Managing service innovation

measuring and modelling dynamic service innovation capabilities

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Managing Service Innovation:
Measuring and Modeling Dynamic Service Innovation Capabilities

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Summary

In the past century, services became to account for more than 70% of GDP and employment figures in Western economies (OECD, 2005). Despite the enormous growth of their socio-economic relevance, services are still being under-researched. Because of their characteristics as intangibility, non-stockability and co-production with clients, traditional economic and innovation theories are not always applicable to services. One key question concerns the innovation-process; how can service innovation processes be managed?

Recently, Den Hertog et al. (2010) developed a conceptual framework (PdH-framework) which defines dynamic capabilities for managing service innovation (Dynamic Service Innovation Capabilities, or DSICs). To empirically verify this framework, some challenges that are idiosyncratic for dynamic capabilities will have to be tackled. The notion of 'dynamic capabilities' (DC) introduced a paradigm that is currently dominant in the field of management, and which we adopt here. Instead of achieving competitive advantage by having a valuable set of resources, firms are said to increase and sustain their fitness by using their capabilities to continuously reconfigure their resources and adapt their routines. However, the relation between capabilities and firm performance is far from clear. One point of debate is the nature of DC; is their effect direct or mediated by other factors such as competences or innovation? And does each firm have its own unique capabilities, or can we find communalities that can be used to develop a framework of 'common' dynamic capabilities? Are they all of (equal) importance for achieving enhanced performance?

Validating theories is problematized by the lack of empirical research. Especially quantitative analyses are scarce. A structural problem that has been emphasized lately is that performance of a firm is often attributed to unique capabilities that are identified ad-hoc and afterwards. Since this kind of case-studies frequently focuses on firms that are selected a priori on the basis of their success, proposed explanations are tautological and un-falsifiable. An approach that looks at the communalities between capabilities could solve this problem (Eisenhardt & Martin, 2000). Building upon a set of pre-defined and measurable capabilities (such as the multi-construct PdH-framework) allows for inter-firm comparison of capability-strengths. Quantitative analyses can then enhance our understanding of the relation with firm performance (Arend & Bromiley, 2009).

Traditional DCV-literature (e.g. Teece, 1997) suggests that dynamic capabilities themselves lead to competitive advantage. However, we hypothesize that this relation is fully mediated by innovation. We argue that dynamic capabilities only lead to improved performance when they are used for enhancing the organization and its products in such a way that it can be valued by the market. In doing so, we equal organizational reconfigurations and adaptions to (service) innovations or innovativeness. The PdH-framework also offers guidance on this account, since its second pillar consists of six service innovation performance dimensions (SIPDs), representing different dimensions that can occur in (even a single) service innovation.

The aim of this research is (A) to *measure DSICs and SIPDs in a quantitative way*, in order (B) to *assess their linkages with performance enhancing service innovations*.
The research questions that results is phrased as follows:

"To what extent do dynamic service innovation capabilities contribute to a firm's ability to develop performance-enhancing service innovations?"

In recent publications, DCV-scholars explicitly urged the need to use a **mixed method** procedure for studying dynamic capabilities (e.g. Helfat et al. 2007). Finding the solution to many of the questions around its vague and conceptual nature is argued to require case-based methods such as from organizational studies (amongst others). These types of research are essential for enhancing our understanding of the measurability and importance of dynamic capabilities, which in turn is crucial for further (quantitative) analysis. We adapt these advices and combine a case-study with a large scale survey.
Both empirical studies could be performed by participating in a wider project on open service innovation (United We Stand, UWS). The case-study is based on six interviews (May-June 2011) about an innovation within a recruitment-office / HR consultancy firm. The data for our survey could be achieved by adding questions to a survey that was also part of the United We Stand project and was deployed between May and July 2011. The target group consists of 5880 firms (10+ employees) that are localized in the Randstad. The sample represents this region, including many SME's. We surveyed both 'pure' service providers and manufacturing enterprises, asking for their service-activities.

