



AN INTEGRATED DYNAMIC CAPABILITY MODEL FOR SERVICE INNOVATION MANAGEMENT

Zur Erlangung des akademischen Grades eines Doktors der
Wirtschaftswissenschaften (Dr. rer. pol) von der Fakultät für
Wirtschaftswissenschaften des Karlsruher Instituts für Technologie (KIT)
genehmigte Dissertation

von

Marc Kohler, M.Sc.

Tag der mündlichen Prüfung: 19. Dezember 2017
Referent: Prof. Dr. Gerhard Satzger
Korreferent: Prof. Dr. Martin Klarmann
Prüfer: Prof. Dr. Hagen Lindstädt

Abstract

The dynamic capability view has emerged as one of the most prolific approaches to studying innovation and the competitive advantage of firms. Focusing on service innovation, a research stream on dynamic capabilities for service innovation has emerged out of this research field. The purpose of this dissertation is to extend on the existing knowledge base and to empirically investigate dynamic capabilities in a service innovation context.

We use three exploratory analyses to empirically approach the dynamic capabilities for service innovation construct and the microfoundations contributing to these capabilities, as well as the resulting performance effects. We then propose an integrated model of dynamic capabilities for service innovation and their contingency relationships, which we evaluate using structural equation modelling techniques. The dynamic capabilities are captured through the constructs sensing, seizing and reconfiguring. In order to gain a rich picture of the effects of the microfoundations, we include microfoundations at the individual level, at the firm level and at the external level.

Through a questionnaire-based survey we obtain 148 responses from executives in knowledge-intensive business service firms, which are used to evaluate the model and the proposed hypotheses. Our results suggest that the individual microfoundations have distinct effects on a firm's dynamic capabilities for service innovation. The microfoundation knowledge exchange and learning emerges as playing a pivotal role due to its significant influence on all three dynamic capabilities. Furthermore, we find direct as well as indirect effects of the dynamic capabilities on firm performance, in particular by the seizing capability.

Our results contribute to the advancement of this research field by improving upon our means to empirically assess dynamic capabilities for service innovation and their contingency relationships. Executives in service firms can use the results to scrutinise investments into their firm's dynamic capabilities, as well as their measurement approaches to service innovation performance.

Zusammenfassung

Der Dynamic Capability View ist einer der vielversprechendsten Ansätze, um Innovation und Wettbewerbsvorteile von Unternehmen zu untersuchen. Aus diesem Ansatz heraus hat sich eine Forschungsströmung mit Fokus auf Dynamic Capabilities für Dienstleistungsinnovation entwickelt. Ziel dieser Dissertation ist es, die existierende Wissensbasis zu erweitern und Dynamic Capabilities in einem Dienstleistungskontext empirisch zu untersuchen.

Mittels drei vorbereitender Analysen erforschen wir das Dynamic Capabilities Konstrukt bezogen auf wissensintensive Dienstleistungen, zusammen mit den zugrunde liegenden Basisfähigkeiten und den resultierenden Erfolgsgrößen. Wir präsentieren ein Modell, das Dynamic Capabilities für Dienstleistungsinnovation und ihre wichtigsten Bezugsgrößen integriert. Die Dynamic Capabilities werden durch die Konstrukte Sensing, Seizing und Reconfiguring operationalisiert. Um ein umfassendes Bild der zugrunde liegenden Basisfähigkeiten zu gewinnen betrachten wir diese auf mehreren Ebenen – Mitarbeiter, Unternehmen und Netzwerk.

Aus einer fragebogenbasierten Umfrage unter Führungskräften von Unternehmen, die wissensintensive Dienstleistungen anbieten, erhalten wir 148 Antworten. Diese Daten werden genutzt um das Strukturgleichungsmodell auszuwerten und die vorgeschlagenen Hypothesen zu testen. Unsere Ergebnisse zeigen, dass die einzelnen Basisfähigkeiten spezifische Effekte auf die Dynamic Capabilities haben. Das Konstrukt Wissensaustausch und Lernen stellt sich als zentral heraus, da es einen signifikanten Einfluss auf alle drei Dynamic Capabilities hat. Darüber hinaus finden wir sowohl direkte als auch indirekte Einflüsse der Dynamic Capabilities auf Erfolgsgrößen auf Unternehmensebene – insbesondere von Seiten der Seizing Capability.

Die Ergebnisse tragen zum Fortschritt des Forschungsfeldes bei, indem wir die existierenden Konstrukte für die empirische Messung von Dynamic Capabilities und ihrer Beziehungen weiterentwickeln. Führungskräfte können die Ergebnisse nutzen um Investitionen in die Dynamic Capabilities ihrer Unternehmen und ihre Ansätze zur Leistungsmessung von Dienstleistungsinnovation zu überprüfen.

Contents

Abstract	iii
Zusammenfassung	v
List of Abbreviations	xiii
1. Introduction	1
1.1. Research Problem	3
1.2. Research Objective	5
1.3. Research Questions	6
1.4. Structure of the Thesis	8
2. Foundations	11
2.1. Dynamic Capabilities	11
2.1.1. From Resource-Based to Dynamic Capability View	11
2.1.2. State of the Art of the Dynamic Capability View	12
2.1.3. Limitations of the Dynamic Capability View	14
2.2. Dynamic Capability for Service Innovation	16
2.2.1. Service Innovation and Service Innovation Research	16
2.2.2. Studies on Dynamic Capability for Service Innovation	19
3. Exploratory Analyses	27
3.1. Exploring the Use of Text Mining to Assess Dynamic Capabilities for Service Innovation	27
3.2. Microfoundations of Dynamic Capabilities for Service Innovation in Practice	38
3.3. Innovation Performance Measures in Knowledge-Intensive Business Services	43
4. Theory Development	49
4.1. Research Framework	49
4.2. Procedure	52
4.3. Dynamic Capability for Service Innovation	53
4.4. Microfoundations of Dynamic Capability for Service Innovation	53
4.4.1. Individual Level	53
4.4.2. Firm Level	55
4.4.3. External Level	58

Contents

4.5. Performance Effects	61
4.5.1. Performance Mediators and Firm Performance	61
4.5.2. The Role of Environmental Dynamism	62
4.6. Theoretical Research Model	64
5. Research Design	67
5.1. Construct Development, Measurement Items and Survey Instrument	67
5.2. Sampling and Data Collection	69
5.3. Data Preparation, Measurement Model and Construct Refinement	74
6. Empirical Analysis and Discussion	77
6.1. Model without Moderation Effects	77
6.2. Model including Moderation Effects	83
6.3. Discussion	88
7. Conclusion	91
7.1. Theoretical Implications	91
7.2. Managerial Implications	93
7.3. Limitations and Avenues for Future Research	94
Bibliography	97
Appendix	113
A. Industries Included in the Sample	113
B. R Environment Used	114
C. Full List of Measurement Items	115
D. Questionnaire	119
E. Measures and Reliabilities	124
F. List of Hypotheses	127

List of Figures

1.1. Structure of the Thesis	8
3.1. Text Mining Model Quality Parameters (First Document Corpus, Default Prior Probabilities)	33
3.2. Text Mining Model Quality Parameters (Second Document Corpus, Default Prior Probabilities)	34
3.3. Text Mining Model Quality Parameters (Second Document Corpus, Equal Prior Probabilities)	35
3.4. Recognised Text Patterns in Documents	36
3.5. Number of Microfoundations associated with each Category and DCSI Dimension	42
4.1. Research Framework	51
4.2. Theoretical Research Model	65
5.1. Final Research Model	75
6.1. Standardised Solution for Model 1	79
6.2. Standardised Solution for Model 2	84
D.1. Questionnaire Page 1 of 4	120
D.2. Questionnaire Page 2 of 4	121
D.3. Questionnaire Page 3 of 4	122
D.4. Questionnaire Page 4 of 4	123

List of Tables

2.1. Studies on Dynamic Capability for Service Innovation	25
3.1. Vocabulary Elements using Regular Expressions	30
3.2. Reported Microfoundations by Category	39
3.3. Reported Microfoundations by Category	40
3.4. Currently employed Performance Indicators	45
3.5. Performance Indicators by Decision Type	46
5.1. Sample Composition	73
5.2. Reliabilities and Correlations	76
6.1. Path Coefficients and Standard Errors from Covariance Structure Analysis for Model 1	80
6.2. Evaluation of Hypotheses H1 – H4 (Model 1)	81
6.3. Evaluation of Hypotheses H5 – H7 (Model 1)	82
6.4. Path Coefficients and Standard Errors from Covariance Structure Analysis for Model 2	85
6.5. Evaluation of Hypotheses H1 – H4 (Model 2)	86
6.6. Evaluation of Hypotheses H5 – H9 (Model 2)	87
A.1. Industry Categories Included in the Sample	114
E.1. Measures, Factor Loadings and Item Reliabilities for Model 1	124
E.2. Measures, Factor Loadings and Item Reliabilities for Model 2	125

List of Abbreviations

- B2B** business to business
- DC** dynamic capability
- DCSI** dynamic capability for service innovation
- DCV** dynamic capability view
- IT** information technology
- KIBS** knowledge-intensive business service
- PSF** professional service firm
- R&D** research and development
- RB** resource base
- RBV** resource-based view
- RQ** research question
- SEM** structural equation modelling
- SI** service innovation

1. Introduction

In many economies the service sector today accounts for the majority of total value added. For the member states of the OECD, the share of services was already around 70% in 2005. What is more, this number has been growing considerably since around the 1970s for most of the OECD countries, which is mainly attributed to growth in business related services (OECD, 2005).

Furthermore, the share of value added through services by firms from the industrial sector is also increasing. This increasing focus of industrial firms on services and solutions has been termed the ‘servitisation of manufacturing’ (Neely, 2007). In conjunction with accelerating market dynamics and shortening product and service life cycles in the last decades, these macro-economic developments have made research on service innovation (SI) a priority for many researchers and business executives.

The study of innovation has a long history - one of the first scholars to systematically analyse phases and patterns of innovation was Schumpeter (1913) in the early 20th century. Due to innovations’ impact on organisational performance and competitive advantage, innovation research has been playing a key role in management research.

Traditionally, innovation research had a strong bias towards manufacturing and technology innovation. As a consequence, the innovativeness of the service sector has attracted comparably little attention until fairly recently. In fact, at the end of the 20th century, Sundbo (1997, p. 432) posed and studied the question of “whether service firms innovate at all”.

With the introduction of the service-dominant logic in marketing (Vargo and Lusch, 2004) and the establishment of service science as an interdisciplinary research field, this picture of SI has changed considerably over the last years. The research topic of SI has seen a steadily growing number of publications and has indeed been identified as a top priority for advancing service science in a survey including scholars from multiple disciplines as well as industry representatives (Ostrom et al., 2010, 2015).

Innovation management is a complex endeavour that requires the consideration of many internal and external contingencies, as well as an interplay of insights from

various disciplines. This is particularly true for the management of SI. Building on the interdisciplinary foundations of service science, authors have introduced and further developed concepts and research lenses that originated in related academic communities, such as the concepts of open and user innovation (Chesbrough, 2010).

In order to successfully advance the field of SI, existing knowledge from manufacturing and goods oriented innovation management and general practices, such as project portfolio management, has to be integrated. At the same time, insights specific for SI may also have a significant impact on innovation success. In fact, analogous to products and services themselves, the lines between manufacturing-based and services-based innovation are increasingly blurring (Kindström and Kowalkowski, 2009; Salter and Tether, 2006). As a result of this, the two aforementioned perspectives on innovation can help each other to advance – this has been termed the ‘synthesis’ view of SI (Coombs and Miles, 2000).

In their review of the SI literature, Droege et al. (2009) find that existing contributions are highly varied, with regard to methodology as well as study focus. Both conceptual and empirical contributions have investigated SI using varying units of analysis, from the project and programme level over the firm level to the national and policy level.

SI exhibits some characteristics – which may also be present in goods based innovation – in a particular intensity. Salter and Tether (2006) identify the following:

- SIs are often architectural innovations, i.e., they are achieved through a new combination of existing components and concepts.
- Services are naturally suited for open and user innovation.
- SI tends to be continuous.
- Discontinuous innovation in services is often introduced by firms outside of an established industry.

Considering a real-world SI, these characteristics are exemplified by a new mobile payment service, which was introduced by Starbucks in 2011 and which already handled more than one billion USD in transactions in 2013 (Heggestuen, 2014). Essentially, Starbucks launched this new service in the form of a mobile application, which integrated previously existing loyalty and customer cards and allows customers to pay for their purchases directly through the application. All core components of the new service had already been developed and used by Starbucks or other firms, at least in a similar fashion. It was the new links created between the shops and their product portfolio, between customers’ smart phones, the corresponding application stores, and financial service providers that enabled the introduction of the new service, which has been accepted very well by customers.

This exactly matches the definition of architectural innovation, which means that existing components are combined and linked in new ways to introduce novel offerings to a market (Henderson and Clark, 1990). Furthermore, in introducing the service, the firm could build on existing customer relationships and usage behaviour

and in turn could learn from customer's use of the service to continuously adapt and improve it. In services, joint value creation between provider and customer is a basic characteristic and puts firms in an ideal position to make use of open and user innovation approaches. Finally, by introducing the new service, Starbucks has become an important player in the domain of mobile payment services and has strengthened this position with further investments, such as acquiring a share of the mobile credit card payment firm Square. This highlights the last characteristic of SI listed above: New services with a high degree of novelty, also called discontinuous services, are often introduced by firms outside of an established industry, in this case the banking sector.

As illustrated by this example, incumbent firms are increasingly getting under pressure to successfully introduce new services. This development is accelerated by the digitalisation of business (D'Emidio et al., 2015). In order to react, incumbents need to take a more proactive and systematic approach towards innovation management (Drucker, 1984). However, in particular in the context of SI, existing knowledge on its success factors arguably does not yet fully support such approaches.

1.1. Research Problem

As illustrated above, discrete SIs can have a significant impact for firms. However, both practitioners and academics have a growing interest in better understanding the firm-wide foundations that foster an innovation orientation and allow repeated innovations (Siguaw et al., 2006; Simpson et al., 2006). In line with this business need, research on SI at the firm level has been focusing predominantly on the success factors of introducing new services (Droege et al., 2009).

However, since research on SI is still comparably recent, the existing body of knowledge exhibits some limitations. Comparably few studies have concentrated on making the enablers and success factors of SI measurable. This operationalisation of the key variables is a prerequisite for making informed decisions on which SI practices to adopt and where to focus investments of resources and attention. Notably, there have been mixed findings on the relationship between SI activities, firm performance and other key organisational variables, which have not been entirely resolved.

Tidd and Hull (2006) quote a lack of necessary differentiation in approaches to SI practices and performance measurement as a possible reason for this. den Hertog et al. (2010) also see the establishment of a link between SI practices and firm performance as a main research challenge. The authors furthermore point out that there has been little research on SI with prescriptive implications, i.e., giving managers in service firms practical advice on how to foster SI practices.

The ability to analyse – and ideally to anticipate – the performance effects of SI activities is essential amongst others for making trade-off decisions between investments in these innovation activities and investments in daily business or in minor improvements. Firms that are able to manage this challenge are referred to as 'ambidextrous' (Tushman and O'Reilly, 1996). This challenge of balancing innovation and daily business is particularly complex for service firms. Innovation in service

firms is often the responsibility of knowledge workers on all levels of the firm and can therefore not be orchestrated in a centralised manner (Drucker, 1999). Improving our knowledge on SI activities and their relationship with other organisational variables, such as performance, can consequently inform and improve decisions on all levels of the firm.

Vargo et al. (2008) point out that in a service context, knowledge and skills play a particularly important role in the creation of competitive advantage – on a firm level these can be considered firm competences or capabilities. Therefore, the analysis of a firm’s capabilities that foster competitive advantage through innovation represents a particularly interesting perspective for developing our knowledge of success factors for SI.

In the management literature, this approach has been established as the resource-based view (RBV) of the firm. As opposed to earlier approaches that mainly build on the configurations of a firm and its environment, the RBV considers the firm’s resources and resource combinations as a main source of competitive advantage. Scholars have further developed the RBV in reaction to criticisms of its static nature, leading amongst others to the dynamic capability view (DCV). While the DCV is rooted in the same school of thought, it considers higher level dynamic capabilities (DCs) of the firm, which allow to remain competitive in changing and dynamic environments.

The DCV provides a framework for integrating many facets of SI, for putting them in relation to other organisational variables and for studying these in empirical settings. In a seminal definition a DC is described as “the firm’s ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments” (Teece et al., 1997, p. 516).

The DCV presents a promising approach for the study of SI and could help close the gap between our current understanding of SI and its effects on firm performance and the knowledge needed to inform decision making on SI activities. Scholars have started applying and adapting the DCV to the study of SI over the last years with publications ranging from conceptual papers to quantitative empirical work (Lawson and Samson, 2001; Agarwal and Selen, 2009; den Hertog et al., 2010; Ordanini and Parasuraman, 2011; Hogan et al., 2011; Agarwal and Selen, 2011, 2013; Kindström et al., 2013; Janssen et al., 2014; Kim et al., 2015). Some authors have combined the ideas of the DCV with the concept of capability maturity (Essmann and Du Preez, 2009).

Research has only begun to address the problem of how to identify DCs for SI – herein termed dynamic capabilities for service innovation (DCSIs) – as well as its relationship with other organisational variables. This represents the point of departure for this thesis and its research objective, which is presented in the following section.

1.2. Research Objective

Building on the existing research on SI and the DCV, this thesis aims to establish an integrated model of DCSIs. In pursuing this goal, it is essential to analyse the relations between these capabilities, a firm's strategy for innovation, and its environment – as opposed to studying the individual components in isolation.

We are starting from the premise that there can be no universal prioritisation of the facets of DCSIs, only configurations that work well in particular settings. This follows the call of Salter and Tether (2006) and Tidd and Hull (2006) for context dependent and specific research on SI, as opposed to a search for generic best practices. According to Alegre and Chiva (2008), focusing on a single industry may be beneficial for innovation research due to diversity in innovation processes, technology and economic contexts.

Accordingly, this study will focus on knowledge-intensive business service (KIBS) firms. These service firms have received comparably little research attention and exhibit several interesting characteristics regarding SI, such as the particularly strong role of knowledge workers and of decentralised structures (Teece, 2003). Focusing on KIBS, the research objective of this study is to develop a model of DCSIs that exhibits the following characteristics:

- Key facets of DCSIs are identified and measured.
- Enablers of DCSIs are identified in order to support active capability development.
- Relationships between DCSIs and other organisational variables, in particular firm performance, are evaluated.

Since this model is not only intended to advance research at the intersection of SI research and the DCV, but also inform decision making in business, gathering data for a particular firm and keeping it up to date is a key issue. Consequently, from a service firm's point of view, the model developed in this thesis should ideally support the following:

- Assess the firm's strengths and weaknesses on facets of DCSIs and focus on developing the most critical ones.
- Observe and react to changes in capability configurations over time.
- Evaluate the fit between the firm's DCSIs and its context and provide impulses for change, if necessary.
- Benchmark the firm against peers, or benchmark internal departments against each other.

As Helfat et al. (2007); Drnevich and Kriauciunas (2011) state, DCs of a firm deteriorate over time if they are not adequately monitored and used, and can be improved by appropriate investments and active management. By being able to assess their

current DCSIs, and by actively developing it over time, a firm could thus take a more systematic approach to SI management.

In particular for capability development and its tracking over time, firms have to gather information repeatedly. This means that data gathering must be implemented efficiently. It might not be feasible for a firm to conduct surveys among their managers and employees on this topic in short intervals. Consequently, in the scope of this thesis, we also begin to explore the use of analytical approaches to complement primary empirical data collection in this context. This combination of approaches could help dramatically speed up data collection and reduce associated cost, thus allowing quicker reactions to changes in the environment or the firm's strategy.

In summary, our objective is to establish an integrative model of the DCs required by firms to successfully pursue SI activities. We also aim to show the capabilities' effects on firm performance and offer insights into how to keep information for the evaluation of a firm's DCSIs up to date and relevant. The next section introduces the research questions that guide these efforts.

1.3. Research Questions

The research objective's elements of building a model that supports assessment, monitoring, and active management of a firm's DCSIs are addressed through three research questions (RQs). These research questions are introduced and explained in the following.

So far, no consensus on the exact definition of DCs has been reached. In fact, some studies in this area do not explicitly provide a definition of this or of related concepts, such as resources, assets, competencies, capabilities and core capabilities. In the context of SI, several conceptualisations of DCs have been proposed, but few have been empirically tested.

As a first step towards building an integrative model of DCSIs, the facets of the innovation capability supporting innovation activities need to be identified. These activities include opportunity identification, idea generation and development and the implementation, marketing and delivery of a new service. Furthermore, in order to make DCSIs measurable and manageable for a firm, these facets need to be made measurable. This is a key task of empirical studies in this area, which has so far been little addressed (Wang and Ahmed, 2007).

The assessment of DCSIs can provide significant benefits for decision-making in SI management. These benefits are, nevertheless, limited by the availability of relevant and up to date information. Traditionally, the empirical assessment of DCs is implemented through questionnaire-based surveys. For the integration of a DCSI assessment into regular management practices – such as benchmarking – however, this represents a significant obstacle with regard to effort, cost and sustained motivation of respondents in the firm.

In order to address this issue, the use of analytical approaches for the measurement of DCSIs should be explored. Analytical approaches are understood as approaches that

use and analyse available information. These approaches are particularly promising today, as a fast growing amount of data is captured and stored both in firm-internal systems, as well as on the Internet (Davenport and Harris, 2007). While data mining approaches have been successfully applied to many challenges in management research and business, there is little knowledge of their applicability in the context of SI management. Together, this leads to our first RQ.

***RQ1:** What are the facets of a firm's dynamic capabilities for service innovation and how can they be measured?*

A firm's DCs are inherently influenced by the firm's environment, as well as by other organisational variables. A necessary step to advancing our understanding of DCSIs is to analyse these relationships and their contingencies (Wang and Ahmed, 2007; Barreto, 2010).

The goal of the DCV is to explain how firms achieve and sustain competitive advantage. In order to do so, however, managers need to know which factors they can invest in to actively develop their firm's DCSIs. This involves an extensive investigation of the microfoundations of DCSIs.

In order to advance our knowledge on the microfoundations of DCSIs, they should be evaluated empirically. In doing so, a balance needs to be found between generally applicable categories of microfoundations and firm-specific implementations. This leads to our second RQ.

***RQ2:** What are the microfoundations of a firm's dynamic capabilities for service innovation and how do they contribute to it?*

The stance assumed by most authors is that a DCs have a positive impact on firm performance. The relationship between a firm's DCs and performance has been pointed out as one of the most important research issues in order to advance our knowledge in the area of the DCV (Barreto, 2010).

Like most recent studies, we assume that the relationship between DCs and firm performance is mediated by further variables. Consequently, we intend to investigate the relationships between a firm's DCSIs, the actual development and introduction of new services and firm performance in more detail.

In doing so, we also address the challenge of performance measurement in the context of SI. So far, performance measurement in this area is underdeveloped and many existing measurements and scales rely on concepts that are not always applicable to service firms, such as approximating innovation output by patents and innovation input by investments in a central research and development (R&D) unit (Coombs and Miles, 2000). This leads to our third RQ.

***RQ3:** What is the relationship between a firm's dynamic capabilities for service innovation and its performance?*

1.4. Structure of the Thesis

This thesis is divided into seven parts (see Figure 1.1). Having introduced the research problem, the objective of this thesis and the research questions used to address the objective, this chapter is followed by a review of the literature in Chapter 2. We present the basic concepts, definitions and theories this thesis builds upon. The state of the art in the relevant research streams is elaborated on and the contribution of this thesis is elucidated.

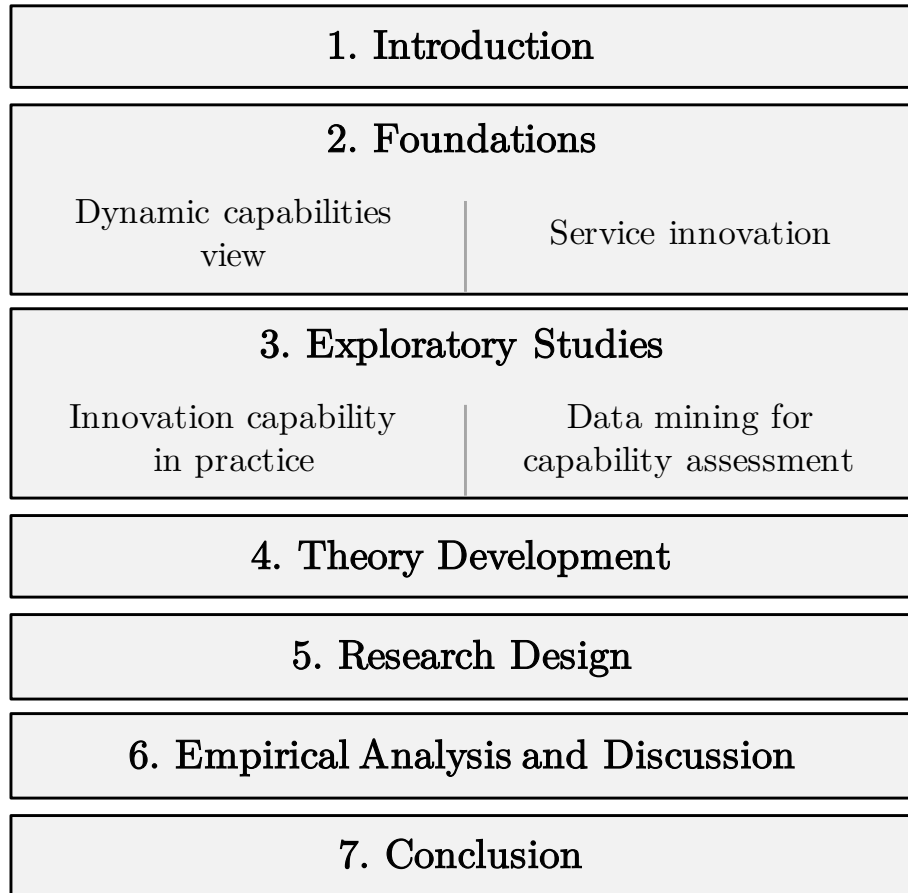


Figure 1.1.: Structure of the Thesis

Chapter 3 presents insights gained from three exploratory analyses carried out to approach our RQs on the aspects and relationships of DCSIs presented above. The studies cover the topics of microfoundations of DCSIs and SI performance measurement in practice, as well as text mining approaches to the assessment of DCSIs using existing data.

Chapter 4 is started off with the presentation of a research framework. This framework guides the development of our research model upon which the empirical study is built. This includes the development of the main constructs and hypotheses.

Subsequently, the study's research design is elaborated in detail in Chapter 5. We present the measurement scales for the model's constructs, our sampling and data

collection approach and the methods used to prepare the data for the evaluation of our research model. The tests for biases, reliability and validity are explained.

In Chapter 6, we present the results of the empirical analysis. The research model is analysed using structural equation modelling (SEM) methods and the proposed hypotheses are evaluated.

The thesis is concluded by a summary and assessment of the findings in Chapter 7. We point out the results' theoretical as well as managerial implications. Finally, we discuss the limitations of this study and suggest avenues for future research on DCSIs and, more generally, SI management.

2. Foundations

2.1. Dynamic Capabilities

2.1.1. From Resource-Based to Dynamic Capability View

The question of how firms can achieve and sustain competitive advantage has led to one of the most prolific literature streams in strategic management research. Within this literature stream, the RBV emerged in the 1980s and 90s, inspired by the earlier work of Penrose (1959), who studied the growth paths of firms.

The RBV was first proposed by Wernerfelt (1984) and was promoted more widely by Barney (1991). While the approach has been further developed by scholars over around two decades, the core proposition of the RBV is that a firm's competitive advantage, constituted by the markets it can enter and by the profits it can achieve, is determined by its resource endowment. In order to lead to competitive advantage, these resources need to fulfil the so-called VRIN criteria (Barney, 1991):

- Valuable: A resource is considered valuable when it allows a firm to realise strategies that lead to increased efficiency or effectiveness
- Rare: A resource or a bundle of resources can only be the basis for strategies that increase competitive advantage when they are rare, i.e., imperfectly distributed across firms
- Imperfectly imitable: While resources that are valuable and rare can lead to competitive advantage through the implementation of first mover strategies, this can only be converted into sustained competitive advantage when other firms that do not possess these resources cannot easily imitate them
- (Non) substitutable: A resource can only lead to competitive advantage if there is no other valuable resource that is not rare or imperfectly imitable that can be used to implement equivalent strategies; otherwise the other resource could be utilised instead of the original resource

While resources that fulfil the posited characteristics are a necessary condition for the creation of sustained competitive advantage in the RBV, they are not sufficient. Penrose (1959) already noted that relevant capabilities are required to make the best use of the firm's resources. Wernerfelt (1989) also discusses the identification, usage and growth of the pool of (critical) resources as important vehicles for leveraging their value.

Nonetheless, an important limitation of the RBV is that it is built around static resources and bundles of resources as the source of competitive advantage. It has been criticised for not considering market dynamism as an influence, as well as not addressing the development and maintenance of a firm's resources over time (Teece et al., 1997; Wang and Ahmed, 2007).

In order to respond to these shortcomings, scholars used the RBV as a starting point to develop a theory that addresses both environmental dynamism and the development of a firm's resource base (RB) over time, called the DCV. The idea of the DCV was introduced by Teece and Pisano (1994) and subsequently gained widespread popularity after the publication of Teece et al. (1997).

2.1.2. State of the Art of the Dynamic Capability View

Contributions to the DCV have been numerous and varied, however most studies follow the basic conceptualisation that DCs are the capabilities that allow a firm to gain, adapt, integrate, release and reconfigure their resources and capabilities to build and sustain a competitive advantage in a dynamic environment (Teece et al., 1997; Eisenhardt and Martin, 2000). Therefore, the primary focus of the DCV is change (Zollo and Winter, 2002; Winter, 2003) - both in terms of a firm's reaction to external change and the proactive shaping of the firm's environment (Teece, 2007a). An example for the former are changing customer needs and trends, an example for the latter is the joint development of innovations with a firm's customers (Kindström et al., 2013; Teece, 2007a). As Helfat (1997) put it, DCs allow a firm to create new products and processes and to respond to changes in the market place.

Studies have used fairly varied definitions, conceptualisations and operationalisations of a firm's DCs. In one of the early contributions by Teece et al. (1997), DCs are proposed to encompass the integration, building and reconfiguring of internal and external competences. Eisenhardt and Martin (2000) add to this conceptualisation of DCs as enabling the creation new resource configurations by including the releasing of resources that are no longer required. The authors also stress that this reconfiguration of the RB cannot only be carried out in reaction to environmental changes, but also to create such change by the firm itself. This approach to DCs is shared by other publications, such as Helfat et al. (2007) and Zahra and George (2002). The latter highlight 'evolving customer demands' and 'competitors' strategies' as dynamic aspects of the environment that may require a firm to reconfigure its RB. Griffith and Harvey (2001) also support this notion that DCs are used to create 'difficult-to-imitate' resource configurations and explicitly include 'inter-organisational relationships' as part of the RB.

Extending the thought of reconfiguring the RB through DCs, Collis (1994) introduced the thought of a hierarchy of capabilities. The capability hierarchy was further developed by Winter (2003), who distinguishes the following levels of capabilities that were also supported in an extensive review of the DCV literature by Wang and Ahmed (2007):

- Zero-level capabilities are “how we earn a living now capabilities” (Winter, 2003, p. 992), i.e., activities that constitute daily business; “Resources are the foundation of a firm and the basis for firm capabilities. Therefore, we refer to resources as the ‘zero-order’ element of the hierarchy” (Wang and Ahmed, 2007, pp. 35-36)
- First-order capabilities enable a firm to deploy, integrate and make changes to the zero-level capabilities in order to reach a desired goal; Wang and Ahmed (2007) further distinguish between ‘capabilities’ and ‘core capabilities’ - the latter are strategically important bundles of relevant resources and capabilities; Winter (2003) calls this level first-order dynamic capabilities; together with zero-level capabilities, these are also more generally referred to as micro-foundations of DCs (Eriksson, 2014)
- Higher order capabilities address the problem that “routinizing the response to familiar types of change” (Winter, 2003, p. 994) in the form of first-order (dynamic) capabilities may lead to rigidities over time; these higher order (dynamic) capabilities allow a firm “to integrate, reconfigure, renew and recreate its resources and capabilities” (Wang and Ahmed, 2007, p. 35) in order to achieve and sustain a competitive advantage

Ambrosini et al. (2009) build on the notion of these higher level capabilities that act upon the RB to renew and reconfigure it. Depending on the dynamism of the environment of the firm, they distinguish between ‘incremental dynamic capabilities’ in stable environments and ‘renewing dynamic capabilities’ in dynamic environments that act upon the RB directly. For very competitive and dynamic, so-called ‘hyper environments’, they introduce ‘regenerative dynamic capabilities’ that act upon the RB through renewing dynamic capabilities.

From this discussion of the hierarchical aspects of capabilities it is already evident that researchers’ vocabularies for conceptualising DCs show – sometimes subtle – but distinctive variations, which exacerbate a coherent development of the DCV. Despite these differences, most studies have described DCs as a multidimensional construct. In particular since the publication of Teece (2007a), researchers have increasingly directed their attention towards an operationalisation and empirical analysis of DCs. Teece (2007a) distinguish between the DCs sensing, seizing and managing threats / reconfiguring. This conceptualisation of DCs is further substantiated by Augier and Teece (2009, p. 412), who define them as “the ability to sense and then seize new opportunities, and to reconfigure and protect knowledge assets, competencies, and complementary assets with the aim of achieving a sustained competitive advantage”.

