing system utilizing the same evaluation strategy (see chapter 6). More specifically, artifact mutability has been analyzed according to three different mutability aspects. First, the degree to which an artifact can be adapted to entirely different sectorial contexts from the way the ITSM ITSM-context has been evaluated. Second, the possibility of adapting the IT-artifact to the situation in a specific context has been evaluated. Third, the degree to which an artifact has the potential to modify, transform, and/or constrain their surrounding environment has been evaluated. One argument for this approach is that there has been an increased recognition of the mutable nature of IT-artifacts and that they are in an almost constant state of change (Gregor and Jones 2007). In order to ensure artifact mutability in other contexts, the ADR-team conducted additional evaluation episodes (see Figure 7.1). The result is presented in chapter 7 (see section 7.2.4).

Rather than setting up an explicit hypothesis prior to the research study, the ADR-team has used theoretical statements found in literature during the design and evaluation of the digital resourcing system. Hence, no *explicit*, '**testable propositions**' were initially set up during the research project. Nevertheless, the three resourcing actions were seen as a tentative base for testable propositions. During the BIE cycles described in chapter 6, testable propositions emerged during reflection and learning. More specifically, they emerged by reflecting on the *evaluation* of the digital resourcing system and interviews with practitioners. Similar to the evaluation of design principles, empirical evidence (quotes from practitioners) have been used to strengthen the validity of the testable propositions. The result is presented in chapters 6 and 7 (e.g., section 7.2.5).

The component '**principles of implementation**' have been evaluated by reflecting on the development process used to design and implement the digital resourcing system. Since ADR has supported the development process, the principles of ADR have influenced the design. However, two additional principles of implementation have emerged during the BIE cycles. The evaluation of the digital resourcing system also supported the evaluation of those principles of implementation; simply put, if the digital resourcing system works, the principles used to implement it in real practice will also work. Moreover, a complementing interview related to the implementation process was conducted. Questions that were asked related to the specific requirement collection, including identification of contextual characteristics, the iterative development approach, collaboration amongst several organizations, and the fact that evaluation was conducted in several contexts. Moreover, researchers and practitioners, including developers of the digital resourcing system, reflected on the result of the implementation processes. The output was finally formulated inspired by the structure suggested by van Aken (2004): If you want to achieve Y in situation Z, then something like action X will help. To sum up, the development process was inspired by theory, but it is clear that the evaluation of the result is more empirically, than it is theoretically, grounded (see also Cronholm Göbel 2018). The principles of implementation are presented in section 7.2.7.

One purpose of the digital resourcing system (i.e., '**expository instantiation**') has been to evaluate design knowledge and to assist in representing and visualizing certain aspects of the design theory (e.g., design principles, artifact mutability, justificatory knowledge, and principles of implementation, etc.). That is, it has constituted the means to generate and evaluate design knowledge. Another purpose of the instantiation has been to constitute an operational digital resourcing system enabling value for practice. The evaluation strategy and the result of the evaluation are described in chapters 5, 6, and 7 (see section 7.2.8).

7.2 COMPONENTS OF THE DESIGN THEORY

An IS design theory in this dissertation, consists of the 'purpose and scope,' constructs, principles of form and function (i.e., design principles), artifact mutability, testable propositions, justificatory knowledge, principles of implementation, and, expository instance. The components should be viewed as parts of a whole and are summarized in the following sections.

7.2.1 Purpose and Scope

The component 'purpose and scope' describes what an IT-artifact (and design theory) is made for, i.e., the boundaries and the goals of the IT-artifact (e.g., Gregor and Jones 2007). The overall 'purpose and scope' of the digital resourcing system has been to enable digital innovation with a specific focus on the management of digital resources in the discovery phase of digital innovation (see chapters 1, 2, and 3). This description of the 'purpose and scope' could be viewed as a high abstraction level, which means that results are generalized and valid beyond the instantiation level (i.e., Cronholm and Göbel 2018). The reason is that it is highly related to the digital resourcing systems class extending the Innovation Management System Class (see chapter 5). From the point of view of a lower abstraction level, the 'purpose and scope' is to leverage the digital resourcing actions (see chapter 6) supporting the high abstraction level. As part of the 'purpose and scope,' a set of goals concerning the digital resourcing system have also been presented. These artifact goals are further elaborated in chapter 5. Finally, the boundary within which the design theory is expected to confine itself has been the ITSM context. However, the theory has shown to provide *utility* also in other contexts containing similar characteristics. This implies that the design knowledge could be applied in other contexts.

7.2.2 Constructs

Constructs are representations of the entities of interest in the theory (Gregor and Jones 2007). The essential constructs have been derived from justificatory knowledge, the characteristics of the ITSM context, and the definition of digital innovation. Together, the constructs form an integrated and coherent conceptual structure in the context of the digital resourcing system. The constructs for the IS design theory are elaborated in chapters 2 and 3, while Table 7.1 includes a summary of the constructs and specific references as to where to find further information in this dissertation.

Table 7.1. A summary of essential constructs inscribed in the IS design theory.

Construct	Definition	Further Descriptions
Value Proposition	It is defined as invitations to engage with an actor (e.g., the service provider or other actors) for the means of enabling value (i.e., someone is better off). A value proposition, in this dissertation, is bundled and communicated as a digital service, i.e., applying digital resources for the benefit of others or oneself.	e.g., section 2.1, and Lusch and Nambisan (2015)
Digital Resource	A digital resource is defined as digitally represented information and software that can be viewed as an integrated resource (Goldkuhl and Röstlinger 2019). Such digital resources emanate from the utilization of digital technology, including information and software (i.e., operand resources) and other non-digital resources (i.e., operant resources) embodied in, related to, or enabled by digital technology within and across organizations.	e.g., section 2.2, Goldkuhl and Röstlinger (2019); Henfridsson et al. (2018)
Co-creating Actors	Actors (e.g., individuals, departments, organizations of service providers, and customers) constitute the engine in digital resourcing. The actors decide what means, and what digital resources are available, and they co-create new operant resources that are stored as digital resources in the digital resourcing system. Actors also use digital resources supported by the digital resourcing system, and by doing so, they can co-create problem-solution pairs that enable value (i.e., value propositions). *Co-creation* in this study refers to two or more actors (e.g., service provider or customer) that conduct digital resourcing together in order to generate novel value propositions.	e.g., section 3.1.2, and Nambisan et al. (2017)
Service Ecosystems	Actors exist in a service-ecosystem, which is conceptualized as a relatively self-contained, self-adjusting system[s] of resource managing actors.	e.g., section 3.1.1 and Lusch and Nambisan (2015)

Resource Liquefying	Resource liquefying is a digital resourcing action and refers to the mobilization and decoupling of resources. Mobilization is defined as an activity where resources are identified and summoned to a specific time and space while decoupling means to free information from its related physical form or device (e.g., Lusch and Nambisan 2015). Such information is then stored as 'digital resources' in the digital resourcing system. Sub-constructs are communication protocols and boundary objects.	e.g., section 3.1.1 and Lusch and Nambisan (2015)
Resource Pairing	The use of digital technology to (re)bundle diverse digital resources that create novel resources by pairing newly created solutions to a problem (i.e., informal pairing) or vice versa (i.e., formal pairing).	e.g., section 3.1.2, von Krogh, and von Hippel (2016), Nambisan et al. (2017)
Resource Opting	To opt-in, or opt-out, a digital option with the best value proposition amongst several different digital options since an actor is usually better suited for one among several possible courses of action. Sub-constructs to resource opting are feasibility, desirability, uncertainty, and defuzzification.	e.g., section 3.1.3 and Sandberg et al. (2014)

7.2.3 Design Principles

The aim of the design principles (aka 'principles of form and function') is to provide normative and prescriptive knowledge of how to design digital resourcing systems. The design principles constitute a 'blueprint' that prescribes aspects of the functioning of the digital resourcing system. In this dissertation, a set of three design principles have been suggested. They should be viewed as a synthesized whole, where the sum is greater than the parts. This means that the design principles contribute complementing ways when developing an operational instance of the digital resourcing system class. As previously described, the design principles are interlinked with the digital resourcing system (chapter 5). In the following section, the three design principles are summarized, including a *title*, a short *description* according to the formula by Van Aken (2004), and a more informative *description* inspired by the example provided by Cronholm and Göbel (2018). The first design principle is labeled 'Design for Digital Resource Liquefying,' and it reads:

> *In order to design a digital resourcing system enabling actors in a service-oriented context to co-create novel value propositions, in the discovery stage of the digital innovation process, developers should design the digital resourcing system to support actors in service-ecosystems so they can mobilize and decouple resources through contextualized communication protocols and defined boundary objects and to store those resources as digital resources.*

The purpose of the first design principle is to support mobilization and decoupling of resources (i.e., both operant and operand resources) that can be stored as digital resources in the digital resourcing system. This will provide a sound digital resource base for forthcoming resourcing actions. The design principle states that the action should be performed by actors in service ecosystems (service providers and customers) in collaboration. A feasible approach to realize the action is to implement a communication protocol supporting actors in order for them to communicate about certain aspects of the context. An example of a communication protocol evaluated in this dissertation is a theoretically and empirically grounded ITSM framework, including processes and process statements directed to both service customers and providers. The argument for inscribing a communication protocol is that it encourages the actors to discuss and share knowledge and skills around the current situation. By communicating about process statements, resources (e.g., both tacit and explicit knowledge) from diverse and sometimes far-flung sources become decoupled from their physical form and are made explicit and transparent. Those operant resources could then be stored in the digital resourcing system as digital resources.

Moreover, the design principle implies that there is a need to inscribe features in the digital resourcing system that support the actors so they can set common boundary objects. Such boundary objects should at least consist of a best practice, contextualized processes, the roles of participating human actors, and obviously the underlying digital service. This approach will help the actors to focus and interact around the essential aspects of the context, and it will make the digital resource liquefying action more efficient than without using boundary objects. In order to evaluate inscribed features in an instance, the developers should use a naturalistic iterative approach, and they should carefully pay attention to contextual characteristics because it supports them in their attempts to identify and improve boundary objects and to contextualize the communication protocol. The first design principle should be seen as a prerequisite to the second design principle, and it is evaluated and described in detail in chapter 6.

The title of the second design principle is; 'Design for Digital Resource Pairing.' The short description of the principle is:

In order to design a digital resourcing system enabling actors in a service-oriented context to co-create novel value propositions in the discovery stage of the digital innovation process, developers should design the digital resourcing system to support actors in service ecosystems to work with formal and informal problem-solution resource pairing through design patterns.

The purpose of the second design principle is to support actors so they can identify problems and co-create solutions holding novel value propositions. The merging of digital resources relating to both problems and solutions should be carried out both through an informal and formal pairing of digital resources. In other words, the digital resources that have been stored through digital resource liquefying action should be used by the human actors as building blocks when pairing problems with solutions or vice versa.

An implemented design principle will support actors to collaborate and generate novel solutions by utilizing *design patterns* inspiring actors to find solutions. The argument for a *combination* of formal and informal pairing is that it will maximize the possibility for actors to co-create new or improved value propositions. More specifically, formal pairing means that actors should identify and base solutions on already identified problems, while informal pairing means that actors also can also identify solutions first and then reflect on the solution in order to find the problem it solves. Thus, problems-solution pairs could be seen as a bundled package of information supporting the value proposition. To support formal pairing, developers should build a functionality that allows actors to prioritize and visualize identified problems e.g. through assessment and ratings of statements. Moreover, features allowing human actors to direct problems towards a solution is necessary to design. In order to support informal pairing, developers should ensure that solutions could be captured in the digital resourcing system regardless of when the solutions occurred in the resourcing process. Moreover, functionality supporting actors to store solutions and map them to a problem should be developed. When designing and implementing the design principle in a digital resourcing system, developers should evaluate the instantiated action in a naturalistic setting. This will help them to understand when ideas, solutions, and problems usually occur and hence help them to contextualize the instance better. The emergence of the second design principle is described in chapter 6.

The title of the third design principle is; ‘Design for Digital Resource Opting.’ The short description is:

In order to design a digital resourcing system enabling actors in a service-oriented context to co-create novel value propositions in the discovery stage of the digital innovation process, developers should design the digital resourcing system to support actors in service ecosystems to work with digital resource opting through contextualization and defuzzification of feasibility, desirability, and uncertainty criteria.

The purpose of the third design principle is to support dyadic human actors to opt-in or opt-out one or more solutions amongst a set of problem-solution pairs (i.e., a set of digital resource options) with the best viable value proposition (i.e., maximized density). A solution, according to this view, consists of a bundle of novel digital resources contributing to an improved value proposition, which is finally realized and communicated to customers as a digital service. The design principle will increase the possibility of realizing a digital service holding a value proposition with high-density. The design principle should be implemented by developing features supporting actors to evaluate each of the created solutions using multiple criteria under the criteria-categories feasibility, desirability, and uncertainty. In addition, the design principle states that functionality to help actors to *contextualize* criteria in the digital resourcing system should be implemented. Such functionality will ensure that specific criteria are fi- for-purpose. Moreover, functionality supporting the actors when rating and weighting each criterion together should be implemented. The reason is that this procedure will generate more digital resources supporting a better possibility for human actors to opt-in the best solution to realize. Thus, also defuzzification of criteria should be implemented in a digital resourcing system. Defuzzification is crucial since it helps to produce a quantifiable result of vague information. Finally, developers should implement functionality supporting the visualization of the result of the defuzzification. The argument is that it will make the final opt-in or opt-out decision easy to take (jointly by human actors). This design principle should first be evaluated in an artificial approach since it ensures that the defuzzification algorithm will work *before* evaluating forthcoming versions in a naturalistic approach. The latter evaluation strategy will help to ensure that contextualized ratings and visualization charts are developed. The emergence of the third design principle is described in chapter 6.