The target of the qualitative **case-study** is to measure accurately and validly the notion of dynamic capabilities. At the same time, it serves as an illustration of both the DSIC and SIPD concepts. Observed and missing capabilities/innovations are discussed (notably from a methodological perspective), but we also raise critique on the PdH-framework.
Secondly, by conducting interviews in which the PdH-framework is applied, we enhance our understanding of its *measurability*. Methodological insights on how to analyze and observe dynamic (service innovation) capabilities contribute to the general literature that concerns the empirical struggles of the DCV (Priem, Butler, 2001). By achieving a better idea about what dynamic capabilities are and how they can be studied, we could move to definitional settlement around the DSIC and the development of the survey-instrument.

The questions in the **survey** are an adaptation of the PdH-framework. Based on our findings from the literature review and case-study, we decide to ask for *functional processes* that underlie the DCs. Which exact practices are used for performing such a process is not relevant; we are only interested in which functional process relates to which dynamic capability (see conceptual illustration next page).

The obtained survey-data allows us to do quantitative research for answering our research question, thereby making a start with filling gaps in both the service innovation literature (on the account of management instruments) and the DCV-literature. As for the *measuring* part, we perform principal component analyses (and related reliability tests) to explore the dimensions that appear in the processes we surveyed. The refined set of capabilities that remains can then be entered in structural equation modeling (SEM). These *modeling* analyses include investigation of both the direct relation between DSICs and relative firm performance, as well as the innovation-mediated relation. Figure s2 shows the research framework that guides our statistical analyses.