An important characteristic of this conceptualisation is that it integrates the external, opportunity exploring aspects of DCs with the internal, opportunity exploiting

aspects. The latter are required to trigger change and to develop and reconfigure the firm's RB to realise the identified opportunities. A substantial number of subsequent studies has built upon and varied these dimensions of DCs. In a recent integrative review of this literature, Barreto (2010, p. 271) has proposed the following definition: "A dynamic capability is the firm's potential to systematically solve problems, formed by its propensity to sense opportunities and threats, to make timely and market-oriented decisions, and to change its resource base". While this definition incorporates and structures the elements of a DC used by a large share of the DCV literature, the definition of the outcome constructs remains somewhat generic.

Pavlou and El Sawy (2011) apply a similar conceptualisation of DCs to the area of new product development. In accordance with Henderson and Clark (1990), they highlight that new product development reconfiguration plays a particularly important role, since new products usually emerge from the reconfiguration of existing competences and capabilities. This argument applies to innovation management in general, underlining why the DCV carries such relevance for analysing how firms pursue innovation.

While the DCV has addressed many of the shortcomings the RBV has been criticised for – in particular the need to consider dynamic environments and the evolution of capabilities over time – the research stream has not yet arrived at a unified understanding of DCs and is facing some criticisms itself. These criticisms of the DCV and open debates are elaborated on in the following.

2.1.3. Limitations of the Dynamic Capability View

In the approximately two decades since the publication of Teece et al. (1997), the DCV research stream has been highly prolific, leading to a large corpus of publications. This literature is not only varied with regard to the operationalisation of DCs as discussed above, its diversity is further increased by the incorporation of theories from adjacent fields, such as (corporate) entrepreneurship (Newbert, 2005; Griffith et al., 2006; Zahra et al., 2006; Borch and Madsen, 2007; Wu, 2007) and information and knowledge management (Zahra and George, 2002; Sher and Lee, 2004; Smith et al., 2005; Marsh and Stock, 2006; Liao et al., 2007).

The missing integration between the conceptualisations and research objectives of the individual studies has indeed been pointed out as a major flaw of the DCV and as impeding further progress in the field. In order to alleviate this problem of missing integration, scholars have particularly in the last few years started to increasingly structure and consolidate the research field. This is discernible for example by the growing number of DCV literature reviews in the recent past:

- Zahra et al. (2006) address the relationship between DCs and entrepreneurial activities
- Wang and Ahmed (2007) identify common features of DCs in the studied publications, leading to the so-called component factors 'adaptive capability', 'absorptive capability' and 'innovative capability'. They analyse contingency

relationships of DCs, in particular with regard to market dynamism, firm strategy and the development of lower level capabilities.

- Ambrosini and Bowman (2009) study the emergence of DCs and both internal and external enabling factors. The authors analyse the relationship between DCs and firm performance and retain that performance effects are dependent on contingency factors such as the complexity of the environment.
- Barreto (2010) synthesises literature to propose an aggregate multidimensional operationalisation of DCs and makes propositions for advancing the field. This regards in particular the study of the relationship between DCs and firm performance, as well as other contingency relationships.
- Di Stefano et al. (2010) use a co-citation analysis to study the origins and the development paths of the DCV literature.
- Vogel and Güttel (2013) perform a bibliometric analysis and clustering of the DCV literature.
- Eriksson (2014) focuses on empirical DCV studies and synthesises their findings, according to a framework consisting of the processes of DCs, their micro-foundations and outcomes.

However, an incoherent understanding within the DCV and diverging terminologies are still pointed out as key criticisms. In their review of the literature, Wang and Ahmed (2007) find that DCs are often understood in a very wide sense, which ultimately makes it difficult to arrive at a common terminology and to measure the concept. An area where this is particularly evident is the hierarchy of capabilities, which has already been introduced above. Winter (2003) for example distinguishes between two levels within the DC construct, with the lower of the levels corresponding to what many other authors call an operational capability.

Furthermore, the conceptualisation of the general nature of DCs differs between some studies. While the avoidance of rigidities is at the core of for example Teece (2007a), Zollo and Winter (2002, p. 340) define a DC as “a learned and stable pattern of collective activity through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness.” To summarise, despite their importance for the DCV, the core concepts or resources and capabilities are often described only in vague, sometimes tautological terms that are difficult to measure (Williamson, 1999; Montealegre, 2002; Priem and Butler, 2001a,b). Hoopes and Madsen (2008) also find that earlier empirical work is only loosely integrated, with significant variations in definitions and operationalisations, leading to a number of unanswered questions.

The issues of definition and conceptualisation of the main constructs of the DCV have also hindered operationalisation and empirical measurement, resulting in quantitative empirical work on the DCV being underdeveloped (Wang and Ahmed, 2007). As a result, practical insights and guidance for firms on how to improve their performance through an active approach to DC evolution still need to be developed (Priem and Butler, 2001a,b).

These difficulties in operationalisation have also contributed to a lack of integration between empirical studies – “thus far, research on dynamic capabilities has been conducted on a piecemeal basis” (Wang and Ahmed, 2007, p. 31). In a review of empirical work on the DCV, Eriksson (2014, p. 65) finds that operationalisations of the DC construct differ notably between studies and range from “the very specific and identifiable to a generic set of knowledge-related processes”, making it difficult to compare findings between the individual empirical works. Furthermore, most publications focus on one kind of microfoundations of DCs – either internal or external to the firm – (Eriksson, 2014), hindering the development of a coherent perspective on how DCs can be built up, developed and maintained by a firm.

One of the most severe shortcomings in empirical studies of the DCV is the analysis of contingency relationships between DCs and other key organisational constructs (Wang and Ahmed, 2007). Several authors have posited that the effectiveness of a firm’s DCs depend on the dynamism of the firm’s environment (Penrose, 1959; Barney, 2001; Eisenhardt and Martin, 2000; Priem and Butler, 2001a). However, empirical research has arrived at contradictory findings with regard to the influence of environmental dynamism (Zhang et al., 2013). Arguably the most notable contingency relationship that needs further investigation is the relationship between DCs and firm performance, which remains an unresolved issue (Barreto, 2010; Eriksson, 2014).

Having discussed the development, state of the art and criticisms of the DCV in general, the next section is concerned with the concept’s application to the domain of SI. Existing work is discussed and research gaps are identified.

2.2. Dynamic Capability for Service Innovation

2.2.1. Service Innovation and Service Innovation Research

As discussed earlier, due to the importance of sustaining competitive advantage for firms, the field of innovation research has been one of the most important in business research. The origins of innovation research have been laid in economics in the early 20th century (Schumpeter, 2013) and the topic has since then applied in studies in a number of disciplines including “marketing, quality management, operations management, technology management, organizational behavior, product development, strategic management, and economics” (Hauser et al., 2006, p. 687). Like the disciplines involved in the topic, the perspectives on it and the concrete aspects investigated have also been quite varied and often poorly integrated (Wolfe, 1994).

In their extensive review of the innovation literature in the fields of economics, sociology and technology management, Gopalakrishnan and Damanpour (1997) also criticise the dispersion of the achieved insights on innovation. The authors identify several dimensions of innovation along which insights can be compared and integrated, i.e., the stage in the innovation process considered, the level of analysis and the type of innovation. In particular within the last dimension, there has been a large

variety of perspectives, differentiating for example between process, organisational, technical and product innovation or between incremental and radical innovation.

The dominant share of the research on innovation and innovation management has so far been carried out in the area of manufacturing (Coombs and Miles, 2000). This is particularly true when considering the more fine grained levels of analysis, i.e., innovation or project level, business unit level or firm level as opposed to industry level or country level. For service firms, however, innovation is linked with particular challenges and opportunities, due to the distinct relationship with the customer and the importance of co-creation, amongst other things (Grönroos, 2006; Chesbrough, 2010). Services can for this purpose be defined as “the application of specialized competences (knowledge and skills) through deeds, processes, and performances for the benefit of another entity or the entity itself” (Vargo and Lusch, 2004, p. 2).

While the measurement and management of innovation and the related capabilities to realise it already pose difficulties in the manufacturing domain (Adams et al., 2006), the gap between the importance of innovation and the ability to adequately measure and manage it may be even greater in the service sector. For example, R&D expenses and the number of registered patents have traditionally served as key indicators for innovativeness. However, the applicability of these indicators cannot be assumed to be equal across different industries and sectors (Hagedoorn and Cloudt, 2003) and measuring service innovation by these indicators may lead to inappropriate conclusions. Analysing data from the German innovation survey in 1999, Hipp and Grupp (2005) find that less than 5% of German service firms had applied for patents in the previous three years. The authors point out that several aspects like the customer’s contribution and the importance of knowledge and non-technical elements for SI require specific measures and typologies – both for SI processes themselves and for their outcomes.

The resulting question is how SI can be defined and implemented and how existing theories, findings, tools and measures can be employed in order to advance our understanding of SI. Authors’ attitudes on this issue have evolved markedly over time – Coombs and Miles (2000) differentiate between three broad approaches in SI theory:

- Assimilation approach: The historically oldest approach to SI assumes that it can essentially be treated equally to manufacturing innovation and therefore does not require to be studied as a separate phenomenon
- Demarcation approach: Recognising the importance of SI, authors’ attitude towards the topic reached the opposite extreme; according to the demarcation approach, manufacturing innovation and SI are fundamentally distinct and need to be investigated separately; as a consequence, theories, methods, tools, etc. for SI would need to be developed afresh
- Synthesis approach: The youngest approach to SI is based on the thought of mutual information and enrichment; according to the synthesis view, SI can be informed by the large body of research on manufacturing innovation where appropriate; in turn, some features that are particularly prominent in SI and

the resulting insights can inform innovation management in the other areas as well

The synthesis approach to SI has gained increasing popularity over the last years and its significance is further increased by the servitisation of a large share of the manufacturing domain (Neely, 2007). Generally speaking, the importance of SI has increasingly been recognised in recent years and it has been identified as a top priority to advance our understanding of services in general (Ostrom et al., 2010, 2015).

However, despite the economic importance of services and the research priority attributed to service innovation, research has not arrived at a unified understanding or definition of SI. On the one hand, this is due to the topics ‘innovation’ and ‘services’ often being considered and studied in isolation, as opposed to investigating ‘innovation in services’ (Gallouj, 2002). On the other hand, SI is a complex, multi-faceted phenomenon, making it somewhat difficult to grasp. Overall, the literature is still fragmented – existing studies have shed light on several characteristics of SI, approaching it from different angles and focusing on different aspects of the concept, such as the degree of novelty, types of innovation or success factors (Droege et al., 2009).

den Hertog et al. (2010) qualitatively study the generic dimensions of SI and define it through the introduction of novelty in one or more of the following dimensions: Service concept, customer interaction, business partner(s), revenue model and delivery system (personnel organisation, culture and technology). Other studies have focused on the manifestations of SI. Gadrey et al. (1995) find that SIs are often architectural innovations. An architectural innovation is defined by its novel linkages between existing components and concepts (Henderson and Clark, 1990).

With regard to the degree of novelty, several studies further find that SI tends to be less disruptive than innovation in the manufacturing sector (Hipp and Grupp, 2005; Salter and Tether, 2006). In their analysis of German innovation panel data, Hipp and Grupp (2005) find that in the three year period from 1996 to 1998, only 16% of service firms had introduced innovations that were new to the market, as opposed to 34% of manufacturing firms. On the other hand, the share of service firms that had introduced innovations that were only new to themselves was much higher – 77% as compared to 57% for manufacturing firms.

With regard to managing SI, a key characteristic is the small prevalence of research and development (R&D) departments in service firms (Sundbo, 1997), which means managers can rely less on this dedicated unit and need to identify ways to engage a larger part of the firm. Indeed, in their review of SI studies, Salter and Tether (2006) find that for innovation in services, the role of organisational change is particularly prominent.

Despite the research attention attributed to the topic, many issues still remain unresolved. Coombs and Miles (2000) point out that our existing knowledge on SI is still missing established measures to assess SI success and the resulting performance impacts. With regard to the impact of SI on firm performance and competitive

advantage, Salunke et al. (2013, p. 1086) point out that “little, if any, empirical research exists on the prevalence of persisting superior market positional advantages in service firms”.

In order to address these shortcomings, several authors have identified the benefits of the DCV perspective for SI research. Based on the importance of organisational change for SI (Salter and Tether, 2006), this is a promising approach. As Lawson and Samson (2001, p. 377) put it, “innovation management can be viewed as a form of organisational capability”. The authors propose that as a consequence, firms should be able to foster product, service and process innovation through the development of this capability. In particular, the DCV provides an opportunity to structure and empirically study key concepts of SI and to connect them with performance impacts – the lack of which has been criticised for service management research in general (Subramony and Pugh, 2015). The following section introduces and discusses studies that have applied the DCV perspective to SI.

2.2.2. Studies on Dynamic Capability for Service Innovation

Studies on DCSIs are rooted in the DCV and apply its logic and concepts to the study of innovation in services. This area of research has been established fairly recently – Lawson and Samson (2001) arguably contributed one of the first DC publication that can be applied to both product innovation and SI, however research on DCSIs picked up pace in 2009–2011.

In the following, we discuss the existing studies on the topic with their strengths and limitations. The criteria guiding the discussion are derived from the analysis of the DCV literature presented above. Additionally, we consider whether the framework or model proposed in the study was developed specifically for SI and whether a large scale empirical sample was used – based on the idea that recent work on the DCV should be integrative and support operationalisation of the key constructs, as discussed above. This leads to the following set of criteria for the studies:

- Specifically developed for the context of SI
- Consideration of multi-level microfoundations
- Inclusion of multiple facets of DCs
- Analysis of contingency relationships between DCs and firm performance
- Construct operationalisation through measurement scales
- Use of a suitably large empirical sample

Lawson and Samson (2001) can be considered as a forerunner of DCSI studies. In their conceptual work, the authors develop the notion of innovation management as a capability, for which they draw upon several streams of literature, as well as a case study of Cisco Systems. While not focusing on SI issues, the authors explicitly mention the development of products and services as targets of their study. Due to

the conceptual nature of the work, the study does not propose an operationalisation or measurement of the key constructs and does not use an empirical sample.

The proposed framework positions innovation capability as an integrative construct consisting of practices and processes, which “are a key mechanism for stimulating, measuring and reinforcing innovation” (Lawson and Samson, 2001, p. 388). Innovation capability is proposed to mediate between ‘innovation newstream’ (exploration) and ‘mainstream’ (exploitation) activities. The authors also propose factors that foster the development of an innovation capability, including the firm’s RB, cultural and other organisational aspects – the framework focuses on firm-level enabling factors. With regard to the firm performance impact of innovation capability, the framework proposes a dual relationship, both a direct relationship with firm performance and one mediated by innovation performance. However, these relations are not analysed or described in detail.

Essmann and Du Preez (2009) propose an innovation capability maturity model based on an extensive review of literature on innovation capability and other innovativeness constructs. The framework aims to support an assessment of a firm’s capability to innovate and spans three dimensions – the elements of the innovation capability itself, the organisational construct they can be mapped to and a capability maturity scale. The assessment of the implementation of a capability through a maturity scale is methodologically rooted in the so-called capability maturity model integration, which has been developed at Carnegie Mellon University, and has been used for the assessment of diverse organisational capability areas.

The authors’ model is one of the first approaches to quantitatively measure innovation capability. Furthermore, the link between the elements of an innovation capability and key organisational constructs is instructive, since it would ideally allow to anticipate the impact of capability development on the firm. With regard to the organisational constructs considered to interact with innovation capability, the model concentrates on firm-internal aspects, but also includes customers and suppliers as an external factor.

In terms of operationalisation, the authors state to have developed a questionnaire, which is built around questions assessing a firm’s maturity on the 42 elements of innovation capability proposed in the model. However, neither the questionnaire nor sample questions are reported in the study. Using the mentioned questionnaire, the model has been prototypically evaluated using five case studies. However, as the authors put it, the “validation was based on executive and management buy-in” (Essmann and Du Preez, 2009, p. 441), rather than an evaluation of the accuracy of the model itself. While service firms served as study objects for these case studies, the model has not been developed to specifically address SI.

den Hertog et al. (2010) propose the first framework specifically targeted at the particularities of SI. The framework is built upon an extensive review of the DCV and innovation management literature, as well as case studies on service firms conducted by the authors. The framework encompasses six dimensions of DCSIs, which span a spectrum from sensing opportunities in the form of user needs and technologies to

the realisation of new services through scaling, as well as the accompanying reflecting and learning. This description is compatible with the dimensions proposed by Teece (2007a), but is more fine-grained and was developed in a SI context.

The study uses qualitative data and therefore does not offer a direct operationalisation or measurement of the capability dimensions. Also, it does not make any explicit statements on the performance impact of the DCSIs. Due to the conceptual nature of the contribution, the proposed framework has not been empirically evaluated – the authors explicitly encourage subsequent studies to do so.

Ordanini and Parasuraman (2011) establish the first model for SI, which jointly considers microfoundations and performance impacts – an important advancement for this research stream. The authors propose three areas of microfoundations for SI outcomes – collaborative competences, knowledge interfaces and the dynamic capability of customer orientation. In contrast to most other studies, they use a rather narrow conceptualisation of DCs, expressed through a combination of customer orientation and innovative orientation. The other microfoundations are proposed to operate on the same level and to have a direct effect on the innovation outcomes.

While the proposed microfoundations can be located at the firm level, they explicitly consider interfaces and collaboration with external parties and therefore extend into the firm’s environment to some extent. All of the proposed constructs are operationalised using multi-item scales and data for the model’s evaluation was collected from 91 five-star hotels in Italy – a commensable sample for the studied industry and geography, but limited with regard to a wider generalisation of the findings. The performance impact of the proposed one-faceted DCSI is hypothesised to be mediated by innovation outcomes – considering volume and degree of radicalness – and is supported for the most part.

Hogan et al. (2011) contribute one of the first publications on DCSIs from the marketing domain. The authors specifically investigate professional services and use both existing constructs, scales and exploratory interviews as inputs. They propose an innovation capability consisting of three components and accompanying scales: Client-focused innovation capability, marketing-focused innovation capability and technology-focused innovation capability.

In a way similar to Ordanini and Parasuraman (2011), the authors include client-oriented microfoundations of innovation capability, however their main attention is on the firm itself and on firm level microfoundations. Their study evaluates measurement scales for the components of innovation capability – they do not propose or evaluate the performance impact.

The model is evaluated using a sample of 463 senior executives from professional service firms (PSFs), which are typical representatives of KIBS firms. The sample is subdivided for item purification, evaluation and cross-validation. To summarise, Hogan et al. (2011) put forward a detailed model of DCSIs, which is based on the characteristics of PSFs, but does not make any statements about the relationship between innovation capability and innovation performance or firm performance.

Agarwal and Selen (2009, 2011, 2013) have published a series of studies that build on each other. The studies focus on the development of DCSIs in service value networks. A service value network is conceptualised as a network of a service firm and other entities with which it collaborates to create value – this is also called service network or service system (Vargo et al., 2008).

In addition to a review of several literature streams with a focus on collaborative and open innovation, the authors collect empirical data from an Australian telecommunications provider and several of its partners, therefore focusing on a specific type of service firm. As opposed to most other studies, the authors do not explicitly operationalise the innovation capability as a multi-dimensional or multi-faceted construct, but instead propose several organisational constructs that encompass the different facets of DCSIs.

Due to the perspective of the study, the importance of external parties (customers and business partners) for SI is stressed. In Agarwal and Selen (2009), the authors propose six constructs: Organizational relationship capital, collaborative organizational learning, collaborative innovative capacity, customer engagement, collaborative agility and entrepreneurial alertness. Besides firm level microfoundations, this operationalisation of DCSIs explicitly considers network level microfoundations, such as collaborative agility.

The authors study the effect of DCSIs on the introduction of new services and their improvements over the status quo, termed elevated service offering. In Agarwal and Selen (2011), they focus on a classification of these improvements, distinguishing between strategic elevated service offerings, operational ones with regard to performance and operational ones with regard to productivity.

In their third publication (Agarwal and Selen, 2013), the authors focus on three of the proposed constructs (organizational relationship capital, collaborative organizational learning and collaborative innovative capacity) to analyse their interplay and their impact on the elevated service offerings. All of the proposed models are confined to elevated service offerings as the outcome construct – a direct or mediated relationship between DCSIs and firm performance is not incorporated.

Kindström et al. (2013) provide a detailed analysis and exploration of the three DC dimensions proposed by Teece (2007a), focusing on industrial services. Using exploratory interviews at eight case firms, the authors develop a set of practices for each of the three capability dimensions.

Due to the set-up of the study, several of the DCSI aspects address the ability of industrial firms to successfully manage a transformation towards, and to run, a service business – an economically considerable development termed servitisation (Neely, 2007). Since this is a qualitative study, the authors do not develop a measurement operationalisation of the identified constructs and do not empirically evaluate the proposed framework. The study focuses on the foundations of the facets of DCSIs and does not make any propositions with regard to its performance impact.

Janssen et al. (2014) propose a conceptualisation and measurement model of DCSIs, which builds upon the framework proposed by den Hertog et al. (2010).

Despite being published as a working paper, their study is included here since it is a recent and SI specific work within the DCV field and it adds several distinctive insights to the existing literature. The authors develop and empirically evaluate measurement scales for five elements of the DCSI construct, namely:

1. Sensing user needs
2. Sensing (technological) options
3. Conceptualizing
4. Co-producing & orchestrating
5. Scaling & stretching

DCSIs are modelled as a multi-dimensional construct, with elements 1 and 2 contributing to element 3, which in turn is proposed to contribute to elements 4 and 5. The model reflectively measures DCSIs through microfoundations (Teece, 2007a). The items used to measure the microfoundations do include some aspects of customer and competitor orientation and interaction, but overall they are restricted to the firm level.

The model is developed specifically for the SI context, but is evaluated using a multiple industry sample, including services, industry and construction. The sample includes 391 Dutch single-business firms with at least ten employees and exhibits a heavy bias towards small firms (84%). The sample is subdivided for exploratory analysis ($N = 196$) and confirmatory analysis ($N = 195$).

The study analyses the performance impact of DCSIs and finds that overall performance is increased by higher scores on the DCSI scales. The authors also analyse the impact of the individual DCSI constructs on two performance areas – however, the study does not explicitly propose or evaluate contingency relationships as for example in Ordanini and Parasuraman (2011) and implies a direct DCSIs–performance impact.

Kim et al. (2015) propose a framework for SI, which builds upon RBV and DCV theory. The authors differentiate between two levels of microfoundations of DCSIs. The first level is constituted by property based and knowledge based resources. The second level is formed by relational capabilities, which connect the resources to the three DCSIs, which they conceptualise as integration, reconfiguration and extraction. The authors describe categorisations and manifestations of the microfoundations in detail, however with a clear focus on the firm’s resources and competences.

The framework does not make any propositions about contingency relationships between the conceptualised DCSIs and firm performance. Since this study introduces a conceptual framework, the proposed constructs are not assessed through measurement scales and the framework is not evaluated empirically.

Table 2.1 provides a summary of the features of the discussed DCSI studies. Some aspects of the evolution of the research field, as well as the alternation between conceptual and empirical studies can be seen from the discussed criteria.

The research field has made significant progress and there are first integrative works building on each other – for example Janssen et al. (2014) and den Hertog et al. (2010). However, it can be concluded that no one of the studies fulfils all of the criteria identified in the discussion of the DCV literature.

In the next chapter, we propose a research framework that allows to address the identified research gaps. The research framework helps guide this study and puts emphasis on the microfoundations of DCSIs, since they represent the elements into which managers can invest attention and resources in order to actively develop their firm's innovative capability.

Table 2.1.: Studies on Dynamic Capability for Service Innovation

Publication	Specifically developed for the context of service innovation	Consideration of multi-level microfoundations	Inclusion of multiple facets of dynamic capabilities	Analysis of contingency relationships between dynamic capabilities and firm performance	Construct operationalisation through measurement scales	Use of a suitably large empirical sample
Lawson and Samson (2001)	-	-	-	(✓)	-	-
Essmann and Du Preez (2009)	-	✓	✓	-	-	-
den Hertog et al. (2010)	✓	✓	✓	-	-	-
Ordanini and Parasuraman (2011)	✓	(✓)	-	✓	✓	(✓)
Hogan et al. (2011)	✓	(✓)	✓	-	✓	✓
Agarwal and Selen (2009, 2011, 2013)	✓	✓	✓	-	✓	(✓)
Kindström et al. (2013)	✓	✓	✓	-	-	-
Janssen et al. (2014)	✓	-	✓	(✓)	✓	✓
Kim et al. (2015)	✓	(✓)	✓	-	-	-

- ✓ Criterion completely satisfied
- (✓) Criterion partially satisfied
- Criterion not satisfied

3. Exploratory Analyses

3.1. Exploring the Use of Text Mining to Assess Dynamic Capabilities for Service Innovation

The results presented in this section build on the publication Kohler et al. (2014) and on contributions elaborated by Lars Kübler in his Master Thesis at Karlsruhe Institute of Technology. The author would like to thank all of the involved collaborators very much for the fruitful co-operation.

When trying to use the concept of DCSIs to support decision-making in SI management, a firm needs to assess its current performance on the individual DCSIs for two reasons. First, this should help identify deficits which can then be used to focus investments. Second, this step is important to establish a baseline against which the effectiveness of all measures and investments undertaken can be compared. A frequently used instrument to support this kind of assessment is a questionnaire-based survey, which has been used by most of the earlier work on DCSIs presented in Chapter 2.

Another approach is to apply a model of DCSIs to existing data using data mining methods. Studies in other areas of service science research have showcased the potential of using existing data to explore questions relevant to service firms, such as Fromm et al. (2012). For the study of DCSIs employing available data, unstructured data, i.e. text, appears most suitable. First, textual data presents a good fit to the multi-faceted nature of the investigated concept of DCSIs. Second, up to 90 per cent of all information in firms' internal networks and information management systems have been reported to be stored in text form (van den Hoven, 2001) – for the Internet in general, most of the information available today is also stored in text form.

The goal of this study is to develop and evaluate means of assessing DCSIs by employing text mining methods. The underlying vision is that in working towards an assessment of DCSIs using secondary text data, firms will be supported in analysing

and developing the most critical aspects of their innovation capabilities by lowering the involved transaction costs for them. This would also help managers monitor developments in their firm’s capability base over time and to benchmark their firm against peers.

A search for similar studies in the context of innovation research supports the novelty of the proposed approach. While there are, to our knowledge, no text mining approaches building on DCSI frameworks so far, two studies that share some characteristics with the work presented here, should be mentioned. Villarroel Ordenes et al. (2014) employ linguistics-based text mining to analyse customer experience feedback for service interactions. The authors propose a framework for analysing service experiences in an encompassing manner, building on the key blocks of interactions, activities, resources, and context. While the authors employ approaches related to the study presented here, the dimensions proposed in their framework do not match with the level of analysis required to assess DCSIs.

The approach most similar to our study was presented in Kabanoff and Keegan (2007), for an overview of relevant earlier work, see therein. In their study, the authors employ annual reports of Australian Stock Exchange listed firms to measure the attention that the firms’ top management teams put on seven strategic dimensions, including innovation. As a source of external validation, the authors employ the Innovation Index Score (IIS), which is published by the Intellectual Property Research Institute of Australia (IPERA). While this approach shows certain similarities with our proposed study, a number of elements, such as keyword vocabulary creation, comparisons between different corpora of text documents, and the development of more complex patterns for text mining warrant a novel approach and evaluation. This analysis is divided into three parts – guided by the following questions:

1. How feasible is the text mining based assessment of multiple dimensions of a firm’s DCSIs based on keyword representations?
2. How robust is the text mining based assessment of DCSIs to different corpora of text documents being used as input data?
3. What is the impact on the results of the text mining based assessment of DCSIs when keyword representations of the capability facets are extended to more complex patterns?

For the purpose of this study, we will use the DCSI framework proposed by den Hertog et al. (2010) presented in Chapter 2. This framework is particularly suited to our approach since the authors offer a rich textual description of the individual DCSI dimensions, which can be converted into appropriate keywords. In the following, the study’s research design is presented.

We build on a text mining approach termed EMCUT – “entity matching [to] classification [schemes] using text” (Kimbrough et al., 2013, p. 388), which allows to recognise the representations of formal concepts – DCSIs in our case – in text documents. The implementation of this approach requires the following elements (Kimbrough et al., 2013):

- Representations of the investigated concept. In the case of keyword representations, these are called vocabularies, in the case of more complex representations, these are called text patterns. In our case, the vocabularies or text patterns need to represent the dimensions of the DCSI framework proposed by den Hertog et al. (2010).
- A corpus of text documents associated with entities that are assessed with regard to the investigated concepts. In our case, these text documents are associated with firms that are analysed with regard to their implementation of DCSIs.
- A matching algorithm that can classify the text documents of the corpus based on similarity to the given representations.
- An existing classification of the same entities (firms) that allows an evaluation of the classification performed in our approach.

The development of these elements of the text mining approach is described in turn in the following. First, we discuss the development of vocabularies, i.e. keyword representations of the DCSI dimensions. In order to generate useful keywords for the individual dimensions, we employed the concept of microfoundations, which Teece (2007a) describes as the manifestations of DCs and which consequently contain evidence of their existence in a firm. The following steps were taken in the process of vocabulary creation:

1. Extracting keywords from the textual descriptions of the DCSI dimensions by den Hertog et al. (2010).
2. Extracting keywords from interviews with SI practitioners (see Section 3.2, Kohler et al. (2013) and Kohler et al. (2014)). The practitioners were shown short textual descriptions of the DCSI dimensions by den Hertog et al. (2010) and were asked to name resources, processes and methods existent in their firms that they associated with the described concepts.
3. Adding keywords using free association based on the keyword list created by steps 1 and 2.
4. Adding keywords using a systematic search for synonyms to the keywords created by steps 1 through 3.
5. Testing the vocabulary against elements of the text document corpus.
6. Modifying the vocabulary, if the tests in step 5 were dissatisfying. This was done by eliminating individual terms (if their essence is otherwise captured in the vocabulary), by adding further synonyms and by splitting up composite terms. Following the modifications, step 5 was repeated.
7. Selecting the vocabulary with the highest model quality estimates as the final version.

To allow for variations of the vocabulary elements in a text document, the vocabulary was implemented using regular expressions, as shown in Table 3.1. In these regular

3.1. Exploring the Use of Text Mining to Assess Dynamic Capabilities for Service Innovation

expressions, an asterisk indicates that any sequence of characters can follow the characters before the asterisk. Square brackets indicate a choice of characters – in the examples shown they indicate that two words can either be separated by a hyphen or by a blank space without changing how a vocabulary element is recognised. Finally, parentheses indicate optional sequences of characters, which can but do not need to be present in order for the vocabulary element to be identified.

Table 3.1.: Vocabulary Elements using Regular Expressions

lead[-]user(s)	social[-]media	involv*
feedback	round[-]table(s)	sens*
survey(s)	interact*	trend*

For this part of the analysis, more complex representations of the individual dimensions were developed. In doing so, the vocabularies described in the previous step were used to form text patterns. This is expected to reduce the number of occurrences where a keyword is identified as relevant for the classification of the investigated entity, although its context indicates that the analysed document used the keyword in a different sense. This is illustrated in the following short example using the keyword ‘network’.

- The service provider collaborated with partners in its network to drive innovation.
- The service provider upgraded its network infrastructure using the latest technology.

For our study, this creation of text patterns as representations is focused on statements about the presence and use of the microfoundations of DCSIs in a firm. A statement containing certain microfoundations would be interpreted as the firm using or strengthening the related capability dimension.

Since the creation of text patterns as a vocabulary requires far more effort than individual keywords, we limit this part of our exploratory analysis to the capability dimension ‘(Co-) Producing and Orchestrating’ in the model of den Hertog et al. (2010). This capability dimension represents various forms of open innovation, such as joint research and development, as well as joint service provision. Specifically, the creation of text patterns for this analysis was targeted at capturing the relationship a firm establishes to foster its innovation activities. This led to the following rules for the creation of text patterns:

- A text pattern must indicate that two or more firms establish a relationship.
- The relationship described in the text pattern needs to be relevant to open innovation activities as described in the cited DCSI dimension.

The patterns were formed based on excerpts of the vocabulary created in the previous step and by manually analysing the relevant document corpus for prototypical

sentences. These sentences were captured and simplified. Multiple variations of each sentence were recorded to make sure that as many relevant occurrences as possible would be matched in the documents to be analysed, similar to the use of regular expressions for the keyword based vocabulary in the previous step.

The classification of the analysed entities requires a matching between the vocabulary and the documents associated with the entity. Kimbrough et al. (2013) point out machine learning as effective in solving these EMCUT problems for large corpora of text documents. For the purposes of this study, we choose the well-established approach of document classification using supervised learning (Bird et al., 2009; Manning et al., 2008). The classifications used here are ‘innovative’ and ‘less innovative’ – following the thought that a firm that scores high on the individual DCSI dimensions should be classified as innovative.

For the keyword based representations, we use classification trees to match vocabulary’s keywords with the text documents associated with the individual firms – this results in an identification of keywords that allow a discrimination between the individual classifications for those firms. The classification tree algorithm scores the analysed text documents using the established vocabulary and shows which keywords have to occur in which number to classify a firm as innovative or less innovative. MATLAB’s classification tree implementation with 10-fold cross validation is used to create a robust and pruned classification tree.

The classification tree’s result are then compared to an existing classification of the same firms. Several rankings for firms’ (perceived) innovation performance are regularly published by a number of issuers. Issuers include BCG, Booz & Company, Fast Company magazine and Forbes magazine. Unfortunately, most publishers do not clearly communicate their ranking criteria. For the requirements of this study, the BCG ranking (BCG, 2013) is the best suited one, as its ranking criteria are the most transparent and it is available for several consecutive years in the past. The BCG ranking uses the following ranking criteria and corresponding weights:

- Surveys with firms’ executives conducted by BCG: 80 %
- Stock returns: 10 %
- Three-year revenue: 5 %
- Profit margin growth: 5 %

In order to create a text document corpus for our analysis, we first selected a set of firms for which to retrieve the relevant documents. From the BCG ranking of the 50 most innovative firms described above, we selected 22 firms based in the United States for matters of data availability and consistency in reporting standards. These firms and the documents associated with them form the set of ‘innovative’ firms. In the next step, for each industry considered in the BCG ranking, we randomly chose five US-based firms – again for data availability and consistency considerations – that did not hold positions in the BCG ranking. These firms and the documents associated with them form the set of ‘less innovative’ firms.