The three aforementioned design principles have been shown to complement existing principles related to the digital resourcing systems class. Figure 7.2 shows how the principles complement already existing design knowledge for the Innovation Management Systems class.

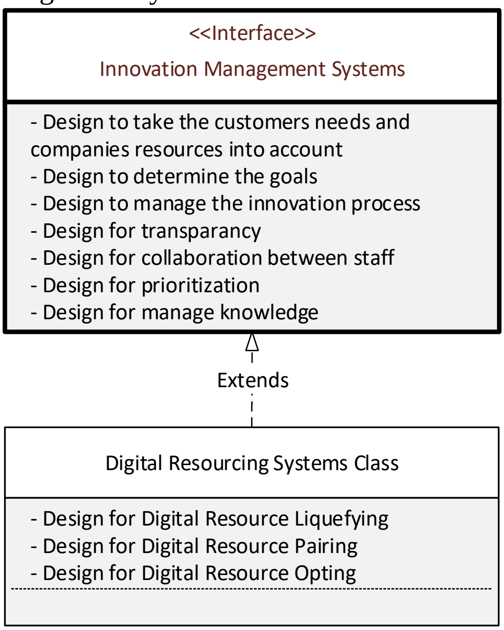

Figure 7.2. Three new design principles that support digital resourcing included in the digital resourcing system subclass.

Although the IS design theory contributes to the research domain of digital innovation, the three design principles especially affect the way we think about the discovery stage of digital innovation. Figure 7.3 shows how digital resource liquefying, digital resource pairing, and digital resource opting constitute a synthesized whole, supporting dyadic actors when managing digital resources to co-create problem-solution pairs and choose one to release into practice (communicated as a digital service). Although it is possible to view the three resourcing actions as part of the development stage of the digital innovation process, I argue that the development stage is more focused on *configuring* the solution opted-in (e.g., Kohli and Melville 2019). Furthermore, it is important to recall that I do not claim that the three actions (Figure 7.3) are the only actions in digital resourcing. Finally, the design principles also extend previous knowledge found in the innovation literature with more detailed, prescriptive, and normative knowledge that could be of assistance to practitioners and researchers when creating purposeful digital resourcing systems.

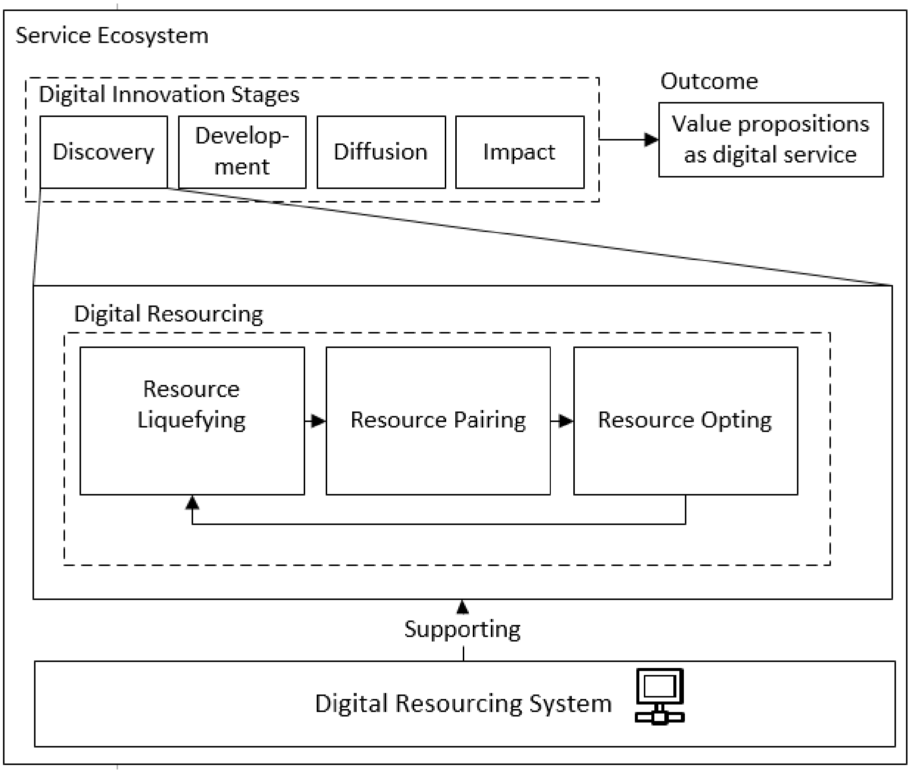

Figure 7.3. Digital resourcing as part of the discovery stage of the digital innovation process.

7.2.4 Artifact Mutability

Artifact mutability is intended to explicate how much it is anticipated that the state of the IT-artifact can change over time (Jones 2011). This indicates that it is favorable if the digital resourcing system and its underlying design knowledge *can* be adaptable to changes in the environment; i.e., it could potentially be more useful, sustainable, and the knowledge could be considered as generic. Consequently, the design theory for digital resourcing systems has been designed and evaluated to incorporate components that align with the state-of-flux that often exists in contemporary contexts in the digital age. First, the digital resourcing system has been designed using a modular architecture that allows users of the design knowledge to add *contextualized* best practices, processes, digital services, roles, etc. and to use such digital resources as a base for a digital resourcing initiative. This means that it is possible to adapt the digital resourcing system to the environment. Similarly, the architecture of a digital resourcing system does not necessarily need to be developed as a *web-based* digital system. Instead, it could be instantiated in different ways, depending on what kind of digital technology is available at the time. This means that future digital technologies could be used while following the design knowledge and still reaching the same result. Consequently, I could conclude that the possibility of adapting the digital resourcing system to the current situation in a specific context was strong.

Second, the design theory was designed to affect and modify the *surrounding environment*. These environmental modifications were visualized during evaluation episodes in various ways, e.g., changed innovation routines, new ways of collaboration between service customers and providers, and innovative digital services as a direct outcome of using the digital resourcing system. Some of these environmental changes were easy to identify during the evaluation episodes described in chapter 6, i.e., a new process activity, a new system feature in an incident management system, or a new policy for release management. Others, such as a new collaborative approach between service customers and providers, were picked up during interviews with practitioners. Consequently, I could conclude that the degree of artifact mutability regarding the surrounding environment was high.

Third, the digital resourcing system was designed to allow practitioners to adapt and apply it in completely different *sectorial contexts* than the ITSM-context. The features allowing for this artifact mutability aspect was the possibility to add best practices, roles, digital service, processes, and statements (as communication protocols and design patterns). The result of the evaluation episodes in different contexts showed that the digital resourcing system also worked in those sectors, which means that this aspect of artifact mutability was considered high. To sum up, I could conclude that the design theory provides a high degree of artifact mutability for all three mutability aspects; it could be adapted to a local situation, to diverse contexts, and it affects the environment where it is implemented.

7.2.5 Testable Propositions

A testable proposition refers to a true statement about the *design theory* (Nunamaker et al. 1990-1991; Gregor and Jones 2007). It means that it has the role of enabling for other scholars to test and verify the design theory. In this study, the testable propositions have been derived from the evaluation of the digital resourcing system and especially the emerging design principles (see chapter 6). In total, 6 testable propositions, that permit the empirical investigation in a range of organizational settings, has been formulated:

- Testable proposition 1: *The design theory for digital resourcing fosters improved capability to mobilize resources.* Before using the digital resourcing system inscribing the design theory, operant resources were not routinely mobilized and shared between actors, and they were not stored as digital resources. This testable proposition is especially derived from the emergence of the design principle 'design for digital resource liquefying.'
- Testable proposition 2: *The design theory for digital resourcing fosters improved capability to decouple operant resources from physical matters and transform those operant resources into digital resources.* Before using the digital resourcing system inscribing the design theory, many operant (or operand) resources were not decoupled, shared, or stored as digital resources. The testable proposition is especially derived from the emergence of the design principle 'design for digital resource liquefying.'
- Testable proposition 3: *The design theory for digital resourcing fosters improved capability to transfer tacit knowledge to explicit knowledge derived from far-flung sources (e.g., present absence).* Before using the digital resourcing system, actors did not recognize operant resources (e.g., tacit knowledge), that were owned by other sources than the obvious ones. The testable proposition is especially derived from the emergence of the design principle 'design for digital resource liquefying.'
- Testable proposition 4: *The design theory for digital resourcing fosters new or improved value propositions through formal and informal problem-solution resource pairing.* Before using the digital resourcing system inscribing the design theory, innovation work was often considered ad-hoc (or non-existent), and such work was always based on anecdotally identified problems. The testable proposition is especially derived from the emergence of the design principle 'design for digital resource pairing.'
- Testable proposition 5: *The design theory for digital resourcing fosters improved capability to identify, discuss, and share problems between actors.* Before using the digital resourcing system inscribing the design theory, communications of practices were seldom performed together by actors in service ecosystems. That is, important practice-related problems remained hidden. The testable proposition is especially derived from the emergence of the design principle 'design for digital resource pairing.'

- Testable proposition 6: *The design theory for digital resourcing reduces the uncertainty, and it increases the feasibility and desirability of the value propositions to realize.* Before using the digital resourcing system inscribing the design theory, no digital support for defuzzification of multi-criteria related to uncertainty, desirability, and feasibility was used. The testable proposition is especially derived from the emergence of the design principle 'design for digital resource opting.'

7.2.6 Justificatory Knowledge

Justificatory knowledge links and explains the different components of the design theory (Gregor and Jones 2007). It constitutes the knowledge underlying design knowledge, and it is usually derived from natural, social, or design sciences (e.g., Walls et al. 1992; Gregor and Jones 2007; Gregor and Hevner 2013). The justificatory knowledge for the suggested design theory was derived from previous research, the contextual characteristics of the ITSM context, the problem, research question, and the definition of digital innovation. An important part of the justificatory knowledge has been the conceptualization of digital resourcing, which has been seen as a kernel theory (see chapter 3). The justificatory knowledge that underpins the proposed design theory has been described in chapters 2, 3, and 6.

7.2.7 Principles of Implementation

Principles of implementation consist of prescriptive knowledge supporting the processes used for implementing the design theory in a specific context. The principles constitute "*the means by which the design is brought into being*" (Gregor and Jones 2007, p.328). Since the underlying project has followed a structured ADR-method, such principles of implementation are also described in the corresponding ADR literature (e.g., Sein et al. 2011). However, two additional principles of implementation have been identified during the design process in the study. The title of the first principle of implementation has been formulated as '*Design by acknowledging contextual characteristics*.' The short description is:

> *In order to design a digital resourcing system enabling actors in a service-oriented context to co-create novel value propositions in the discovery stage of the digital innovation process, developers should design the digital resourcing system by identifying and reflecting on contextual characteristics in order to shape boundary objects, communication protocols, and design patterns.*

The purpose of this principle of implementation is to identify the *specific* characteristics of the context because they affect the design. Those characteristics should then be transformed into specific system requirements. As previously described, Schatzki (2002, p.63) suggests that a context can be seen as webs "*of intelligibility, activities, events, specific individuals, histories, and 'obviousnesses' […] in which intelligibility is articulated or words are meaningful*". Consequently, it is positive to put decisions about what characteristics are important to consider in the designer's hands (e.g., Dey 2001). However, the principle of implementation narrows the search down to looking for characteristics that influence the set of specific boundary objects, communication protocols, and design patterns to be implemented in the design. Moreover, this principle of implementation will support developers wanting to identify characteristics that help to fine-tune and configure other features in the digital resourcing system (such as evaluation criteria, labels, and instructions to practitioners). The principle should be performed through interviews with various actors in the service ecosystem, but it is equally important to pay attention to the context during the concurrent building, intervention, and evaluation of the digital resourcing system. The latter correlates well with ADR (e.g., Sein et al. 2011). The principle is innovative because it provides prescriptive knowledge on how contextual characteristic could be extracted from the context, and how those characteristics could influence the design of the digital resourcing system. The emergence of the principle of implementation is described in chapter 6.

The title of the second principle of implementation identified during the research effort is '*Design together with multiple actors in various contexts*.' The short description is:

> *In order to design a digital resourcing system enabling actors in a service-oriented context to co-create novel value propositions in the discovery stage of the digital innovation process, developers should design the digital resourcing system by recognizing and involving multiple actors from various contexts and they should evaluate the* digital resourcing *system in those contexts.*

The purpose of the second principle is to ensure that developers work together with multiple actors from various contexts (i.e., service ecosystems) during the design and evaluation of the digital resourcing system. One argument for the principle is that it will increase the three aspects of artifact mutability; i.e., the digital resourcing system will be adapted to a local situation, to diverse contexts, and it will positively affect the environment where it is implemented. This is especially important if the digital resourcing system is to be used in several service ecosystems, which is obviously not always the case. However, since a single context can change over time, the principle is also important in the case where the digital resourcing system is developed for only one specific context (e.g., one organization). Simply put, environmental characteristics such as laws, rules, the policies on a macro-level, as well as routines and strategies on a micro-level, can change, and the digital resourcing system should be designed to conform to such changes. The principle should be performed by identifying different actors (humans, organizations etc.) with similar goals in various contexts. The emergence of this principle of implementation is described in chapter 6.

7.2.8 Expository Instantiation as digital resourcing system

The expository instantiation refers to the physical instantiation of the IS design theory, i.e., the digital resourcing system. According to Cronholm and Göbel (2018), an IT-artifact could be viewed from two different abstraction levels, i.e., a low and a high level of abstraction. In this study, the expository instance is represented by the web-based digital resourcing system, which corresponds to a low level of abstraction. As previously described, the digital resourcing system should be seen as a sub-class of the Innovation Management Systems class. The latter corresponds to a high level of abstraction (ibid). That is, a digital resourcing system inherit characteristics from the Innovation Management System class, but it also extends the parent class.