3.1. Exploring the Use of Text Mining to Assess Dynamic Capabilities for Service Innovation

For both the innovative and the less innovative firms' set, annual reports from 2007 to 2010 were collected. In total, 455 suitable annual reports were collected from this time interval, with 78 annual reports associated with the innovative firms' set and 377 with the less innovative firms' set. For more details on the acquisition process of the annual reports, please see Kohler et al. (2014).

The document corpus was enriched by a further set of documents, which was based on the proportions and characteristics of the first set, with the aim of including a totally different source of information. The first set of documents, firms' annual reports, captures firms' self reported data and, therefore, to a certain extent their self-image. The second set of documents therefore consists of firms' profiles written by third parties. Such firm profiles are regularly published by a number of providers. Typical features of these reports include the firm's organisational structure, its history, its assets and key activities. The reports for our text corpus were collected using LexisNexis (www.lexisnexis.de) in late 2013. Through LexisNexis, the databases of a large number of providers are searchable. To increase the robustness of the document corpus used for our study, we included information from six different publishers: Canadean, Hoovers, Marketline, GlobalData, ICD Research and World Market Intelligence. In total, we collected a document corpus of 470 firm profiles, of which 91 are associated with the innovative firms and 379 are associated with the less innovative firms. As with the annual reports, multiple documents can be associated with a single firm.

From the comparison between the algorithm's classification of the documents associated with the analysed firms and the existing classification of the firms through the BCG ranking, a confusion matrix is calculated containing the following possibilities:

- Firms classified as innovative, which hold top positions in the BCG ranking and are therefore correctly classified as innovative
- Firms classified as less innovative, which do not hold top positions in the BCG ranking and are therefore correctly classified as less innovative
- Firms classified as innovative, which do not hold top positions in the BCG ranking and are therefore falsely classified as innovative
- Firms classified as less innovative, which hold top positions in the BCG ranking and are therefore falsely classified as less innovative

This confusion matrix is used to calculate the model quality parameters used for assessing machine learning algorithms, i.e., accuracy, recall and precision. For the case of text pattern based representations, we need to perform a different analysis since the only available variable is the count of patterns in the investigated documents. For this case, we use statistical hypothesis tests in order to assess whether there is a correlation between the pattern count in a document and the ranking based classification of the firm associated with this document.

For the hypothesis tests, we assume that documents associated with firms classified as innovative will exhibit a higher number of relationship-oriented text patterns,

i.e., signs of conducting open innovation activities. We use both the parametric t-Test and the non-parametric Mann-Whitney-U-Test, which are both applicable to two-class classification schemes. In our situation, the distribution of values of one variable differs between two classes, and these tests provide an indication of whether this difference is systematic or coincidental. Both tests make the assumption of equality of means as the null hypothesis, i.e., a difference in means is interpreted as systematic if the null hypothesis is rejected.

The results for the first part of the analysis based on keyword representations were calculated assuming default prior probabilities, i.e., the ratio of the probabilities of a firm being classified as innovative or less innovative is set to the same as the ratio between the number of text documents in the corpus associated with innovative or less innovative firms. Figure 3.1 shows the results of this analysis. The models for every DCSI dimension of the den Hertog et al. (2010) framework exhibit very high accuracy values (over 89 %). Also, the models for every dimension consistently produce by far higher precision values than recall values. This means that the classifications represented by the models produce relatively few false positives at the expense of producing a high number of false negatives. The models for the first, fourth and sixth dimension can be considered acceptable with regard to their model quality parameters. The other models are discarded due to their low recall scores of 52.63 % (dimension two), 47.37 % (dimension three) and 43.42 % (dimension five).

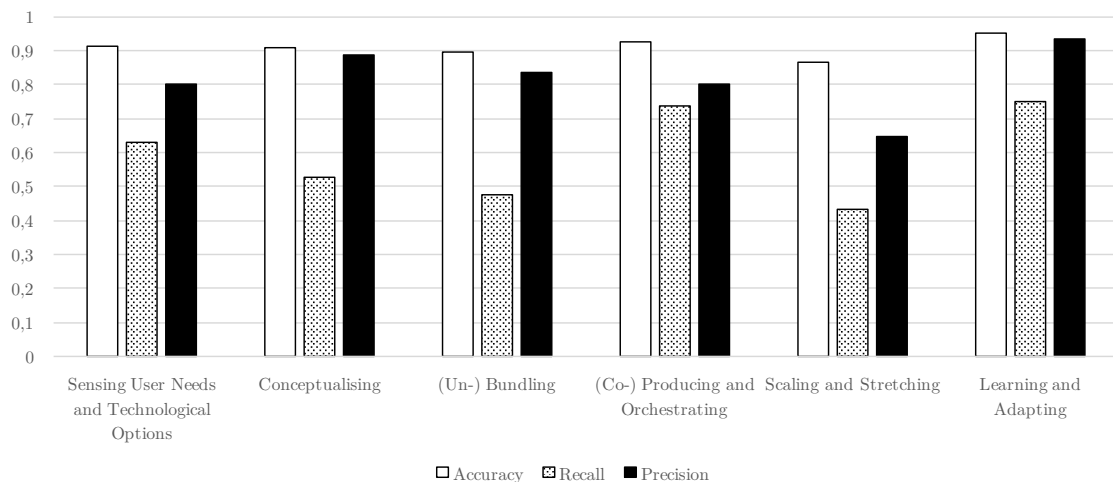


Figure 3.1.: Text Mining Model Quality Parameters (First Document Corpus, Default Prior Probabilities)

It should be noted that the employed keyword-based vocabularies have been refined in an iterative process (see above) and the best performing version has been used to produce the reported results. For the model dimension ‘(Un-) Bundling’, for example, four evolution steps of the vocabulary were created and tested.

These results suggest that some aspects of a firm’s DCSIs can more readily be assessed using a keyword-based text mining approach. In this particular study setting, representations for three of the six DCSI dimensions could be achieved that produce

3.1. Exploring the Use of Text Mining to Assess Dynamic Capabilities for Service Innovation

overall acceptable model quality parameters – the models for the other three dimensions had to be discarded due to their low recall scores, even though the other quality parameters showed significantly better scores.

We conclude that the EMCUT text mining approach is suitable to assess several aspects of a firm’s DCSIs using text documents associated with the firm and keyword-based representations of the DCSI dimensions. Based on the results from this analysis, we also conclude that not all DCSI dimensions are equally suited to be assessed using this approach. One limitation of this analysis is that the lower recall values for some of the models could result from a poor fit between the generated keyword-based vocabularies and the specific text documents employed. In this scenario, the text documents considered were limited to annual reports, i.e., documents published by the firms themselves.

In order to further investigate this limitation, we repeated the analysis for the second corpus of text documents described above, which was compiled using firm profiles published by third parties. This analysis was carried out using the minimum cost tree as the classification model. Figure 3.2 shows the results of this analysis – note that for the first and fifth dimension no quality measures could be calculated since the corresponding models consisted of only one leaf node.

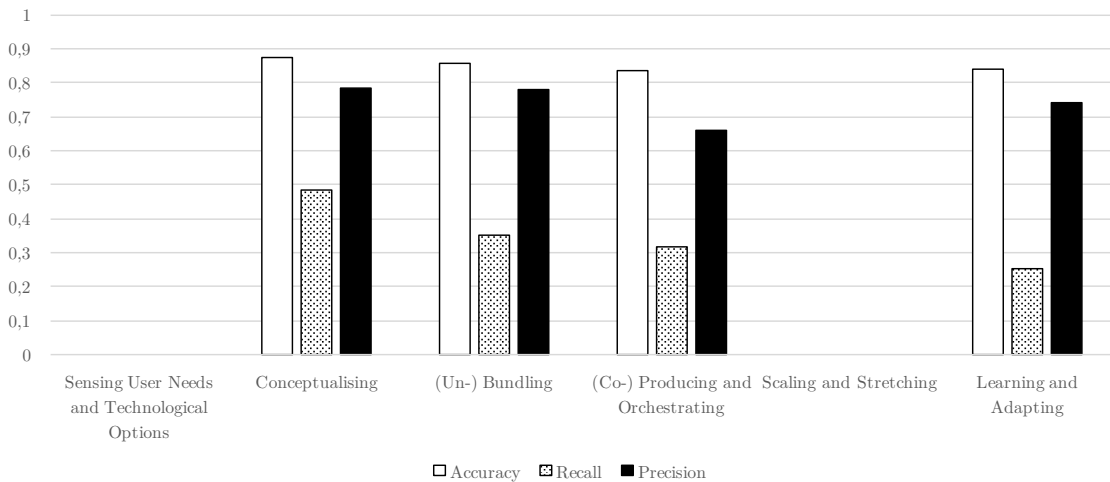


Figure 3.2.: Text Mining Model Quality Parameters (Second Document Corpus, Default Prior Probabilities)

The other models show good accuracy values (84 % to 87 %) and precision values (66 % to 79 %). However, recall values score too low (25 % to 48 %) to accept the corresponding models. The analysis shows that in this setting the DCSI dimension conceptualising produces the best performance. Furthermore we record that all model quality parameters score lower for all DCSI dimensions when compared with the first document corpus.

Assuming equal prior probabilities yields better results for the second document corpus. However, model quality still remains below that found for the first document

corpus. Results are reported in Figure 3.3. All models exhibit comparably low precision scores of 52 % to 64 %. In this analysis, all but the models for the first and fourth dimension (sensing user needs and technological options, (co-) producing and orchestrating) need to be rejected due to these precision scores.

Comparing the model quality measures of the results from the first document corpus and that from the second document corpus, we conclude that in this setup of our approach, the vocabulary-document fit bears a large influence on performance. In order to investigate this issue, this part of the analysis focuses on the performance of classification rules using text patterns, as opposed to keywords.

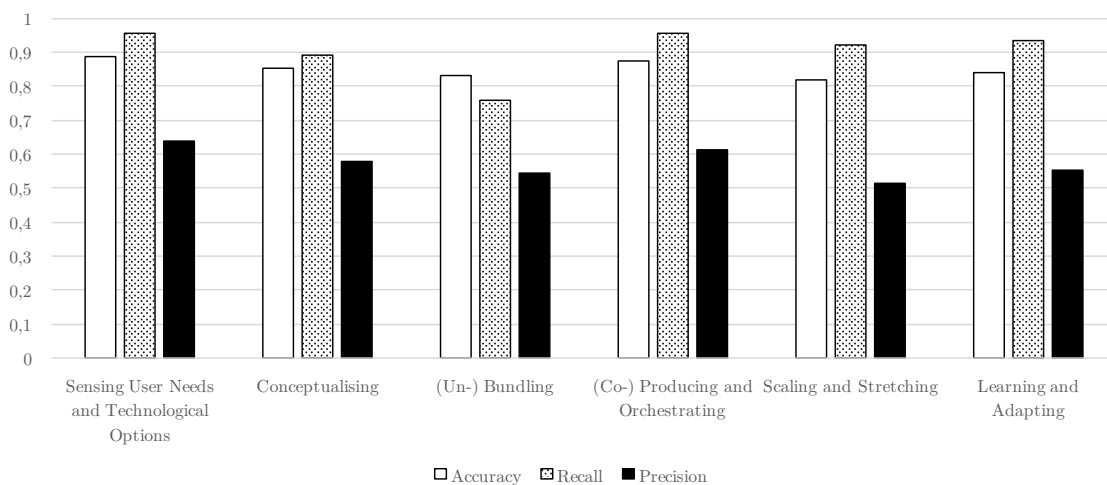


Figure 3.3.: Text Mining Model Quality Parameters (Second Document Corpus, Equal Prior Probabilities)

Due to the complexity of this analysis, it is exemplarily carried out for the DCSI dimension of (co-) producing and orchestrating. This DCSI dimension captures aspects of a firm’s collaboration with others, particularly with regard to realising joint innovations. Taking this into account, we study the usability of relationship patterns between multiple firms as an extension of the keyword based vocabulary for representing this DCSI dimension. Collaboration for innovation between firms is multi-faceted – we therefore focus on formal relationships in the context of innovation activities, including the following:

- Strategic alliances
- Joint research projects
- Research and development cooperations
- Joint ventures

We assume that firms classified as innovative will exhibit a larger number of such relationship patterns in their innovation activities than firms classified as less innovative. This means that in order to classify documents associated with firms as

3.1. Exploring the Use of Text Mining to Assess Dynamic Capabilities for Service Innovation

innovative or less innovative, the number of text patterns representing relationships in innovation are counted and scored.

Figure 3.4 shows the distribution of the number of recognised text patterns for both document classifications. A comparison of the median of both classes shows a much higher score of 12.2 for the innovative class as opposed to 4.5 for the less innovative class, as expected. In order to assess whether these differences in text pattern counts are systematic or coincidental, we use statistical hypothesis tests. Both the t-Test and the Mann-Whitney-U-Test used here assume as the null hypothesis that the number of patterns is equally distributed across both classes. This means that if the null hypothesis is rejected, the difference in pattern count distributions between the two classes is shown to be systematic, supporting our assumptions for this analysis.

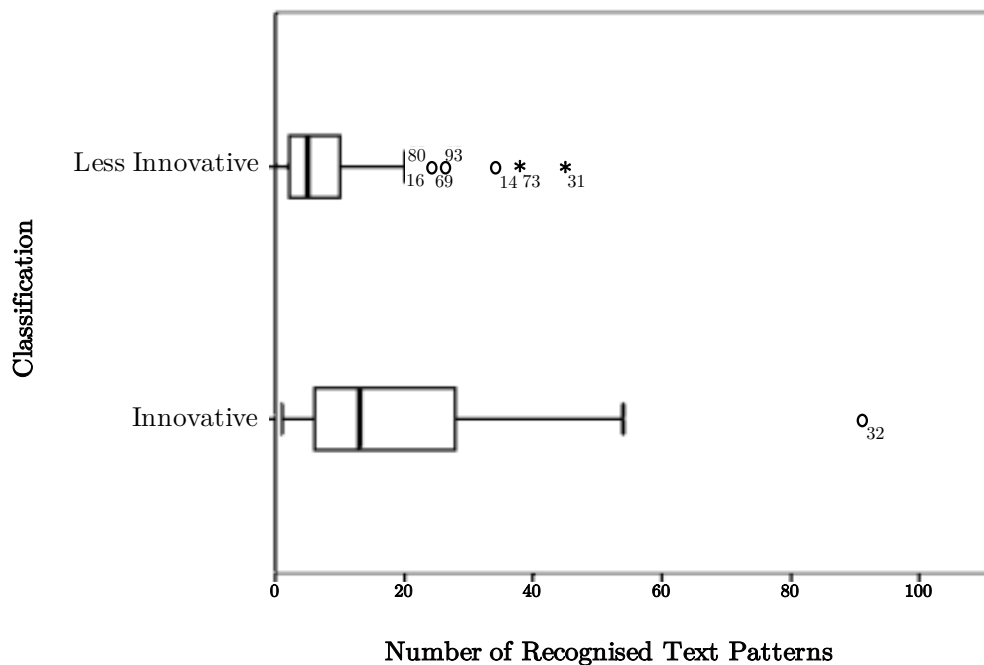


Figure 3.4.: Recognised Text Patterns in Documents

The t-Test shows a significant difference in the distribution of the number of text patterns for documents classified as innovative (mean = 12.2, standard deviation = 14.6) as opposed to those classified as less innovative (mean = 4.54, standard deviation = 6.6). The test statistics for the t-Test are $t(99.031) = 4.889$, $p < 0.0005$. A visual inspection reveals that the distribution of the text pattern numbers for innovative and for less innovative documents are indeed not similar.

In the Mann-Whitney-U-Test, the text pattern numbers for documents classified as innovative (mean rank = 317.89) are shown to be statistically significantly higher than for documents classified as less innovative (mean rank = 215.72). The test statistics for the Mann-Whitney-U-Test are $U = 9747$, $z = -6.512$, $p < 0.0005$.

Both statistical tests reject the null hypothesis and therefore indicate that the distribution of the number of recognised text patterns – representing formal relationships

in innovation activities – is systematically different between documents associated with firms classified as innovative and those classified as less innovative. However, both the normal distribution assumption for the t-Test and the shape assumption for the Mann-Whitney-U-Test were violated – the results should therefore be interpreted with caution. For example, we cannot draw any direct conclusions from the size of the difference between the mean values of text pattern numbers in the two classes.

Based on these results, we conclude the following. The first part of the analysis showed that the assessment of multiple dimensions of a firm’s DCSIs using keyword representations is generally feasible. However, the individual dimensions do not necessarily exhibit the same performance when compared on the same corpus of documents. In our analysis, the classification models for three out of the six considered DCSI dimensions could be accepted, while the other half needed to be rejected.

In the following analysis, we investigated the influences of the document corpus used. The influence of the document corpus was shown to be significant in that the fit between the documents and the vocabulary used for the analysis has a strong impact on the results. In our analysis, the fit between the firms’ annual reports and the used vocabulary was much better than the fit between the same vocabulary and firm profiles written by third parties.

In order to alleviate the sensitivity of the approach to this keyword document fit, the third part of the analysis used text patterns instead of keywords to analyse and classify the documents associated with the individual firms. Due to the complexity of this approach, it was only applied to one of the six DCSI dimensions of the den Hertog et al. (2010) framework. This analysis yielded encouraging results and suggests that innovative firms tend to have a higher number of formal relationships for innovation with other firms.

In conclusion, the presented approach is shown to be highly dependent on the design parameters of the individual analysis – in particular on the fit between the vocabulary and document corpus used. The use of keyword based vocabularies may be a feasible assessment approach in selected scenarios and is associated with significantly less effort than the text pattern based analysis. However, in this case the fit between the document corpus used and the vocabulary warrants particular attention.

The use of text patterns instead of keywords was shown to be a more robust representation of DCSIs in the instance of firms’ collaboration for innovation, since they more fully capture specific actions or the use of a firms’ assets. This conclusion was supported by a manual analysis of a sample of the document corpus during the development of the text patterns, which revealed that the relationship patterns detected by the classification algorithm were in nearly all cases relevant representations of the desired innovation activities. The indication that we can assess aspects of firms’ innovativeness through existing documents is very promising. If developed further this approach could present a meaningful addition to existing questionnaire and interview based assessments.

3.2. Microfoundations of Dynamic Capabilities for Service Innovation in Practice

This section builds on results previously published in Kohler et al. (2013). As reasoned by Kindström et al. (2013), while the arguably generic dimensions of DCs can be expected to apply to a SI context as well as to the industrial settings from which they were mainly inferred, the microfoundations of the individual DCSIs could vary greatly depending on the considered industry and context. Since existing research does not offer a comprehensive collection of microfoundations for a SI setting, this is set as the focus of this exploratory work. In particular, we want to analyse which microfoundations SI experts perceive to have a relevant influence on their firms' DCSIs and how they would measure their level of implementation.

In order to quickly achieve a reasonably consistent understanding of the DCSI concept among the involved firm representatives, we structure our data collection along the lines of an existing DCSI framework. Of the existing frameworks presented in Chapter 2, we choose den Hertog et al. (2010). This framework offers a number of advantages in this particular research setting. First, it has been specifically developed for a SI context and can therefore be expected to be suitable to the elicitation of microfoundations in this context. Second, the authors provide in-depth qualitative descriptions of the individual DCSI dimensions, which again aids in achieving a consistent understanding among the study's participants. Third, the authors explicitly encourage the empirical application and evaluation of their conceptual framework. den Hertog et al. (2010) propose six dimensions of DCSI:

- Sensing user needs and technological options (Originally 'signalling', but the qualitative description and subsequent publications suggest 'sensing' as a more appropriate wording)
- Conceptualising
- (Un-) Bundling
- (Co-) Producing and orchestrating
- Scaling and stretching
- Learning and adapting

Due to the exploratory nature of this analysis, semi-structured interviews are chosen as the method of data collection. This method ensures that the discussed topics can be captured in adequate breadth, while still allowing deep dives on particularly interesting themes that arise during an interview.

A convenience sample of five executives from German KIBS firms was chosen for this first step of exploratory research. Interviews were conducted in person or over the telephone, whenever a face-to-face interview was not possible. Each interview lasted approximately 60 minutes. The interviewees were provided with a list of the six DCSI dimensions listed above, including short qualitative descriptions.

For each of the dimensions, we asked the participants to name microfoundations they considered as relevant and that are present in their respective firms. In order to elicit a multifaceted representation of these microfoundations, we provided the interviewees with a list of possible categories. We used a list compiled by Weill and Ross (2004), which allows to distinguish between the categories human resources, financial resources, physical resources, intellectual property, information and information technology (IT) and relationships. We conducted five interviews within the selected sample group. The process was stopped after this number of interviews, since we already reached a certain saturation with regard to the reported themes.

Overall, the interviewees reported 201 microfoundations, which were directly transcribed by the author. The distribution of microfoundations by category is displayed in Table 3.2. It is interesting to note that microfoundations categorised as intellectual property are hardly mentioned. This might be explained by intellectual property protection often being a complex effort in KIBS, which might employ a combination of different mechanisms (Amara et al., 2008) and might therefore be less directly visible than in other domains. Microfoundations categorised as physical are also barely reported by the interviewees, which is in line with existing findings that present knowledge as the key resource in KIBS, while physical resources do not allow as much differentiation between different service providers. Knowledge transformation plays a pivotal role in KIBS (Gallouj, 2000), which is why the three highest ranked microfoundation categories do not come as a surprise – the knowledge and relationships of a firm’s employees represent a key microfoundation for the firm. In a digitized world, these knowledge sharing and transformation processes are mostly carried out using IT channels, which explains why so many microfoundations belonging to this category were reported. Surprisingly, microfoundations belonging to the financial category are hardly mentioned by the interviewees. Arguably, financial resources are perceived as a very limited differentiator in the KIBS domain, similar to physical resources.

Table 3.2.: Reported Microfoundations by Category

Information and IT	103
Relationships	43
Human resources	38
Intellectual property	6
Physical resources	6
Financial resources	5

The microfoundations reported in the interviews were categorised in an iterative process using open labels (Corbin and Strauss, 2014). Independent labelling was performed by two members of the research team and the resulting categories were compared and discussed. This process led to nine categories of microfoundations, which were well populated with microfoundations and which were relevant for at least one dimension of the underlying DCSI framework. Seven of the reported 201 microfoundations could not be assigned to meaningful categories and are discarded

in the following presentation of results.

Table 3.3 shows the number of microfoundations reported for each of these categories. While the distribution between the categories is for the most part fairly even, the results show a strong reliance of the firms on their respective networks and, in particular, on advantages in their operating model. This last category accounts for over a third of the total number of microfoundations pointed out by the respondents.

It is important to note that the identified categories of microfoundations operate on different levels of abstraction. For example, the category People Mix can be associated with the level of the individual or of a team. Other categories, such as the Operating Model, are clearly associated with the level of the firm as an entity. Lastly, categories such as Network, Inspiration, Customer Insight and Market Analysis represent a level that goes beyond the scope of the individual firm. In order to understand the significance of the individual microfoundation categories for a firm's DCSIs in more detail, a mapping of the categories against the DCSI dimensions is presented in the following.

Table 3.3.: Reported Microfoundations by Category

Operating Model	71
Network	26
Learning & Culture	19
People Mix	16
Inspiration	15
Platforms	15
Customer Insight	13
Market Analysis	11
Documentation	8

The category with the highest number of reported microfoundations, Operating Model, is highly relevant for all of the DCSI dimensions with exception of the first one (see Figure 3.5). This highlights the importance of the firm's Operating Model for the internal aspects of its DCSIs. On the other hand, Network, Customer Insight, Market Analysis and Inspiration make up the most important contributors to the external perspective of the first DCSI dimension.

Furthermore, a clear distinction can be seen between 'supporting' categories, such as Learning & Culture and Platforms, which are distributed comparably evenly over the DCSI dimensions, while more specific categories are attributed predominantly to a smaller number of dimensions. Customer Insight and Market Analysis for example are associated most often with the dimensions that represent the 'early phases' of an innovation process, which is gathering ideas and developing them into concepts. On the other hand, the importance of the category Documentation rises towards the 'late phases' of an innovation process – while overall being of comparably little importance.

In summary, the different categories of microfoundations exhibit quite distinct associations with the individual DCSI dimensions and should therefore not be treated as a homogenous factor. Furthermore, the categories of microfoundations identified in this exploratory analysis are associated with multiple levels of analysis - the individual, the firm, and the external network.

While the microfoundations of a firm's DCSIs are of key importance for making investment and allocation decisions within its innovation activities, the effectiveness of these decisions can only be assessed if a proven set of performance measures is available. As discussed in Chapter 2, this constitutes another research area with significant potential in the DCV domain. The following section presents an exploratory analysis of performance measures for DCs in the context of KIBS.

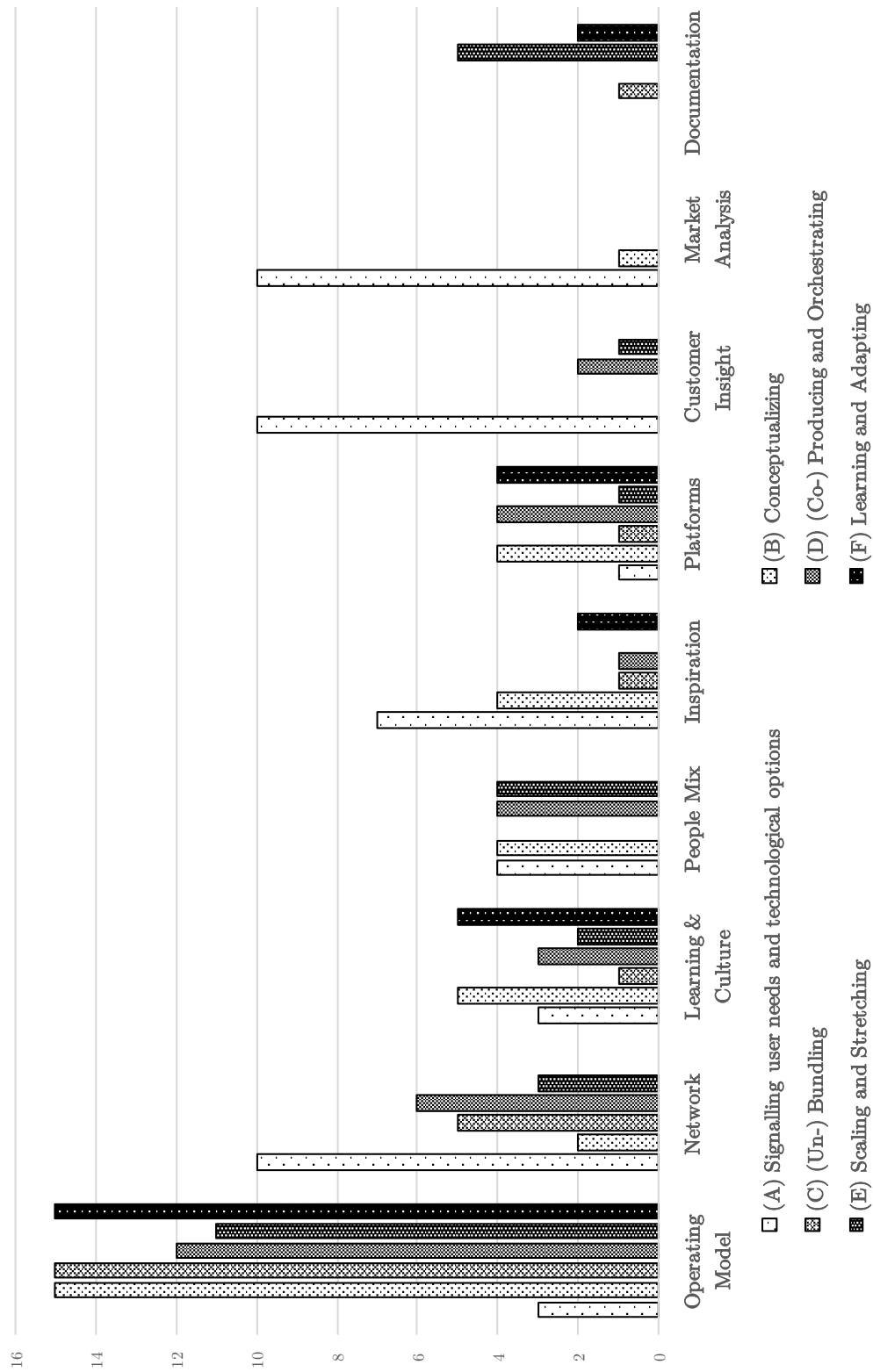


Figure 3.5.: Number of Microfoundations associated with each Category and DCSI Dimension

3.3. Innovation Performance Measures in Knowledge-Intensive Business Services

The results presented in this section build on contributions elaborated by Sascha Rudolph and Charlotte Meyer in their Master Theses at Karlsruhe Institute of Technology. The author would like to thank them very much for the fruitful collaboration.

Performance at the firm level as the dependent variable in many quantitative DCSI studies warrants particular attention. Previous work has for a large part relied on performance measures adopted from other domains, such as the general innovation management or marketing literature. In order to complete this picture and to take into consideration the particular challenges of SI, this section presents empirical evidence on performance measurement from KIBS firms.

The focus of this exploratory work is on learning about the performance measurements these firms are currently using and on the ones they are striving to develop. To this end, we pursued a two-step qualitative approach. The assessment of the current measurement practices for SI performance was focused on the set of measures used, the underlying decisions at the executive level and a perspective on the set of key performance indicators the measures could be reduced to. The second step focused on the advancement of SI performance measurement and asked how the firms assess different dimensions of SI, which performance measures they would like to establish.

We chose the firm as the level of analysis. We focused on management consultancies as typical representatives of KIBS firms. Due to the exploratory nature of this analysis, we employed purposive sampling to define a set of firms that ensured sufficient diversity for the interviews (Devers and Frankel, 2000).

Semi-structured interviews were used to produce the data for answering these questions. Semi-structured interviews exhibit a conversational or discussion style (Burgess, 1984). While providing some order and structure to cover a number of topics the researcher is interested in, this interview style provides flexibility to develop and explore unexpected themes emerging in the interviewing process (Mason, 2002). The interviews were conducted by telephone and lasted approximately 45 minutes each. The interviews were recorded and transcribed in anonymous form by the interviewer.

For the first step of this study, three management consultancies with affiliates in Germany were chosen. Each of the three firms serves clients from a broad spectrum of industries and frequently carries out projects at the executive management level. The firms can be characterised as follows (all names have been edited to ensure anonymity):

- **StrategicConsult:** An international partner-owned consultancy employing more than 1,000 consultants in Germany. Their customer base features the majority of the DAX-30 firms. The firm was founded in 1963.
- **TechOrg:** The consultancy branch of a multinational corporation, employing more than 3,000 consultants in Germany. The firm mainly serves large clients and often combines strategy and technology projects. It was founded in 1911.

- **SystemArchitects:** A partner-owned German-based consulting firm employing more than 200 consultants. They have a broad and varied customer base with a focus on technology projects. The firm was founded in 1999.

The main purpose of this research step was to give an account of current practices of performance measurement in SI. In order to ensure robustness for this issue, we chose a dyadic design with two informants per firm – a senior executive and an operational level manager – this was done independently of the firm size in order to attribute equal weight to each case.

In the initial part of the interviews, the significance of innovation to the firm was focused upon, since the importance a firm attributes to SI arguably should be related to their efforts with regard to success measurement. The respondents from StrategicConsult stated that their firm is perceived as a premium service provider by its customers. Therefore, they saw being an innovation leader as a prerequisite for winning contracts with clients. The interviewees from SystemArchitects also attributed a high level of importance to SI, mainly focusing on the development of new consulting approaches in order to open up new markets and to increase efficiency in the existing business. The interview partners from TechOrg interestingly reported that with regard to innovation in their firm, more focus is placed on new technologies and patents. They suspected that the lower priority attributed to SI results from its being considered to have only “indirect effects on commercial success”. Consequently, the interviewees reported no specific activities to foster SI.

In line with the importance attributed to innovation for the firm, the respondents from StrategicConsult reported that a comparably structured approach to SI is pursued. This process is usually started by clients’ requests or interest in a topic and focuses heavily on research and knowledge-building projects. The main outcomes of this process are typically publications building the firm’s expertise in the new area, as well as new project requests. Both participants from the smaller firm, SystemArchitects, reported SI to be quite present in their business, but to be significantly less structured. The firm’s focus with regard to SI is more inward-facing and relies on the creation and internal documentation of new consulting methods, tools and approaches.

The respondents were also asked for the performance indicators their firms are currently using to measure SI – their answers are reported in Table 3.4. SystemArchitects is not using any objective SI performance indicators, but relies on the managing partners’ judgement. This can arguably be attributed to the firm’s size and comparably earlier stage of development with regard to firm age and growth. TechOrg, which places less emphasis on SI, takes a purely financial approach in measuring signings (business generated) and revenue from new services. One explanation for this is that the firm extended the existing measures from the dominant and more mature technology innovation area to include services, without incorporating SI specific aspects.

StrategicConsult, which reported SI to be a key element for their brand and customer perception, uses a multi-dimensional approach to SI performance measurement, including both on the firm-internal and on the market-oriented perspectives. Their

indicators focus on knowledge generated and published, as well as on the public perception in reaction to these publications. Interestingly, the participants from StrategicConsult did not report any direct financial measures for SI. This suggests that in spite of the importance attributed to SI, their performance management systems do not establish a direct connection between SI and overall firm performance.

Table 3.4.: Currently employed Performance Indicators

Firm name	Performance indicators
StrategicConsult	Firm-oriented indicators: Number of reports published Number of new entries in knowledge database
	Market-oriented indicators: Number of website hits generated from reports Number of report downloads from website Number of times reports are cited
	Financial indicators: Number of signings from new services Revenue generated with new services
SystemArchitects	(none)

In order to evaluate satisfaction with the reported performance indicators as well as potentials for improvement, the respondents were asked to name the greatest weaknesses of their firm’s current SI performance measurement system. From TechOrg’s point of view, their senior executive criticised the lack of an indicator that can communicate the firm’s innovation performance to customers and potential customers, since the current state of measurement focuses purely on internal finances. The respondents from SystemArchitects saw no immediate need for action because of rapid growth and near-full utilisation of their associates, however they were aware of the limitations of their current approach and stated that “in good times clever companies have to keep in mind what needs to be done when the good times are over”.

The participants from StrategicConsult addressed the missing connection to financial performance pointed out above, stating that the firm will probably need to introduce indicators to see which new services will “actually make money at some point”. Furthermore, the interviewees criticised the predominant focus on publication measures, which skip the assessment of the direct outcomes of SI projects, such as knowledge and expertise building.

The last part of the interviews was aimed at uncovering white spots and potential for development in the firms’ SI performance measurement. Rather than building on the currently used indicators, the researchers employed an approach for establishing value-adding measures developed by Hubbard (2007). The aim of this approach is to develop measures that provide greater value to the firm than their cost in added measurement activities and information to consider in decisions. In this three-step

approach, the interviewees were first asked to name decisions at the executive level in their firm for which the measurement of SI performance was relevant. From these decisions, they were asked to prioritise the most important one. Lastly, they should name indicators that could in their opinion best support this decision. This approach led to the indicators presented in Table 3.5.

Table 3.5.: Performance Indicators by Decision Type

Performance indicators	Firm name
Firm-oriented indicators:	
Effects of education activities on utilisation	TechOrg
Level of qualification assigned to innovative topics	TechOrg
Number of new approaches per resources invested	SystemArchitects
Market-oriented indicators:	
Customer survey of firm innovativeness	StrategicConsult
Website hits generated by new project topics	StrategicConsult
Citations in general press	StrategicConsult
Conference presentations	StrategicConsult
Public awareness of innovations	StrategicConsult
Financial indicators:	
Revenue from new project topics	StrategicConsult
Price premium from new project topics	StrategicConsult
Cost to profit ratio of education activities	TechOrg
Innovation return on investment	SystemArchitects

The measures proposed by StrategicConsult are clearly market-oriented and focus heavily on public perceptions of their expertise and publications. This can be interpreted as a high level of satisfaction with their current measurement system. However, the respondents added some financial measures to connect SI performance more directly to overall firm performance, both with regard to revenue and to margin. Furthermore, the respondents proposed a ‘soft’ customer-centric indicator measuring their perception of the firm’s innovativeness, which could complement the other objective and quantitative indicators.

The indicators brought forward by TechOrg are focused on decisions of human resources allocation. They include two distinct perspectives: First, they aim to measure whether the innovation topics seen as relevant by the firm are covered by enough talent. Second, the indicators are meant to assess the performance of education and training activities for new service topics that have been introduced.

The two indicators developed by SystemArchitects stand out somewhat in that they both directly relate SI input to output. One of the indicators focuses on the intermediary results important to the firm – new consulting approaches – while the second indicator is targeted directly at the resulting revenues.

This section has elaborated on firms’ perspectives on SI performance measurement – both with regard to its current state and with regard to potentials for devel-

opment. The next section will discuss the feasibility of an approach to assess SI performance using existing data. This would reduce the associated costs of assessment significantly and could result in a much more broad adoption of SI performance management in daily business.

4. Theory Development

4.1. Research Framework

In this chapter, we propose a research framework to guide this study, addressing several of the identified limitations of the existing work on DCSIs in Chapter 2. As elaborated above, one of the key questions in the DCV literature is what exactly constitutes the microfoundations of DCs. Answering this question is a precondition of allowing the active management of a firm's DCSIs. The findings from the exploratory analyses presented in Chapter 3 stress the need to understand these microfoundations and their individual impact on the DCSIs in more detail.

In her literature review, Eriksson (2014) distinguishes between internal and external microfoundations. Microfoundations internal to the firm should further be differentiated into individual level and firm level constructs (Subramony and Pugh, 2015). The consideration of the resulting three levels of microfoundations provides guidance for identifying potential microfoundations and for analysing their individual impact on DCSIs.

The DCV ultimately aims to explain how firms can achieve and maintain competitive advantage in dynamic and turbulent environments. While most studies in this area implement competitive advantage in terms of a firm's performance, they differ greatly in their models of the relationship between DCs and performance. Gaining a better understanding of this relationship is one of the most important challenges for advancing the DCV and therefore deserves particular attention (Barreto, 2010; Eriksson, 2014).

As highlighted by our findings presented in Chapter 3, performance measurement for SI is a very important issue for KIBS firms, stressing the need to further our understanding of the performance impact of a firm's DCSIs. The existing DCV literature has proposed both direct and indirect performance effects of DCs and a consensus has not been reached. The discussed points lead us to propose the following research framework to guide this study (see Figure 4.1). This framework allows to analyse

the potential microfoundations and their respective impact in detail, as well as to distinguish the direct and indirect performance effects of DCSIs.

This conceptualisation of the relationship between DCSIs and firm performance has several advantages. First, it avoids causal ambiguity in the relationship between DCSIs and the RB. If the RB were to be used as a performance mediator, the temporal effects of the creation of DCSIs and of the reconfiguration of the RB would first need to be analysed in much more detail through longitudinal studies before analysing the performance relationship itself. Furthermore, the performance mediators construct allows us to observe the results of the reconfiguration of the RB and not the reconfiguration itself, which does not need to result in the introduction of new services at all. Second, by using this mediator construct, DCSIs are clearly conceptualised as a firm's potential to innovate, which can then be realised through corresponding actions. Third, this operationalisation allows a comparative evaluation of direct and indirect performance effects of DCSIs, thus contributing to one of the key open debates in the DCV literature.

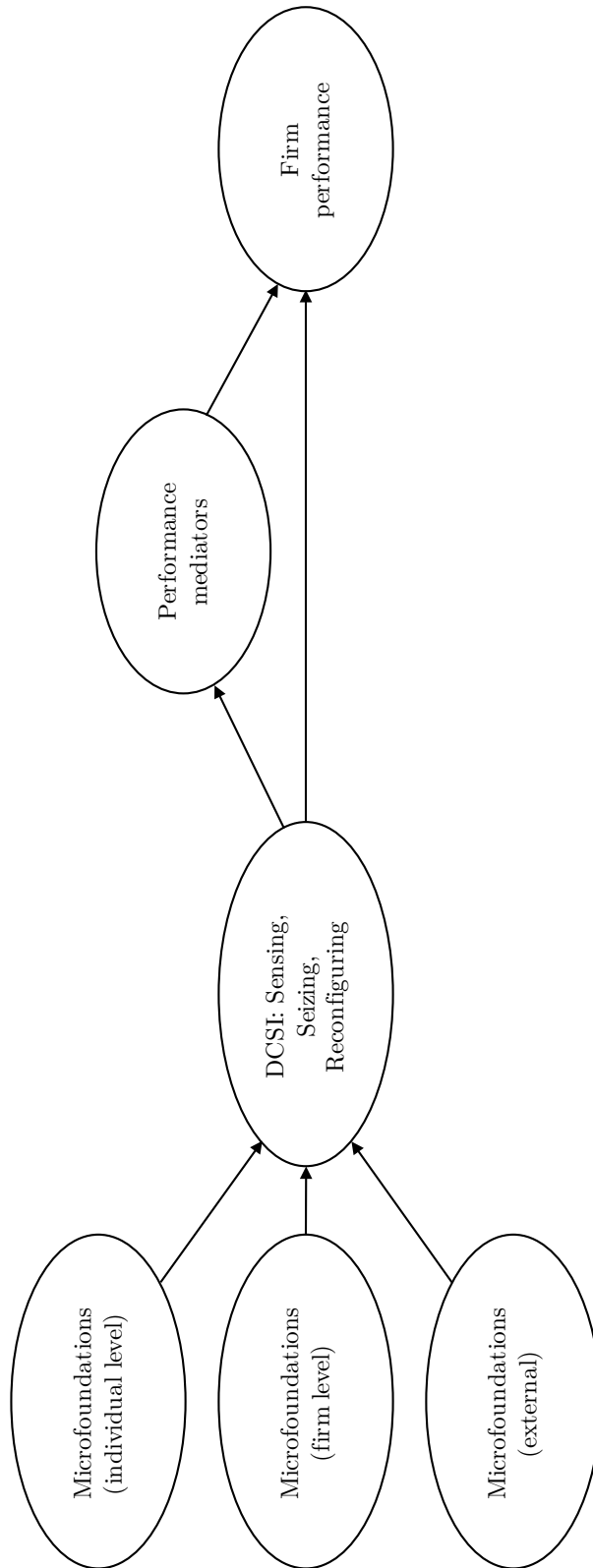


Figure 4.1.: Research Framework

4.2. Procedure

Building on the research framework presented above, a structured literature review was performed in order to establish a solid foundation for the following quantitative empirical study by identifying relevant and established constructs to build the research model. The concept-centered review was performed using keyword based searches, complemented by forward, backward and similarity searches (Webster and Watson, 2002; Nardi, 2006).

In addition to the studies already discussed in Chapter 2, further key contributions were identified through keyword based searches in major journal databases. The keywords used herefore were “ ‘dynamic capability’ + innovation” and “ ‘dynamic capabilities’ + innovation”. These keywords were chosen, since the review’s goal was to identify a substantial number of publications with high relevance for the DCSI construct. Searching simply for “dynamic capability” would have produced many non-relevant results, since the DCV has been applied to a number of only distantly related areas, such as the management of business networks and internationalisation. Searching for “ ‘dynamic capability’ + ‘service innovation’ ” on the other hand would have excluded many relevant studies and would have produced few results overall, since the corpus of DC publications focusing on SI is not yet very extensive, as explained in Chapter 2. The search results had to fulfil the following criteria to be included in the review:

- Unit of analysis: Individual firm(s)
- Consideration of relevant dimensions of DCs, in particular innovation orientation
- Consideration of contingency relationships of DCs, for example DCs \leftrightarrow RB or DCs \leftrightarrow Firm performance

Subsequently, forward, backward and similarity searches were performed based on the previously identified publications – concept saturation was used as the stop criterion for this step (Webster and Watson, 2002). Lastly, in order to gain a richer picture and options for the operationalisation of some constructs, a few specific detail searches were carried out in related literature streams (service science, corporate entrepreneurship, innovation management, marketing), targeting individual constructs identified as important through the preceding search steps. This led to a total of 119 studies considered – exhibiting the following methodological breakdown:

- Conceptual (10)
- Qualitative methods (24)
- Quantitative methods (82)
- Mixed methods (3)

From the identified studies, the key concepts employed were extracted (Webster and Watson, 2002). These concepts were then aggregated over several iterations until arriving at a manageable set. Below, the identified concepts and the hypothesised relationships between them are elaborated.

4.3. Dynamic Capability for Service Innovation

A definitive consensus regarding terminology and measurement of our central construct, a firm's DCSIs, has not yet been reached. Operationalisations of DCs construct show significant variation between individual studies, as pointed out above. However, most authors agree on a DC being a multidimensional construct that acts in a dynamic relationship with the RB of the firm. This is also the case for DCSIs (den Hertog et al., 2010; Agarwal and Selen, 2011; Hogan et al., 2011; Agarwal and Selen, 2013; Janssen et al., 2014).

Furthermore, most studies integrate external, opportunity exploring aspects of DCs with internal, opportunity exploiting aspects. DCs not only allow firms to react to changes in their environment, but to anticipate them – for example in the form of changing customer needs (Wang and Ahmed, 2007). In acting together, they allow identifying opportunities to innovate and triggering the change required to reconfigure the firm's RB to bring new commercial offers based on these opportunities to the market. As put by Mizik and Jacobson (2003), the combination of value creation capabilities and of value appropriation capabilities of the firm lays the basis for sustainable competitive advantage. Building on seminal work on the DCV (Augier and Teece, 2009; Barreto, 2010; Teece et al., 1997; Teece, 2007a, 2009), we propose the following definition of DCSIs:

Dynamic capabilities for service innovation (DCSIs) embody a firm's potential to realise service innovation (SI), formed by the capabilities to sense opportunities and threats, to seize opportunities and to reconfigure the firm's resource base (RB) appropriately.

As illustrated in our study's research framework (see Figure 4.1), we position DCSIs as driven by a number of enabling factors in the form of microfoundations and as generating direct and indirect performance effects. Using this comparably simple conceptualisation of DCSIs built on established research results allows us to focus attention on the SI specific microfoundations of DCs (Kindström et al., 2013), as well as on exploring the relationships between DCSIs and other key constructs – in particular firm performance. The analysis of the contingencies of a firm's DCs should be a research priority, since its effects will by its very definition be context specific (Barreto, 2010; Collis, 1994; Winter, 2003). This also allows us to link insights back to managerial practice. The following sections focus on the microfoundations of firms' DCSIs.

4.4. Microfoundations of Dynamic Capability for Service Innovation

4.4.1. Individual Level

The human capital of a firm is an important precondition for achieving competitive advantage through innovation – this is particularly true in dynamic, complex and competitive environments (Barney, 1991; Hayton, 2003). Human capital is defined

as “the abilities and know-how of men and women that have been acquired at some cost and that can command a price in the market because they are useful in the productive process” (Parnes, 1984, p. 32). As Snell and Dean Jr. (1992, p. 468) put it, “the concept of human capital is that people possess skills, experience, and knowledge that have economic value to firms.” According to the authors, this value can be realised through both the firm’s current, as well as future offerings, thus underlining the importance of human capital for innovation.

Teece (2003, p. 902) stresses that for PSF, “investment decisions are primarily people acquisition, training, and retention decisions”, instead of investments into physical capital. Snell and Dean Jr. (1992) differentiate several dimensions of human capital, namely selective staffing, comprehensive training, developmental performance appraisal and equitable reward systems. The result of firms’ investments into human capital can be measured in terms of human capital value and human capital uniqueness (Lepak and Snell, 2002). Hayton (2003) focuses on the contribution of firms’ human resource management for entrepreneurial performance, including both traditional and discretionary human resource management practices.

Particularly for innovation in services, non-technological innovation and human capital play a key role (Djellal and Gallouj, 2001; Drejer, 2004). SI often emerges from the interactions and relationships between a firm’s employees and its customers (Chesbrough, 2010). More generally, while the acquisition, transformation and sharing of knowledge can be supported by systems and tools, they are essentially driven by people (Nonaka, 1994). According to Drucker (1999), innovation in KIBS cannot be organised entirely centrally, but needs to be understood as a part of the work and responsibility of the individual knowledge worker.

A firm can invest in its human capital through hiring, training and education. However, it is important to note that unlike physical capital, a firm does not own human capital. Employees can switch between firms and their productivity depends on their motivation and satisfaction with their environment (Snell and Dean Jr., 1992). In fact, in professional and knowledge-intensive firms, employees are in a particularly powerful position. These professionals’ productivity and motivation depend to a large extent on the presence of other professionals (Teece, 2003), making investments into human capital a key factor in creating and developing DCSIs.

Therefore, we hypothesise that human capital contributes positively to a firm’s DC-SIs:

H1a: *Human capital contributes positively to a firm’s sensing capability.*

H1b: *Human capital contributes positively to a firm’s seizing capability.*

H1c: *Human capital contributes positively to a firm’s reconfiguring capability.*

In developing new offerings, firms need to be able to adapt to current and future customers’ needs and demands. This ability is fostered by the employees’ willingness and ability to experiment and to take calculated risks in the different stages of the

development of new services. In this regard, a firm's top management team plays a particularly important role. Their messages, decisions and actions heavily influence the level of experimentation and risk aversion in the firm. Besides top managers' direct influence through the acceptance or refusal of certain innovation projects, they have an important indirect influence on the matter through employees' adaptation to and imitation of their actions. In their study, Jaworski and Kohli (1993) find that a lower risk aversion of a firm's top management leads to higher market orientation, which in turn positively influences business performance.

In their study of almost 200 firms' executive directors in the Italian and Spanish manufacturing industry, Alegre and Chiva (2008) identify experimentation and risk-taking as key components of a firm's organisational learning capability. The authors further find that this organisational learning capability has a positive impact on the respective firm's product innovation performance. Risk tolerance has also been found to have a strong positive effect on radical innovation (Tellis et al., 2009).

Smith et al. (2005) studied a sample of high technology firms through a mixed methods approach including a questionnaire-based survey of the firms' top management team and individual knowledge workers, as well as structured interviews with the CEOs and the analysis of documents from the firms' archives. They find that when a firm establishes a climate for risk-taking, this positively influences the firm's capability for knowledge creation, which in turn has a positive impact on the number of new products or services introduced by the firm.

Herrmann et al. (2007) use a cross-industry sample of 72 firms from manufacturing, high technology and the pharmaceutical industry to investigate the effects of a firm's willingness to take risks. They find that willingness to take risks has a positive influence upon both the firm's ability to transform its competencies and the ability to transform its markets. These two constructs are in turn found to have a positive influence on the introduction of radical product innovations.

Accordingly, we hypothesise that experimentation and risk-taking contribute positively to a firm's DCSIs:

***H2a:** Experimentation and risk-taking contribute positively to a firm's sensing capability.*

***H2b:** Experimentation and risk-taking contribute positively to a firm's seizing capability.*

***H2c:** Experimentation and risk-taking contribute positively to a firm's reconfiguring capability.*

4.4.2. Firm Level

It is the core business of KIBS firms to continuously acquire new information and knowledge and to combine it with the existing knowledge base of the firm to address the customers' needs and to solve their problems. This means that KIBS firms are

founded on knowledge transformation processes, in which knowledge can be considered both a key input and a key output (Gallouj, 2000). Knowledge management is consequently of critical importance to these firms.

Furthermore, mastering this discipline is arguably more difficult in these firms than in more mechanical organisational structures. Information flows in KIBS do not follow a traditional hierarchical structure, but usually occur peer-to-peer – this means that one-to-many and many-to-one communication are replaced by many-to-many information flows, thus significantly increasing complexity (Teece, 2003). In a study of almost 1000 senior level managers from supply chain management professional associations, Allred et al. (2011) record that a firm's capability for collaboration is influenced increasingly by collaboration within the firm as opposed to by external effects. They highlight the reduction of barriers between different functional units within the firm as a key managerial priority.

Focusing on high technology firms, Smith et al. (2005) find that the education of the top management team and of knowledge workers, their direct contacts and the strength of the ties within the firm, as well as teamwork have a positive impact on the firm's capability for knowledge creation, which in turn has a positive impact on the number of new products or services introduced.

Kostopoulos et al. (2011) find that external knowledge inflows have a positive effect on absorptive capacity, which in turn has a positive effect on innovation performance and financial performance. Liao et al. (2007) report that another significant influence on a firm's absorptive capacity comes in the form of knowledge sharing within the firm. The authors also find that absorptive capacity has a positive effect on the firm's innovation capability.

Keskin (2006) focuses on the effects of learning orientation, which they capture through four dimensions: Commitment to learning, shared vision, open-mindedness, and intraorganisational knowledge sharing. For their sample of 157 Turkish small and medium sized firms they find that learning orientation has a positive effect on firm innovativeness. Calantone et al. (2002) arrive at a similar result in their cross-industry study involving almost 200 vice presidents for research and development from US firms. They find a positive effect of learning orientation – which is captured using the same four dimensions – on both firm innovativeness and firm performance.

Alegre and Chiva (2008) identify dialogue and participative decision making as key components of a firm's organisational learning capability. This capability, in turn, is found to have a positive impact upon product innovation performance. Furthermore, Marsh and Stock (2006) find that knowledge retention and knowledge interpretation have a positive effect on intertemporal integration, which together with knowledge interpretation has a positive effect on new product development performance. Zheng et al. (2011) also find that knowledge acquisition, generation and combination capability are positively related to innovation performance.

Learning mechanisms contribute to the development of a firm's dynamic capabilities (Zollo and Winter, 2002). Several studies specifically analyse the relationship between aspects of knowledge management and a firm's innovation capability. Sher and

Lee (2004) find that the management of endogenous knowledge and the management of exogenous knowledge both contribute positively to a firm's dynamic capability. Chien and Tsai (2012) find that knowledge resources have a positive direct effect on a firm's dynamic capabilities, as well as a positive indirect effect on dynamic capabilities by means of learning mechanisms. Yang (2012) also find that commitment to learning has a positive effect on a firm's innovation capability. Herrmann et al. (2007) find that a learning organisation has a positive effect on the transformation of competencies of a firm, which in turn has a positive effect on the introduction of radical product innovations.

Consequently, we hypothesise that knowledge management contributes positively to a firm's DCSIs:

H3a: *Knowledge management contributes positively to a firm's sensing capability.*

H3b: *Knowledge management contributes positively to a firm's seizing capability.*

H3c: *Knowledge management contributes positively to a firm's reconfiguring capability.*

One key enabler of a firm's dynamic capability for innovation is autonomy (Teece and Pisano, 1994). In KIBS firms specifically, employees have a particularly defining influence on the results of innovation activities. As knowledge workers, they need to have the freedom to flexibly react to customer needs and demands and to gather the knowledge and information required to generate the corresponding solutions. KIBS firms rely on the expertise and exceptional talents of their knowledge workers, who in turn strive for and demand higher levels of autonomy than traditional employment positions offer (Teece, 2007b). Accordingly, Sundbo (1996) recommends to organise SI through systems of expert empowerment. Autonomy is a defining characteristic of exploration activities (O'Reilly and Tushman, 2008). de Jong and Kemp (2003) find that autonomy is directly positively related to innovative behaviour of the employees. However, this is not limited to certain employee levels in the firm. As Helfat et al. (2007) and Teece (2009) point out, the development of dynamic capabilities in a firm is heavily influenced by the behaviour of senior executives – they need to set fitting frameworks and incentives by living entrepreneurial management and corporate entrepreneurship. Autonomy and adequate support by management have been shown to positively impact a firm's dynamic capabilities for product development, while performance management can counteract this (Prieto et al., 2009).

In addition to a conducive environment and autonomy, employees also need to have the necessary time and resources at their disposal to drive innovation in a self-dependent mode. This means that organisational slack plays a particularly interesting role in forming a firm's dynamic capabilities for innovation. Slack resources have an important contribution in all stages of the innovation process. The availability of slack determines how much effort can be invested into searching for relevant information and knowledge, which is costly (Augier and Teece, 2008, 2009; March and

Simon, 1958). This is particularly relevant when considering the repeated evaluation of potential opportunities in the market (Teece, 2012). Furthermore, employees engaged in innovation need time away from daily business and short-term activities to process, develop and shape this information and the resulting ideas (Lawson and Samson, 2001). As Bitar and Hafsi (2007) point out, slack resources also play an important part on a managerial level, where they can foster the identification and solution of problems that have otherwise been overlooked due to missing capacity – this can drive the creation and development of organisational capabilities. Slack resources ultimately help a firm cope with bad successes in innovation and provide them with a cushion to see through the establishment of new offerings (Damanpour, 1991; Rosner, 1968). O’Connor (2008) proposes that particularly for fostering a firm’s dynamic capability for major innovation – defined by the author as radical and really new innovation – it is important to take into account the specific high risks and uncertainty in the management of this capability and to provide it with corresponding slack resources.

Slack resources are particularly important for a firm in order to adapt quickly to fast changing environments (Krasnikov and Jayachandran, 2008), which is a cornerstone of dynamic capabilities. Danneels (2008) finds that slack has both a contemporaneous and a lagged effect on a firm’s higher order capabilities – measured through marketing and R&D competences. Branzei and Vertinsky (2006) find that higher levels of slack support a firm’s refinement and development of capabilities, exhibited through improving current processes and commercialising new offerings. Indeed, O’Brien (2003) proposes that innovation-oriented firms should make financial slack a strategic priority.

Building on this, we hypothesise that degrees of freedom – capturing the combination of autonomy and slack present – contribute positively to a firm’s DCSIs:

***H4a:** Degrees of freedom contribute positively to a firm’s sensing capability.*

***H4b:** Degrees of freedom contribute positively to a firm’s seizing capability.*

***H4c:** Degrees of freedom contribute positively to a firm’s reconfiguring capability.*

4.4.3. External Level

As described in section 4.4.2, KIBS are defined by their knowledge transformation processes. These processes heavily rely on information external to the firm as inputs – interaction with the external environment is a key component of a firm’s organisational learning capability (Alegre and Chiva, 2008). Consequently, SIs are often found to result from collaborative activities between a service firm and other parties, i.e., in service networks or systems (Lusch and Nambisan, 2015). Indeed, Agarwal and Selen (2013) report that SIs are increasingly actually launched by firm networks and alliances.

A firm's connectivity is an important precondition of how much input it can utilise for innovation activities – this connectivity is shaped by formal relationships as well as by informal ones (Hess and Rothaermel, 2011). This means that when assessing a firm's external collaboration for innovation, we should consider official, strategic and long-term alliances as well as personal relationships between the firm's employees and members of their network in other firms and institutions. As Teece (2003) points out, this is particularly relevant for KIBS, since access to other top talent – within the firm or outside of it – is a key criterion for the attractiveness of a firm to prospective employees.

Collaboration is a key part of a firm's innovation orientation, and therefore, a foundation of its innovativeness (Hurley and Hult, 1998). Firms are increasingly collaborating and working in networks to foster innovativeness and there is a vast variety of possible collaboration partners – from universities to consultants and research institutes to suppliers, customers and competitors (Brettel and Cleven, 2011).

Engaging in collaboration with these external parties can amongst other things enhance a firm's sensing capability (Kyläheiko and Sandström, 2007). Supporting this argument, Camacho and Rodríguez (2005) find that collaboration with universities is particularly prevalent in highly innovative service sectors – including R&D services, software and other IT-related services. Tether and Tajar (2008) find that service firms more frequently use access to specialist knowledge providers than manufacturing firms and that their preferred type of knowledge providers are consultants.

In order for collaborations to successfully contribute to innovation and new business development, it is important to focus on the development of the firm's capabilities, as opposed to focusing only on direct product or resource acquisition (Assink, 2006). According to Szeto (2000), there is a dynamic interplay between innovation resources supplied and knowledge accumulated in firm networks, which contributes positively to the development of a firm's innovation capability. It is also important to take the evolution of a collaboration into accounts, since some benefits from collaboration only emerge over time as the result of continuous collaboration between firms (Lavie, 2006). In a longitudinal study of leading IT firms, Patrakosol and Olson (2007) find that external collaboration is positively associated with evolutionary innovation and that this effect grows with the duration of the engagement. Capability complementarity of the firms engaged in the collaboration is also an important predictor of successful capability development. Anand et al. (2010) show that a firm can successfully benefit from an alliance for its capability development – in particular following technological discontinuities – if that firm already possesses requisite complementary capabilities. Xu et al. (2008) find that the density, reciprocity and multiplicity of a firm network are positively associated with the innovation capabilities of the participating firms.

In summary, we hypothesise that external collaboration contributes positively to a firm's DCSIs:

***H5a:** External collaboration contributes positively to a firm's sensing capability.*

H5b: *External collaboration contributes positively to a firm's seizing capability.*

H5c: *External collaboration contributes positively to a firm's reconfiguring capability.*

In order to continuously generate a basis for new service offerings, a firm needs to have a close and proactive access to its markets in order to capture impulses for innovation. A firm's market orientation is consequently a key competence contributing to a firm's capability to seize market opportunities (Chen and Jaw, 2009). Market orientation is a heavily studied construct – amongst other disciplines in marketing, (corporate) entrepreneurship and innovation management. Market orientation is frequently implemented in terms of the behavioural components customer orientation, competitor orientation and interfunctional coordination (Atuahene-Gima, 2005; Akman and Yilmaz, 2008; Hult et al., 2005; Narver and Slater, 1990; Siguaw et al., 2006).

Market orientation plays a special role with regard to a firm's capability for innovation, since it integrates intraorganisational and interorganisational mechanisms. Market orientation has been found to have a positive effect on firm innovativeness, mediated by the firm's learning orientation (Keskin, 2006). Menguc and Auh (2006) find that in interaction with other aspects of firm innovativeness, market orientation can contribute to developing a firm's dynamic capability. They recommend to further study the effects of the interplay of market orientation and other firm competencies. Tellis et al. (2009) points out that future market orientation in particular has a strong positive effect on radical innovation.

Hult et al. (2004) report market orientation as a key contributor to firm innovativeness. Many studies point out the effect of customer orientation in particular. Akman and Yilmaz (2008) find that customer orientation directly strengthens a firm's innovative capability. Lisboa et al. (2011) register a significant positive effect of a firm's customer orientation on its dynamic capabilities, concerning both product development and market exploration. Atuahene-Gima (2005) also find that customer orientation as well as competitor orientation contribute significantly to a firm's competence exploration.

To conclude, we hypothesise that market orientation contributes positively to a firm's DCSIs:

H6a: *Market orientation contributes positively to a firm's sensing capability.*

H6b: *Market orientation contributes positively to a firm's seizing capability.*

H6c: *Market orientation contributes positively to a firm's reconfiguring capability.*

4.5. Performance Effects

4.5.1. Performance Mediators and Firm Performance

The DCV aims to explain how firms attain and develop a competitive advantage in dynamic and turbulent environments. Therefore, the relationship between a firm's DCs and its performance is one of the most important for the development of this theory – the proposed approaches can be divided into three categories (Barreto, 2010):

- Direct relationship between DCs and firm performance
- Indirect relationship between DCs and firm performance, by means of for example firm innovativeness
- No direct relationship between DCs and firm performance, instead this arises from how firms employ their DCs and from the resulting new configurations of the RB

In line with Wang and Ahmed (2007), we focus on the outputs of these transformation processes on the RB, which constitute a measurable superior value for customers, i.e., on exploring the first two approaches to the DCs – performance relationship. Due to its circular setup, the third option will require longitudinal studies examining a stable set of firms over the course of several years.

Lisboa et al. (2011) substantiate a direct performance effect of dynamic capabilities. They find that explorative capabilities focused on product development have a positive effect on the future performance of the firm. The same holds for capabilities focused on market exploration. Yang (2012) show that innovation capability is strongly positively related to corporate growth performance in Chinese high technology firms.

Mizik and Jacobson (2003) find that in combination, value creation and value appropriation capabilities lead to a sustainable competitive advantage for the firm, which in turn leads to superior financial performance. Similarly, Li and Liu (2014) report a positive effect of DCs on a firm's competitive advantage and Lin and Wu (2014) find that DCs positively affects firm performance.

It should be noted that in fact, the construct of competitive advantage is not the same as firm performance. The way it was conceived, competitive advantage should lead to superior performance of the firm, but there could be intervening factors. In the literature considered, the two constructs are often used interchangeably. We will be focusing on firm performance, which is easier to create a common understanding for in the context of self-reported data. Pursuant to this, we hypothesise that a firm's DCSIs contribute positively to its market and financial performance:

H7a: *A firm's sensing capability contributes positively to its market and financial performance.*

H7b: *A firm's seizing capability contributes positively to its market and financial performance.*

H7c: *A firm's reconfiguring capability contributes positively to its market and financial performance.*

By now, many studies have not only observed a direct performance effect of DCs, but a combination of direct and indirect effects. Wang and Ahmed (2007), for example, confirm both direct and indirect performance effects.

Prieto et al. (2009) find that a firm's DCs positively influence its superior process and product competence in product development.

Alegre and Chiva (2008) report that a firm's organisational learning capability has a positive impact upon its product innovation performance. Similarly, Zheng et al. (2011) acknowledge a positive effect of a firm's knowledge combination capability on its innovation performance.

Atuahene-Gima (2005) study the effect of competence exploration and competence exploitation on radical innovation performance of the firm. They find that competence exploration as well as the combination of competence exploration and competence exploitation have a significant positive effect on radical innovation performance. This is supported by Herrmann et al. (2007) who find that the transformation of competencies in a firm, i.e., its DCs positively influence radical product innovations. The same holds for the transformation of markets.

In their SI specific studies, Agarwal and Selen (2009, 2011, 2013) confirm elevated service offerings, i.e., the introduction of new and improve services, as a mediator between DCSIs and firm performance. Similarly, Ordanini and Parasuraman (2011) propose innovation outcomes as a mediator between dynamic capabilities and firm performance. The performance effects of a firm's innovativeness are also corroborated by Hult et al. (2004) and Keskin (2006). In this sense, we hypothesise that the effect of a firm's DCSIs on its market and financial performance is mediated by the firm's introduction of new services:

H8a: *A firm's sensing capability contributes positively to its new service introduction.*

H8b: *A firm's seizing capability contributes positively to its new service introduction.*

H8c: *A firm's reconfiguring capability contributes positively to its new service introduction.*

H9: *New service introduction contributes positively to a firm's market and financial performance.*

4.5.2. The Role of Environmental Dynamism

The DCV evolved out of the RBV in part to address criticisms of how a firm's RB can contribute to its competitive advantage in increasingly dynamic and turbulent environments. Neely et al. (2001) propose a general framework for research on

innovation, firm performance and their contingency factors. The authors propose an impact of the external environment on both a firm's capacity to innovate and on its innovation activities. This would mean that environmental dynamism as a key aspect of the external environment should play a significant role with regard to the effects of a firm's DCSIs. Eisenhardt and Martin (2000) posit that market dynamism influences the complexity and flexibility of DCs as well as the paths through which they affect firm-level outcomes.

However, empirical results regarding the effect of environmental dynamism on firms' capability for innovation and innovation results have been mixed (Zhang et al., 2013). Datta et al. (2005) study the impact of industry dynamism on the results obtained from high-performance work systems. The authors define high-performance work systems as human resource practices with the objective of increasing skills, commitment and productivity of a firm's employees. This relates to the human resource elements of our model described above. The authors postulate a positive moderating influence of industry dynamism between these human resource practices and the productivity gains obtained from them. However, they do not find a significant moderating relationship.