The digital resourcing system presented in this dissertation can be viewed as an instance that assists in representing the design theory for digital resourcing. It also constitutes a digital resource (e.g., Goldkuhl and Röstlinger 2019) illustrating design knowledge, and it has assisted researchers and practitioners in testing the suggested theory. In other words, the digital resourcing system should be viewed as an instance that materializes the design theory for digital resourcing and all its components. The digital resourcing system in this dissertation has also played a dual role in relation to digital innovation; i.e., the digital resourcing system is a digital innovation *per se*, but it also supports actors to co-create digital innovations. Finally, the digital resourcing system is strongly connected to artifact goals, meta-design, and meta-requirements. The digital resourcing system is presented in chapter 5.

7.3 Summary of Evaluation

The evaluation of the digital resourcing system identified needs, and the fact that practitioners in several contexts have agreed on the '**purpose and scope,**' points to the fact that it should be considered trustworthy. The result of the evaluation shows that the 'purpose and scope' are fulfilled and that all artifact goals have been reached (see also chapter 6).

In order to gain informative, understandable, and transparent content and functionality, the '**design principles**' should include prescriptions of certain aspects. Those aspects are summarized in Cronholm and Göbel (2018) as three meta-design principles, i.e., *content, structure, and level of abstraction*. The first meta-design principle, i.e., *content,* states that a design principle should include prescriptions of the purpose, actions concerning the building of the artifact, context where the artifact can be used, properties of the artifact, and actions regarding evaluation. The second meta-design principle states that a design principle should have a homogenous structure; it should be congruent (directed to the same artifact), logically connected (directed towards different aspects of the artifact that together form a whole), and are consistent (having uniformity). The third meta-design principle state that different levels of abstraction (i.e., high- and low levels of abstraction, relating to both a system instance and a class) should be described. By studying the description of the design principles suggested in chapter 6 and section 7.2, it is possible to conclude that the description fulfills the three meta-design principles apart from 'action concerning building' and high and low levels. Finally, the evaluation episodes in chapter 6 show that the design principles work and that they provide utility.

The '**justificatory knowledge**' and its '**constructs**' have justified, explained, and inspired the design of the digital resourcing system. By further evaluation and redesign of the digital resourcing system in real contexts, a design theory for digital resourcing has emerged, which provides feedback to (and adds new knowledge) to the justificatory knowledge. Since the design-theory components have been evaluated through the digital resourcing system, the constructs and justificatory knowledge used should be regarded as applicable in an ITSM context as well as in similar contexts. The four specific evaluation episodes that aimed to evaluate '**artifact mutability**' showed that the digital resourcing system had a high degree of mutability. This means that it is adaptable for other contexts than the ITSM-context, that it is a possibility to adapt the digital resourcing system in relation to the specific situation in a specific context, and that the digital resourcing system could affect the surrounding environment. Hence, it is possible to conclude that design knowledge has a high degree of mutability and that the design knowledge works for digital resourcing in multiple contexts that share the characteristics of ITSM. The '**testable propositions**' presented have also shown to be trustworthy. Table 7.2 shows simple complimentary quotes from practitioners that strengthen this claim. Additional empirical quotes related to testable propositions are presented in chapter 6. Please, recall that all practitioners have agreed on the statements/quotes during summative evaluation.

Table 7.2. Testable propositions and empirical evidence.

Testable proposition (id)	Examples of Empirical Evidence (quotes)
The design theory for digital resourcing fosters improved capability to decouple operant resources from physical matter and transform those operant resources into digital resources (2)	*The tool [digital resourcing system] enables a better understanding between service providers and customers*
-The design theory for digital resourcing fosters improved capability to identify, discuss, and share problems between actors (5) -The design theory for digital resourcing fosters new or improved value propositions through formal and informal problem-solution resource pairing (4)	*The tool [digital resourcing system] supports improved visualization and traceability of the right problems and solutions.*
The design theory for digital resourcing fosters new or improved value propositions through formal and informal problem-solution resource pairing (4)	*The tool [digital resourcing system] enables increased value for both customers and the provider.*
The design theory for digital resourcing reduces the uncertainty, and it increases the feasibility and desirability of the value propositions to be realized (6)	*It is easy to understand which innovation that could enable most value [i.e., density].*
-The design theory for digital resourcing fosters new or improved value propositions through formal and informal problem-solution resource pairing (4) -The design theory for digital resourcing reduces the uncertainty, and it increases the feasibility and desirability of the value propositions to be realized (6)	*The [digital resourcing] system works in our context and supports the generation of valuable innovations*
The design theory for digital resourcing fosters improved capability to mobilize resources (1) The design theory for digital resourcing fosters improved capability to decouple operant resources from physical matter and transform those operant resources into digital resources (2) The design theory for digital resourcing fosters improved capability to transfer	*The tool [digital resourcing system] supports improved communication and resource transfer between customer and provider.*

tacit knowledge to explicit knowledge derived from far-flung sources (e.g., present absence) (3)	

The evaluation of the two ‘**principles of implementation**’ shows that they work for the development of digital resourcing systems that enable discovery of digital innovations. The ultimate evidence for that is that the digital resourcing system provides utility, and therefore, the development process works. However, the two principles must be combined with principles from other development/research methods such as ADR. The principles of implementation have been applied throughout the design of the digital resourcing system. The digital resourcing system (i.e., ‘**expository instance**’), which inscribes the IS design knowledge, provides utility in practice, and the result is presented in chapter 6. However, in order to ensure that the proposed IS design theory for digital resourcing follows a similar *pattern and form* as other IS design theories published in established IS journals, a benchmarking analysis has been made. The benchmarking shows that the composition of the suggested design knowledge for digital resourcing follows established formats and that it corresponds well with contemporary design theory approaches. The design knowledge fulfills all the different views of a design theory suggested by Gregor (2006). The benchmark analysis is presented more extensively in Appendix 6.

To conclude, the design theory presented in this dissertation provides statements that say how digital resourcing should be performed in practice. It provides a lens for viewing or explaining a situation in the world, and it provides statements of relationships among constructs that can be tested. Apart from drawing on theories, the design knowledge presented rests on a strong empirical base; it is based on a real problem, a real system, involving real practitioners and users (c.f., Sun and Kantor 2006). *Since I have shown that the design theory works, provides utility for its purpose, helps to solve a problem, and is correct (Venable et al. 2016), the design knowledge for digital resourcing should be considered reliable and trustworthy*.

8 FORMALIZATION OF LEARNING

The purpose of chapter 8 is to formalize the learnings and restate the findings of this dissertation for both theory and practice. Moreover, the purpose is to discuss the limitations of the research effort and, finally, to point out further research opportunities. The contents of the chapter continue with 8.1 Contributions to Research and Practice, 8.2 Limitations and Future Research Opportunities, and finally, 8.3 Concluding Remarks.

8.1 CONTRIBUTIONS TO RESEARCH AND PRACTICE

Numerous scholars have identified the need to study a variety of questions related to digital innovation. Such need has included studying how innovations form and how actors should organize for innovation, (e.g., Nambisan et al. 2017), how digital resources becomes a central component of digital innovation (e.g., Henfridsson et al. 2018; Saldanha et al. 2017), and how empirical patterns and intellectual tools for understanding and managing innovation should be designed (e.g., Svahn et al. 2017). In this study, the research effort complements this urge to understand the phenomenon of digital innovation better, but it has also gone beyond previous scientific and practical approaches, since it has studied three different abstraction levels of design knowledge that support digital resourcing. The three levels have shaped a dialectic process where several BIE cycles and evaluation strategies mutually feed each other in order to identify and reflect on emerging design knowledge.

By providing different levels of design knowledge, this research effort corresponds well with the broad consensus within IS; i.e., that researchers should recognize and fulfill a dual mission of making theoretical contributions to the research community and assist in solving current and anticipated problems for practitioners (Sein et al. 2011; Iivari 2003; Rosemann and Vessey 2008). More specifically, the following research question has guided this research effort: *How should digital resourcing systems be designed to spur the discovery of digital innovations?* The research question addressed a design problem stating that there is a lack of design knowledge enabling the development of digital resourcing systems. This means that there has been a need to identify new design knowledge that better corresponds to contemporary ideals, and that better serves the requirements of practitioners. The problem addressed has been approached by developing and evaluating a purposeful digital resourcing system inscribing previous fragmented *and* newly found knowledge related to the management of digital resources in digital innovation. As a result, the anticipated contributions stated in chapter 1 has been fulfilled.

The specific contributions of this dissertation consist in design knowledge that relates to an ensemble IT-artifact (e.g., the digital resourcing system), design principles, and an IS design theory. The three levels are integrated, and they all help to contribute to the design knowledge for digital resourcing. The design knowledge has been based on a digital resourcing concept, including three resourcing actions, i.e., resource liquefying, resource pairing, and resource opting. Those actions have previously been presented in a fragmented manner in the digital innovation literature. The design knowledge presented in this dissertation not only shows how those concepts should be synthesized and applied in order to streamline the discovery stage of digital innovation but also how those constructs and the underlying theory have been extended with further knowledge. This move has redirected the attention from different types of innovation outcomes toward *digital resources* and associated actions. In a similar way, this study has redirected the attention from the traditional ideals related to the narrow and traditional product-oriented perspective toward a service-oriented perspective (e.g., Vargo and Lusch 2004; 2008; 2016; Lusch and Nambisan 2015; Barrett et al. 2010; 2015). The synthesized design knowledge could be viewed as a response to the specific call for research related to the early stages of innovation (Kohli and Melville 2019). Alternatively, it could be viewed as a response to the more generic call for IS researchers to develop research that may guide and inform both practice and the research community, into innovation in a digital age (e.g., Barrett et al. 2015). In the following sections, a brief summary of the abstraction levels of design knowledge is restated.

8.1.1 Abstraction Level 1: Digital Resourcing System

The first, and lowest, abstraction level of design knowledge constitutes knowledge related to the objective world of material objects (c.f., Popper 1978; 1980; Habermas 1984). In this case, it consists of the digital resourcing system (Figure 8.1). The digital resourcing system is not only a contribution directed to practice, but it is also important to research; i.e., *"Demonstration of a novel artifact can be a research contribution that embodies design ideas and theories yet to be articulated, formalized, and fully understood"* (Gregor and Hevner 2013, p.341). In this dissertation, the digital resourcing system *should* be viewed as a distributor of design knowledge. Nonetheless, the digital resourcing system presented in chapters 5 and 6 is specific, limited, and less mature than the second and third levels of design knowledge. However, a closer look at the digital resourcing system reveals that it communicates design knowledge. Such knowledge includes specific features of the design, e.g., *how* to realize digital resource liquefying, resource pairing, and resource opting functionality. That is, the contribution reflects not only the theoretical precursors but also the influence of users and usage in a real context (e.g., Sein et al. 2011).

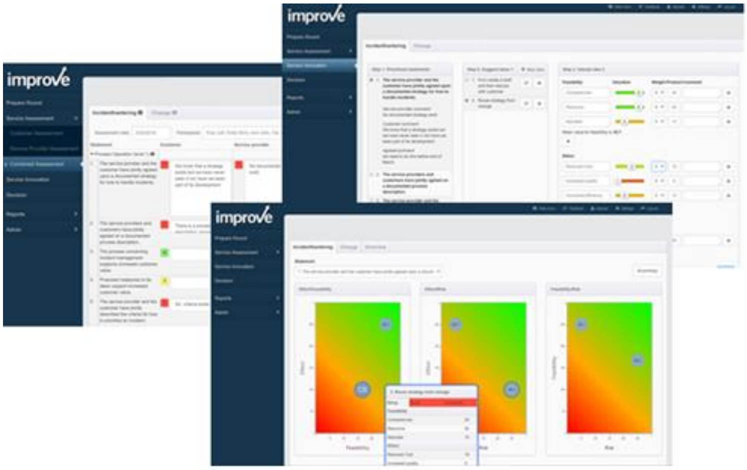

Figure 8.1. The digital resourcing system visualizing design knowledge (see also chapter 5, and 6).

During the cyclic design process described in chapter 4 and 6, the digital resourcing system has been rigorously evaluated, which has provided evidence of reliability (i.e., consistency of the evaluation method) and validity (i.e., different statements are true since they represent those features of the design that it is intended to explain). Evidence has been presented that the digital resourcing system works, that it provides utility for its purpose, that it helps to solve the problem in practice, and that it is correct. Moreover, the digital resourcing system epitomizes the systems class as a subclass of Innovation Management Systems because it shows in detail *how* abstract concepts, meta-requirements, and specific requirements could be represented in the design.

Finally, the first abstraction level contributes to practitioners in many ways. First, it supports service customers and providers in the service ecosystem who have a need for digital support during when discovering digital innovations. Second, it supports system developers who could find inspiration in the design when developing other instances of the digital resourcing systems class. The first abstraction level also supports researchers because it helps to concretize and visualize design knowledge with examples of the different propositions included in the suggested theory. There are numerous examples of how this is expressed in the digital resourcing system. For example, it includes a set of novel processes and statements that have been evaluated theoretically and empirically (see Appendix 5). Such processes constitute examples of communication protocols, and design patterns, as a feasible way to support digital resource liquefying and pairing. More examples are provided in chapters 5 and 6.

8.1.2 Abstraction Level 2: Design Principles

The design principles constitute the second abstraction level presented in this dissertation. Viewed separately, the principles can be regarded as a *nascent design theory* (e.g., Gregor and Hevner 2013; Heinrich and Schwabe 2014). The design principles extend the first abstraction level, and it is considered as one-step farther on the road to the IS design theory.