Jansen et al. (2009) analyse the moderating effect of environmental dynamism on the relationship between different leadership patterns and different types of innovation. Their results suggest that in dynamic environments, transactional leadership will negatively affect exploratory innovation. They do not find significant moderating effects of environmental dynamism on the other proposed relationships between transactional and transformational leadership and exploratory and exploitative innovation. Hult et al. (2004) establish a direct relationship between innovativeness and firm performance and study this relationship given different levels of market turbulence. The authors propose a positive moderation of market turbulence between innovativeness and firm performance, but do not find a significant moderation effect.

Pavlou and El Sawy (2011) on the other hand find that the relationship between DCs and operational capabilities is moderated by environmental turbulence. This means that environmental turbulence affects the mode of operation of DCs, i.e., the way in which they act upon a firm's RB in order to produce results.

Furthermore, the study published by Drnevich and Kriauciunas (2011) specifically distinguishes between ordinary and dynamic capabilities. The authors find that environmental dynamism has a negative effect on the contribution of ordinary capabilities to firm performance, but a positive effect on the contribution of DCs to firm performance.

To the best of our knowledge, there have been no empirical studies on the role of environmental dynamism regarding the effects of DCSIs. In order to shed light on the question of whether and how environmental dynamism moderates the relationship between DCSIs and firm-level outcomes, we propose the following hypotheses:

H10a: *The effect of a firm's sensing capability on its introduction of new services is moderated by the level of environmental dynamism.*

H10b: *The effect of a firm's seizing capability on its introduction of new services is moderated by the level of environmental dynamism.*

H10c: *The effect of a firm's reconfiguring capability on its introduction of new services is moderated by the level of environmental dynamism.*

H11a: *The effect of a firm's sensing capability on its market and financial performance is moderated by the level of environmental dynamism.*

H11b: *The effect of a firm's seizing capability on its market and financial performance is moderated by the level of environmental dynamism.*

H11c: *The effect of a firm's reconfiguring capability on its market and financial performance is moderated by the level of environmental dynamism.*

4.6. Theoretical Research Model

In summary, this leads us to the theoretical research model presented in Figure 4.2. According to Barreto (2010), one of the keys to advancing our understanding of the DCV is a clear specification of the constructs, of their categories and of their relationships. This is particularly true for the study of DCSIs and we aim to provide a foundation for this by means of the presented research model.

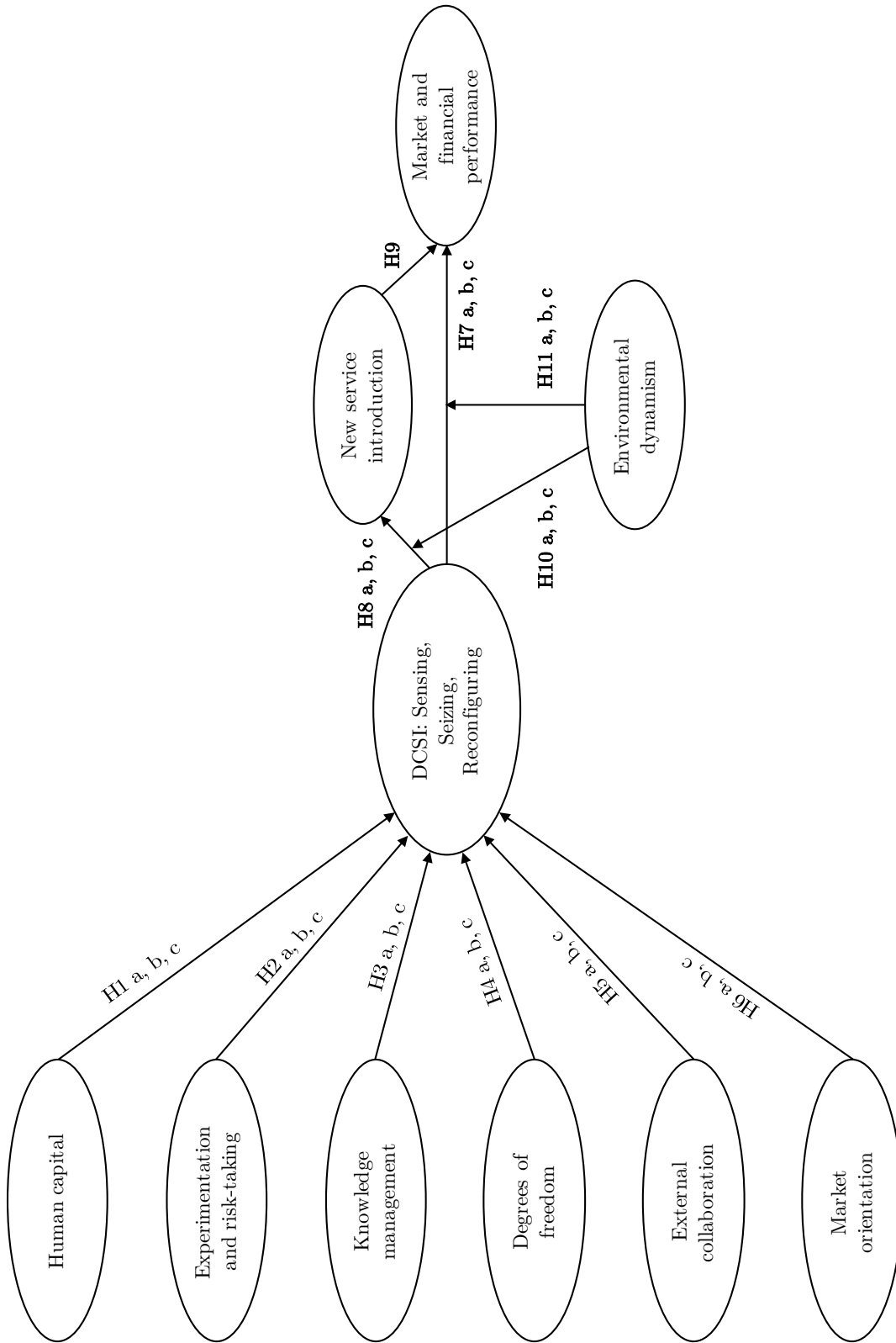


Figure 4.2.: Theoretical Research Model

5. Research Design

5.1. Construct Development, Measurement Items and Survey Instrument

In order to empirically evaluate the research model presented in Chapter 4, a questionnaire based survey in combination with an SEM approach was chosen. This is a tried and tested research design in the DCV literature and many related research fields. Since we did not need to develop constructs from the ground up, we followed a shortened construct measurement and validation procedure, in keeping with MacKenzie et al. (2011).

Endogeneity concerns were addressed by relying on theory-driven construct and hypothesis development. Microfoundations were captured on the distinct levels individual, firm and network. DCSIs were operationalised relying on seminal definitions and models in the DCV literature. For the performance constructs, established and proven approaches were used. We ensured not to omit variables that are highlighted as key in the existing literature and we modelled the relationships between the constructs in a way supported by the majority of publications in the field.

The research model introduced in Chapter 4 is constituted by a number of latent constructs. These cannot be readily observed, but need to be measured using a set of indicators. In this study, we employ sets of indicators, termed scales – the values of the indicators are determined by the underlying latent variables (DeVellis, 2011). Following general best practices and the often expressed call for integration in the field of DCV research (Newbert, 2007; Wang and Ahmed, 2007; Barreto, 2010), this study utilises existing latent constructs and their measurement scales as far as possible. The existing literature on DCSIs and, more generally, DCs was systematically screened to identify existing operationalisations of the relevant constructs, based on studies identified through a structured literature review (compare Chapter 4). When appropriate sets of measurement items could not be found in this literature stream, the research was widened to related areas, mostly following connections and references available in the previous studies.

While some of these measurement scales are quite mature and have been empirically validated by a number of studies, this is not the case for the majority of the constructs of interest. Consequently, measurement items developed in several studies needed to be recombined to form adequate scales for a number of constructs. The generation of completely new measurement items was kept to a minimum. This step was only carried out in very few occasions where existing literature left a white space. New items were inspired by the findings of our exploratory analyses presented in Chapter 3.

The main objective of the item generation phase is to ensure content validity of the scales to be created (Hinkin, 1998). A clear theoretical foundation of the content domain to be measured is the basis for this and is provided by an explicit definition of each construct above. Furthermore, the adopted measurement items have for the most part been published in DC and DCSI specific studies, which strengthens their connection to the content domain being researched. For the new items created, we followed established recommendations for item writing. These included a consistent perspective across the items, succinctness and the avoidance of multiple negatives, double barreled items, colloquialisms and redundancy between items (Hinkin, 1998; Sheatsley, 1983; DeVellis, 2011).

Existing items were all adopted from publications written in English and were translated into German by the researcher for use on the questionnaire, since the survey was limited to Germany, Austria and Switzerland. In the process, emphasis was placed on matching the target audience's vocabulary rather than on word-for-word translation, following the approach of Hinkin (1998, pp. 107–108) for writing items: "the language used should be familiar to target respondents". Minor modifications to the wording of several items were made to increase their fit with the SI context.

The resulting draft questionnaire was pre-tested and refined using the feedback of eight experts, including five practitioners with relevant industry experience and three academics with a strong background in quantitative empirical research and questionnaire design, following procedures used amongst others by Spanos and Lioukas (2001) and building on elements of the 'total design method' by Dillman (1978). The participants for the pre-tests were convenience-sampled. The main goal of the pre-tests was to ensure content validity and unambiguous understandability of the survey items. The participants were invited to 'think out loud' while reading and processing the entire questionnaire, including the provided instructions on how to answer the questions. The pre-tests lasted 60 to 90 minutes for each participant and were conducted in person whenever possible. One session was carried out via video conference and one participant was only available via telephone. When the participants found the wording of an item unclear or wanted to have an item changed, the modifications were elaborated in dialogue to eliminate ambiguity as far as possible. The pre-tests resulted in the elimination of a large number of items. Several items were rewritten or split up to avoid ambiguity and to better match the business domain of the target audience.

This process led to the set of measurement items for the latent variables reported in Appendix C. A copy of the final questionnaire used to carry out the survey can be

found in Appendix D. We deliberately used the question sequence and we reverse coded a small number of items in order to alleviate potential common-method bias ex-ante. Data for most of the items was gathered using 7 point Likert type scales.

5.2. Sampling and Data Collection

As pointed out earlier, DCs offer a promising perspective to gain a deeper understanding of the management of innovation in services and of its influencing factors. However, DCV research has not arrived at an agreement with regard to several key questions, such as the performance effects of DCs (Barreto, 2010). One factor arguably contributing to this situation is an often rather undifferentiated approach towards the types of firms being studied. Different service sectors exhibit very distinct characteristics (Salter and Tether, 2006) and in order to derive meaningful insights for managerial practice, an explicit selection of considered service sectors is necessary.

KIBS have been pointed out as one of the main drivers of innovation in services (Miles et al., 1995; Koch and Stahlecker, 2006). KIBS are characterised by building on professional knowledge as one of their most important resources to deliver information, knowledge and value to the customer; innovations in this sector are often realised through new combinations of such knowledge (Miles et al., 1995; Miles, 2005; Amara et al., 2008, 2009). As Doloreux and Shearmur (2012) put it, KIBS firms deliver knowledge-intensive input to their clients' business processes. In doing so, they act as intermediaries of knowledge (Consoli and Elche-Hortelano, 2010). These conceptualisations of KIBS highlight that they are predominantly situated in the business to business (B2B) domain.

As Cramer (2002) points out, the term 'knowledge-intensive business service' was developed in the style of the earlier known capital and labour intensive services, highlighting the role of key resources for the respective firms. He defines KIBS as services that use knowledge as the most important input factor for value creation. This makes the knowledge and skills of a firm's employees a key asset, which it makes accessible for its clients (Miles, 2008). In doing so, in-depth interaction between the service provider and the client is required in order to create value (Koch and Stahlecker, 2006). Desmarchelier et al. (2013) go somewhat further and define KIBS as services in which knowledge is the most important resource as well as the most important output.

Building on a service categorisation developed by Schmenner (1986), Miles et al. (1995) propose a service typology along two dimensions: 'Service providers' typical relation to technology' and 'Typical relation between service provider and client'. In this classification, KIBS are placed on the 'high' end of both dimensions, being early adopters and transfer institutions for new technologies and offering highly interactive, highly customised solutions for their clients.

Bettencourt et al. (2002, pp. 100–101) define KIBS firms as "enterprises whose primary value-added activities consist of the accumulation, creation, or dissemination of knowledge for the purpose of developing a customized service or product solution

to satisfy the client's needs". As examples for this sector they name IT consulting, technical engineering and software design.

According to Desmarchelier et al. (2013) consultancy, research and engineering are typical representatives of the KIBS sector. Gallouj (2000) highlights research, consultancy and engineering business services. Miozzo and Grimshaw (2005) distinguish between KIBS based on social and institutional knowledge (for example accounting and management consultancy services) and those based on technological knowledge, such as computer, R&D and engineering services.

Based on a standard industrial classification in Canada, Doloreux and Shearmur (2012) list legal, accounting, architectural, engineering, surveying, mapping, design, management, scientific and technical consulting, scientific R&D and advertising services as the main representatives of KIBS. In an extensive review of the literature on KIBS, Toivonen (2004) lists computer, R&D, legal, financial and management consultancy, advertising, marketing and technical services as categories of KIBS, which have received a wide consensus in previous studies.

With the general trend of a development towards a knowledge economy, the importance of KIBS is rising (Muller and Zenker, 2001). With it, academic interest in KIBS has steadily increased since the 1990s, as evidenced in the number of yearly publications on the subject (Muller and Doloreux, 2007).

den Hertog (2000) highlights that KIBS firms act as carriers and co-producers of innovation, through their very close relationships with their client firms, thus facilitating innovation in a wide range of industries. However, Hogan et al. (2011) is one of the first and few empirical studies of DCSIs in KIBS. Consequently, KIBS firms are considered an ideal focus for this study.

Before selecting a sample to be studied, the population to be sampled for needs to be defined (Sudman, 1983). KIBS categories to be included in the sampling procedure were selected based on the consensus lists reported above. The geographic scope of this study was limited to the German speaking countries (Germany, Austria and Switzerland) in order to be able to carry out the survey without translation biases and in order to attain a high level of cultural homogeneity. The KIBS categories were converted to be applied to this geography using the German classification of industries (WZ, 2008), which is fully compatible with the European and Swiss classification systems. For a full list of the selected categories, please see Appendix A.

Individual firms were chosen as the unit of analysis. In order to support the measurement of objective and firm-level performance data, the study was limited to single business firms or units (Spanos and Lioukas, 2001; Hult et al., 2005). Furthermore, the sample was targeted towards larger firms, since these can be expected to have a greater need for defined and managed DCs than smaller firms, where for example communication flows among employees are far easier to organise. The European Union Commission (2003) defines small and medium-sized enterprises as firms that have no more than 250 employees as well as 50 Million € in turnover or 43 Million

€ in balance sheet total. By implication, we define a large firm as one that has 250 or more employees.

In order to address these criteria, we needed to employ a non-random sampling method and opted for purposive sampling (Kelley et al., 2003), due to its ability to incorporate all of the presented criteria. The sample panel was created through research on the professional career network platform XING (www.xing.com). First, the selected industry categories representing KIBS were matched to XING's industry categories, which closely resembled the official European classification. From these industry categories, firms with over 250 employees that were listed as being situated in Germany, Austria or Switzerland were selected.

We employed a dyadic sampling design and identified two participants for each of the selected firms (Pasteels, 2015) in order to address key informant bias. Our exploratory analyses, as well as earlier publications on DCs, such as Allred et al. (2011), suggested limiting participants to senior managers with a broad overview of the firm and its innovation activities, as well as access to firm-level performance data. This is in line with the recommendations of Huber and Power (1985) for conducting studies using key informants.

For the first participant for each firm, a chief executive or managing director was selected. For the second participant, a senior executive from one of the following areas was chosen: Innovation, product management, marketing, strategy and business development. If for the second position no suitable candidates from these areas could be identified, executives from controlling and financial management were selected as a back up strategy, since they have a firm-wide overview of investments and performance data.

Key informants based approaches are frequently used in strategic management research in general and in the DCSI studies presented in Chapter 2 in particular. Besides their hierarchical level and functional area, the participants' competency for answering the study's questions was assured by the amount of time they had been working at the respective firm (Kumar et al., 1993). We required at least one year of work experience at the firm, however the actual experience was higher for most of the participants.

Overall, 1,888 participants from 979 firms were included in the sample. The survey was sent to the participants by post and was accompanied by a cover letter explaining the purposive and procedure of the study and assuring anonymised treatment of the responses. In order to increase the response rate and to motivate participants to provide accurate data (Huber and Power, 1985), they were promised a report of the study's results. A postage paid envelope addressed to the researchers' institute was also included. Two weeks after the initial mailing, participants received another mail with the same content. Six weeks after the initial mailing, we sent out a concluding email to the remaining participants offering them to fill out an online version of the questionnaire, reacting to feedback we had received from several of the respondents. Overall we received 148 usable responses, which corresponds to a good response rate of about eight per cent. For both modes of questionnaire

administration, each participants's questionnaire was given a unique ID to ensure that each respondent did not complete more than one questionnaire. We did not receive multiple responses per firm as intended in the research design – likely, the invited respondents coordinated themselves regarding who provided the answers.

Table 5.1 shows the composition of the survey sample. It can be seen that the sample provides a good coverage of KIBS areas. Furthermore, many of the respondents are from senior management or occupy positions with a close relationship to innovation and most of the respondents have been working at their firm for at least several years. As pointed out above, these were important criteria for ensuring the reliability of our key informants.

Table 5.1.: Sample Composition

	%
Sector	
Consulting	41
IT services	18
Marketing and communications	13
Legal and financial services	10
Research	7
General services	7
Civil engineering	4
Number of employees	
< 100	11
100 - 249	6
250 - 499	17
500 - 999	13
1,000 - 2,999	28
3,000 - 10,000	4
> 10,000	21
Function the respondents are working in	
Senior management	45
Marketing & Sales	20
Innovation management & Product management	15
Research & Development	3
Controlling & Finance	2
HR	2
Other	11
Number of years the respondents have been working at their firm	
< 1 year	3
1 - 2 years	10
3 - 5 years	21
6 - 10 years	27
> 10 years	38

5.3. Data Preparation, Measurement Model and Construct Refinement

The survey results were exported to a CSV file and were loaded into the statistical software package R for data preparation and analysis. We used R 3.4.2 and the SEM package lavaan (Rosseel, 2012) to carry out the factor analyses and the SEM evaluation reported in Chapter 6. The details of the software environment can be found in the Appendix (Section B).

The survey results that were captured in the form of labels were converted to ordinal scales for further analysis in order to be compatible with the rest of the data. The scales for the reverse coded items were inversed. Non-response bias was addressed through a comparative analysis of the construct means of early and late responses (Armstrong and Overton, 1977). The analysis showed that non-response bias was not an issue for the sample.

Subsequently, we conducted a confirmatory factor analysis to ensure construct validity and reliability. This analysis revealed an issue with discriminant validity (Voorhees et al., 2016) with regard to the microfoundation constructs. We followed recommended procedures and carried out exploratory factor analyses to refine the constructs. As recommended by Ruscio and Kaczetow (2008), we combined a number of exploratory factor analyses to make the results more robust. We compared the results of a scree plot, parallel analysis, the very simple structure criterion and a comparison data analysis (Ruscio and Kaczetow, 2008) and opted to reduce the number of microfoundations constructs from six to four. We subsequently carried out a factor rotation analysis to establish the four microfoundations constructs using a varimax rotation. For the other constructs, we used exploratory factor analyses to retain the items with the best empirical fit.

The refined constructs and corresponding hypotheses are shown in Figure 5.1. The full list of hypotheses is recorded in Appendix F. Confirmatory factor analysis was used to assess the reliability and validity of the constructs. Composite reliabilities (CR) are above the recommended threshold of 0.70 for all constructs (Bagozzi and Yi, 1988) and discriminant validity is established (Fornell and Larcker, 1981). Table 5.2 provides descriptive statistics, average variance extracted (AVE), CR, and correlations. Most item reliabilities are greater than the recommended value of 0.40. Item reliabilities and factor loadings can be found in Appendix E. A Harman single-factor test suggests that common method variance does not seem to be a serious concern to the presented findings. The variance explained by a single factor is 0.23 and therefore well below the commonly accepted threshold of 0.50. Key informant bias is potentially an issue for all surveys relying heavily or solely on key informants. We addressed this using the measures described in Section 5.2. An analysis of the descriptive statistics of the dependent variables new service introduction and market and financial performance shows no anomalies in comparison to the other variables. This suggests that social desirability bias does not seem to be an issue with the key informants.

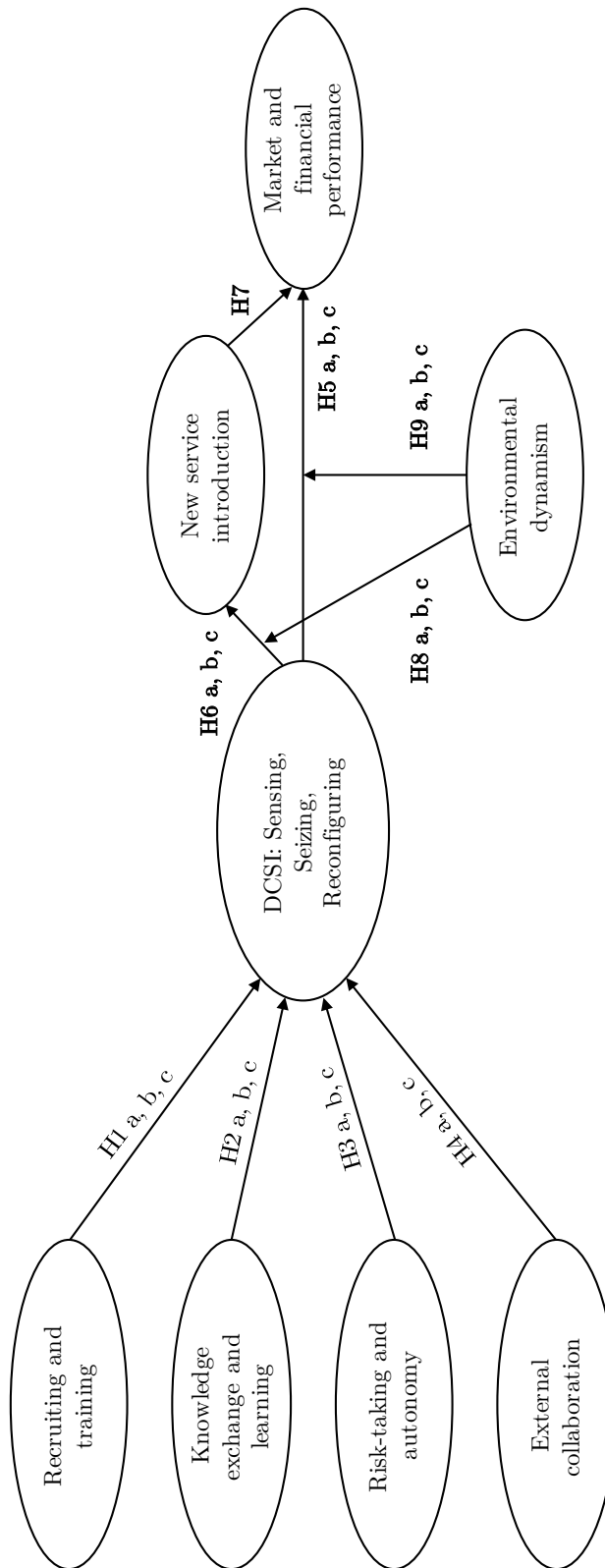


Figure 5.1.: Final Research Model

Table 5.2.: Reliabilities and Correlations

#	Variable	Mean	SD	CR	AVE	1	2	3	4	5	6	7	8	9	10	11	12	13	
1	Recruiting and training	3.87	1.39	0.90	0.51	1.00													
2	Knowledge exchange and learning	5.16	1.30	0.95	0.52	0.22	1.00												
3	Risk-taking and autonomy	4.00	1.44	0.97	0.43	0.32	0.55	1.00											
4	External collaboration	4.15	1.81	0.89	0.46	0.12	0.13	0.21	1.00										
5	Sensing	5.25	1.27	0.89	0.42	0.11	0.25	0.29	0.16	1.00									
6	Seizing	4.91	1.33	0.97	0.55	0.36	0.57	0.85	0.13	0.38	1.00								
7	Reconfiguring	4.87	1.47	0.94	0.46	0.31	0.47	0.62	0.37	0.42	0.56	1.00							
8	New service introduction	4.21	1.45	0.90	0.54	0.22	0.23	0.41	0.20	0.22	0.40	0.42	1.00						
9	Market and financial performance	4.51	1.37	0.97	0.54	0.38	0.36	0.43	0.06	0.16	0.59	0.25	0.42	1.00					
10	Service share	4.33	1.16	n/a ^a	n/a ^a	0.07	0.18	0.04	-0.10	-0.05	0.03	-0.16	-0.05	0.03	1.00				
11	B2B share	4.42	1.19	n/a ^a	n/a ^a	0.04	-0.01	0.09	-0.06	-0.03	-0.02	-0.20	-0.04	0.02	0.32	1.00			
12	Firm size	4.35	1.90	n/a ^a	n/a ^a	0.14	-0.10	-0.05	-0.01	-0.10	-0.03	-0.20	-0.11	0.15	0.26	0.09	1.00		
13	Environmental dynamism	4.31	0.20	0.89	0.39	0.05	0.02	0.12	0.07	0.15	0.10	0.15	0.13	0.10	-0.02	0.10	0.14	1.00	

^a Variable measured by a single indicator: CR and AVE cannot be computed

6. Empirical Analysis and Discussion

6.1. Model without Moderation Effects

As described in more detail in Section 5.3, we used the statistical software package R for all of the SEM analyses. Due to the mixed published findings on the role of environmental dynamism as a moderator on the effect of DCSIs, we opted to conduct two separate model tests – Model 1 without moderation effects and Model 2 including the moderation effects of environmental dynamism. The results for Model 1 and Model 2 are compared and discussed in Section 6.3.

Model 1 includes all of the core and control variables described in the research model (see Figure 4.2), but it does not include environmental dynamism as a moderating variable. There is no definitive test of model quality in SEM, but following the fit indices recommended by Homburg and Klarmann (2006), the model exhibits good global fit measures (RMSEA = 0.060; SRMR = 0.086; CFI = 0.818; NNFI = 0.801). All standardised path coefficients for Model 1 are shown in Figure 6.1. More details are provided in Table 6.1.

Regarding the effect of the microfoundations on DCSIs, we see support for many of the proposed relationships as well as differentiated patterns for the individual constructs. An overview of the hypothesis evaluation for the microfoundations-DCSIs relationships is shown in Table 6.2.

We record support for all of the hypothesised relationships between knowledge exchange and learning and the DCSIs. External collaboration has a significant effect on the dimensions sensing and reconfiguring. The two other microfoundation constructs, recruiting and training and risk-taking and autonomy each have a significant effect on the seizing capability.

An overview of the hypothesis evaluation for the DCSIs-new service introduction and firm performance relationships is shown in Table 6.3. A direct significant effect

on market and financial performance is only found for a firm's seizing capability - the other two DCSIs show no significant effect.

With regard to new service introduction, both the effect of the seizing capability and of the reconfiguring capability are significant. There is also very strong support for the relationship between new service introduction and market and financial performance. Taken together, this gives us a significant indirect relationship between both the seizing capability and the reconfiguring capability and the firm's market and financial performance, mediated by new service introduction.

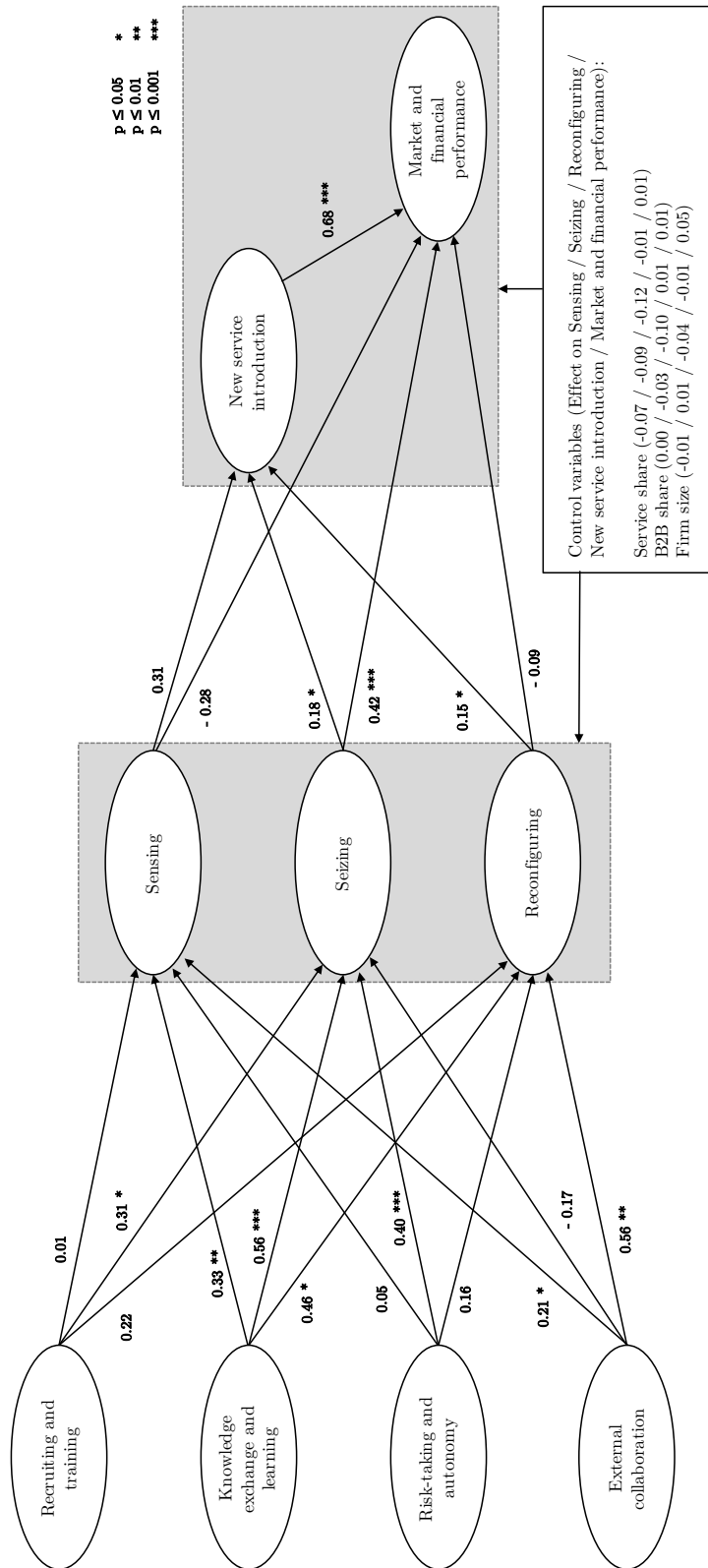


Figure 6.1.: Standardised Solution for Model 1

Table 6.1.: Path Coefficients and Standard Errors from Covariance Structure Analysis for Model 1

	Sensing	Seizing	Reconfiguring	New service introduction	Market and financial performance
Recruiting and training	0.01 (0.08)	0.31* (0.14)	0.22 (0.19)	-	-
Knowledge exchange and learning	0.33** (0.11)	0.56*** (0.16)	0.46* (0.22)	-	-
Risk-taking and autonomy	0.05 (0.07)	0.40*** (0.11)	0.16 (0.15)	-	-
External collaboration	0.21* (0.09)	-0.17 (0.12)	0.56** (0.21)	-	-
Sensing	-	-	-	0.31 (0.17)	-0.28 (0.23)
Seizing	-	-	-	0.18* (0.08)	0.42*** (0.12)
Reconfiguring	-	-	-	0.15* (0.08)	-0.09 (0.11)
New service introduction	-	-	-	-	0.68*** (0.21)
Service share	-0.07 (0.04)	-0.09 (0.07)	-0.12 (0.10)	-0.01 (0.05)	0.01 (0.07)
B2B share	0.00 (0.04)	-0.03 (0.06)	-0.10 (0.10)	0.01 (0.05)	0.01 (0.07)
Firm size	-0.01 (0.02)	0.01 (0.04)	-0.04 (0.05)	-0.01 (0.03)	0.05 (0.04)

Based on $N = 148$. One-tailed tests were used. Completely standardised coefficients with standard errors in parentheses.

Table 6.2.: Evaluation of Hypotheses H1 – H4 (Model 1)

Hypothesis	Effect	Support
H1a: Recruiting and training contribute positively to a firm's sensing capability.	0.01	–
H1b: Recruiting and training contribute positively to a firm's seizing capability.	0.31 *	✓
H1c: Recruiting and training contribute positively to a firm's reconfiguring capability.	0.22	–
H2a: Knowledge exchange and learning contribute positively to a firm's sensing capability.	0.33 **	✓
H2b: Knowledge exchange and learning contribute positively to a firm's seizing capability.	0.56 ***	✓
H2c: Knowledge exchange and learning contribute positively to a firm's reconfiguring capability.	0.46 *	✓
H3a: Risk-taking and autonomy contribute positively to a firm's sensing capability.	0.05	–
H3b: Risk-taking and autonomy contribute positively to a firm's seizing capability.	0.40 ***	✓
H3c: Risk-taking and autonomy contribute positively to a firm's reconfiguring capability.	0.16	–
H4a: External collaboration contributes positively to a firm's sensing capability.	0.21 *	✓
H4b: External collaboration contributes positively to a firm's seizing capability.	- 0.17	–
H4c: External collaboration contributes positively to a firm's reconfiguring capability.	0.56 **	✓

- ✓ Hypothesis is supported
– Hypothesis is not supported

Table 6.3.: Evaluation of Hypotheses H5 – H7 (Model 1)

Hypothesis	Effect	Support
H5a: A firm's sensing capability contributes positively to its market and financial performance.	- 0.28	–
H5b: A firm's seizing capability contributes positively to its market and financial performance.	0.42 ***	✓
H5c: A firm's reconfiguring capability contributes positively to its market and financial performance.	- 0.09	–
H6a: A firm's sensing capability contributes positively to its new service introduction.	0.31	–
H6b: A firm's seizing capability contributes positively to its new service introduction.	0.18 *	✓
H6c: A firm's reconfiguring capability contributes positively to its new service introduction.	0.15 *	✓
H7: New service introduction contributes positively to a firm's market and financial performance.	0.68 ***	✓

- ✓ Hypothesis is supported
- Hypothesis is not supported

6.2. Model including Moderation Effects

The evaluation of Model 2 follows the procedure described for Model 1 in Section 6.1. Model 2 includes all of the core and control variables described in the research model (see Figure 4.2), including environmental dynamism as a moderating variable. We followed the recommendations of Homburg et al. (2010) for incorporating the moderation effects into our model. First, all constructs involved in the interaction relationship were mean centred. We then created the interaction variables using the mean centred indicator products of the respective constructs. In doing so, we maximised information use – for variables with different numbers of indicators, one of the indicators was used twofold.