Three design principles have been suggested. Firstly, *design for digital resource liquefying* provides normative and prescriptive knowledge on how mobilization and decoupling should be conducted and implemented in a digital resourcing system. The design principle prescribes how resource liquefying should be conducted by providing examples of boundary objects and contextualized communication protocols. Thus, the principle sheds light on a somewhat abstract action that has been difficult to grasp and transform in practice, since it shows how tacit knowledge can be transformed into explicit knowledge that can be stored in a system as a digital resource. Next, the design principle of *digital resource pairing* describes how the more creative stage of discovery could be maximized through a combination of formal and informal problem-solution pairing by using design patterns. Although it is not an entirely novel principle, it extends previous knowledge of *how* rare and unique digital resources should be managed by activities conducted by both service providers and customers. Moreover, it gives examples of contextualized design patterns that could help the actors to identify solutions. The third design principle, design for *digital resourcing opting*, is interesting since it extends previous knowledge on ‘digital options’; it adds a finer granularity of *how* digital resources could be used to evaluate digital options (e.g. problem-solution pairs) using feasibility, desirability, and uncertainty through defuzzification.

In total, the three synthesized design principles extend the discovery stage of the digital innovation process. This means that the sum of the three design principles is greater than the sum of its parts. This synthesized view also helps to illustrate how actors in service ecosystems use digital resources in digital innovation practices from a modern service-oriented perspective (c.f., Helfat and Petraf 2003; Henfridsson et al. 2018; Holmström 2018). The synthesized design principles are important since they guide developers to design instances of digital resourcing systems. That is, they articulate the principles upon which the digital resourcing system was based in a better way than in the expository instance. However, the design principles are also important because they allow abstracting away from singular settings, and thus they constitute generalized prescriptive knowledge. Furthermore, the suggested design principles contribute refinements to the theories that supported the design (see chapters 2, 3, and 6). Such refinements consist of normative and prescriptive knowledge that explain the actions are managing valuable, rare, and inimitable *digital* resources, i.e., the four attributes, known as the VRIO framework from a service perspective in a digital age (e.g., Barney 1991; 2001; Wade and Hulland 2004). This dissertation could better help practitioners and researchers to utilize the VRIO framework and recognize resources from other sources than the (internal) service provider and therefore attain sustainable competitive advantages. The synthesized view also creates a sufficient balance between stringent and unstructured digital innovation procedures. Finally, the synthesized design principles constitute new knowledge that can shape and explain the concept of digital resourcing.

8.1.3 Abstraction Level 3: Information Systems Design Theory for Digital Resourcing

If the aforementioned contributions can be expressed with "*...more explanation, more precision, more abstraction, and more testing of beliefs facilitated, then there is a move toward a more mature and well-developed body of knowledge*"; i.e., a design theory (Gregor and Hevner 2013, p.352). The design theory for digital resourcing should be interesting for the IS research community. The main argument is that previous research has not synthesized the previously fragmented actions that relate to the management of digital resources in the discovery stage of digital innovation. It should also raise interest because it adds knowledge to both theory and practice about the systems class as well as refinements to theories that contributed to the initial design.

The design theory for digital resourcing offers a solution to a generic and real problem. The problem state that there has been a lack of design knowledge for digital resourcing systems. Hence, previous knowledge did not adequately support the development of instances of the digital resourcing systems class. Since the problem addressed has been grounded and evaluated, the problem per se should be regarded as relevant for the design theory and interesting for other researchers who are interested in the search for complementary solutions to the problem. The design theory for digital resourcing should also be of interest to the research community because previous research within digital innovation rarely consist of an IS Design Theory. Finally, the design theory is important for practice because it is practical; i.e., it is a well-known adage that a good theory should be practical (Lewin 1945). The design theory for digital resourcing is practical because it offers benefits over traditional and non-theoretical system requirements; i.e., it has been grounded and evaluated in both practice and theory using an established research method. Hence, it is possible to trust the design theory, which is not necessarily the case with non-theoretical system requirements that might rest on anecdotal grounds.

The idea of providing a design theory points to the notion of searching for the truth, a fundamental requirement of propositional knowledge (e.g., Pritchard

2010; Müller and Urbach 2017). The design theory for digital resourcing is grounded in theory and has been evaluated in practice. The different design theory components have been revised and matured for several years. Consequently, the design theory should be regarded as a valid and true (mid-range) theory that integrates both theory and empirical research (e.g., Merton 1957; Boudon 1991). To conclude, the design theory helps to solve a generic problem for practitioners, and it provides knowledge for research, which means that it fulfills the dual mission of IS research. A summary of each design theory component is provided in Table 8.1.

Table 8.1. Summary of the design theory for digital resourcing.

Component	Summary
Core components	
Purpose and scope	The overall 'purpose and scope' is to provide a contextualized and easy-to-use digital resourcing system (inscribing design knowledge) supporting actors in service ecosystems to generate novel value propositions in the discovery stage of the digital innovation process. The overall 'purpose and scope' for the design theory are described in chapters 1, 4, and 6.
Constructs	A range of constructs has been summarized in section 7.2.2. They have been thoroughly elaborated on in chapters 2 and 3, and they have evolved during BIE cycles and during 'reflection and learning.' Essential design theory constructs presented in this dissertation are value propositions, digital resources, digital resource liquefying, digital resource pairing, digital resource opting, and co-creating actors in service ecosystems. Constructs are described in chapter 2, 3 and 7
Principle of form and function (i.e., design principles)	Three normative and prescriptive design principles have been offered; 1. Design for digital resource liquefying: *In order to design a digital resourcing system enabling actors in a service-oriented context to co-create novel value propositions, in the discovery stage of the digital innovation process, developers should design the digital resourcing system to support actors in service-ecosystems so they can mobilize and decouple resources through contextualized communication protocols and defined boundary objects and to store those resources as digital resources.* *2.* Design for digital resource pairing: *In order to design a digital resourcing system enabling actors in a service-oriented context to co-create novel value*

	propositions in the discovery stage of the digital innovation process, developers should design the digital resourcing system to support actors in service ecosystems to work with formal and informal problem-solution resource pairing through design patterns. *3.* Design for digital resource opting: *In order to design a digital resourcing system enabling actors in a service-oriented context to co-create novel value propositions in the discovery stage of the digital innovation process, developers should design the digital resourcing system to support actors in service ecosystems to work with digital resource opting through contextualization and defuzzification of feasibility, desirability, and uncertainty criteria.* A summary of each principle is provided in chapter 7, while full descriptions of their emergence and further descriptions are provided in chapter 6.
Artifact mutability	Artifacts exhibit adaptive behavior. The mutability appears in three different aspects; i.e., 1) the degree to which the digital resourcing system can be adapted in order to be applied in different sectorial contexts, 2) the degree to which the digital resourcing system can be adapted to the specific context, and 3) the degree to which the digital resourcing system can modify, transform and/or constrain its surrounding environment. The artifact mutability for all aspects is high, meaning that the design theory for digital resourcing exhibits a high degree of mutability. See also chapters 6 and 7.
Testable propositions	An instantiated design theory for digital resourcing…: 1. …fosters improved capability to mobilize resources 2. …fosters improved capability to decouple operant resources from physical matters and transform those operant resources into digital resources 3. …fosters improved capability to transfer tacit knowledge to explicit knowledge derived from far-flung sources (e.g., present absence) 4. …fosters new or improved value propositions through formal and informal problem-solution resource pairing 5. …fosters improved capability to identify, discuss, and share problems between actors 6. …reduces the uncertainty, and it increases the feasibility and desirability of the value propositions to be realized

	Read more about the emergence of testable propositions in chapters 6 and 7.
Justificatory knowledge	A range of knowledge has been derived from different research discourses, i.e., digital innovation, resource-based theory, and service-dominant logic. In addition, existing knowledge in practice has been considered, i.e., digital systems, contextual characteristics, etc. Justificatory knowledge has been described in chapters 2, 3, and 6. Moreover, the research method ADR has inspired the principles of implementation (see chapter 4).
Additional IS design theory components	
Principles of Implementation	The emergence of the two principles of implementation is summarized in chapter 6. The final formulation follows with a title and short description: 1. Design by identifying contextual characteristics: *In order to design a digital resourcing system enabling actors in a service-oriented context to co-create novel value propositions in the discovery stage of the digital innovation process, developers should design the digital resourcing system by identifying and reflecting on contextual characteristics in order to shape boundary objects, communication protocols, and design patterns.* 2. Design by recognizing and involving multiple actors from various contexts: *In order to design a digital resourcing system enabling actors in a service-oriented context to co-create novel value propositions in the discovery stage of the digital innovation process, developers should design the digital resourcing system by recognizing and involving multiple actors from various contexts and they should evaluate the* digital resourcing *system in those contexts.*
Expository instantiation	The expository instantiation, i.e., the digital resourcing system, is described in chapters 5 and 6.

8.2 Limitation and Future Research Opportunities

Every study has limitations, and this dissertation is no exception. The most important limitations are presented here. One limitation relates to the problem of generalization. The study is mainly conducted in the context of ITSM, which means that the design knowledge builds on characteristics belonging to this context. This fact will reduce the degree of generalization or mutability of the design knowledge presented. One should not uncritically transfer knowledge generated in one context to another context. Consequently, and in order to reduce this limitation, the digital resourcing system has been evaluated in additional contexts but with similar characteristics as ITSM, e.g., resource and service-orientation (see chapters 2, 6 and 7). Since the result of the evaluation showed that the digital resourcing system worked, there are good reasons to believe that the inscribed design knowledge is valid also for other contexts holding the same or similar characteristics as the ITSM context. Yet, more evaluation episodes should be conducted in complementary contexts including other contextual characteristics, to continue evaluating the design theory. Another limitation is that the effort of human actors using the digital resourcing system has mainly resulted in novel value propositions consisting of improved processes and practices; i.e., only a few value propositions consisted of explicit operand resources of hardware and software. Stated differently, the outcome from using the digital resourcing system has seldom resulted in new features of an operand (such as a new digital mobile app, etc.). Consequently, future research efforts should design digital resourcing systems that more explicitly support outcomes as operands. The result of such research could possibly generate complementary design principles.

A third limitation of this study is that it has involved mainly two groups of human actors in service ecosystems, i.e., service customers and service providers. Although the concept of present absence helps to expand the resource base virtually, a hypothesis is that even more sources (e.g., more knowledge and skills from other human actors in the service ecosystem) could enhance the digital resourcing initiative. However, to include more human actors possessing further resources also comes with a cost. Thus, future research should identify other relevant actors and evaluate the effects of involving such actors in digital resourcing. Furthermore, Hjalmarsson et al. (2015) have found that the key role of the facilitator has not been researched extensively. The researchers propose a conceptual framework that can be used to examine facilitation measures within process modeling projects. Since the digital resourcing system is associated with a facilitator, I believe that it constitutes an excellent opportunity to evaluate styles of behavioral in facilitation empirically. Moreover, the justificatory knowledge presented in chapters 2, 3, and 6, constitute an enabler as well as a constraint. On the one hand, justificatory knowledge constitutes an enabler since it inspired the design. On the other hand, it comes with boundaries for the design and thus constitutes a limitation. As a result, a future research opportunity would be to design other digital resourcing systems using other theories, other perspectives, and other constructs found in the knowledge base.

A study should be set in its social and historical context so that the intended audience can *see how the current situation under investigation emerged* (Klein and Myers 1999). In this dissertation, the ADR method has been used to guide the development of design knowledge. It has helped the participating researchers and practitioners to understand how design knowledge has emerged. However, in order to address the limitations that come with a specific choice of a research methodology, a variety of actions have been taken throughout this research effort. Such actions include; publishing peer-reviewed papers related to this dissertation, the use of objective data sources; the generation of different abstraction levels of knowledge; and the use of different evaluation strategies, including multiple evaluation episodes to verify and reject results (see chapter 4). ADR has indeed provided a good structure for the research effort, but during the research process, also additional knowledge related to ADR has been identified. That knowledge, which includes recommendations, will be presented in Cronholm and Göbel (2019a). A final limitation is that, due to the constraints in project resources (e.g., time and money), there has been no possibility of designing a second digital resourcing system built on the suggested design knowledge. Such an action would have further strengthened and generalized contributions. To this end, future research should use the suggested design theory to develop other instances to either confirm or reject the different design theory components. Finally, I do not claim that actions of digital resourcing, i.e., resourcing liquefying, resource pairing, and resource opting, are the only actions that can support actors in the discovery stage of the digital innovation process. Therefore, I urge other researchers to study other stages of digital innovation and elaborate on those actions from a service and digital resource perspective.

8.3 Concluding Remarks

There are at least three steps on the road to theory development in design-science research projects (Gregor and Hevner 2013). The three steps constitute various abstraction levels of design knowledge. In this study, they have been; 1) the digital resourcing system, 2) the three design principles, and 3) the IS design theory for digital resourcing. I consider that the three abstraction levels of design knowledge for digital resourcing matter because this knowledge is true, new, and interesting for both research *and* practice (e.g., Ramirez 2015; Tellis 2017).

In order to claim that results are *truthful*, this study has been structured according to the ADR methodology (Sein et al. 2011). ADR has contributed an approach that supported the simultaneous design of the digital resourcing system while addressing a problematic situation in real contexts (c.f., Sein, et al. 2011; Baskerville and Wood-Harper 1998; Hevner et al. 2004). The primary source of evaluation has been an organizational intervention. To reinforce the claim for truth further, different evaluation strategies and grounding approaches have complemented the use of the ADR methodology. Since rigorous evaluation processes have been carried out in a transparent way, practitioners and researchers should consider the result trustworthy (e.g., Venable et al. 2016).

In order to claim *newness*, a novel digital resourcing system, and new associated levels of design knowledge have been suggested. This knowledge helps to solve a heretofore-unsolved design problem. The term 'newness' is sometimes linked to the term innovation, and the success of an innovation is defined as an organization's ability to exploit the innovation or utilize it for increased value (e.g., Gopalakrishnan and Damanpour 1997; Hevner et al. 20004; Lusch and Nambisan 2015). Since the evaluation in contexts has shown that organizations who have used the digital resourcing system have been able to co-create valuable innovations, it is possible to claim that the digital resourcing system could be classified as an *innovation* per se. That is, I argue that rather than designing an innovation that no one has seen before and that 'solves everything,' the most important thing about innovation is that it creates value and that it gets implemented. Consequently, the study should also be considered to provide a sufficient degree of newness.

Finally, the research contribution should be '*interesting*.' On the one hand, multiple organizations have called for a solution to the problem addressed, and they have, in a co-creative manner, participated in the design and evaluation of the digital resourcing system. This implies that the results are interesting for practitioners. On the other hand, several scholars have called for more knowledge of digital resources in the digital innovation discourse. For example, there is a need for more knowledge that sheds light on digital resources in the discovery stage of the digital innovation process. Hence, the design knowledge presented in this dissertation should be viewed as an attempt to supply additional knowledge contributions to the digital innovation discourse. Consequently, I argue that the contribution should be of interest also to the research community.

To conclude, the research result complies with the requirements calling for design research to be *true*, *new*, and *interesting*, and therefore, the design knowledge presented in this dissertation could be used to illustrate a design-science-research effort.

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APPENDICES

The research effort underlying the result presented in this dissertation is extensive. That means that there are a lot of details regarding the design of the digital resourcing system that could have been described in previous chapters but that has been left out since it risked miring the reader down. In this section, however, information is placed that is relevant to the study but that should be regarded as non-essential for understanding digital resourcing systems. Consequently, the Appendix is simply a place for additional information related to the study, aimed for those readers who have an urge to know more about the research effort, analyses and results.

APPENDIX 1: PROBLEMS IN PRACTICE

The first chapter of this dissertation briefly describes the main problem addressed and how that problem has been based in both practice and research. The second, and third chapters provide even more knowledge, which apart from including valuable information supporting the design of the digital resourcing system, also provide an extended description of the main problem addressed. Apart from the theoretical discussions in the first chapters of this dissertation, many of the problems underlying the main problem identified were verified by recent surveys. For example, Axelos (2017b) surveyed 677 ITSM professionals, with more than 90% of respondents based in Europe, North America, Asia, the Middle East, Africa, and South America. The professionals participating in the survey, highlighted the following challenges for ITSM organizations, which correspond to some of the detailed problems stated e.g.,:

- Design decisions are based on assumptions and documents rather than real work practice, meaning that there is a lack of systematic innovation procedures in the discovery stage.
- There is a lack of collaboration between teams and actors are working in silos, which means that there is a lack of a contemporary service perspective.
- There is an insufficient focus on, or understanding of, customer needs (i.e., lack of a contemporary service perspective). (ibid)

Moreover, ITSM Benchmarking (2017) adds that ITSM practitioners often lack time and cost which corresponds to the result of the interviews of practitioners in this study. This fact implies that "*organizations need to find a way to support their teams, so they remain competitive and innovative, providing them with the structures and tools for success*" (Axelos 2017a, p.22). A statement that strengthens the need for digital resourcing systems. Another statement confirming the need for new design knowledge is "*organizations are relying on technological innovations to deliver their services, for both internal* *and external customers…*" (Axelos 2017b, p.8). Finally, Cronholm and Göbel (2014a; 2014b) find problems in ITSM that aligns well with the result presented below. To sum up, the detailed problems identified in practice related to; lack of digital systems supporting the management of digital resources in the discovery stage of digital innovation, lack of synthesized design knowledge, lack of a contemporary service perspective, lack of collaboration with customers, and lack of easy-to-use digital best practices. All problems were verified by the participating practitioners in the study (see chapter 4). The different problems are summarized in the figure below.

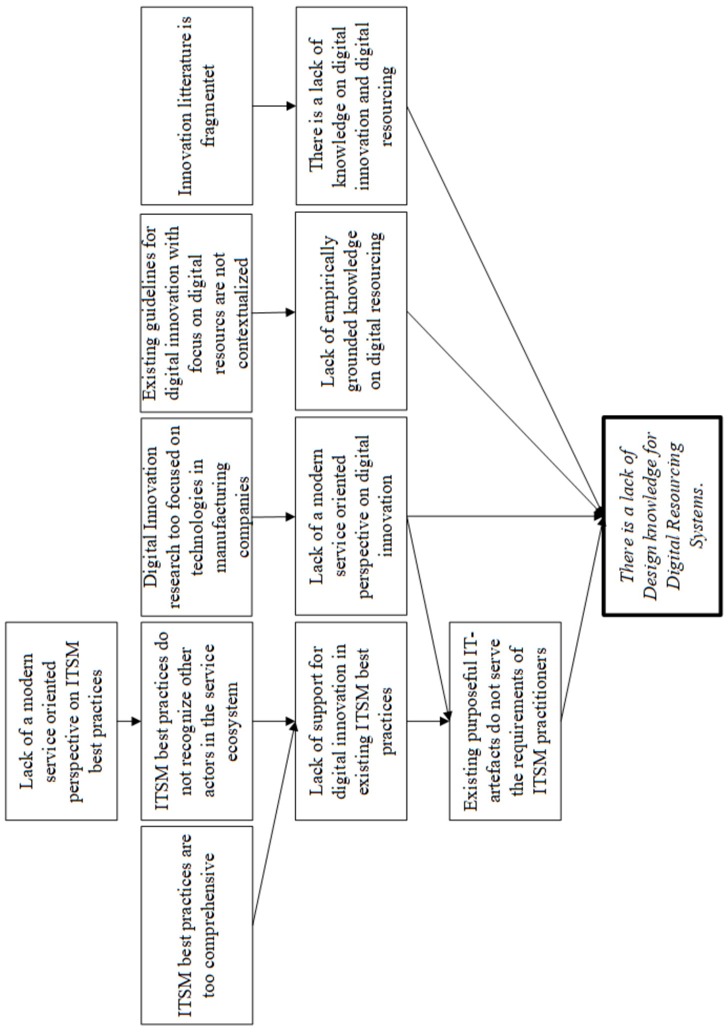

Figure. Summary of identified problems in practice.

The figure above should be read top-down (Goldkuhl and Röstlinger 1988). It complements the need for the problem addressed in chapters 1-3. Together, the detailed problems shape a knowledge gap that is important to solve; i.e., there is a lack of design knowledge for digital resourcing systems enabling the discovery of digital innovations.

APPENDIX 2: FOUNDATIONAL PREMISES OF S-D LOGIC

During this research effort, the Foundational Premises (FP) of Service-Dominant Logic (Vargo and Lusch 2016) have been utilized when analyzing existing ITSM frameworks (see Appendix 5), existing solutions in practice (see Appendix 5). Moreover, they have inspired the design of the digital resourcing system. Examples of the latter case is that the digital resourcing system have been designed to focus on operant resources (i.e., FP4), service (i.e., FP1, FP5), value co-creation (i.e., FP6, FP10, FP11), actors (i.e., FP7, FP8), resource integration (i.e., FP9). Also operand resources have been conducted (i.e., FP3). The table below contains the eleven FPs, of which five are considered to be axioms (c.f., Vargo and Lusch 2016). Since an axiom could be viewed as something that is accepted without controversy, it is possible to argue that those axioms are a base from which the other FPs are derived (ibid).

Table. FPs of S-D Logic. (e.g., Vargo and Lusch 2016; Mele and Della Corte 2013).

ID	FP	Further explanation
FP1*	*Service is the fundamental basis of exchange.*	Service is the application of knowledge and skills (operant resources). Service is exchanged for service."
FP2	*Indirect exchange masks the fundamental basis of exchange.*	What you see is not always what you get. That is, service is not always clear and obvious since, e.g., operands, such as tangible goods, exist in the foreground and hide the knowledge, skills, and processes, enabling value.
FP3	*Goods are a distribution mechanism for service provision.*	Operand resources (usually physical things), sometimes an essential component of a service, need to be put into practice and be used by an actor in order to enable value.
FP4	*Operant resources are the fundamental source of strategic benefit.*	Operant resources are defined in Vargo and Lusch (2004a) as knowledge and skills. Without (integrated) knowledge and skills, there is no service.

FP5	*All economies are service economies.*	Singular "service" in contrast to plural "services" reflect the process of integrating and using resources for the benefit of an actor. This is true no matter the type of economy (e.g., market, mixed, or plan-economy, etc.).
FP6*	*Value is co-created by multiple actors, always including the beneficiary.*	*"...value obtained in conjunction with market exchanges cannot be created unilaterally but always involves a unique combination of resources*" (Lusch et al. 2007, p.8).
FP7	*Actors cannot deliver value but can participate in the creation and offering of value propositions.*	"*Enterprises can offer their applied resources for value creation, and can collaboratively (interactively) create value once value propositions have been accepted, but they cannot create and/or deliver value independently*" (Mele and Della Corte 2013 p. 199). This FP stresses "the non-deliverable nature of value, and it does not imply that, once value propositions have been embraced by potentially beneficial actors, nothing else can be done by the service-providing actor to contribute to value creation" (Vargo and Lusch 2016, p.10
FP8	*A service-centered view is inherently beneficiary oriented and relational.*	States that no fixed consumer orientation is necessary. It is partly derived from FP6, which argues for co-creation.
FP9*	*All social and economic actors are resource integrators.*	Not only service providers are resource integrators but also individuals and households (Arnould 2006). It implies that "…the context of value creation is networks of networks (resource integrators)." (Mele and Della Corte 2013 p. 199)
FP10*	*Value is always uniquely and phenomenologically determined by the beneficiary.*	The value is different for each referent and must be assessed separately (Vargo and Lusch 2016, p.10).

FP11*	*Value co-creation is coordinated through actor-generated institutions and institutional arrangements.*	Institutions not only "*allow conservation of cognitive resources for optimum utilization for the purpose of utility maximization*" but also…. "*institutions represent the humanly devised integrable resources that are continually assembled and reassembled to provide the structural properties we understand as social context and thus are fundamental to our understanding of value co-creation processes*" (Vargo and Lusch 2016, p.10).

APPENDIX 3: S-D LOGIC EXTENDING RBT

Although a majority of scholars agree that RBT is well-grounded in theory, several scholars have criticized the current knowledge level. For example, Kraaijenbrink et al. (2010 p.350) argue that RBT "*has diminished its opportunities for making further progress*" and that the theory has clung too "*long to an inappropriately narrow neoclassical economic rationality*." This statement implies that RBT is grounded in a time where G-D logic was *the* dominant perspective on the market and when products (operand resources embedding value) were the only way to create wealth in society. The scholars have further collected and analyzed the RBT critiques identified in the literature, and they found that RBT has limited managerial implications and that RBT is difficult to apply in practice and that there is a lack of normative guidelines. Another concept that needs to be addressed in a better way is *value* because RBT adopts a too narrow view of what is a valuable resource. This idea implies that a wider view of resources needs to be adopted during the design of a digital resourcing system. Finally, RBT provides a narrow conceptualization of a service provider's competitive advantage.

One way to address the issues in this study has been to apply the contemporary service-oriented perspective of S-D Logic. That is, an S-D Logic perspective extends the narrow RBT explanation of, e.g., the *sources* of resources. The RBT idea of resources as being possessed by a *single service provider* implies that only internal resources are essential to consider (Wade and Hulland 2004; Hilton and Hughes 2013). In contrast, S-D logic state that not only resources from within a single service provider are essential when creating a novel value proposition but also resources that reside from outside the service provider (e.g., humans such as customers or technical databases). This means that the view of the VRIO framework can be thought of as indicators of how useful resources (resided from several actors) are for generating SCA for multiple actors. Finally, an S-D logic perspective helps to extend the resource view taken in RBT. The reason is that it provides relevant and theoretical foundations that are especially relevant to innovation, e.g., resource integration, co-creation, and service ecosystems (Lusch and Nambisan 2015). The table below summarizes how S-D Logic help to extend the view of resources in RBT.

Table. RBT and an extended S-D Logic perspective on resources (adapted from Mele and Della Corte (2013, p.197-198).

Items	RBT	S-D Logic Perspective
Original Focus	Firm	provider-customer and other actors in service ecosystems
Period of development	1980	2000
Theoretical perspective	Mainly normative (suggestions to managers)	Mainly positive (explaining)
Basic goals	Finding the roots of competitive advantage, Looking at the contents of previously developed strategic tools (five forces analysis, value chain, etc.). Trying to analyses competitive advantage, including reference to inter-company relations (networks) (e.g., Achrol and Kotler 2012)	A new perspective on value creation. A resource and value-based foundation for a unified theory of market and marketing.
Asked questions	Why do some service providers outperform others? Why are there wider spreads in performances of service providers that belong to the same sector, than between service providers of different sectors? What really generates a competitive advantage? How can it become sustainable? What role do intangible factors (including knowledge creation, relations, and governance choices) play?	What is the value? What is the role of knowledge and capabilities (‘operant resources’) in value creation? What are the bases for developing a market theory? How does resource integration occur?
Disciplinary Background	Management	Marketing

	An interdisciplinary approach that starts with the competitive advantage issue, thus investing in the theory of the service provider. Its roots lie in strategic management, but it also includes previous approaches, such as transaction cost economics, agency theory, and studies on industrial organizations.	It is a synthetic approach, combining service(s), and relationship marketing, and the RBT and as well as competency-based and knowledge-based extensions. Network theory is also included.
Key topics	Only strategic resources that are valuable, rare, difficult/costly to imitate can generate sustainable competitive advantage. This results in above-normal performance (greater than shareholders' expectations). The term 'resource' also refers to any capability or competence. Over time, the resource possession concept transformed into resource control and/or availability. Furthermore, the unit of analysis has also extended to strategic networks.	Goods are distribution mechanisms for service provision. The customer is a co-creator of value, and the company makes value propositions. Capabilities or competencies are the key resources (operant resources) for creating value propositions and for getting value from them. Actors are resource integrators in a network-to-network conceptualization of value creation.
Level/Unit of analysis	Firm, network	Actor, dyad, network, market Process perspective
Resource integration	N/A	Main focus
Resource Value	A resource's value is generated within the service provider,	Resources are service renders for the customer, who, within his or her own background, determines their value (that is value in use)

APPENDIX 4: THE ARCHITECTURE OF THE IT-ARTIFACT

Since practitioners and researchers wanted the digital resourcing system to be accessible in different locations without having to install specific software on a computer, they requested that it should be designed as a web application (see also artifact goal 1). This objective also implied that other material objects needed to be in place in order for the digital resourcing system to work. Example of such material objects was a computer, internet, projectors (or a large computer screen), a projector screen, a room, chairs and other material objects that usually are needed for common workshops. To fulfill the artifact goals and meta-requirements the widely accepted Model View Controller (MVC) design pattern inspired the architecture. MVC is according to Buschmann et al. (1996) and Krasner and Pope (1988), a useful way to create an architecture for interactive software systems (figure below). This pattern has also been successful in using an online web application, which has been the reason why we chose the MVC.