There is no definitive test of model quality in SEM, but following the fit indices recommended by Homburg and Klarmann (2006), the model exhibits good global fit measures (RMSEA = 0.064; SRMR = 0.086; CFI = 0.71; NNFI = 0.686). However, the CFI and NNFI values are lower than for Model 1. All standardised path coefficients for Model 2 are shown in Figure 6.2. More details are provided in Table 6.4.

Regarding the effects of the microfoundations on the DCSIs, we observe similar patterns as compared to Model 1. The only marked difference is the relationship between knowledge exchange and learning and the reconfiguring capability, which is not significant in Model 2. An overview of the hypothesis evaluation for the microfoundations-DCSIs relationships is shown in Table 6.5.

We record support for the hypothesised relationships between knowledge exchange and learning and the DCSIs sensing and seizing. External collaboration has a significant effect on the dimensions sensing and reconfiguring. The two other microfoundation constructs, recruiting and training and risk-taking and autonomy each have a significant effect on the seizing capability.

An overview of the hypothesis evaluation for the DCSIs-new service introduction and firm performance relationships, as well as for the moderated relationships is shown in Table 6.6. As in Model 1, a direct significant effect on market and financial performance is only found for a firm's seizing capability - the other two DCSIs show no significant effect.

With regard to new service introduction, both the effect of the seizing dimension and of the reconfiguring capability are significant. There is also very strong support for the relationship between new service introduction and market and financial performance – this path coefficient is even slightly larger than in Model 1. Taken together, this gives us a significant indirect relationship between both the seizing capability and the reconfiguring capability and the firm's market and financial performance, mediated by its introduction of new services.

The role of environmental dynamism as a moderator of the influence of the DCSIs on new service introduction and market and financial performance cannot be confirmed by our model. None of the moderated paths show any significant effects.

6.2. Model including Moderation Effects

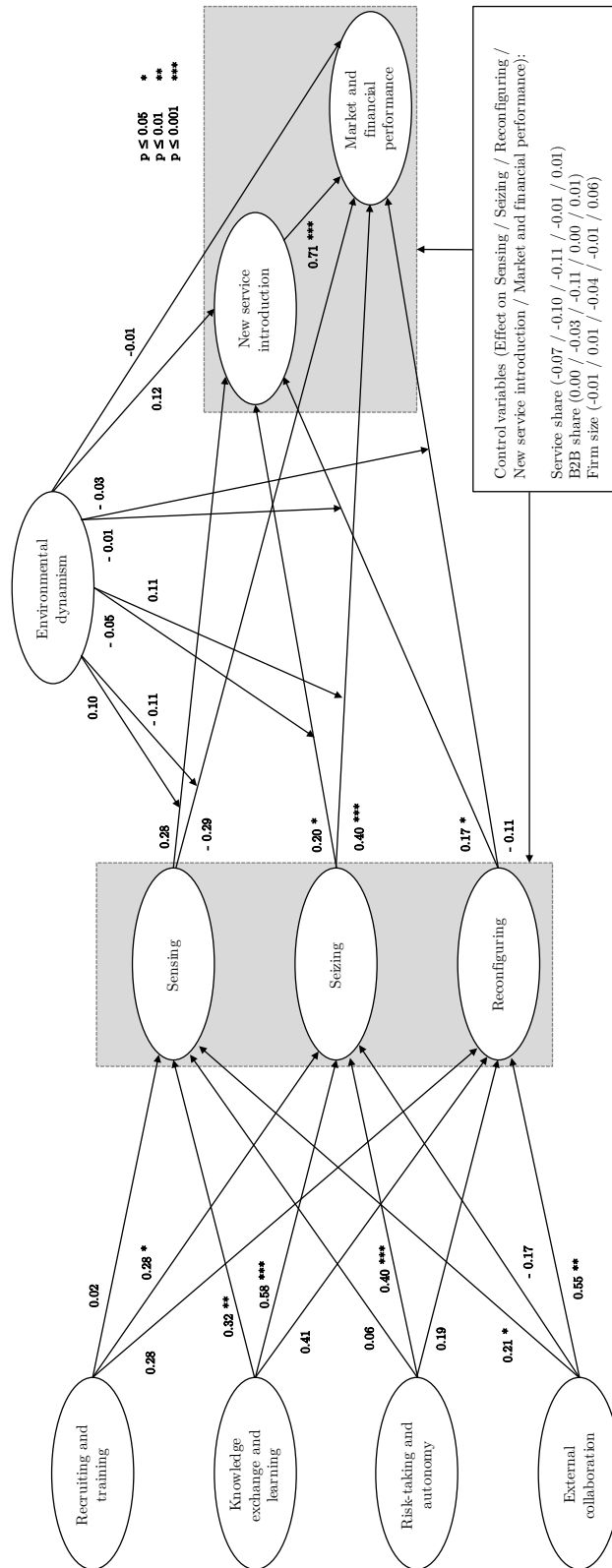


Figure 6.2.: Standardised Solution for Model 2

Table 6.4.: Path Coefficients and Standard Errors from Covariance Structure Analysis for Model 2

	Sensing	Seizing	Reconfiguring	New service introduction	Market and financial performance
Recruiting and training	0.02 (0.08)	0.28* (0.14)	0.28 (0.20)	-	-
Knowledge exchange and learning	0.32** (0.11)	0.58*** (0.16)	0.41 (0.22)	-	-
Risk-taking and autonomy	0.06 (0.07)	0.40*** (0.11)	0.19 (0.15)	-	-
External collaboration	0.21* (0.09)	-0.17 (0.12)	0.55** (0.21)	-	-
Sensing	-	-	-	0.28 (0.18)	-0.29 (0.24)
Seizing	-	-	-	0.20* (0.08)	0.40*** (0.12)
Reconfiguring	-	-	-	0.17* (0.08)	-0.11 (0.11)
New service introduction	-	-	-	-	0.71*** (0.22)
Environmental dynamism	-	-	-	0.12 (0.10)	-0.01 (0.13)
Sensing x Environmental dynamism	-	-	-	0.10 (0.11)	-0.11 (0.15)
Seizing x Environmental dynamism	-	-	-	-0.05 (0.11)	0.11 (0.16)
Reconfiguring x Environmental dynamism	-	-	-	-0.01 (0.07)	-0.03 (0.10)
Service share	-0.07 (0.04)	-0.10 (0.07)	-0.11 (0.10)	-0.01 (0.05)	0.01 (0.08)
B2B share	0.00 (0.04)	-0.03 (0.06)	-0.11 (0.09)	0.00 (0.05)	0.01 (0.07)
Firm size	-0.01 (0.02)	0.01 (0.04)	-0.04 (0.05)	-0.01 (0.03)	0.06 (0.04)

Based on N = 148. One-tailed tests were used. Completely standardised coefficients with standard errors in parentheses.

Table 6.5.: Evaluation of Hypotheses H1 – H4 (Model 2)

Hypothesis	Effect	Support
H1a: Recruiting and training contribute positively to a firm's sensing capability.	0.02	–
H1b: Recruiting and training contribute positively to a firm's seizing capability.	0.28 *	✓
H1c: Recruiting and training contribute positively to a firm's reconfiguring capability.	0.28	–
H2a: Knowledge exchange and learning contribute positively to a firm's sensing capability.	0.32 **	✓
H2b: Knowledge exchange and learning contribute positively to a firm's seizing capability.	0.58 ***	✓
H2c: Knowledge exchange and learning contribute positively to a firm's reconfiguring capability.	0.41	–
H3a: Risk-taking and autonomy contribute positively to a firm's sensing capability.	0.06	–
H3b: Risk-taking and autonomy contribute positively to a firm's seizing capability.	0.40 ***	✓
H3c: Risk-taking and autonomy contribute positively to a firm's reconfiguring capability.	0.19	–
H4a: External collaboration contributes positively to a firm's sensing capability.	0.21 *	✓
H4b: External collaboration contributes positively to a firm's seizing capability.	- 0.17	–
H4c: External collaboration contributes positively to a firm's reconfiguring capability.	0.55 **	✓

- ✓ Hypothesis is supported
 – Hypothesis is not supported

Table 6.6.: Evaluation of Hypotheses H5 – H9 (Model 2)

Hypothesis	Effect	Support
H5a: A firm's sensing capability contributes positively to its market and financial performance.	- 0.29	–
H5b: A firm's seizing capability contributes positively to its market and financial performance.	0.40 ***	✓
H5c: A firm's reconfiguring capability contributes positively to its market and financial performance.	- 0.11	–
H6a: A firm's sensing capability contributes positively to its new service introduction.	0.28	–
H6b: A firm's seizing capability contributes positively to its new service introduction.	0.20 *	✓
H6c: A firm's reconfiguring capability contributes positively to its new service introduction.	0.17 *	✓
H7: New service introduction contributes positively to a firm's market and financial performance.	0.71 ***	✓
H8a: The effect of a firm's sensing capability on its new service introduction is moderated by the level of environmental dynamism.	0.10	–
H8b: The effect of a firm's seizing capability on its new service introduction is moderated by the level of environmental dynamism.	- 0.05	–
H8c: The effect of a firm's reconfiguring capability on its new service introduction is moderated by the level of environmental dynamism.	- 0.01	–
H9a: The effect of a firm's sensing capability on its market and financial performance is moderated by the level of environmental dynamism.	- 0.11	–
H9b: The effect of a firm's seizing capability on its market and financial performance is moderated by the level of environmental dynamism.	0.11	–
H9c: The effect of a firm's reconfiguring capability on its market and financial performance is moderated by the level of environmental dynamism.	- 0.03	–

✓ Hypothesis is supported

– Hypothesis is not supported

6.3. Discussion

There have been mixed findings regarding the moderating role of environmental dynamism on the effect of DCs. In order to address this open issue, we have proposed and tested Model 1 and Model 2 above – Model 2 including environmental dynamism as a moderating variable and Model 1 without the moderation effects. As reported above, we could not find any significant moderating effects of environmental dynamism on the relationships between the DCSIs and the outcome variables in Model 2.

There are several possible explanations for this. One possibility would be that the differences in dynamism between the studied firms' environments are too small to derive meaningful results. However, the variance of the environmental dynamism variable is 2.33 on a 7-point scale, so this should arguably provide some basis for the analysis.

Another possibility would be that environmental dynamism affects how DCSIs act differently than hypothesised in our model. For example, the effect of environmental dynamism could be stronger regarding the evolutionary paths of DCSIs than regarding their performance relationships, which were tested here.

However – for our research model and based on our sample – we do not find any significant effects of environmental dynamism. Additionally, the global fit indices suggest a slightly better fit of the data for Model 1 as compared to Model 2. In summary, this leads us to select Model 1 over Model 2 – the following discussion is based on the results obtained for Model 1.

As discussed in Chapter 4, a key debate regarding the DCV is on the performance effects on DCs. We hypothesised both direct and indirect performance effects of the DCSIs in our model and find support for both – depending on the considered DCSI. We find a significant direct relationship between the DCSI seizing and market and financial performance. The seizing capability measures a firm's ability to advance the development of ideas into new services, to quickly react to changes in the market and to change business procedures accordingly. This means that these traits play a pivotal role in order to achieve direct performance effects from DCSIs. Furthermore, the seizing capability also has a significant indirect performance effect through the introduction of new services and therefore emerges as the key DCSI construct regarding results from SI.

The path coefficients for the direct relationships between the other two DCSIs, sensing and reconfiguring, and market and financial performance are even slightly negative, but they are not significant. A possible explanation for this could be that both sensing and reconfiguring are necessary elements of a firm's potential for realising SI, but by themselves their characteristic is more that of an investment than that of a direct performance contributor. The DCSI sensing captures a firm's ability to routinely search for and identify new opportunities, in particular outside of the firm. While necessary to trigger innovation processes, these activities are arguably time and cost intensive. Supporting this line of thought, sensing also does not show an indirect performance effect through the introduction of new services.

The reconfiguring capability captures how well a firm is able to adapt its core procedures and methods in order to deliver new offers. Like the sensing capability, this capability also does not show a direct performance impact. An argument can be made similar to that for the sensing capability, with the exception of indirect performance effects – reconfiguring has a significant positive effect on the introduction of new services.

The results suggest seizing as a pivotal DCSI regarding performance effects. There are three microfoundations that have a significant relationship contributing to a firm's seizing DCSI – recruiting and training, knowledge exchange and learning and risk-taking and autonomy. Recruiting and training captures a firm's ability to recruit quickly, from a wide selection of applicants and from renowned universities. It also captures the firm's investments into formal training. This means that by investing into these abilities, a firm should be able to positively influence its seizing capability. Recruiting and training, on the other hand, does not show any significant effects on the other two DCSIs sensing and reconfiguring. A possible explanation could be that these capabilities are driven more by informal activities, such as the ones captured in the microfoundation knowledge exchange and learning.

Knowledge exchange and learning is revealed by the results as a pivotal microfoundation, which has a significant positive effect on all three DCSIs. The construct knowledge exchange and learning captures many aspects of continuous learning and informal sharing of knowledge across the firm – a key challenge for KIBS firms (Teece, 2003). The microfoundation also captures how learnings from past projects are used to inform current projects – an important factor to continuously improve SI processes and activities. These findings again highlight the significance of knowledge to KIBS firms, for which it constitutes both a key input and a key output factors (Gallouj, 2000).

Another microfoundation that supports a firm's seizing capability is risk-taking and autonomy. This microfoundation measures executives' willingness to take risks in the development of new services, as well as their autonomy and that of their employees to make decisions and to assign resources to SI projects. Next to knowledge exchange and learning this is a key driver of the seizing capability and should therefore be closely considered by executives when trying to improve SI performance. We do not find significant effects of risk-taking and autonomy on the other two DCSIs. This is somewhat surprising, since the search for opportunities and new ideas sometimes arguably requires autonomous decision-making. Also, we would have expected more of an influence of this microfoundation on the reconfiguring capability. Likely, the effects of quick decision-making and risk-taking are outweighed in this context by the requirement of centrally coordinated development efforts for example for changing core business processes to deliver a new service.

Lastly, the microfoundation external collaboration captures many aspects of a firm's external network, its partnerships for innovation and even for the joint development of offers. We find a significant positive relationship between external collaboration and the sensing capability as well as the reconfiguring capability. If we would map the DCSIs against the phases of an innovation process, this would mean that the

firm's external collaboration activities and network play a particularly important role both in the early and in the late phases.

No significant influence on seizing is found, which fits well with the influences of the other microfoundations on this DCSI, which have been described above. A firm's seizing capability is largely driven by its inward-focused abilities to recruit the right people, to allow continuous learning and open exchange of knowledge between them and to foster calculated risk-taking and decision-making without red tape. External collaboration on the other hand has a more outward-focused role. It supports a firm's sensing capability through providing access channels to important information, technology, needs and trends.

The strong effect of external collaboration on the reconfiguring capability is a particularly interesting result. The effect suggests that firms can draw significant benefits from their collaboration partners and networks for improving and developing their business procedures and key methods used to deliver new services. This could include access to training providers, development partnerships and possibly also specialised recruiting channels, for example through collaborations with universities and research institutions.

To summarise, we find support for many of the hypothesised relationships between the microfoundations and the three DCSIs. Knowledge exchange and learning emerges as a pivotal construct, which has a significant effect on all three DCSIs. For KIBS firms, knowledge is a key resource and benefiting from knowledge consequently shapes many of the processes and behaviours present in these firms. The exchange of knowledge and continuous learning carry particular significance, since KIBS firms are usually driven by knowledge workers in decentralised structures. This means that traditional communication paths are often substituted by many-to-many communication networks (Teece, 2003), which can be considered both an opportunity and a risk with regard to fostering a firm's DCSIs.

Regarding performance we find both direct and indirect effects. The DCSI seizing plays a pivotal role here and exhibits both types of performance effects. Reconfiguring shows a significant indirect performance relationship, mediated by the introduction of new services. Our evaluation of the relationships between the DCSIs and other key constructs for the firm suggests that in order to derive useful insights, it is pivotal to distinguish between the effects of the individual microfoundations as well as DCSIs.

7. Conclusion

7.1. Theoretical Implications

Firms, employees and managers increasingly need to act and react in environments that are characterised by volatility, uncertainty, complexity and ambiguity (Kail, 2010). This means that in order to obtain and to ascertain a competitive advantage, service firms cannot rely on static sets of resources, but they need to be able to flexibly adapt and to reinvent themselves. Based on the DCV, we have proposed and empirically tested a model that captures firms' capabilities to introduce SIs and to benefit from their introduction. The model is centred around the DCs sensing, seizing and reconfiguring.

This study constitutes an empirical assessment of the DCV, which is frequently demanded in the previous literature. Our study has focused on the application of the DCV to KIBS – an underrepresented sector in DCV studies, with exceptions such as Hogan et al. (2011). KIBS firms are characterised by knowledge workers and decentralised structures. This means that SI is carried out and influenced across all areas and levels of the firm. Accordingly, they are faced with a particular set of complexities and challenges, which can inform SI in other firms and sectors. Our study employs a specific sample of KIBS firms and relies on key informants who hold senior positions at their firms with several years of relevant experience.

The findings have implications for the DCV literature in particular, as well as more generally for innovation management research. The microfoundation constructs constitute a set of concrete resources, activities and procedures that can be used to foster and to study innovation processes. The DCSIs and their interactions with the microfoundation constructs present an opportunity to study the effects of innovation management in changing and dynamic environments – in particular the evolutionary paths of firms' resources and capabilities.

Our study has addressed the three RQs put forward in Chapter 1. Regarding the first RQ, we have analysed the facets of DCSIs and their measurement from different

perspectives. In an exploratory analysis using a text mining approach we have shown how existing data in the form of text documents can be used to assess aspects of DCSIs (see Section 3.1). To our knowledge, this is the first use of a text mining approach for assessing DCSIs. We have demonstrated that given suitable documents on the firms as well as keywords, we can use characteristics of DCSIs to reliably categorise firms regarding their innovativeness. Furthermore, we have explored the extension of a keyword based approach to a text pattern based approach. Using this approach we have demonstrated how a more nuanced and robust text mining based assessment of firms' DCSIs could be implemented.

Building on a pivotal framework of DCs put forward in Teece et al. (1997) and Teece (2007a), we have modelled DCSIs using the constructs sensing, seizing and reconfiguring. We have developed elaborate measurement models for these DCSIs building on existing publications and integrating our own findings. This represents a step forward in making DCSIs and their various aspects measurable – a necessary condition of advancing DCSI research.

In terms of our second RQ, we have advanced the existing knowledge on the micro-foundations of DCSIs – regarding both the set of potential microfoundations and the relationships of individual microfoundations with a firm's DCSIs. In an exploratory analysis reported in Section 3.2 we surveyed executives in service firms in order to elucidate which microfoundations of DCSIs they consider important from a practical point of view. This has revealed a strong reliance on information, IT, relationship and human resource oriented microfoundations. Based on the suggestions of existing studies and the results of this exploratory analysis, we have analysed the effects of microfoundations on the individual level, on the firm level and on the external level in our research model.

This rich consideration of microfoundations of DCSIs represents an important contribution to advancing research on DCSIs. Furthermore, our empirical analysis has revealed the different patterns in which the identified microfoundations influence a firm's DCSIs. Knowledge exchange and learning emerged as a key construct which has a significant influence on all DCSIs – sensing, seizing and reconfiguring. For the other microfoundations, we have shown different significant relationships with DCSIs. These findings make an important contribution to understanding the patterns through which DCSIs can be developed. This understanding is the basis for making prescriptive recommendations to executives in how to foster their firms' DCSIs through investing in the relevant microfoundations for their respective situation.

According to several publications, the relationship between DCs and firm performance or competitive advantage is one of the most important relationships to understand in more detail in order to advance the DCV. On that note, we have contributed to the open debate on the performance effects of DCs in addressing our third RQ. In an exploratory analysis focusing on KIBS firms, we have shed some light on how these firms themselves measure SI performance (see Section 3.3).

Addressing different findings in the previous literature, we have incorporated both direct and indirect performance effects into our research model. Our results suggest

that the conceptualisations of both indirect and direct performance effects have their merits. Our analysis contributes to advancing this open research issue in showing that performance effects are discernibly different for the individual DCSIs sensing, seizing and reconfiguring. Adopting this more differentiated look at DCSIs could help advance the to date unresolved debate on their performance effects.

To summarise, we have integrated several of the key relationships and contingencies of DCSIs into one model. By proposing and empirically testing this integrated model, we believe we have made a worthwhile contribution to the development of DCSI research.

7.2. Managerial Implications

Our research results suggest that a firm's DCSIs – captured in our study as sensing, seizing and reconfiguring – can contribute positively to firm-level performance. This is the case both through direct effects on market and financial performance and through increases in the introduction of new services to the market.

Executives engaged in SI can use the results of this study towards a number of ends. They can utilise the results on the DCSIs-performance relationships to better understand how the aspects of their firm's DCSIs influence performance. This offers an important basis for developing and advancing SI performance measurement systems. As our exploratory analyses suggest, performance measures for SI are strongly context dependent and they need to exhibit a good fit with the firm's situation in order to be effective and not to stifle innovation. Our results can help build apprehension of which performance effects to expect when investing in a firm's DCSIs.

Investing in the firm's seizing capability through expediting development related decisions for example can be expected to show positive effects both in the introduction of new services and in the performance of the firm. According to our results, investing in the firm's sensing capability on the other hand will not show direct performance results. Of course this does not mean that investments into this DCSI are not useful – it could be argued that it is a necessary precondition for all following activities in the SI process, which are captured by the other DCSIs.

The analysed relationships between the individual microfoundations and the DCSIs offer a basis for challenging and focusing attention and resource investments for fostering a firm's DCSIs. The DCSIs sensing, seizing and reconfiguring can be considered as associated with phases in the flow of an SI process. Consequently, SI responsables could use the DCSI constructs as an approximation to evaluate their current process maturity performance and to draw corresponding conclusions for investments.

For example, in order to foster the DCSI reconfiguring – associated with the later phases in an innovation process – the results suggest to direct attention towards external collaboration and knowledge exchange and learning. This could increase information inflow via the firm's collaboration partners as well as idea development through improved knowledge exchange inside the firm.

In order to take a structured approach to developing their firm's DCSIs, executives could take our research model and the associated measurement models as a basis for a DCSI assessment and benchmarking tool. By continuously assessing their DCSIs, they will be able to measure the impact of their intended investments into their firm's potential to innovate. Furthermore, this could be used for benchmarking developments for example between different subsidiaries of one firm. In order to reduce the effort associated with the continuous application of such a tool, firms could look into applying and extending the presented text mining approach for assessing DCSIs.

7.3. Limitations and Avenues for Future Research

Due to the nature of its design, this study exhibits several limitations. We relied on self-reported data, which means that respondents could appraise the maturity of their firm on individual constructs differently depending on their respective views. It is particularly important to point out that with our key informants we used the same data source for both the independent and for the dependent variables. Additionally, social desirability could potentially influence respondents' answers. This issue could be alleviated in future studies by triangulating responses with additional data. Possible data sources would be externally reported objective performance data, firm profiles published by third parties, firm internal documents and respondents from collaboration partners. Future studies could also retry to collect multiple responses per firm.

Data triangulation could also be supported by the use of text mining approaches, such as the one presented in Section 3.1 in order to make results on DCSIs more robust. In order to further develop such approaches, researchers will need to address a number of issues. Existing dictionaries will need to be augmented with SI-specific terminology. This is even more important for advancing semantic analysis. We have presented a demonstrator for the collaboration aspects of DCSIs in our exploratory analysis – expanding this to all aspects will require the elaboration and description of a large number of scenarios. Studies will also need to incorporate further analysis techniques, such as sentiment analysis, in order to increase the robustness of the results achieved.

We used a cross-sectional as opposed to a longitudinal design. This offers a number of advantages, however, it did not allow us to verify temporal developments – for example the results of a firm's investments into particular microfoundations. Future longitudinal studies could aim to improve our understanding of the evolutionary paths of DCSIs and of their sustainable effects on other key variables for the firm. Furthermore, a longitudinal study design would allow to illuminate a path between DCSIs and firm performance not tested here. Thereby, it has been suggested that performance effects could arise not directly from DCSIs, but from how firms are employing their DCSIs to reconfigure their RB (Barreto, 2010).

We have investigated the relationship between DCSIs and firm performance. Utilising firm performance as an outcome variable is common practice in research on

the DCV, since extensive empirical operationalisations of competitive advantage are arguably difficult to realise. Furthermore, the construct firm performance addresses many important aspects of competitive advantage. However, as pointed out by Newbert (2007), there is a conceptual distinction between firm performance and competitive advantage, which could be addressed by future DCSI studies.

Another issue concerns the role of environmental dynamism as a moderator between DCSIs and the outcome variables, for which we did not find any significant effects. We consider this a limitation of this study that should be addressed by future work in different settings in order to advance our understanding of the contingencies of a firm's DCSIs. The last years have seen an increasing number of empirical studies on the the DCV, but many aspects of the theory still need convergence, empirical testing and confirmation. This is particularly true for the still emergent DCSI research area.

Empirical studies could further address and test the theoretical work published on the performance effects of DCs relative to those of the firm's RB. Additional work could help further our understanding of the specific microfoundations of DCSIs and their importance to firms. Effectively, microfoundations are where SI responsables can direct their attention, resources and investments, so additional knowledge in this area should help increase innovation results markedly. One particular aspect that our exploratory analyses have touched upon is the role of innovation performance management for a firm's DCSIs and for the resulting innovation activities. Future studies could dive deeper into this topic and could help illuminate success factors for firms in designing effective innovation performance management systems. Future studies could also purposefully include further aspects of adjacent and related theories, such as knowledge management, corporate entrepreneurship and organisational studies.

We would recommend to use the proposed model or elements of it as basis for repeat and confirmation studies. Repeat studies could incorporate an analysis of differences between KIBS and other service sectors. In this context it seems particularly interesting to include sectors in transition from a production model to a hybrid or service model and to record what these firms and the more traditionally service-oriented sectors can learn from each other. Since data for this study was collected in Germany, Austria and Switzerland, future studies could include different geographies and analyse country- and culture-specific differences around DCSIs.

We would also like to recommend to further close the loop between DCSI research and SI professionals by incorporating design science approaches (Hevner et al., 2004) into future studies. This could help substantiate the usefulness of such models for guiding and evaluating actions to develop DCSIs in firms.

We are confident that research on DCSI is developing well. By taking these recommendations into account for future studies, research will be able to substantiate the realisation of sustained performance effects and to help executives actively develop their firms' DCSI.

Bibliography

- Adams, R., Bessant, J., and Phelps, R. (2006). Innovation management measurement: A review. *International Journal of Management Reviews*, 8(1):21–47.
- Agarwal, R. and Selen, W. (2009). Dynamic capability building in service value networks for achieving service innovation. *Decision Sciences*, 40(3):431–475.
- Agarwal, R. and Selen, W. (2011). Multi-dimensional nature of service innovation: Operationalisation of the elevated service offerings construct in collaborative service organisations. *International Journal of Operations & Production Management*, 31(11):1164–1192.
- Agarwal, R. and Selen, W. (2013). The incremental and cumulative effects of dynamic capability building on service innovation in collaborative service organizations. *Journal of Management & Organization*, 19(5):521–543.
- Akman, G. and Yilmaz, C. (2008). Innovative capability, innovation strategy and market orientation: An empirical analysis in turkish software industry. *International Journal of Innovation Management*, 12(1):69–111.
- Alegre, J. and Chiva, R. (2008). Assessing the impact of organizational learning capability on product innovation performance: An empirical test. *Technovation*, 28(6):315–326.
- Allred, C. R., Fawcett, S. E., Wallin, C., and M., M. G. (2011). A dynamic collaboration capability as a source of competitive advantage. *Decision Sciences*, 42(1):129–161.
- Amara, N., Landry, R., and Doloreux, D. (2009). Patterns of innovation in knowledge-intensive business services. *The Service Industries Journal*, 29(4):407–430.
- Amara, N., Landry, R., and Traoré, N. (2008). Managing the protection of innovations in knowledge-intensive business services. *Research Policy*, 37(9):1530–1547.
- Ambrosini, V. and Bowman, C. (2009). What are dynamic capabilities and are they a useful construct in strategic management? *International Journal of Management Reviews*, 11(1):29–49.

- Ambrosini, V., Bowman, C., and Collier, N. (2009). Dynamic capabilities: An exploration of how firms renew their resource base. *British Journal of Management*, 20(S1):S9–S24.
- Anand, J., Oriani, R., and Vassolo, R. S. (2010). Alliance activity as a dynamic capability in the face of a discontinuous technological change. *Organization Science*, 21(6):1213–1232.
- Armstrong, J. S. and Overton, T. S. (1977). Estimating nonresponse bias in mail surveys. *Journal of Marketing Research*, 14(3):396 – 402.
- Assink, M. (2006). Inhibitors of disruptive innovation capability: a conceptual model. *European Journal of Innovation Management*, 9(2):215–233.
- Atuahene-Gima, K. (2005). Resolving the capability-rigidity paradox in new product innovation. *Journal of Marketing*, 69(4):61–83.
- Augier, M. and Teece, D. J. (2008). Strategy as evolution with design: The foundations of dynamic capabilities and the role of managers in the economic system. *Organization Studies*, 29(08 & 09):1187–1208.
- Augier, M. and Teece, D. J. (2009). Dynamic capabilities and the role of managers in business strategy and economic performance. *Organization Science*, 20(2):410–421.
- Bagozzi, R. P. and Yi, Y. (1988). On the evaluation of structural equation models. *Journal of the Academy of Marketing Science*, 16(1):74–97.
- Barney, J. B. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1):99–120.
- Barney, J. B. (2001). Resource-based theories of competitive advantage: A ten-year retrospective on the resource-based view. *Journal of Management*, 27(6):643–650.
- Barreto, I. (2010). Dynamic capabilities: A review of past research and an agenda for the future. *Journal of Management*, 36(1):256–280.
- BCG (2013). Innovation 2010.
- Bettencourt, L. A., Ostrom, A. L., Brown, S. W., and Roundtree, R. I. (2002). Client co-production in knowledge-intensive business services. *California Management Review*, 44(4):100–128.
- Bird, S., Klein, E., and Loper, E. (2009). *Natural language processing with python*. O’Reilly, Sebastopol, CA.
- Bitar, J. and Hafsi, T. (2007). Strategizing through the capability lens: sources and outcomes of integration. *Management Decision*, 45(3):403–419.
- Borch, O. J. and Madsen, E. L. (2007). Dynamic capabilities facilitating innovative strategies in smes. *International Journal of Technoentrepreneurship*, 1(1):109–125.

- Branzei, O. and Vertinsky, I. (2006). Strategic pathways to product innovation capabilities in smes. *Journal of Business Venturing*, 21(1):75–105.
- Brettel, M. and Cleven, N. J. (2011). Innovation culture, collaboration with external partners and npd performance. *Creativity and Innovation Management*, 20(4):253–272.
- Burgess, R. G. (1984). *In the Field: An Introduction to Field Research*. Allen & Unwin, London, UK.
- Calantone, R. J., Cavusgil, S. T., and Zhao, Y. (2002). Learning orientation, firm innovation capability, and firm performance. *Industrial Marketing Management*, 31(6):515–524.
- Camacho, J. A. and Rodríguez, M. (2005). How innovative are services? an empirical analysis for spain. *The Service Industries Journal*, 25(2):253–271.
- Chen, C.-L. and Jaw, Y.-L. (2009). Building global dynamic capabilities through innovation: A case study of taiwan’s cultural organizations. *Journal of Engineering and Technology Management*, 26(4):247–263.
- Chesbrough, H. W. (2010). *Open services innovation: Rethinking your business to grow and compete in a new era*. John Wiley & Sons, San Francisco, CA, 1st edition.
- Chien, S.-Y. and Tsai, C.-H. (2012). Dynamic capability, knowledge, learning, and firm performance. *Journal of Organizational Change Management*, 25(3):434–444.
- Collis, D. J. (1994). Research note: How valuable are organizational capabilities? *Strategic Management Journal*, 15(Special Issue: Organizational Behavior):143–152.
- Consoli, D. and Elche-Hortelano, D. (2010). Variety in the knowledge base of knowledge intensive business services. *Research Policy*, 39(10):1303–1310.
- Coombs, R. and Miles, I. (2000). Innovation, measurement and services: The new problematique. In Metcalfe, J. S. and Miles, I., editors, *Innovation Systems in the Service Economy - Measurement and Case Study Analysis*, pages 85–103. Springer, 2nd edition.
- Corbin, J. and Strauss, A. (2014). *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*. Sage Publications, 4th edition.
- Cramer, J. (2002). Grundlagen wissensintensiver dienstleistungen. In Hermann, S., editor, *Wissensintegration und -koordination: Schlüsselkompetenzen wissensintensiver Dienstleistungsunternehmen*, Zwischenbericht aus dem BMBF-Verbundprojekt SIAM ‘Strategien, Instrumente und arbeitsorganisatorische Gestaltungsmodelle zur Förderung der Dienstleistungskompetenz in Unternehmen’ 2, pages 11–18. Fraunhofer IRB Verlag, Stuttgart, Germany.