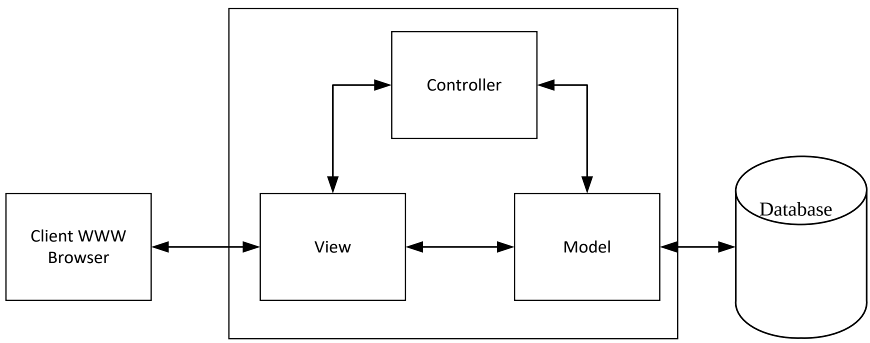

Figure. MVC of the IT-artifact.

The MVC pattern was used to divide the digital resourcing system into three interconnected parts, the model, the view, the controller. The argument for selecting this pattern was that it solves the problem of data (Model) affecting the presentation (View) and vice versa by introducing an intermediate component called the Controller. By doing so, one layer could be changed without reorganizing another layer. The specific techniques chosen to develop the digital resourcing system were Microsoft ASP.net using C#, JavaScript, and HTML. That database was implemented using 'SQL Server,' and the digital resourcing system was deployed on a Microsoft Windows Server 2012. Although there were specific requirements forcing the ADR-team to use this very architecture, it does not mean that it is not possible to use other technical architectures or patterns when designing other instances of the same system class.

APPENDIX 5: ANALYSIS OF DIGITAL SYSTEMS AND BEST PRACTICES

Contextualized ITSM Best practices and Digital Systems

As described in chapter 4, existing IT-artifacts related to the discovery of digital innovations in the context of ITSM have been identified, described, and analyzed. Although existing ITSM best practices are resourceful, thorough, feasible, and work in practice, they are not fully supported by IT- artifacts (see also Göbel 2014). Yet, a few attempts related to digital innovation and the context of ITSM exist: e.g., 'Improve 1.0' (Göbel 2014); 'OGC self-assessment tool for ITIL service support' (ITSM community 2016); Service Desk Plus (Zoho 2016); and 'Service Improvement Manager' (Solisma 2014). In this study, I do not claim that existing best practices or IT-artifacts are poor; they are indeed valuable for practitioners. However, none of the mentioned solutions have been explicitly developed from a contemporary service-oriented perspective focusing on digital resources, and they do not fully comply with the discovery stage of the digital innovation process. Hence, there is a risk that the value of the customer is not identified and fulfilled.

Nevertheless, these IT-artifacts have supported researchers and practitioners by stressing that ITSM *processes* are significant and should be considered when designing a digital resourcing system. I have also learned that it is essential to design an IT-artifact that provides an assessment of existing processes and includes functionality that facilitates innovation activities. These lessons are in line with the artifact goals that are described in chapter 5. Therefore, researchers and practitioners recognize these existing and contextualized IT-artifacts as valuable inspiration when designing the digital resourcing system.

Through an online search, I found other IT-artifacts that are dedicated to support actors in the ITSM context. ServiceNow, BMC, and Cherwell are the top vendors for ITSM IT-artifacts. Matchett et al. (2017) argue in their study that ServiceNow is the leader of contextualized IT-artifacts. Their digital system provides end-to-end visibility into processes and infrastructure through a single system, which comes with a built-in ITIL best practice. The digital system supports end-users to submit and track requests without making a call (ServiceNow Documentation 2017). The solution includes functions that support users to prioritize and assign work with drag-and-drop visual task boards. Although the system, which includes 'ideation,' is related to the discovery of digital innovation, it does not include an explicit digital innovation process from an S-D Logic perspective, nor does it emphasize digital resources.

Moreover, ServiceNow defines a service as an "*application or feature that performs activities in support of either business applications or the ServiceNow platform*" (ServiceNow Wiki 2017). An application is defined as "…*a packaged set of configuration records that provide a business solution*" (ibid). These definitions do not correspond to a contemporary service perspective.

'BMC' is another digital system dedicated for actors in the ITSM context. It focuses on the service desk functionality, and therefore it is not fully dedicated to digital innovation. Furthermore, Matchet et al. (2017) find that the digital system labeled 'Cherwell,' specifically focuses on infrastructure and operations, which does not correspond well to the process of digital innovation. Infocumulus (2018) has developed the tool 'Idea Hub.' This digital system is a solution linked to the SharePoint platform with the purpose of managing ideas submitted by employees of the firm. This process involves submitting employee ideas, elaborating ideas, as well as evaluating and commenting on suggested ideas. The digital system is promising, but it does not include a service perspective recognizing multiple actors in a service ecosystem, and it does not focus on digital resources.

I have also searched for and analyzed more generic and commercial digital innovation systems. Qmarkets (2019) claim that it should be clear to every employee what the company process is for testing ideas. To this end, the company provides the tool 'Q-ideate,' which engages the employees of an organization to deliver ideas. The company describes that the tool supports invitation of *internal* stakeholders to generate ideas meaning that it does not focus on diverse actors in service ecosystems to collaborate using digital resources. The company Wazoku (2019), also markets an idea management system i.e., 'Idea Spotlight.' By using the system, employees can submit and share ideas on anything, wherever they are, on any device (ibid). Similarly, the company Exago (2019) sells an online innovation management system that supports idea submission and evaluation by gamification and the company Capterra (2019), provides an idea management system that provides all employees or members of an organization with a platform for sharing ideas. Other digital systems, not mentioned here, also exist. However, the systems found and analyzed, differ qualitatively from the digital resourcing system suggested in this dissertation. Although they often support the discovery of innovation, they are not explicitly directed for *digital* innovations and they are not designed using service-oriented perspectives. Moreover, they are not focusing on digital resources, and they are seldom aimed for the ITSM context.

Examples of innovation systems are provided by Nambisan et al. (2017). One example that is relevant for this study is given: GitHub, which supports the innovation processes and fosters knowledge sharing and work execution (ibid).

However, GitHub is a development platform that allow developers to review code, manage a project, and to build software. That is, the tool is not focused on supporting multiple actors in the service ecosystem, and it is not dedicated to the ITSM context. Moreover, Göbel (2014) proposed design principles that should be taken considered when designing IT-artifacts in the ITSM context. The purpose of the design principles was to improve the internal efficiency of small and medium-sized service providers. However, the study was not conducted using a kernel theory of digital resourcing, nor did it include justificatory knowledge from S-D Logic. Moreover, it had a strong focus on service providers and not on other actors, such as service customers, which did not participate in the design of the digital resourcing system. Hence, that version of the digital resourcing system could not be viewed as an instance that solves the problems addressed in this dissertation. Nevertheless, the work presented in Göbel (2014) constitutes a sound foundation for conducting this very study. Finally, Shrestha et al. (2015) have used an iterative design process to develop an ITSM assessment method called The Software-Mediated Process Assessment (SMPA) approach. The method enables researchers and practitioners to assess ITSM processes transparently and efficiently. The method has four steps: 1) preparation for the assessment; 2) online survey to collect assessment data; 3) measurement of process capability; and 4) reporting of process improvement recommendations. The design principles, digital systems, and methods above have provided valuable input to the design of the digital resourcing system.

Analysis of ITSM Best practices

As explained in chapter 4, it was important to increase the understanding of the existing ITSM 'best practices' to design a digital resourcing system. The argument for that was that practitioners in the project often found existing best practices trustworthy, and therefore they applied them often in their existing practices. Hence, they could possibly serve as communication protocols and/or design patterns for the resourcing actions. First, the ADR-team analyzed the frameworks to understand possible barriers for applying specific practices and especially their compliance with a contemporary service perspective.

Although a vast amount of ITSM best practices exists, the most frequent frameworks and standards have been analyzed and used in the study. According to itSMF international (2013), the most adopted best practices are ITIL, CMMI, COBIT, and ISO/IEC 20000. A critical stance was taken to find discrepancies between the current state of the ITSM best practice and a service view on resources view (see also chapter 2). The most recognized ITSM framework is ITIL (c.f. itSMF international 2013; Cannon et al. 2011; Axelos 2017a), and that is why that framework was analyzed more thoroughly than the other best practices. ITIL is a set of good practices and offers detailed descriptions of processes with comprehensive checklists, activities, roles, and responsibilities related to a service lifecycle. The service lifecycle, as in most ITSM best practices, is depicted as a 'hub-and-spoke' design, with 'service strategy' as the hub, and 'service design', 'service transition' and 'service operation' as iterative lifecycle stages or 'spokes' (c.f. Cannon et al. 2011). 'Continual service improvement' surrounds and supports all other stages of the service lifecycle. Karu et al. (2016, p.10) assert, "*...it is important to note that the guidance is written for the service provider and is from the service provider's point of view*". This goods-dominant perspective also permeates the ITSM processes of the ITIL framework. For instance, the incident management process describes activities such as incident identification, logging, categorization, prioritization, diagnosis, resolution, etc. from a unilateral service provider point of view. That is, no sharing of resources with other actors. The purpose of incident management is to restore normal service operation as quickly as possible, and it does not explicitly mention any involvement of a beneficiary.

Furthermore, ITIL states that "*services are a means of delivering value to customers*" (Cannon et al. 2011, p.13). ITIL also states, "*services are produced and consumed at the same time and cannot be separated from their providers*" (Cannon et al. 2011, p.48). A contemporary service-oriented perspective (i.e., S-D Logic) means that a service provider cannot deliver value but that they can participate in the creation and offering of value propositions. Thus, the service view of ITIL conflicts with FPs such as FP6, FP7, FP8, and FP9 of the S-D Logic (see Appendix 2). Furthermore, the statements above suggesting that value is delivered are direct contradictions to FPs, such as FP7 and FP6. That is, the ITIL statements and expressions actually entail a view of the market economy that refers to a traditional view that is similar to the goods dominant (G-D) logic. Even though ITIL is highly valuable, the potential for improvement exists. This fact is recognized by Axelos (2018), who argues that a new version of ITIL is needed (a new ITIL version was released 2019 (Jouravlev et al. 2019)).

Moreover, the results in Göbel and Cronholm (2015) show that there are several categories of barriers and benefits that should be considered when designing future versions of ITSM frameworks that could serve as communication protocols. The authors identified barriers related to different categories such as service perspective, costs, adoption, and complexity, while they identified benefits that are related to categories such as structure and reliability (ibid) (see also figure below). The complexity barrier category consists, amongst others, of the fact that organizations argue that ITIL is too comprehensive, including too much documentation, which leads to great investments of time for practitioners to learn the framework. Hence, this category relates to the adaption category. However, to reach good returns on investments, usually, some effort is needed, which means that the comprehensiveness of current ITIL publications is understandable. Nevertheless, comprehensibility is a barrier that leads to high costs related to ITIL, and a solution (i.e., a digital resourcing system) is regarded as necessary (see also Appendix 1).

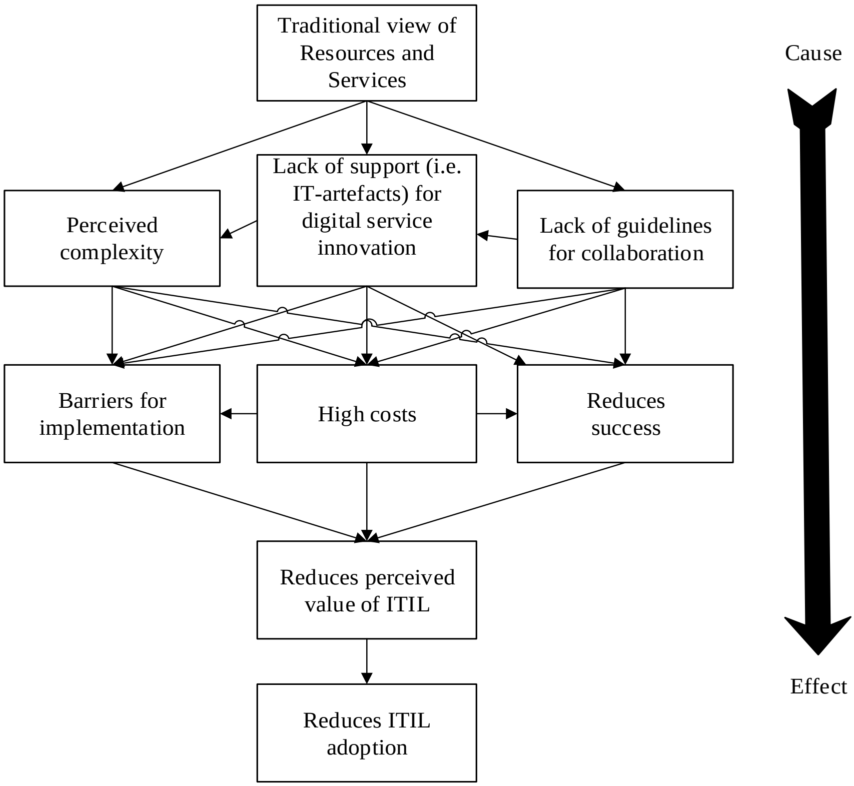

Figure. Different barriers in ITIL reduces the ‘adaption and the adoption’ of the framework.