- Damanpour, F. (1991). Organizational innovation: A meta-analysis of effects of determinants and moderators. *Academy of Management Journal*, 34(3):555–590.
- Danneels, E. (2008). Organizational antecedents of second-order competences. *Strategic Management Journal*, 29(5):519–543.
- Datta, D. K., Guthrie, J. P., and Wright, P. M. (2005). Human resource management and labor productivity: Does industry matter? *Academy of Management Journal*, 48(1):135 – 145.
- Davenport, T. H. and Harris, J. G. (2007). *Competing on analytics: The new science of winning*. Harvard Business Press.
- de Jong, J. P. J. and Kemp, R. (2003). Determinants of co-workers' innovative behaviour: An investigation into knowledge intensive services. *International Journal of Innovation Management*, 7(2):189–212.
- D'Emidio, T., Dorton, D., and Duncan, E. (2015). Service innovation in a digital world. Technical report, McKinsey.
- den Hertog, P. (2000). Knowledge-intensive business services as co-producers of innovation. *International Journal of Innovation Management*, 4(4):491–528.
- den Hertog, P., van der Aa, W., and de Jong, M. W. (2010). Capabilities for managing service innovation: towards a conceptual framework. *Journal of Service Management*, 21(4):490–514.
- Desmarchelier, B., Djellal, F., and Gallouj, F. (2013). Knowledge intensive business services and long term growth. *Structural Change and Economic Dynamics*, 25:188–205.
- DeVellis, R. F. (2011). *Scale Development: Theory and Applications*. Applied Social Research Methods. Sage Publications, 3rd edition.
- Devers, K. J. and Frankel, R. M. (2000). Study design in qualitative research – 2: Sampling and data collection strategies. *Education for Health*, 13(2):263–271.
- Di Stefano, G., Peteraf, M. A., and Verona, G. (2010). Dynamic capabilities deconstructed: a bibliographic investigation into the origins, development, and future directions of the research domain. *Industrial and Corporate Change*, 19(4):1187–1204.
- Dillman, D. A. (1978). *Mail and Telephone Surveys - The Total Design Method*. John Wiley & Sons, New York, USA.
- Djellal, F. and Gallouj, F. (2001). Patterns of innovation organisation in service firms: postal survey results and theoretical models. *Science and Public Policy*, 28(1):57–67.

- Doloreux, D. and Shearmur, R. (2012). Collaboration, information and the geography of innovation in knowledge intensive business services. *Journal of Economic Geography*, 12(1):79–105.
- Drejer, I. (2004). Identifying innovation in surveys of services: a schumpeterian perspective. *Research Policy*, 33(3):551–562.
- Drnevich, P. L. and Kriauciunas, A. P. (2011). Clarifying the conditions and limits of the contributions of ordinary and dynamic capabilities to relative firm performance. *Strategic Management Journal*, 32(3):254–279.
- Droege, H., Hildebrand, D., and Forcada, M. A. H. (2009). Innovation in services: present findings, and future pathways. *Journal of Service Management*, 20(2):131–155.
- Drucker, P. F. (1984). The discipline of innovation. *Harvard Business Review*, 63(3):67–72.
- Drucker, P. F. (1999). Knowledge-worker productivity: The biggest challenge. *California Management Review*, 41(2):79–94.
- Eisenhardt, K. M. and Martin, J. A. (2000). Dynamic capabilities: What are they? *Strategic Management Journal*, 21(10–11):1105–1121.
- Eriksson, T. (2014). Processes, antecedents and outcomes of dynamic capabilities. *Scandinavian Journal of Management*, 30(1):65–82.
- Essmann, H. E. and Du Preez, N. (2009). An innovation capability maturity model: Development and initial application. *World Academy of Science, Engineering and Technology*, 53:435–446.
- European Union Commission (2003). Commission recommendation of 6 may 2003 concerning the definition of micro, small and medium-sized enterprises. *Official Journal of the European Union*, 46:36–41.
- Fornell, C. and Larcker, D. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1):39–50.
- Fromm, H., Habryn, F., and Satzger, G. (2012). Service analytics: leveraging data across enterprise boundaries for competitive advantage. In *Globalization of Professional Services*, pages 139–149. Springer.
- Gadrey, J., Gallouj, F., and Weinstein, O. (1995). New modes of innovation: How services benefit industry. *International Journal of Service Industry Management*, 6(3):4–16.
- Gallouj, F. (2000). Knowledge-intensive business services: Processing knowledge and producing innovation. In *Economics and socioeconomics of services international conference*, Lille, France.

- Gallouj, F. (2002). *Innovation in the service economy: the new wealth of nations*. Edward Elgar Publishing, Glos, UK; Northampton, Mass.
- Gopalakrishnan, S. and Damanpour, F. (1997). A review of innovation research in economics, sociology and technology management. *International Journal of Management Science*, 25(1):15–28.
- Griffith, D. A. and Harvey, M. G. (2001). A resource perspective of global dynamic capabilities. *Journal of International Business Studies*, 32(3):597–606.
- Griffith, D. A., Noble, S. M., and Chen, Q. (2006). The performance implications of entrepreneurial proclivity: A dynamic capabilities approach. *Journal of Retailing*, 82(1):51–62.
- Grönroos, C. (2006). Adopting a service logic for marketing. *Marketing Theory*, 6(3):317–333.
- Hagedoorn, J. and Cloudt, M. (2003). Measuring innovative performance: is there an advantage in using multiple indicators? *Research Policy*, 32(8):1365–1379.
- Hauser, J., Tellis, G. J., and Griffin, A. (2006). Research on innovation: A review and agenda for marketing science. *Marketing Science*, 25(6):687–717.
- Hayton, J. C. (2003). Strategic human capital management in smes: An empirical study of entrepreneurial performance. *Human Resource Management*, 42(4):375–391.
- Heggestuen, J. (2014). Starbucks generated over \$1 billion from mobile transactions last year. <http://www.businessinsider.com/mobile-payments-at-starbucks-explode-in-2013-passing-the-1-billion-mark-2-2014-1>. Accessed on 04/03/2014.
- Helfat, C. E. (1997). Know-How and Asset Complementarity and Dynamic Capability Accumulation: The Case of R&D. *Strategic Management Journal*, 18(5):339–360.
- Helfat, C. E., Finkelstein, S., Mitchell, W., Peteraf, M. A., Singh, H., Teece, D. J., and Winter, S. G. (2007). *Dynamic Capabilities: Understanding Strategic Change in Organizations*. Blackwell Publishing, Malden, MA, 1st edition.
- Henderson, R. M. and Clark, K. B. (1990). Architectural innovation: The reconfiguration of existing product technologies and the failure of established firms. *Administrative Science Quarterly*, 35(1):9–30.
- Herrmann, A., Gassmann, O., and Eisert, U. (2007). An empirical study of the antecedents for radical product innovations and capabilities for transformation. *Journal of Engineering and Technology Management*, 24(1):92–120.
- Hess, A. M. and Rothaermel, F. T. (2011). When are assets complementary? star scientists, strategic alliances, and innovation in the pharmaceutical industry. *Strategic Management Journal*, 32(8):895–909.

- Hevner, A. R., March, S. T., and Ram, S. (2004). Design science in information systems research. *MIS Quarterly*, 28(1):75–105.
- Hinkin, T. R. (1998). A brief tutorial on the development of measures for use in survey questionnaires. *Organizational Research Methods*, 1(1):104–121.
- Hipp, C. and Grupp, H. (2005). Innovation in the service sector: The demand for service-specific innovation measurement concepts and typologies. *Research Policy*, 34(4):517–535.
- Hogan, S. J., Soutar, G. N., McColl-Kennedy, J. R., and Sweeney, J. C. (2011). Reconceptualizing professional service firm innovation capability: Scale development. *Industrial Marketing Management*, 40(8):1264–1273.
- Homburg, C. and Klarmann, M. (2006). Die kausalanalyse in der empirischen betriebswirtschaftlichen forschung - problemfelder und anwendungsempfehlungen. *Die Betriebswirtschaft*, 66(6):727–748.
- Homburg, C., Klarmann, M., and Schmitt, J. (2010). Brand awareness in business markets: When is it related to firm performance? *International Journal of Research in Marketing*, 27(3):201 — 212.
- Hoopes, D. G. and Madsen, T. L. (2008). A capability-based view of competitive heterogeneity. *Industrial and Corporate Change*, 17(3):393–426.
- Hubbard, D. W. (2007). *How to Measure Anything: Finding the Value of “Intangibles” in Business*. John Wiley & Sons, Hoboken, NJ, 1st edition.
- Huber, G. P. and Power, D. J. (1985). Retrospective reports of strategic-level managers: Guidelines for increasing their accuracy. *Strategic Management Journal*, 6(2):171–180.
- Hult, G. T. M., Hurley, R. F., and Knight, G. A. (2004). Innovativeness: Its antecedents and impact on business performance. *Industrial Marketing Management*, 33(5):429–438.
- Hult, T. M., Ketchen Jr., D. J., and Slater, S. F. (2005). Market orientation and performance: An integration of disparate approaches. *Strategic Management Journal*, 26(12):1173–1181.
- Hurley, R. F. and Hult, T. M. (1998). Innovation, market orientation, and organizational learning: An integration and empirical examination. *Journal of Marketing*, 62:42–54.
- Jansen, J. J., Vera, D., and Crossan, M. (2009). Strategic leadership for exploration and exploitation: The moderating role of environmental dynamism. *The Leadership Quarterly*, 20(1):5 — 18.

- Janssen, M., Castaldi, C., and Alexiev, A. (2014). Dynamic capabilities for service innovation: Conceptualization and measurement. Working paper 14.07, Eindhoven Centre for Innovation Studies (ECIS), School of Innovation Sciences, Eindhoven University of Technology, Eindhoven, The Netherlands.
- Jaworski, B. J. and Kohli, A. K. (1993). Market orientation: Antecedents and consequences. *Journal of Marketing*, 57(3):53–70.
- Kabanoff, B. and Keegan, J. (2007). Studying strategic cognition by content analysis of annual reports: A validation involving firm innovation. In *Proceedings of the 21st ANZAM Conference: Managing Our Intellectual and Social Capital*, pages 1–14, Sydney, Australia.
- Kail, E. G. (2010). Leading in a vuca environment: C is for complexity. *Harvard Business Review*, December(3).
- Kelley, K., Clark, B., Brown, V., and Sitzia, J. (2003). Good practice in the conduct and reporting of survey research. *International Journal for Quality in Health Care*, 15(3):261–266.
- Keskin, H. (2006). Market orientation, learning orientation, and innovation capabilities in smes. *European Journal of Innovation Management*, 9(4):396–417.
- Kim, M., Song, J., and Triche, J. (2015). Toward an integrated framework for innovation in service: A resource-based view and dynamic capabilities approach. *Information Systems Frontiers*, 17(3):533–546.
- Kimbrough, S. O., Chou, C., Chen, Y.-T., and Lin, H. (2013). On developing indicators with text analytics: exploring concept vectors applied to english and chinese texts. *Information Systems and e-Business Management*, 12(3):385–415.
- Kindström, D. and Kowalkowski, C. (2009). Development of industrial service offerings: a process framework. *Journal of Service Management*, 20(2):156–172.
- Kindström, D., Kowalkowski, C., and Sandberg, E. (2013). Enabling service innovation: A dynamic capabilities approachabilities approach. *Journal of Business Research*, 66(8):1063–1073.
- Koch, A. and Stahlecker, T. (2006). Regional innovation systems and the foundation of knowledge intensive business services. a comparative study in bremen, munich, and stuttgart, germany. *European Planning Studies*, 14(2):123–145.
- Kohler, M., Feldmann, N., Habryn, F., and Satzger, G. (2013). Service innovation analytics: Towards assessment and monitoring of innovation capabilities in service firms. In *46th Hawaii International Conference on System Sciences*. IEEE Computer Society.
- Kohler, M., Feldmann, N., Kimbrough, S. O., and Fromm, H. (2014). Service innovation analytics: Leveraging existing unstructured data to assess service innovation capability. *International Journal of Information System Modeling and Design*, 5(2):1–21.

- Kostopoulos, K., Papalexandris, A., Papachroni, M., and Ioannou, G. (2011). Absorptive capacity, innovation, and financial performance. *Journal of Business Research*, 64(12):1335–1343.
- Krasnikov, A. and Jayachandran, S. (2008). The relative impact of marketing, research-and-development, and operations capabilities on firm performance. *Journal of Marketing*, 72(4):1–11.
- Kumar, N., Stern, L. W., and Anderson, J. C. (1993). Conducting interorganizational research using key informants. *The Academy of Management Journal*, 36(6):1633–1651.
- Kyläheiko, K. and Sandström, J. (2007). Strategic options-based framework for management of dynamic capabilities in manufacturing firms. *Journal of Manufacturing Technology Management*, 18(8):966–984.
- Lavie, D. (2006). The competitive advantage of interconnected firms: An extension of the resource-based view. *The Academy of Management Review*, 31(3):638–658.
- Lawson, B. and Samson, D. (2001). Developing innovation capability in organisations: A dynamic capabilities approach. *International Journal of Innovation Management*, 5(3):377–400.
- Lepak, D. P. and Snell, S. A. (2002). Examining the human resource architecture: The relationships among human capital, employment, and human resource configurations. *Journal of Management*, 28(4):517–543.
- Li, D.-Y. and Liu, J. (2014). Dynamic capabilities, environmental dynamism, and competitive advantage: Evidence from china. *Journal of Business Research*, 67(1):2793–2799.
- Liao, S.-H., Fei, W.-C., and Chen, C.-C. (2007). Knowledge sharing, absorptive capacity, and innovation capability: an empirical study of taiwan’s knowledge-intensive industries. *Journal of Information Science*, 33(3):340–359.
- Lin, Y. and Wu, L.-Y. (2014). Exploring the role of dynamic capabilities in firm performance under the resource-based view framework. *Journal of Business Research*, 67(3):407–413.
- Lisboa, A., Skarmeas, D., and Lages, C. (2011). Innovative capabilities: Their drivers and effects on current and future performance. *Journal of Business Research*, 64(11):1157–1161.
- Lusch, R. F. and Nambisan, S. (2015). Service innovation: A service-dominant logic perspective. *MIS Quarterly*, 39(1):155–175.
- MacKenzie, S. B., Podsakoff, P. M., and Podsakoff, N. P. (2011). Construct measurement and validation procedures in mis and behavioral research: Integrating new and existing techniques. *MIS Quarterly*, 35(2):293–334.

- Manning, C. D., Raghavan, P., and Schütze, H. (2008). *Introduction to Information Retrieval*. Cambridge University Press, Cambridge, UK.
- March, J. G. and Simon, H. A. (1958). *Organizations*. Wiley, New York, USA.
- Marsh, S. J. and Stock, G. N. (2006). Creating dynamic capability: The role of intertemporal integration, knowledge retention, and interpretation. *Journal of Product Innovation Management*, 23(5):422–436.
- Mason, J. (2002). *Qualitative Researching*. Sage Publications, London, UK.
- Menguc, B. and Auh, S. (2006). Creating a firm-level dynamic capability through capitalizing on market orientation and innovativeness. *Journal of the Academy of Marketing Science*, 34(1):63–73.
- Miles, I. (2005). Knowledge intensive business services: prospects and policies. *Foresight*, 7(6):39–63.
- Miles, I. (2008). Patterns of innovation in service industries. *IBM Systems Journal*, 47(1):115–128.
- Miles, I., Kastrinos, N., Flanagan, K., Bilderbeek, R., den Hertog, P., Huntink, W., and Bouman, M. (1995). Knowledge-intensive business services: Users, carriers and sources of innovation. A report to dg13 sprint-eims, University of Manchester.
- Miozzo, M. and Grimshaw, D. (2005). Modularity and innovation in knowledge-intensive business services: It outsourcing in germany and the uk. *Research Policy*, 34(9):1419–1439.
- Mizik, N. and Jacobson, R. (2003). Trading off between value creation and value appropriation: The financial implications of shifts in strategic emphasis. *Journal of Marketing*, 67(1):63–76.
- Montealegre, R. (2002). A process model of capability development: Lessons from the electronic commerce strategy at bolsa de valores de guayaquil. *Organization Science*, 13(5):514–531.
- Muller, E. and Doloreux, D. (2007). The key dimensions of knowledge-intensive business services (kibs) analysis: a decade of evolution. Arbeitspapiere Unternehmen und Region U1/2007, Leibniz Information Centre for Economics.
- Muller, E. and Zenker, A. (2001). Business services as actors of knowledge transformation: the role of kibs in regional and national innovation systems. *Research Policy*, 30(9):1501–1516.
- Nardi, P. M. (2006). *Doing survey research: A guide to quantitative methods*. Pearson/Allyn and Bacon, Boston, MA, USA.; London, UK, 2nd edition.
- Narver, J. C. and Slater, S. F. (1990). The effect of a market orientation on business profitability. *Journal of Marketing*, 54(October):20–35.

- Neely, A. (2007). The servitization of manufacturing: An analysis of global trends. In *14th European Operations Management Association Conference*, pages 1–10, Ankara, Turkey.
- Neely, A., Filippini, R., Forza, C., Vinelli, A., and Hii, J. (2001). A framework for analysing business performance, firm innovation and related contextual factors: perceptions of managers and policy makers in two european regions. *Integrated Manufacturing Systems*, 12(2):114–124.
- Newbert, S. L. (2005). New firm formation: A dynamic capability perspective. 43(1):55–77.
- Newbert, S. L. (2007). Empirical research on the resource-based view of the firm: An assessment and suggestions for future research. *Strategic Management Journal*, 28(2):121–146.
- Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization Science*, 5(1):14–37.
- O’Brien, J. P. (2003). The capital structure implications of pursuing a strategy of innovation. *Strategic Management Journal*, 24(5):415–431.
- O’Connor, G. C. (2008). Major innovation as a dynamic capability: A systems approach. *Journal of Product Innovation Management*, 25(4):313–330.
- OECD (2005). Enhancing the performance of the services sector. Technical report, OECD, Paris.
- Ordanini, A. and Parasuraman, A. (2011). Service innovation viewed through a service-dominant logic lens: A conceptual framework and empirical analysis. *Journal of Service Research*, 14(1):3–23.
- O’Reilly, C. A. I. and Tushman, M. L. (2008). Ambidexterity as a dynamic capability: Resolving the innovator’s dilemma. *Research in Organizational Behavior*, 28:185–206.
- Ostrom, A. L., Bitner, M. J., Brown, S. W., Burkhard, K. A., Goul, M., Smith-Daniels, V., Demirkan, H., and Rabinovich, E. (2010). Moving forward and making a difference: Research priorities for the science of service. *Journal of Service Research*, 13(1):4–36.
- Ostrom, A. L., Parasuraman, A., Bowen, D. E., Patrício, L., and Voss, C. A. (2015). Service research priorities in a rapidly changing context. *Journal of Service Research*, 18(2):127–159.
- Parnes, H. S. (1984). *People Power*. Sage Publications, Beverly Hills, CA.
- Pasteels, I. (2015). How to weight survey data with a dyadic multi-actor design? *Survey Insights: Methods from the Field*, Special Issue:1–11.

- Patrakosol, B. and Olson, D. L. (2007). How interfirm collaboration benefits it innovation. *Information & Management*, 44(1):53–62.
- Pavlou, P. A. and El Sawy, O. A. (2011). Understanding the elusive black box of dynamic capabilities. *Decision Sciences*, 42(1):239–273.
- Penrose, E. E. (1959). *The Theory of the Growth of the Firm*. Oxford University Press, Oxford, UK.
- Priem, R. L. and Butler, J. E. (2001a). Is the resource-based "view" a useful perspective for strategic management research? *Academy of Management Review*, 26(1):22–40.
- Priem, R. L. and Butler, J. E. (2001b). Tautology in the resource-based view and the implications of externally determined resource value: Further comments. *Academy of Management Review*, 26(1):57–66.
- Prieto, I. M., Revilla, E., and Rodríguez-Prado, B. (2009). Building dynamic capabilities in product development: How do contextual antecedents matter? *Scandinavian Journal of Management*, 25(3):313–326.
- Rosner, M. M. (1968). Economic determinants of organizational innovation. *Administrative Science Quarterly*, 12(4):614–625.
- Rosseel, Y. (2012). lavaan: An r package for structural equation modeling. *Journal of Statistical Software*, 48(2):1–36.
- Ruscio, J. and Kaczetow, W. (2008). Simulating multivariate nonnormal data using an iterative algorithm. *Multivariate Behavioral Research*, 43(3):355–381.
- Salter, A. and Tether, B. S. (2006). Innovation in services - through the looking glass of innovation studies. Technical report, Tanaka Business School, Imperial College, London.
- Salunke, S., Weerawardena, J., and McColl-Kennedy, J. R. (2013). Competing through service innovation: The role of bricolage and entrepreneurship in project-oriented firms. *Journal of Business Research*, 66(8):1085–1097.
- Schmenner, R. W. (1986). How can service businesses survive and prosper? *Sloan Management Review*, 27(3):21–32.
- Schumpeter, J. (2013). *Theorie der wirtschaftlichen Entwicklung: Eine Untersuchung über Unternehmergewinn, Kapital, Kredit, Zins und den Konjunkturzyklus (1926)*. Duncker Humblot, 9th edition.
- Sheatsley, P. B. (1983). Questionnaire construction and item writing. In Rossi, P. H., Wright, J. D., and Anderson, A. B., editors, *Handbook of Survey Research*, Quantitative Studies in Social Relations, pages 195–230. Academic Press, New York, USA.

- Sher, P. J. and Lee, V. C. (2004). Information technology as a facilitator for enhancing dynamic capabilities through knowledge management. *Information & Management*, 41(8):933–945.
- Siguaw, J. A., Simpson, P. M., and Enz, C. A. (2006). Conceptualizing innovation orientation: A framework for study and integration of innovation research. *Journal of Product Innovation Management*, 23(6):556–574.
- Simpson, P. M., Siguaw, J. A., and Enz, C. A. (2006). Innovation orientation outcomes: The good and the bad. *Journal of Business Research*, 59(10):1133–1141.
- Smith, K. G., Collins, C. J., and Clark, K. D. (2005). Existing knowledge, knowledge creation capability, and the rate of new product introduction. *The Academy of Management Journal*, 48(2):346–357.
- Snell, S. A. and Dean Jr., J. W. (1992). Integrated manufacturing and human resource management: A human capital perspective. *Academy of Management Journal*, 35(3):467–504.
- Spanos, Y. E. and Lioukas, S. (2001). An examination into the causal logic of rent generation: contrasting porter’s competitive strategy framework and the resource-based perspective. *Strategic Management Journal*, 22(10):907–934.
- Subramony, M. and Pugh, S. D. (2015). Services management research: Review, integration, and future directions. *Journal of Management*, 41(1):349–373.
- Sudman, S. (1983). Applied sampling. In Rossi, P. H., Wright, J. D., and Anderson, A. B., editors, *Handbook of Survey Research*, Quantitative Studies in Social Relations, pages 145–194. Academic Press, New York, USA.
- Sundbo, J. (1996). The balancing of empowerment - a strategic resource based model of organizing innovation activities in service and low-tech firms. *Technovation*, 16(8):397–409.
- Sundbo, J. (1997). Management of innovation in services. *The Service Industries Journal*, 17(3):432–455.
- Szeto, E. (2000). Innovation capacity: working towards a mechanism for improving innovation within an inter-organizational network. *The TQM Magazine*, 12(2):149–158.
- Teece, D. J. (2003). Expert talent and the design of (professional services) firms. *Industrial and Corporate Change*, 12(4):895–916.
- Teece, D. J. (2007a). Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal*, 28(13):1319–1350.

- Teece, D. J. (2007b). The role of managers, entrepreneurs and the literati in enterprise performance and economic growth. *International Journal of Technological Learning, Innovation and Development*, 1(1):43–64.
- Teece, D. J. (2009). *Dynamic Capabilities and Strategic Management: Organizing for Innovation and Growth*. Oxford University Press, New York.
- Teece, D. J. (2012). Dynamic capabilities: Routines versus entrepreneurial action. *Journal of Management Studies*, 49(8):1395–1401.
- Teece, D. J. and Pisano, G. (1994). The dynamic capabilities of firms: an introduction. *Industrial and Corporate Change*, 3(3):537–556.
- Teece, D. J., Pisano, G., and Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18(7):509–533.
- Tellis, G. J., Prabhu, J. C., and Chandy, R. K. (2009). Radical innovation across nations: The preeminence of corporate culture. *Journal of Marketing*, 73(1):3–23.
- Tether, B. S. and Tajar, A. (2008). Beyond industry-university links: Sourcing knowledge for innovation from consultants, private research organisations and the public science-base. *Research Policy*, 37(6–7):1079–1095.
- Tidd, J. and Hull, F. M. (2006). Managing service innovation: the need for selectivity rather than 'best practice'. *New Technology, Work and Employment*, 21(2):139–161.
- Toivonen, M. (2004). *Expertise as business: Long-term development and future prospects of knowledge-intensive business services (KIBS)*. Dissertation for the degree of Doctor of Philosophy, Helsinki University of Technology, Espoo, Finland.
- Tushman, M. L. and O'Reilly, C. A. I. (1996). Ambidextrous organizations: Managing evolutionary and revolutionary change. *California Management Review*, 38(4):8–30.
- van den Hoven, J. (2001). Information resource management: Foundation for knowledge management. *Information Systems Management*, 18(2):1–4.
- Vargo, S. L. and Lusch, R. F. (2004). Evolving to a new dominant logic for marketing. *Journal of Marketing*, 68(1):1–17.
- Vargo, S. L., Maglio, P. P., and Akaka, M. A. (2008). On value and value co-creation: A service systems and service logic perspective. *European Management Journal*, 26(3):145–152.
- Villarroel Ordenes, F., Theodoulidis, B., Burton, J., Gruber, T., and Zaki, M. (2014). Analyzing customer experience feedback using text mining: A linguistics-based approach. *Journal of Service Research*, 17(3):278–295.

- Vogel, R. and Güttel, W. H. (2013). The dynamic capability view in strategic management: A bibliometric review. *International Journal of Management Reviews*, 15(4):426–446.
- Voorhees, C. M., Brady, M. K., Calantone, R., and Ramirez, E. (2016). Discriminant validity testing in marketing: an analysis, causes for concern, and proposed remedies. *Journal of the Academy of Marketing Science*, 44(1):119 — 134.
- Wang, C. L. and Ahmed, P. K. (2007). Dynamic capabilities: A review and research agenda. *International Journal of Management Reviews*, 9(1):31–51.
- Webster, J. and Watson, R. T. (2002). Analyzing the past to prepare for the future: Writing a literature review. *MIS Quarterly*, 26(2):xiii–xxiii.
- Weill, P. and Ross, J. W. (2004). *IT Governance: How Top Performers Manage IT Decision Rights for Superior Results*. Harvard Business Press.
- Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal*, 5(2):171–180.
- Wernerfelt, B. (1989). From critical resources to corporate strategy. *Journal of General Management*, 14(3):4–12.
- Williamson, O. E. (1999). Strategy research: Governance and competence perspectives. *Strategic Management Journal*, 20(12):1087–1108.
- Winter, S. G. (2003). Understanding dynamic capabilities. *Strategic Management Journal*, 24(10):991–995.
- Wolfe, R. A. (1994). Organizational innovation: Review, critique and suggested research directions. *Journal of Management Studies*, 31(3):405–431.
- Wu, L.-Y. (2007). Entrepreneurial resources, dynamic capabilities and start-up performance of taiwan’s high-tech firms. *Journal of Business Research*, 60(5):549–555.
- WZ (2008). Klassifikation der Wirtschaftszweige - Mit Erläuterungen. Technical Report Bestellnummer 3100100089004, Statistisches Bundesamt, Wiesbaden, Germany.
- Xu, Z., Lin, J., and Lin, D. (2008). Networking and innovation in smes: evidence from guangdong province, china. *Journal of Small Business and Enterprise Development*, 15(4):788–801.
- Yang, J. (2012). Innovation capability and corporate growth: An empirical investigation in china. *Journal of Engineering and Technology Management*, 29(1):34–46.
- Zahra, S. A. and George, G. (2002). Absorptive capacity: A review, reconceptualization, and extension. *The Academy of Management Review*, 27(2):185–203.

- Zahra, S. A., Sapienza, H. J., and Davidsson, P. (2006). Entrepreneurship and dynamic capabilities: A review, model and research agenda. *Journal of Management Studies*, 43(4):917–955.
- Zhang, J. A., Garrett-Jones, S., and Szeto, R. (2013). Innovation capability and market performance: The moderating effect of industry dynamism. *International Journal of Innovation Management*, 17(2):1350004–1–1350004–35.
- Zheng, S., Zhang, W., Wu, X., and Du, J. (2011). Knowledge-based dynamic capabilities and innovation in networked environments. *Journal of Knowledge Management*, 15(6):1035–1051.
- Zollo, M. and Winter, S. G. (2002). Deliberate learning and the evolution of dynamic capabilities. *Organization Science*, 13(3):339–351.

Appendix

A. Industries Included in the Sample

From the German classification of industries (WZ, 2008), industry categories that matched the consensus lists reported in Section 5.2 were selected. Table A.1 lists the categories that were included. The titles were translated into English by the author.

Table A.1.: Industry Categories Included in the Sample

Industry Code	Original Title	Translation of Title
62.01.9	Sonstige Softwareentwicklung	Other software development
62.02	Erbringung von Beratungsleistungen auf dem Gebiet der Informationstechnologie	IT consultancy
69.1	Rechtsberatung	Legal consultancy
69.2	Wirtschaftsprüfung und Steuerberatung	Auditing and tax consultancy
70	Verwaltung und Führung von Unternehmen und Betrieben; Unternehmensberatung	Administration and management of firms; Management consultancy
71	Architektur- und Ingenieurbüros	Architecture and engineering
72	Forschung und Entwicklung	Research and development
73	Werbung	Advertisement
73.20	Markt- und Meinungsforschung	Market and opinion research
74.10.1	Industrie-, Produkt und Mode-Design	Industrial, product and fashion design
74.10.2	Grafik- und Kommunikationsdesign	Graphic and communication design

B. R Environment Used

- R version 3.4.2 (2017-09-28), x86_64-apple-darwin15.6.0
- Locale:
en_US.UTF-8/en_US.UTF-8/en_US.UTF-8/C/en_US.UTF-8/en_US.UTF-8
- Running under: macOS High Sierra 10.13.1
- Matrix products: default
- BLAS: /System/Library/Frameworks/Accelerate.framework/Versions/A/Frameworks/vecLib.framework/Versions/A/libBLAS.dylib
- LAPACK: /Library/Frameworks/R.framework/Versions/3.4/Resources/lib/libRlapack.dylib
- Base packages: base, datasets, graphics, grDevices, methods, stats, utils
- Other packages: dummies 1.5.6, lavaan 0.5-23.1097, plyr 1.8.4, semPlot 1.1
- Loaded via a namespace (and not attached): abind 1.4-5, acepack 1.4.1, arm 1.9-3, backports 1.1.1, base64enc 0.1-3, BDgraph 2.41, boot 1.3-20, car 2.1-5, checkmate 1.8.5, cluster 2.0.6, coda 0.19-1, colorspace 1.3-2, compiler 3.4.2, corpcor 1.6.9, d3Network 0.5.2.1, data.table 1.10.4-3, digest 0.6.12, ellipse 0.3-8, fdrtool 1.2.15, foreign 0.8-69, Formula 1.2-2,

ggm 2.3, ggplot2 2.2.1, glasso 1.8, grid 3.4.2, gridExtra 2.3, gtable 0.2.0, gtools 3.5.0, Hmisc 4.0-3, htmlTable 1.9, htmltools 0.3.6, htmlwidgets 0.9, huge 1.2.7, igraph 1.1.2, jpeg 0.1-8, knitr 1.17, lattice 0.20-35, latticeExtra 0.6-28, lazyeval 0.2.0, lisrelToR 0.1.4, lme4 1.1-14, magrittr 1.5, MASS 7.3-47, Matrix 1.2-11, matrixcalc 1.0-3, MatrixModels 0.4-1, mgcv 1.8-22, mi 1.0, minqa 1.2.4, mnormt 1.5-5, munsell 0.4.3, network 1.13.0, nlme 3.1-131, nloptr 1.0.4, nnet 7.3-12, OpenMx 2.7.10, parallel 3.4.2, pbivnorm 0.6.0, pbkrtest 0.4-7, pkgconfig 2.0.1, png 0.1-7, psych 1.7.8, qgraph 1.4.4, quadprog 1.5-5, quantreg 5.34, RColorBrewer 1.1-2, Rcpp 0.12.13, reshape2 1.4.2, rjson 0.2.15, rlang 0.1.2, rockchalk 1.8.101, rpart 4.1-11, scales 0.5.0, sem 3.1-9, semTools 0.4-14, sna 2.4, SparseM 1.77, splines 3.4.2, statnet.common 4.0.0, stats4 3.4.2, stringi 1.1.5, stringr 1.2.0, survival 2.41-3, tibble 1.3.4, tools 3.4.2, whisker 0.3-2, XML 3.98-1.9

C. Full List of Measurement Items

- **Human capital:**

- Our employees are experts in their respective positions and areas.
- Our employees are considered the best in our sector.
- Our employees are very creative.
- Our employees develop a large number of new ideas.
- Training is considered as an investment in our firm rather than as cost.
- We facilitate high-value trainings for our employees.
- Our firm spends more money on training per employee than our competitors.
- In comparison to our competitors we hire a particularly large number of employees from renowned universities.
- In comparison to our competitors we hire employees with a particularly extensive work experience.
- Our firm receives more applications per external job advertisement than our competitors.
- Our firm fills open positions faster than our competitors.

- **Experimentation and risk-taking:**

- Our firm offers many incentives for employees to work on ideas for new services.
- Our employees are encouraged to take calculated risks in the development of new services.