The barrier category called “adaption” refers to the fact that ITIL is regarded by some users as hard to adapt and integrate with already existing processes (ibid). That category therefore also relates to the concretion barrier category because the guidelines about the subject of adaption seem to be scarce in ITIL publications (or they are inaccessible for users). Other quotes by practitioners, presented in Göbel and Cronholm (2015), claim that ITIL must be adapted to the service providers' organizational goals. This information implies that ITIL is not something you buy off-the-shelf and implement as-is. To new or inexperienced ITSM users, this situation is a significant barrier because they need time and experience to learn ITIL before being able to adapt it to the service provider (ibid). Thus, as shown in the figure above, the lack of adaption guidelines increases costs and reduces ITIL success. By communicating a traditional view of service in a framework that only targets providers of services, users of ITIL are confronted with major barriers to overcome to adapt and adopt the framework.

Another common ITSM framework is the Capability Maturity Model Integrated for Services (CMMI-SVC®). CMMI-SVC models are collections of best practices that help organizations to improve service-related processes; "processes allow you to leverage your resources and to examine business trends" (ibid, p.4). The purpose of CMMI-SVC is, according to CMMI Product Team (2010 p.495), to provide *"...guidance for applying CMMI best practices in a firm organization*." Consequently, it is not designed to support more than one actor in the service ecosystem. Moreover, they argue that service is "*a product that is intangible and non-storable*" and that "*service is considered to be a special variety of product*" (CMMI Product Team 2010, p.38). Process areas of CMMI are also directed to service providers. One example is the "incident resolution and prevention" process area. The purpose of Incident Resolution and Prevention (IRP) is to ensure a timely and effective resolution of service incidents and the prevention of service incidents as appropriate (CMMI Product Team 2010, p.171). That is, CMMI process areas have adopted a view that is close to the traditional view of services (i.e., G-D Logic) where several of the FPs (e.g., FP2, FP6, FP8, and FP10) in S-D Logic are not incorporated, and where co-creative processes are overridden in favor of internal service provider processes.

COBIT is a framework for the governance and management of IT, and according to ISACA (2017a), it builds and expands on ITIL. The COBIT 5 view of service is that it is the day-to-day provision to customers of IT infrastructure and applications and support for their use - e.g., service desk, equipment supply and moves, and security authorizations (ISACA 2017b). This view, again suggests that a service can be delivered and that service is limited to specific activities related to hardware and software, which is a contrast to the S-D Logic definition of service. Resources are also crucial in COBIT, and the view of a resource is that it is either tangible or intangible value that is worth protecting, including people, information, infrastructure, finances, or reputation (ISACA 2017a). This view corresponds better with the view of resources in this dissertation. Moreover, the processes of COBIT are directed to service providers and do not explain if or how a service customer is involved in the processes. One such example is the process called "*Manage Service Requests and Incidents*," the purpose of which is to "*Achieve increased productivity and minimise disruptions through quick resolutions of user queries and incidents"* (Bernard

2012 p.75). It includes statements (called best practices) such as "*Define incident and service request classification schemes*," "*Record, classify and priorities requests and incidents*," "*Verify, approve and fulfil service requests*," and "*Investigate, diagnose and allocate incidents*." Consequently, COBIT has adopted a traditional view of service, which affects the way they manage resources. More specifically, the view does not correlate to FPs such as FP7, FP8, and FP10.

Another prominent ITSM framework is VeriSM™ (Agutter 2017). VeriSM is a framework that describes a service management approach from the *organizational level*. Based on a specific model (the VeriSM model), it shows how organizations can adopt a range of different management practices. Agutter (2017) argue that VeriSM helps organizations to respond to their consumers and to *deliver value* with integrated service management practices. Since the framework is provided through a book (not an IT-artifact), and claims to support service providers to *deliver value*, it is not directly related to a contemporary service perspective.

Finally, the most adopted *standard* for ITSM is ISO/IEC20 000 (ISO/IEC 2011). As with other service-oriented best practices, the resources are considered the key to success. Especially, "*human, technical, information and financial resources necessary to achieve the service management objectives*" (ISO/IEC 20000-2 2011, p.11). The standard contains requirements for processes aiming to manage IT as a service. Such processes relate to relationship processes, resolution processes, and control processes. Furthermore, the standard "*specifies requirements for the firm to plan, establish, implement, operate, monitor, review, maintain and improve an SMS [Service Management System]*" (ISO/IEC 2000-1 2011, p.1). The standard defines a service as a "*means of delivering value for the customer by facilitating results the customer wants to achieve*" (ISO/IEC 20000-1 2011 p.6), and, it asserts, "*service is generally intangible*" (ibid, p.6). By studying the process activities, the ADR-team understands that the processes are directed to service providers. One such example is the requirement saying: "*When prioritizing incidents and service requests, the firm shall take into consideration the impact…*". (ISO/IEC 20000-1 2011 p. 21). This view does not correlate to FP2, FP6, FP7, FP8, or FP10 of S-D Logic. Consequently, also the most adopted ITSM standard has not yet adopted a contemporary service perspective, which is shown in how they define service as well as in its description of various process requirements.

Although existing ITSM best practices and supporting IT-artifacts guide ITSM practitioners on strategic, tactical and operative organizational levels, they also cause problems for those practitioners who are unaware of the ideals on which they are designed. One example of this claim is that although ITSM practitioners have started to adopt a service-oriented perspective, the predominant perspective on existing best practices in the IT sector still adheres to the product-orientated perspective (Göbel and Cronholm 2016a; itSMF international 2013). Moreover, Göbel and Cronholm (2015) have shown that existing ITSM best practices unilaterally focus on how *service providers* deliver value and that they often separate services from goods. This perspective also affects their view of resources where internal resources possessed by a single service provider are considered key. By doing so, existing ITSM best practices automatically address a traditional, product-oriented view of service and resources. This perspective constitutes problems since it provides a view closer to the traditional G-D Logic view, and it reduces innovation. Moreover, such a view could reduce the possibility for actors in service ecosystems to collaborate around resources, which in turn could reduce an actor's ability to co-produce digital innovations.

To conclude, existing ITSM best practices have not yet incorporated an entirely contemporary service-oriented perspective on resources, and they do not provide digital resourcing enabling digital innovation. Established ITSM best practices and supporting IT-artifacts often adopt a perspective of the market where the focus lies on output and infrastructure of a single service provider (i.e., firm) instead of the value propositions co-created by bundling resources together with multiple actors (Göbel and Cronholm 2016a). Lusch et al. (2007 p.5) argue that managers in general, "*though motivated to perform and being aware of the links among service, competitive advantage, and firm performance, often fail to execute on service knowledge.*" This perspective could be one reason that Cater-Steel (2009) finds that also ITSM organizations are still struggling to adopt contemporary service-oriented perspectives and that there is a need for a change. The latter claim was recently confirmed by Exin (2017), which finds that only 24% of 3783 worldwide respondents think that existing ITSM best practices have kept up with the changing IT and business landscapes. Stated differently, there has been an under usage of existing digital innovation knowledge in practice, and many businesses are not ready to respond to digital trends (e.g., Kohli and Melville 2019).

Identification and Analysis of core ITSM processes

As previously described, existing ITSM best practices apply a process-based approach to manage a service lifecycle (e.g. Cannon et al. 2011; Cater-steel 2009; Galup et al. 2009; Shrestha 2015). According to TSO (2011), a process is defined as a structured set of activities designed to accomplish a particular objective. A process has inputs that are transformed by the set of activities, which then turns into one or more outputs, and ultimately enables value. A high number of well-defined processes and work procedures are suggested and used within the ITSM context. Examples of such ITSM processes are the 'Service portfolio management process,' 'Business relationship management process,' Availability management process," 'Change management process,' 'Request fulfillment process,' and 'Incident management process.' Such processes have been suggested to support service providers on different organizational levels to delivery services. However, practitioners argue that there are too many ITSM processes to learn, and maintain and they find that existing ITSM best practices are too comprehensive, and it is hard to know where to start (Göbel 2014a). This comprehensiveness is also the reason why practitioners argue that they need to know which the core ITSM processes are and how they should be conducted from a contemporary service perspective. Such processes could then serve as a communication protocol or design pattern in the digital resourcing system.

Only a few studies have sought to identify core ITSM processes. Cater-Steel et al. (2009) found that priority has been given to the processes; 'Service Desk,' 'Change Management,' and 'Incident Management.' This finding is in line with DuMoulin and Turbit (2007), who assert that the most common processes are 'Incident Management,' followed by 'Change Management.' To those processes, they add 'Problem Management,' 'Service Level Management' and 'Release Management' (ibid). According to two other surveys conducted in 2010 and 2013 by itSMF International, the level of implementation for the respondents is generally similar between those years, and the top few ITIL processes are incident management process, change, request fulfillment process, problem management process and service level management process (itSMF International 2013). Furthermore, Iden and Eikebrokk (2014) argue that most service providers choose a single-process approach when implementing ITIL by prioritizing user-centric areas such as the Service Desk and Incident Management. From there, service providers gradually continue with processes like 'Service Level Management', 'Change Management', and 'Problem Management' (ibid). Fry (2008) presents seven core ITSM processes that are required by all IT departments (e.g., service providers): 1) 'Event Management', 2) 'Problem Management', 3) 'Service Asset and Configuration Management'', 4) 'Change Management', 5) 'Incident Management', 6) 'Request Fulfillment', and 7) 'Release and Deployment management'. Göbel et al. (2014b) show that the core of ITSM consists of five processes: 'Service Agreement Management,' 'Service Design and Development,' 'Service Delivery Management,' 'Service Issue Management,' and, 'Service Improvement." Axelos (2017) find that the "Incident management process' and "Change management process" are the processes most likely to be implemented by ITSM practitioners. In addition, ITSM best practices also provide specific processes for innovation. One such example is Lloyd et al. (2011), who propose a 'Seven-step improvement process.' However, the processes and improvement initiatives are not designed by considering a contemporary service perspective (Göbel and Cronholm 2016a). This point implies that they are not sufficient and need to be refined to fit the needs of ITSM practitioners. Nevertheless, the knowledge presented above has support the focus on, and selection of, specific ITSM processes to be used as communication protocols and design patterns. In other words, the aforementioned knowledge on core processes is important because it not only helps to identify an essential ITSM characteristic, but it also implies that the digital resourcing system should include a focus on core ITSM processes.

Following the research process in chapter 4, three sub-activities were conducted to generate process-based content that could constitute a base for the design of the content of the digital resourcing system. Those ITSM processes should be viewed as the communication protocol (see chapter 3) that could support practitioners to liquefying but also to conduct problem-solution pairing. Finalized processes were later inscribed as content, a process model, into the digital resourcing system. The result from the first activity (analysis of existing ITSM best practices) is presented above, while the result from the three sub-activities is described below.

First, the ADR-team identified core processes from existing studies. When analyzing previous studies, it was possible to discern a pattern where specific processes could be considered to be essential and more prioritized than other processes; i.e., incident management process and change management were considered crucial for ITSM practitioners (c.f., Cater-Steel et al. 2009; Du-Moulin and Turbit 2007). Moreover, prior studies highlighted processes such as the 'Request Fulfilment process', 'Problem Management process', 'Service Level Management process' and, 'Continuous Service Improvement' (e.g., Axelos 2017a).

The core IT processes identified in previous research have been identified from a one-sided service provider perspective and did not correlate well with a contemporary service perspective on resources. In contrast to previous studies, this study included a perspective where both service providers and service customers have been viewed as equally important sources for digital resourcing. Although this study has used a different lens, it reveals similar results to previous surveys; with a slight difference in that the ADR-team also found that practitioners prioritized 'Business Relationship Management', 'Release Management', and 'Service Catalogue Management'. The practitioners argued that 'Business Relationship Management' and 'Service Catalogue Management' processes could be concatenated and that 'Change Management' could be merged with 'Release Management'. The processes were argued to match the different practices suggested by Skålén et al. (2015) (e.g., provision practices, representational practices and management, and organizational practices). To summarize, the processes identified as core processes for digital resourcing were built on previous work, literature, and empirical findings. The final processes identified were: Business Relationship Management (includes Service Catalogue Management), Service Level Management, Change Management (including Release Management), Incident Management, Request Fulfilment, and Problem management. Rather than being a process on its own Continuous Service Improvement activities were included in all other processes.

To improve the correlation between the identified core processes, RBT, and the S-D logic perspective, the purpose and content of the identified processes have been modified by the ADR-team. The purpose of the process was essential to adapt to an S-D logic perspective since it describes the reason for which the process exists. The content of the process was important to adapt because it helps to fulfill the purpose of the process. The table below shows the original *and* the modified purpose of each identified process and its relation to one or more foundational premises of S-D logic. In addition, the relation to resources is highlighted. Practitioners in the research project have accepted the modified purposes in consensus. The latter was done in one of the workshops (see chapter 4).

Table. Core Processes Purposes and relation to justificatory knowledge in brackets.

Process	**Original purpose (ITIL Wiki 2018)**	**Overarching purpose with digital resourcing relation in brackets**	**Inspired by FPs**
Business relationship	To maintain a positive relationship with customers. The process identifies the needs of existing and potential customers and ensures that appropriate services are developed to meet those needs.	To routinely structure relationship-building activities [i.e., institutional arrangements; resource mobilizations] and to meet the needs [i.e., resource liquefying, pairing] of the beneficiary [actors] through iterative innovation [i.e., resource pairing]. This includes [co-create] and maintain a service catalog containing a mix of service(s) that enables [value	FP4, FP6, FP9, FP11

		co-creation, i.e., resource opting] with the beneficiary.	
Service level	To negotiate Service Level Agreements with the customers and to design services in accordance with the agreed service level targets	To [co-create] service level agreements, a type of organizational agreement, between [actors in the service ecosystem] that constitute guidance for relationship framework [i.e., routines, institutional arrangements, organizational practices].	FP4, FP6, FP9, FP11
Change	To control the lifecycle of all Changes. The primary objective of this process is to enable beneficial Changes to be made, with minimum disruption to IT services….to plan, schedule, and control the movement of releases to test and live environments. T	To [co-create, i.e., all digital resourcing activities value-enabling] service changes in order to correlate to [service ecosystem] modifications. CRM also controls the transition of new service(s) (or releases) from development and test environments into live environments.	FP4, FP8, FP11
Incident	To manage the lifecycle of all Incidents. Incident Management ensures that normal service operation is restored as quickly as possible, and the business impact is minimized.	To [jointly] manage incidents in order to restore the possibility for the actors to [co-create value] as quickly as possible [i.e., all digital resourcing activities]. This process also manages underlying problems, the cause of incidents.	FP4, FP6, FP8, FP9, FP11
Request	To fulfill Service Requests, which in most cases are minor (standard) Changes (e.g., requests to change a password) or requests for information.	To scan, listen, and communicate beneficiary demand [i.e., resource mobilization, resource liquefying] for service(s). This does include not only minor (standard) changes (e.g., requests to change a password) but also major	FP4, FP9

		changes that could affect service(s) [i.e., resource pairing].	
Problem	Problem Management aims to manage the lifecycle of all Problems. The primary objectives of this ITIL process are to prevent Incidents from happening and to minimize the impact of incidents that cannot be prevented.	To [jointly] manage the lifecycle of all problems in collaboration with customers [i.e., resource mobilization] in order to minimize the impact of incidents.	FP4, FP9

In the table below, examples of modified content activities of core ITSM processes are presented. They are presented as statements that dyadic actors (service provider and customers) should use to assess their current situation considering a digital service. The examples in the table below consist of statements that were developed to relate to RBT (from an S-D logic view), and they represent one or more of the FPs. In particular, the process statements take into account both the views of the service provider and service customer.

Table. Examples of inscribed and changed process statements and their relationship to digital resourcing and FPs .

Process	Example of inscribed process statements/activities	Relation to FP and digital resourcing
1. All processes	a) "The beneficiary agrees that the formalized process enables increased value." b) "There is a documented process description that is jointly developed by all actors." c) "The actors have jointly developed a strategy for digital innovation."	FP4, FP6, FP7, FP8, FP10, FP6, FP8, FP9, FP11, FP6, FP7 The three statements imply that all actors are resource integrators and that digital resourcing (i.e., resource opting) is crucial.
2. Business relationship	a) "Actors meet regularly to improve the relationship."	FP8, FP6, FP8, FP10, FP11, FP8

	b) "Actors discuss and document how service offerings support the work practices and enable and increase the value of the beneficiary." c) "The service customer informs the provider about changes in their environment that affect service(s)."	Statements foster resource mobilization, resource liquefying, resource paring, and resource opting in the service ecosystem.
3. service level	a) "Actors have jointly agreed on how results will be measured and presented." b) "There is a common understanding of the value that the service intends to enable." c) "Actors are jointly reviewing performance reports in order to ensure that outcome and work procedures are in compliance with agreements."	FP8, FP9, FP10, FP6, FP7, FP10, FP11, FP8, FP9 Resource liquefying and pairing is inscribed in the statement
4. change	a) "There are agreed instructions for how a 'change' is initiated." b) "Actors conduct a joint appraisal of how the suggested change affects the value beneficiary." c) "Actors jointly determine when and how the change is released." d) "Actors monitor implemented changes to ensure that they enable expected value."	FP8, FP9, FP6, FP8, FP9 FP9, FP6, FP10, FP11 Directly related to resource opting and resource liquefying
5. incident	a) "Criteria supporting how to determine the priority of an incident have been jointly designed by the actors." b) "The proposed solution enables greater value for the beneficiary." c) "The beneficiary is available to provide information about the incident."	FP8, FP9, FP11, FP6, FP7, FP9 Related to resource pairing in a service ecosystem
6. request	a) "Actors jointly determine whether the request is an incident or if it is a basis for a new or changed service." b) "The provider logs information about the request and keeps it updated."	FP9, FP11 Related to resource pairing

	c) "The beneficiary uses a standardized approach to initiate requests."	
7. problem	The service provider and the customer have jointly agreed upon a documented strategy for how to solve problems.	FP9, FP11

By extending the scope and change ITSM processes, they were better embraced by several of the FPs. As a result, the core ITSM processes presented, incorporates a contemporary service perspective as the fundamental basis for exchange (FP1) and thus enables operant resources to flow across different actors. This process will enable the strategic benefit (FP4 and FP9). The processes also enable an improved service culture where resources are shared and where digital resourcing is co-created by multiple actors, always including the beneficiary (FP6). This procedure leads to a view that is inherently relational (FP8). FP10 is also inscribed because the beneficiary is always present in the suggested core processes to co-create value in several ways, and to determine what the value is. FP11 is fulfilled through the institutional arrangements that are automatically created when actors are working in, and with, the core ITSM processes. Finally, statements related to digital resourcing are inscribed in all identified ITSM processes. This information is a contrast to existing ITSM best practices, where continual improvement (i.e., incremental digital resourcing) is seen as a separate process.

APPENDIX 6: BENCHMARKING OF DESIGN THEORY CONSTRUCTION

Table. References to design theories suggested by other scholars and compared to the suggested IS design theory of this study.

Components	Chiang and Mookerjee (2004)	Jones (2011)	Löhe and Legler (2014)	Brendel et al. (2017)	This IS design theory
Purpose and scope	To develop a software fault threshold policy	Provide ICT functionality to support learning and teaching within a university environment	Give prescriptions that will support companies implementing EAM	To compute pricing areas which positively influence vehicle supply	Described in chapter 5

				and demand	
Constructs	incremental development, system integration, fault threshold, testing, faults detected	A range of constructs and their definition such as e-learning, service, package, and conglomerations	e.g., IT processes, EAM goal/ concern, viewpoint, EAM practice, EA artifact, EA component	Demand, Supply, Areas, Vehicle Distribution, Rental, Pick-Up, Drop-Off, Vehicle, Customer, Bonus, Fee	Described in chapters 2, 3, and 6.
Principles of form and function	Dynamic guidelines for when system integration should occur	Principles such as an emergent university e-learning system should provide… 1) Comprehensive, integrated, and independent services. d	e.g., design for vertically and horizontally embedding EAM	a grid-based majority voting process should be applied	Described in chapters 6 and 7.
Artifact mutability	show how the policy will vary over a number of cycles	the ability to learn and evolve in response to system use is a key part of the purpose of this IS design theory	Mutual factors such as organizational setting, process type, degree of formalization of the process description, and	The modular architecture allows adding and switching of modules in the backend.	It is described in chapters 6 and 7.

			organizational change.		
Testable propositions	Predictions about outcomes are provided that are tested in simulation experiments	The digital resourcing system: 1. provides the functionality and services necessary to support university e-learning 2. enables and encourages the university, its e-learning information systems, and its staff and students to observe and respond to new learning about the design, support and use of university e-learning	If the EAM practices and EA artifacts are embedded well in existing IT processes, EAM is more likely to succeed.	The DSS increases vehicle availability and accessibility.	It is described in chapters 6 and 7.
Justificatory knowledge	The theory is offered relating to group coordination processes, team cognition, software development productivity, and fault	A range of theories and knowledge from software engineering, information systems	e.g., knowledge management, Contingency theory in, Concern-driven EA modeling	Car sharing Literature, DSS Literature, Supply and Demand Theory	Described in Chapter 2, 3, and 6.

	growth models.				
Principles of implementation	It is stated that it might be necessary to build some randomness into the model in a real-life project, and this is left for further work.	1.Multi-skilled, integrated development and support team. 2. An adopter-focused, emergent development process. 3. A supportive organizational context	Conceptual modeling involving IT managers and enterprise architects to define EAM-embedded IT processes	NA	Described in chapter 6, and 7
Expository instantiation	Examples of the policy in-action are provided through simulations	The Webfuse system from 2000 through 2009	Shown as an image	NA	Illustrated and described in chapter 5.

APPENDIX 7: CHARACTERISTICS AND OUTCOME OF DIGITAL INNOVATION

A question that remains to be answered is, what outcome from digital innovation can qualify as a digital innovation? Abernathy and Clark (1985, p.4) find that "*some innovations disrupt, destroy and make obsolete established competence; others refine and improve.*" Disruptive innovation is something that interrupts the normal trajectory of an industry, thus causing marketplace disorder (Nylén 2015). While such radical innovations typically offer higher profit margins per unit, they may require a significant reorientation of the firm (Yoo et al. 2010a). However, unlike innovations in product manufacturing, those innovations that radically redefine the delivery of service are relatively rare (Ramdas et al. 2012). As implied before, the outcome from digital innovation in this dissertation does not only include radical advances in the technological state of the art; it also includes the utilization of small-scale changes in technological know-how and associated processes. The latter has previously been better known as incremental innovations (c.f., Gardiner and Rothwell 1985), which usually are seen as small improvements in existing practices enabling organizations to operate more efficiently (Weber 2011). Incremental innovations are innovations that happen when a practice changes, e.g., a new or changed process as well as a new feature in an IT system (e.g., Tuomi 2002). Nevertheless, even small changes can have a massive impact on the practice (Beloglazov et al. 2015). Consequently, a novel digital service could consist of a new or changed product, business process, method, model, or any other construct that results from the use of digital resources (e.g., Lusch and Nambisan 2015; Nambisan et al. 2017). That is, the digital technologies *and* associated processes form an innate part of the outcome (e.g., Lusch and Nambisan 2015; Nambisan et al. 2017). Stated differently, as long as the innovation outcome consists of bundled value-enabling digital resources fostering new ways of doing things that are embodied in, related to, or enabled by, digital technology it qualifies as a digital innovation in this dissertation (c.f., Rogers 2003; Nambisan and Lusch 2015; Nambisan et al. 2017). To sum up, the definition of digital innovation used in this dissertation differs from more product-oriented definitions[64] because it adopts a broad view of the outcome. It is, however, important to emphasize that this study has a socio-technical view of digital resources. Thus, digital innovation in this dissertation, not only recognizes knowledge and skills but it also recognizes physical ‘products’ (e.g., hardware or infrastructure; operand resources); such digital resources are by several scholars considered as the core in IS research (e.g., Walls et al. 1992; March and Smith 1995; Benbasat and Zmud 2003; Hevner et al. 2004).

This information leads to the obvious question: is it not enough to discuss generic innovation instead of *digital* innovation? The answer is that digital innovation and digital technology includes specific characteristics that are different from traditional and analog innovation (Yoo et al. 2010a; 2010b; Fichman et al. 2014). Those characteristics affect the way we innovate using digital technology. That is, since digital technology is essential to the innovation process, it is reasonable to describe its nature. Three unique socio-technical characteristics of digital technology have been identified by Yoo (2010a). The scholars argue that those characteristics make digital technology powerful: 1) the homogenization of data, 2) the re-programmability, and 3) the self-referential nature of digital technology. Yoo (2010b) claims that such characteristics make digital innovations fundamentally different from non-digital innovations. The homogenization of data refers to that analog data are being digitized, which means that any type of content (e.g., audio, video, text, and image) can be

[64] For example, Yoo et al. (2010a p.3) draw on Schumpeter (1934), and define digital innovation "*as the carrying out of new combinations of digital and physical components to produce novel products.*"

stored, merged, and transmitted, meaning that the existing boundaries in the analog world are dissolved. Re-programmability means that a digital artifact can be flexibly programmed and changed by using or manipulating data (unlike a non-digital artifact). Thus, the tight coupling of a device and analog data is blurred (Yoo et al. (2010b) exemplify the phenomena with a vinyl record). Finally, Self-referential implies that digital innovation requires ubiquitous use of and access to digital technology (e.g., Nambisan et al. 2017; Holmström 2018). A digital service also consists of material properties that cannot be found in non-digital products or processes. Such properties are suggested, according to Yoo et al. (2010b):

- programmability: i.e., the ability of a now digitized artifact to accept new sets of instructions and to modify its behaviors
- addressability: i.e., that each digitalized artifact can be uniquely identified
- sensibility: i.e., the ability of a digitalized artifact to sense and respond to changes in its environment
- memorability: i.e., ability to record and store information that it has generated
- communicability: i.e., the ability of a digitalized artifact to send and receive digitized messages
- traceability: i.e., the ability of a digitalized artifact to chronologically identify, store, and relate encounters with events and entities in time)
- associability, i.e., the ability of digitalized artifacts to be related to and identified with other entities (such as other artifacts, places, or people)).

In chapter 2, it is described that innovation processes have started to change because of digital technology. Yoo (2010b) argues that the primary factors of digital technology affecting the process are the heterogeneity, generativity, convergence, locus of innovation, and pace. *Heterogeneity* refers to the integration of diverse forms of data, information, knowledge, and tools. *Generativity* refers to a high degree of equivocality, which enables reinterpretations, expansions, and refinements of outcomes. *Convergence* refers to diverse information is transformed into a unified digital format that connects previously unrelated knowledge. *Distributed locus of innovation* refers to the dramatic geographical and social dispersion of innovation sites and processes due to low communication and storage costs. Finally, *pace* refers to the increase in the speed of innovation cycles due to programmability. The combination of the factors mentioned supporting the emergence of the ad-hoc processes of digital innovation.

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