- When employees pitch new ideas of their own initiative, colleagues frequently respond with “Yes, but ...”. (reverse coded)
- Our employees are opportunity oriented and like to pursue new ideas.
- Executives in our firm are ready to accept greater risks for the development of radical service innovations than for incremental improvements.
- Executives in our firm support the exploration of new areas even when failure can have significant financial consequences.
- Executives only pursue plans when they expect the risk of failure to be small. (reverse coded)
- In our firm, failure is considered an opportunity to learn.

● **Knowledge management:**

- When we need new capabilities or technologies, we are quick to establish the necessary employee knowledge.
- We are very good at closing the gap between our current knowledge and the knowledge needed for offering new services.
- In our firm, learning is considered a basis of survival in the long-run.
- Executives in our firm routinely stress the importance of passing on knowledge.
- Informal exchange and collaboration between departments is common in our firm.
- Our employees understand very well how the goals and activities across our entire firm are connected.
- We are very good at applying experiences from past projects to new projects.
- Information on innovation projects is regularly distributed across the firm through newsletters, seminars or similar channels.
- We conduct a formalised evaluation at the end of innovation projects in order to analyse successes and failures.

● **Degrees of freedom:**

- Our firm has disposable resources that can be quickly used for innovation projects.
- Executives in our firm have substantial resources at their disposal for financing innovation projects.
- Our firm has a sufficient level of financial resources available.
- We always find enough employees to staff the development of new services.

- There is strong mutual trust between employees and executives in our firm.
- Employees have the freedom to plan their time and activities on their own.
- Employees can make a large share of their decisions without asking their manager for permission.
- When employees violate processes and rules in order to successfully advance an innovation project, executives react sympathetically.
- **External collaboration:**
 - Our firm has finalised several agreements over the last three years for joint development with other firms.
 - Over the last three years, our firm has developed complementary services together with other firms.
 - We have introduced service innovations together with other firms over the last three years.
 - Our firm has established successful partnerships with other firms or start ups outside of our sector.
 - Our firm has established successful partnerships with universities or research institutes.
 - Employees in our firm have far reaching networks, even beyond our sector.
- **Market orientation:**
 - Our business goals are mainly directed at customer satisfaction.
 - Our strategy is oriented towards offering value to our customers.
 - We measure customer satisfaction systematically and frequently.
 - Our sales force routinely shares information on our competitors' strategies with each other.
 - Executives in our firm regularly discuss the strengths and strategies of our competitors.
 - The departments in our firm work together closely to fulfil the needs of our target markets.
 - The departments in our firm are easily accessible for mutual requirements and inquiries.
- **Sensing:**
 - We routinely search for new business opportunities in our environment.
 - We routinely reflect the foreseeable effects of changes in our environment on our customers and markets.

- We frequently check our innovation projects in order to ensure that they are addressing actual customer needs.
- We have established routines for identifying new target markets, segments, customer needs and innovations by customers.
- We very closely monitor the standards and best practices in our sector.
- **Seizing:**
 - Our firm can quickly implement new standards and best practices for our sector.
 - We can quickly change our business procedures when customers prompt us to.
 - Ideas brought up by customers, employees and partners are continuously evaluated and, if possible, converted into the development of new services.
 - We routinely pursue business opportunities and innovations that have been developed outside of our firm.
 - Our firm invests heavily in the development of new services for our customers.
- **Reconfiguring:**
 - In the past three years we have established several new management methods.
 - In the past three years we have used many new or significantly changed marketing methods.
 - In the past three years we have significantly developed our business procedures.
 - We are very good at deploying our employees and systems in order to provide new services.
 - We have clear procedures to assign employees to new services.
 - We are able to quickly react to the actions of our competitors.
 - Our firm is able to quickly react to changes in the market.
- **New service introduction:**
 - The introduction of new services by our firm has accelerated over the last three years.
 - Our firm is often the first to introduce new services to the market.
 - The introduction of new services by our firm often causes changes that competitors need to react to.
- **Market and financial performance:**

- Our customers are happier with our services than with those of our competitors.
 - Our customer base has grown faster than those of our competitors over the last three years.
 - We are more successful than our competitors in retaining regular customers.
 - The share of our service innovations that are successful in the market is larger than those of our competitors.
 - Our firm’s market share has grown faster over the last three years than those of our competitors.
 - Our revenue per customer has grown faster over the last three years than those of our competitors.
 - Our development costs for new services have reduced over the last three years.
 - Our firm’s profit margin has grown faster over the last three years than those of our competitors.
 - Which share of your firm’s current service revenue is from new services (introduced in the last three years)?
- **Environmental dynamism:**
- Demand in our sector is very unstable.
 - Our markets are subject to significant changes.
 - In our environment, new services are frequently introduced.
 - The attitudes and needs of our customers are subject to strong changes.
 - The challenges for our firm from environmental changes are easily foreseeable. (reverse coded)
 - There is strong revenue growth in our sector. (reverse coded)
 - Our business is very risky.
 - Our sector exhibits a hostile environment.
 - In our sector there is a particularly large number of competitors.
 - Customer needs in our sector are very diverse.
 - In our sector there is a very large choice of different services.

D. Questionnaire

The questionnaire used to administer the survey comprised four pages and was sent to recipients by mail, accompanied by a personalised cover letter. Since the survey was limited to Germany, Austria and Switzerland, the questionnaire was composed in German. The questionnaire is reproduced on the following pages in Figure D.1, Figure D.2, Figure D.3 and Figure D.4.

D. Questionnaire

SurveyGrid	Benchmark-Studie Dienstleistungsinnovation	 <small>Electric Paper EVALUATIONSTRENE</small>
Karlsruhe Service Research Institute (KSRI) Prof. Dr. Gerhard Satzger, Marc Kohler		
Bitte so markieren: <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		
Korrektur: <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>		

1. Einleitung

Vielen Dank, dass Sie sich Zeit für das Beantworten unseres Fragebogens nehmen!
Alle Antworten werden vertraulich behandelt. Ergebnisse werden nur aggregiert veröffentlicht und lassen keine Rückschlüsse auf Unternehmen und Personen zu. Die ID Ihres Fragebogens dient lediglich der korrekten Auswertung.
 Unter Umständen wird diese Studie zusätzlich durch eine weitere Person aus Ihrem Unternehmen beantwortet. In diesem Fall werden die Ergebnisse pro Unternehmen aggregiert, um die Aussagekraft des Benchmarks zu erhöhen.
Alle folgenden Fragen beziehen sich auf den Dienstleistungsbereich Ihres Unternehmens.
Bitte kreuzen Sie jeweils an, inwieweit die Aussagen auf den Dienstleistungsbereich zutreffen.

2. Potential: Innovationsfähigkeit im Dienstleistungsbereich

"Dienstleistungsinnovationen" und "neue Dienstleistungen" bezeichnen Angebote und Leistungen, die neu für die Märkte sind, in denen Ihr Unternehmen agiert. Dies kann Inhalte, Technologien oder Kundeninteraktion betreffen.

		1	2	3	4	5	6	7	
		Trifft überhaupt nicht zu						Trifft voll und ganz zu	
2.1	Wir suchen regelmäßig nach neuen Geschäftschancen in unserem Unternehmensumfeld.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2.2	Wir reflektieren regelmäßig die voraussichtlichen Auswirkungen von Veränderungen in unserem Umfeld auf unsere Kunden und Märkte.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2.3	Wir überprüfen häufig unsere Innovationsprojekte, um sicherzustellen, dass sie tatsächliche Kundenbedürfnisse adressieren.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2.4	Wir verfügen über etablierte Abläufe, um neue Zielmärkte und -segmente, veränderte Kundenbedürfnisse und Kundeninnovationen zu identifizieren.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2.5	Wir beobachten die Standards und Best Practices in unserer Branche sehr genau.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2.6	Unser Unternehmen kann neue Standards und Best Practices unserer Branche schnell umsetzen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2.7	Wir können unsere Geschäftsabläufe schnell verändern, wenn uns Kunden dazu anregen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2.8	Ideen, die von Kunden, Mitarbeitern und Partnern eingebracht werden, werden kontinuierlich evaluiert und, wenn möglich, in die Dienstleistungsentwicklung überführt.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2.9	Wir verfolgen regelmäßig Geschäftschancen und Innovationen, die außerhalb unseres Unternehmens entwickelt wurden.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2.10	Unser Unternehmen investiert stark in das Entwickeln von neuen Dienstleistungen für unsere Kunden.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2.11	Wir haben in den vergangenen drei Jahren einige neue Managementmethoden etabliert.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2.12	Wir haben in den vergangenen drei Jahren viele neue bzw. wesentlich veränderte Marketingmethoden eingesetzt.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2.13	Wir haben in den vergangenen drei Jahren unsere Geschäftsabläufe stark weiterentwickelt.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2.14	Wir sind sehr gut darin, unsere Mitarbeiter und Systeme neu einzusetzen, um neue Dienstleistungen anzubieten.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2.15	Wir haben klare Abläufe für die Zuordnung von Mitarbeitern zu neuen Dienstleistungen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2.16	Wir sind in der Lage, schnell auf Handlungen von Wettbewerbern zu reagieren.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2.17	Unser Unternehmen ist in der Lage, schnell auf Veränderungen im Markt zu reagieren.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

3. Zielgröße: Dienstleistungsinnovation und neue Märkte im Dienstleistungsbereich

3.1	Unsere Einführung von neuen Dienstleistungen hat sich über die letzten drei Jahre beschleunigt.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
-----	-------------------------------------------------------------------------------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------

F13061U54566P1PL1V1

27.08.2015, Seite 1/4



Figure D.1.: Questionnaire Page 1 of 4

SurveyGrid		Benchmark-Studie Dienstleistungsinnovation					Electric Paper EINLAGEKOPPIERT	
3. Zielgröße: Dienstleistungsinnovation und neue Märkte im Dienstleistungsbereich [Fortsetzung]								
		Trifft überhaupt nicht zu			Trifft voll und ganz zu			
		1	2	3	4	5	6	7
3.2	Unser Unternehmen bringt neuartige Dienstleistungen häufig als Erstes auf den Markt.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.3	Unser Unternehmen verursacht mit neuen Dienstleistungen häufig Veränderungen, auf die Wettbewerber reagieren müssen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.4	Unsere Kunden sind mit unseren Dienstleistungen zufriedener als mit denen unserer Wettbewerber.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.5	Unser Kundenstamm ist in den letzten drei Jahren stärker gewachsen als der unserer Wettbewerber.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.6	Wir sind erfolgreicher als unsere Wettbewerber im Halten von Bestandskunden.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.7	Der Anteil der am Markt erfolgreichen Dienstleistungsinnovationen unseres Unternehmens ist höher als der unserer Wettbewerber.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.8	Der Marktanteil unseres Unternehmens ist in den letzten drei Jahren stärker gewachsen als der unserer Wettbewerber.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.9	Unser Umsatz pro Kunde ist in den letzten drei Jahren stärker gewachsen als der unserer Wettbewerber.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.10	Unsere Entwicklungskosten für neue Dienstleistungen sind in den letzten drei Jahren gesunken.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.11	Die Gewinnmarge unseres Unternehmens ist in den letzten drei Jahren stärker gewachsen als die unserer Wettbewerber.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.12	Wie viel Prozent des aktuellen Dienstleistungsumsatzes Ihres Unternehmens stammen in etwa von neuen Dienstleistungen (in den letzten drei Jahren eingeführt)?	<input type="checkbox"/> < 20 %		<input type="checkbox"/> 20-39 %		<input type="checkbox"/> 40-59 %		
		<input type="checkbox"/> 60-79 %		<input type="checkbox"/> 80-100%				
4. Einflussfaktor: Qualifikation und Weiterentwicklung der Mitarbeiter im Dienstleistungsbereich								
4.1	Unsere Mitarbeiter sind Experten in ihren jeweiligen Funktionen und Tätigkeitsbereichen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2	Unsere Mitarbeiter gelten als die Besten in unserer Branche.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.3	Unsere Mitarbeiter sind sehr kreativ.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.4	Unsere Mitarbeiter entwickeln viele neue Ideen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.5	Weiterbildungen und Trainings werden in unserem Unternehmen als Investition angesehen, nicht als Kosten.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.6	Wir fördern hochwertige Weiterbildungen und Trainings für unsere Mitarbeiter.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.7	Unser Unternehmen gibt mehr Geld pro Mitarbeiter für Weiterentwicklung aus als unsere Wettbewerber.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.8	Im Vergleich zu Wettbewerbern stellen wir besonders viele Mitarbeiter von renommierten Universitäten ein.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.9	Im Vergleich zu Wettbewerbern stellen wir Mitarbeiter ein, die über besonders viel Berufserfahrung verfügen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.10	Unser Unternehmen erhält mehr Bewerbungen pro extern ausgeschriebener Stelle als unsere Wettbewerber.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.11	Unser Unternehmen besetzt offene Positionen schneller als unsere Wettbewerber.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Einflussfaktor: Experimentierfreudigkeit und Risikobereitschaft im Dienstleistungsbereich								
5.1	Unser Unternehmen stellt viele Anreize für Mitarbeiter zur Verfügung, an Ideen für neue Dienstleistungen zu arbeiten.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.2	Mitarbeiter werden ermutigt, bei der Entwicklung neuer Dienstleistungen kalkulierbare Risiken einzugehen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.3	Wenn Mitarbeiter aus Eigeninitiative neue Ideen vorstellen, reagieren Kollegen häufig mit „Ja, aber ...“.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.4	Unsere Mitarbeiter sind chancenorientiert und verfolgen gerne neue Ideen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.5	Führungskräfte in unserem Unternehmen sind bereit, für die Entwicklung von disruptiven neuen Dienstleistungen deutlich größere Risiken einzugehen als für inkrementelle Verbesserungen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.6	Führungskräfte in unserem Unternehmen fördern die Erprobung von Neuem, auch wenn das Scheitern deutliche finanzielle Konsequenzen haben kann.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

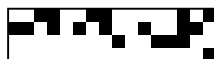


Figure D.2.: Questionnaire Page 2 of 4

D. Questionnaire

SurveyGrid	Benchmark-Studie Dienstleistungsinnovation	Electric Paper <small>UNIVERSITÄT</small>
5. Einflussfaktor: Experimentierfreudigkeit und Risikobereitschaft im Dienstleistungsbereich [Fortsetzung]		
		Trifft überhaupt nicht zu 1 2 3 4 5 6 7 Trifft voll und ganz zu
5.7	Führungskräfte verfolgen Pläne nur, wenn sie das Risiko des Scheiterns als gering ansehen.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
5.8	Fehler werden in unserem Unternehmen als Chance angesehen, zu lernen.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
6. Einflussfaktor: Wissensmanagement im Dienstleistungsbereich		
6.1	Wenn wir neue Fähigkeiten oder Technologien benötigen, können wir schnell das notwendige Mitarbeiterwissen aufbauen.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
6.2	Wir sind sehr gut darin, die Lücke zwischen unserem heutigen Wissen und dem für neue Dienstleistungen benötigten Wissen zu schließen.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
6.3	Lernen wird in unserem Unternehmen als Grundvoraussetzung gesehen, um langfristiges Überleben sicherzustellen.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
6.4	Führungskräfte in unserem Unternehmen betonen immer wieder die Wichtigkeit der Weitergabe von Wissen.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
6.5	Bereichsübergreifender informeller Austausch und Zusammenarbeit sind in unserem Unternehmen üblich.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
6.6	Unsere Mitarbeiter verstehen sehr gut, wie die Ziele und Aktivitäten innerhalb unseres gesamten Unternehmens zusammenhängen.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
6.7	Wir sind sehr gut darin, Erfahrungen aus vergangenen Projekten auf neue Projekte anzuwenden.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
6.8	Informationen über Innovationsprojekte werden regelmäßig durch Newsletter, Seminare oder Ähnliches in unserem Unternehmen verteilt.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
6.9	Wir führen eine formalisierte Bewertung am Ende von Innovationsprojekten durch, um Erfolge und Misserfolge zu untersuchen.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
7. Einflussfaktor: Freiheitsgrade im Dienstleistungsbereich		
7.1	Unser Unternehmen verfügt über freie Ressourcen, die schnell für Innovationsprojekte genutzt werden können.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
7.2	Den Führungskräften in unserem Unternehmen stehen substantielle Ressourcen zur Verfügung, um Innovationsprojekte zu finanzieren.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
7.3	In unserem Unternehmen haben wir ausreichend finanzielle Ressourcen zur freien Verfügung.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
7.4	Für die Entwicklung neuer Dienstleistungen finden wir stets genügend viele Mitarbeiter.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
7.5	Zwischen Mitarbeitern und Führungskräften in unserem Unternehmen herrscht starkes gegenseitiges Vertrauen.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
7.6	Mitarbeiter in unserem Unternehmen haben den Freiraum, ihre Zeit und ihre Aktivitäten selbst einzuteilen.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
7.7	Mitarbeiter in unserem Unternehmen können viele Entscheidungen ohne direkte Rücksprache mit ihren Vorgesetzten tätigen.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
7.8	Wenn Mitarbeiter Prozesse und Regelungen verletzen, um ein Innovationsprojekt erfolgreich voranzubringen, zeigen sich Führungskräfte verständnisvoll.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
8. Einflussfaktor: Marktorientierung im Dienstleistungsbereich		
8.1	Unsere Geschäftsziele sind vor allem auf die Zufriedenheit unserer Kunden ausgerichtet.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
8.2	Unsere Strategie orientiert sich daran, wie wir Mehrwert für unsere Kunden schaffen können.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
8.3	Wir messen Kundenzufriedenheit systematisch und häufig.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
8.4	Unser Vertrieb teilt regelmäßig Informationen über die Strategien unserer Wettbewerber untereinander.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
8.5	Führungskräfte in unserem Unternehmen diskutieren regelmäßig die Stärken und Strategien unserer Wettbewerber.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
8.6	Unsere Unternehmensbereiche arbeiten eng zusammen, um die Bedürfnisse unserer Zielmärkte zu erfüllen.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

F13061U54566P3PL1V1 27.08.2015, Seite 3/4

Figure D.3.: Questionnaire Page 3 of 4

SurveyGrid		Benchmark-Studie Dienstleistungsinnovation					Electric Paper EVALUATIONSTRENE	
8. Einflussfaktor: Marktorientierung im Dienstleistungsbereich [Fortsetzung]								
		Trifft überhaupt nicht zu			Trifft voll und ganz zu			
		1	2	3	4	5	6	7
8.7	Unsere Unternehmensbereiche sind für gegenseitige Anforderungen und Anfragen leicht zugänglich.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Einflussfaktor: Zusammenarbeit mit Kunden und anderen Organisationen im Dienstleistungsbereich								
9.1	Unser Unternehmen hat in den letzten drei Jahren mehrere Entwicklungsvereinbarungen mit anderen Unternehmen geschlossen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.2	Unser Unternehmen hat in den letzten drei Jahren komplementäre Leistungen zusammen mit anderen Unternehmen entwickelt.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.3	Wir haben in den letzten drei Jahren neue Dienstleistungsinnovationen zusammen mit anderen Unternehmen auf den Markt gebracht.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.4	Unser Unternehmen hat erfolgreiche Partnerschaften mit anderen Unternehmen oder Start-Ups außerhalb unserer Branche etabliert.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.5	Unser Unternehmen hat erfolgreiche Partnerschaften mit Universitäten oder Forschungseinrichtungen etabliert.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.6	Mitarbeiter in unserem Unternehmen verfügen über weitreichende Netzwerke, auch außerhalb unserer Branche.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Hintergrund: Dienstleistungsbranche und Umfeld								
10.1	Die Nachfrage in unserer Branche ist sehr instabil.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.2	Unsere Märkte sind sehr starken Veränderungen unterworfen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.3	In unserem Umfeld werden sehr häufig neue Dienstleistungen eingeführt.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.4	Die Einstellungen und Wünsche unserer Kunden sind starken Veränderungen unterworfen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.5	Die Herausforderungen, vor die Umweltveränderungen unser Unternehmen stellen, sind leicht vorhersehbar.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.6	Die Umsätze in unserer Branche wachsen stark.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.7	Unser Geschäft ist sehr risikoreich.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.8	Unsere Branche weist ein feindliches Umfeld auf.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.9	In unserer Branche gibt es eine besonders große Anzahl an Wettbewerbern.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.10	Die Bedürfnisse der Kunden in unserer Branche sind sehr divers.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.11	In unserer Branche gibt es ein sehr großes Angebot an unterschiedlichen Dienstleistungen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Hintergrund: Unternehmen								
11.1	Wie viel Prozent des Umsatzes Ihres Unternehmens machen Dienstleistungen in etwa aus?	<input type="checkbox"/> < 20 %	<input type="checkbox"/> 20-39 %	<input type="checkbox"/> 40-59 %	<input type="checkbox"/> 60-79 %	<input type="checkbox"/> 80-100 %		
11.2	Wie viel Prozent des Dienstleistungsumsatzes machen B2B-Dienstleistungen in etwa aus?	<input type="checkbox"/> < 20 %	<input type="checkbox"/> 20-39 %	<input type="checkbox"/> 40-59 %	<input type="checkbox"/> 60-79 %	<input type="checkbox"/> 80-100 %		
11.3	Was ist Ihre Position im Unternehmen?	<input type="checkbox"/> Geschäftsführer/Vorstand	<input type="checkbox"/> Abteilungsleiter/Bereichsleiter	<input type="checkbox"/> Teamleiter/Gruppenleiter	<input type="checkbox"/> Projektmanager	<input type="checkbox"/> Andere		
11.4	In welchem Bereich sind Sie tätig?	<input type="checkbox"/> Geschäftsführung/Stabsabteilung	<input type="checkbox"/> Innovationsmanagement/Produktmanagement	<input type="checkbox"/> Forschung und Entwicklung	<input type="checkbox"/> Marketing/Vertrieb	<input type="checkbox"/> Controlling/Finanzen	<input type="checkbox"/> Personalwesen	<input type="checkbox"/> Anderer
11.5	Seit wie vielen Jahren arbeiten Sie in Ihrem Unternehmen?	<input type="checkbox"/> < 1 Jahr	<input type="checkbox"/> 1-2 Jahre	<input type="checkbox"/> 3-5 Jahre	<input type="checkbox"/> 6-10 Jahre	<input type="checkbox"/> > 10 Jahre		
11.6	Wie viele Mitarbeiter sind im Dienstleistungsbereich Ihres Unternehmens beschäftigt?	<input type="checkbox"/> < 100	<input type="checkbox"/> 100-249	<input type="checkbox"/> 250-499	<input type="checkbox"/> 500-999	<input type="checkbox"/> 1.000-2.999	<input type="checkbox"/> 3.000-10.000	<input type="checkbox"/> > 10.000



Figure D.4.: Questionnaire Page 4 of 4

E. Measures and Reliabilities

Table E.1.: Measures, Factor Loadings and Item Reliabilities for Model 1

Measures	FL	IR
Recruiting and training		
Our firm spends more money on training per employee than our competitors.	0.48	0.23
In comparison to our competitors we hire a particularly large number of employees from renowned universities.	0.67	0.44
Our firm receives more applications per external job advertisement than our competitors.	0.84	0.71
Our firm fills open positions faster than our competitors.	0.81	0.65
Knowledge exchange and learning		
When we need new capabilities or technologies, we are quick to establish the necessary employee knowledge.	0.63	0.39
In our firm, learning is considered a basis of survival in the long-run.	0.76	0.57
Executives in our firm routinely stress the importance of passing on knowledge.	0.73	0.54
Informal exchange and collaboration between departments is common in our firm.	0.79	0.63
Our employees understand very well how the goals and activities across our entire firm are connected.	0.79	0.63
We are very good at applying experiences from past projects to new projects.	0.58	0.34
Risk-taking and autonomy		
Executives in our firm are ready to accept greater risks for the development of radical service innovations than for incremental improvements.	0.75	0.56
Executives in our firm support the exploration of new areas even when failure can have significant financial consequences.	0.76	0.58
Executives only pursue plans when they expect the risk of failure to be small. (reverse coded)	0.56	0.32
Executives in our firm have substantial resources at their disposal for financing innovation projects.	0.65	0.42
We always find enough employees to staff the development of new services.	0.66	0.43
Employees can make a large share of their decisions without asking their manager for permission.	0.57	0.32
When employees violate processes and rules in order to successfully advance an innovation project, executives react sympathetically.	0.62	0.38
External collaboration		
We conduct a formalised evaluation at the end of innovation projects in order to analyse successes and failures.	0.43	0.18
Our firm has finalised several agreements over the last three years for joint development with other firms.	0.82	0.67
Over the last three years, our firm has developed complementary services together with other firms.	0.94	0.88
We have introduced service innovations together with other firms over the last three years.	0.86	0.74
Our firm has established successful partnerships with other firms or start ups outside of our sector.	0.52	0.27
Our firm has established successful partnerships with universities or research institutes.	0.54	0.29
Employees in our firm have far reaching networks, even beyond our sector.	0.42	0.18
Sensing		
We routinely search for new business opportunities in our environment.	0.50	0.25
We routinely reflect the foreseeable effects of changes in our environment on our customers and markets.	0.61	0.37

Continued on next page

Appendix

Table E.1 – *Continued from previous page*

Measures	FL	IR
We frequently check our innovation projects in order to ensure that they are addressing actual customer needs.	0.79	0.62
We have established routines for identifying new target markets, segments, customer needs and innovations by customers.	0.67	0.45
We routinely pursue business opportunities and innovations that have been developed outside of our firm.	0.63	0.39
Seizing		
We can quickly change our business procedures when customers prompt us to.	0.73	0.54
Ideas brought up by customers, employees and partners are continuously evaluated and, if possible, converted into the development of new services.	0.53	0.28
We are very good at deploying our employees and systems in order to provide new services.	0.68	0.47
We are able to quickly react to the actions of our competitors.	0.81	0.66
Our firm is able to quickly react to changes in the market.	0.89	0.79
Reconfiguring		
In the past three years we have established several new management methods.	0.74	0.55
In the past three years we have used many new or significantly changed marketing methods.	0.60	0.36
In the past three years we have significantly developed our business procedures.	0.70	0.49
New service introduction		
The introduction of new services by our firm has accelerated over the last three years.	0.49	0.24
Our firm is often the first to introduce new services to the market.	0.82	0.68
The introduction of new services by our firm often causes changes that competitors need to react to.	0.82	0.67
The share of our service innovations that are successful in the market is larger than those of our competitors.	0.76	0.57
Market and financial performance		
Our customer base has grown faster than those of our competitors over the last three years.	0.71	0.51
We are more successful than our competitors in retaining regular customers.	0.70	0.49
Our firm's market share has grown faster over the last three years than those of our competitors.	0.83	0.69
Our revenue per customer has grown faster over the last three years than those of our competitors.	0.83	0.69
Our firm's profit margin has grown faster over the last three years than those of our competitors.	0.57	0.33
Service share		
What share of your firm's revenue comes from services?	n/a	n/a
B2B share		
What share of your firm's service revenue comes from B2B services?	n/a	n/a
Firm size		
How many employees does the service part of your firm have?	n/a	n/a

Table E.2.: Measures, Factor Loadings and Item Reliabilities for Model 2

Measures	FL	IR
Recruiting and training		
Our firm spends more money on training per employee than our competitors.	0.48	0.23
In comparison to our competitors we hire a particularly large number of employees from renowned universities.	0.66	0.43

Continued on next page

E. Measures and Reliabilities

Table E.2 – *Continued from previous page*

Measures	FL	IR
Our firm receives more applications per external job advertisement than our competitors.	0.84	0.71
Our firm fills open positions faster than our competitors.	0.81	0.66
Knowledge exchange and learning		
When we need new capabilities or technologies, we are quick to establish the necessary employee knowledge.	0.62	0.39
In our firm, learning is considered a basis of survival in the long-run.	0.76	0.58
Executives in our firm routinely stress the importance of passing on knowledge.	0.73	0.54
Informal exchange and collaboration between departments is common in our firm.	0.80	0.63
Our employees understand very well how the goals and activities across our entire firm are connected.	0.79	0.63
We are very good at applying experiences from past projects to new projects.	0.58	0.34
Risk-taking and autonomy		
Executives in our firm are ready to accept greater risks for the development of radical service innovations than for incremental improvements.	0.75	0.56
Executives in our firm support the exploration of new areas even when failure can have significant financial consequences.	0.76	0.59
Executives only pursue plans when they expect the risk of failure to be small. (reverse coded)	0.56	0.31
Executives in our firm have substantial resources at their disposal for financing innovation projects.	0.64	0.41
We always find enough employees to staff the development of new services.	0.65	0.43
Employees can make a large share of their decisions without asking their manager for permission.	0.56	0.32
When employees violate processes and rules in order to successfully advance an innovation project, executives react sympathetically.	0.62	0.38
External collaboration		
We conduct a formalised evaluation at the end of innovation projects in order to analyse successes and failures.	0.43	0.18
Our firm has finalised several agreements over the last three years for joint development with other firms.	0.82	0.67
Over the last three years, our firm has developed complementary services together with other firms.	0.94	0.89
We have introduced service innovations together with other firms over the last three years.	0.86	0.73
Our firm has established successful partnerships with other firms or start ups outside of our sector.	0.52	0.27
Our firm has established successful partnerships with universities or research institutes.	0.54	0.29
Employees in our firm have far reaching networks, even beyond our sector.	0.42	0.18
Sensing		
We routinely search for new business opportunities in our environment.	0.50	0.25
We routinely reflect the foreseeable effects of changes in our environment on our customers and markets.	0.61	0.37
We frequently check our innovation projects in order to ensure that they are addressing actual customer needs.	0.79	0.62
We have established routines for identifying new target markets, segments, customer needs and innovations by customers.	0.67	0.45
We routinely pursue business opportunities and innovations that have been developed outside of our firm.	0.63	0.39
Seizing		

Continued on next page

Table E.2 – *Continued from previous page*

Measures	FL	IR
We can quickly change our business procedures when customers prompt us to.	0.73	0.53
Ideas brought up by customers, employees and partners are continuously evaluated and, if possible, converted into the development of new services.	0.53	0.28
We are very good at deploying our employees and systems in order to provide new services.	0.69	0.47
We are able to quickly react to the actions of our competitors.	0.81	0.66
Our firm is able to quickly react to changes in the market.	0.89	0.79
Reconfiguring		
In the past three years we have established several new management methods.	0.74	0.55
In the past three years we have used many new or significantly changed marketing methods.	0.60	0.36
In the past three years we have significantly developed our business procedures.	0.70	0.49
New service introduction		
The introduction of new services by our firm has accelerated over the last three years.	0.50	0.25
Our firm is often the first to introduce new services to the market.	0.81	0.66
The introduction of new services by our firm often causes changes that competitors need to react to.	0.81	0.65
The share of our service innovations that are successful in the market is larger than those of our competitors.	0.77	0.59
Market and financial performance		
Our customer base has grown faster than those of our competitors over the last three years.	0.72	0.51
We are more successful than our competitors in retaining regular customers.	0.70	0.49
Our firm's market share has grown faster over the last three years than those of our competitors.	0.83	0.69
Our revenue per customer has grown faster over the last three years than those of our competitors.	0.83	0.69
Our firm's profit margin has grown faster over the last three years than those of our competitors.	0.57	0.33
Environmental dynamism		
Demand in our sector is very unstable.	0.46	0.22
Our markets are subject to significant changes.	0.63	0.40
In our environment, new services are frequently introduced.	0.68	0.47
The attitudes and needs of our customers are subject to strong changes.	0.70	0.48
Service share		
What share of your firm's revenue comes from services?	n/a ^a	n/a ^a
B2B share		
What share of your firm's service revenue comes from B2B services?	n/a ^a	n/a ^a
Firm size		
How many employees does the service part of your firm have?	n/a ^a	n/a ^a

^a Construct measured through a single indicator – item reliability cannot be computed.

F. List of Hypotheses

H1a: Recruiting and training contribute positively to a firm's sensing capability.

H1b: Recruiting and training contribute positively to a firm's seizing capability.

F. List of Hypotheses

H1c: *Recruiting and training contribute positively to a firm's reconfiguring capability.*

H2a: *Knowledge exchange and learning contribute positively to a firm's sensing capability.*

H2b: *Knowledge exchange and learning contribute positively to a firm's seizing capability.*

H2c: *Knowledge exchange and learning contribute positively to a firm's reconfiguring capability.*

H3a: *Risk-taking and autonomy contribute positively to a firm's sensing capability.*

H3b: *Risk-taking and autonomy contribute positively to a firm's seizing capability.*

H3c: *Risk-taking and autonomy contribute positively to a firm's reconfiguring capability.*

H4a: *External collaboration contributes positively to a firm's sensing capability.*

H4b: *External collaboration contributes positively to a firm's seizing capability.*

H4c: *External collaboration contributes positively to a firm's reconfiguring capability.*

H5a: *A firm's sensing capability contributes positively to its market and financial performance.*

H5b: *A firm's seizing capability contributes positively to its market and financial performance.*

H5c: *A firm's reconfiguring capability contributes positively to its market and financial performance.*

H6a: *A firm's sensing capability contributes positively to its new service introduction.*

H6b: *A firm's seizing capability contributes positively to its new service introduction.*

H6c: *A firm's reconfiguring capability contributes positively to its new service introduction.*

H7: *New service introduction contributes positively to a firm's market and financial performance.*

H8a: *The effect of a firm's sensing capability on its new service introduction is moderated by the level of environmental dynamism.*

H8b: *The effect of a firm's seizing capability on its new service introduction is moderated by the level of environmental dynamism.*

H8c: *The effect of a firm's reconfiguring capability on its new service introduction is moderated by the level of environmental dynamism.*

H9a: *The effect of a firm's sensing capability on its market and financial performance is moderated by the level of environmental dynamism.*

H9b: *The effect of a firm's seizing capability on its market and financial performance is moderated by the level of environmental dynamism.*

H9c: *The effect of a firm's reconfiguring capability on its market and financial performance is moderated by the level of environmental dynamism.*