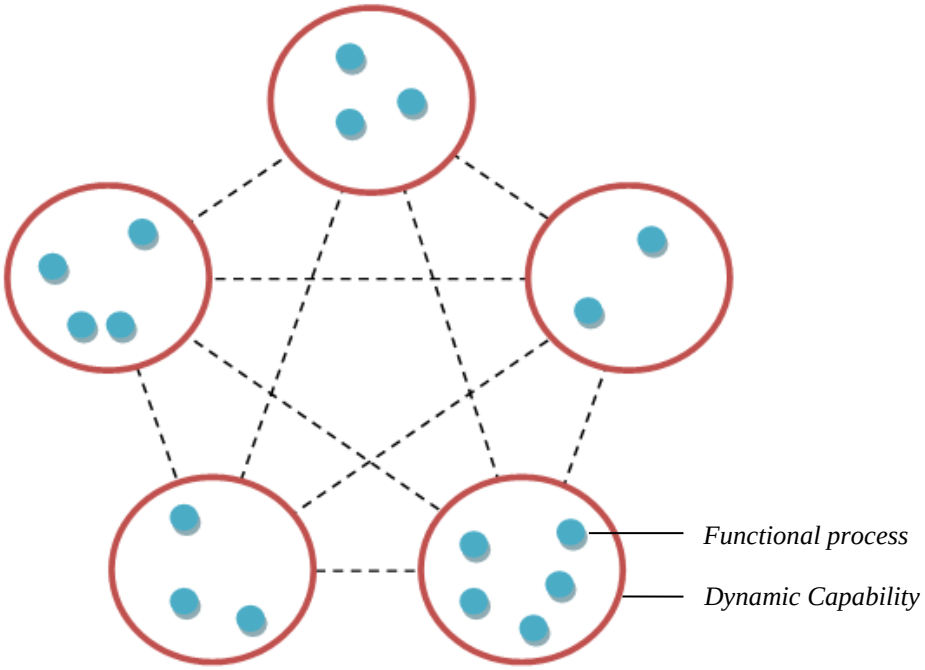

Figure s1. Conceptual model of a dynamic capability view on functional processes

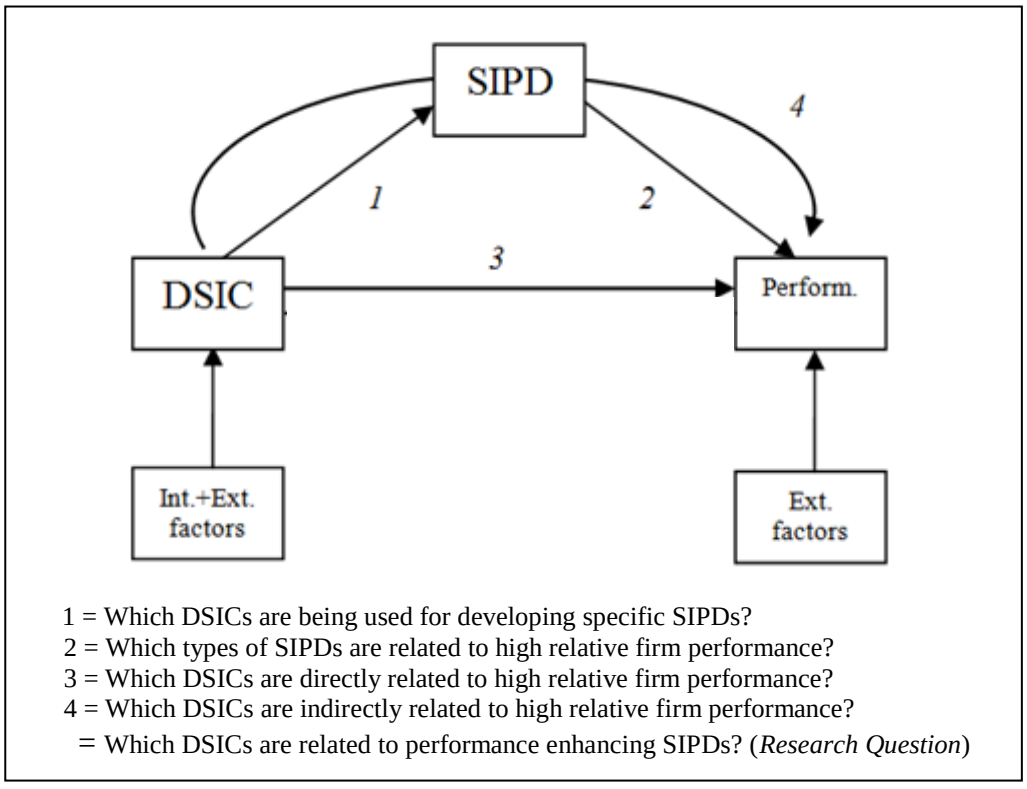

Figure s2. Research framework

Main Conclusions

Principal component analyses resulted in the development of refined scales for both DSICs and SIPDs. The original DSICs 'Conceptualizing' and 'Learning' did not possess discriminative attributes, which can be explained by the common belief that they both have a very distributed character. Sensing User Needs and (Technological) Options is divided in two sub-capabilities that are different from each other, but still have a bit more in common with each other than with the other capabilities.
About 44% of the data on SIPDs can be captured by a single component. This implies that not too much difference is perceived between the different dimensions. For this reason, we used a single construct of 'Service innovativeness' in our SEM-analyses. However, when looking at the rest of the variance within the SIPD-data, we could observe different underlying dimensions. Only 'New Delivery System: Personnel, Organizational & Culture' is not distinct enough in our data; at least one of its items turns out to be highly correlated to the DSIC of 'New Revenue Model', which could also mean that they tend to imply each other.

We did not encounter remarkable findings when it comes to occurrences of DSICs and SIPDs (looking at differences per size, sector), probably because of the current limitations of our data-set. Only firms that did not at all rely on services turn out to possess less DSICs.
What we did find were confirmations on the account of co-occurrences (between DSICs and SIPDs). Most of the links that were hypothesized by Den Hertog turned out to be present in our data, suggesting that specific dynamic capabilities are related to specific (service) innovations (Loasby, 2010).

By using SEM, we tested to what extent the effect of DSIC on performance was mediated by service innovativeness. This analysis resulted in a significantly fitting model in which four out of five (redefined) dynamic capabilities had a significant positive correlation with service innovativeness. However, none of the DSICs has a significant relation with performance and neither does service innovativeness, which could be concluded as well from several additional analyses. These extra analyses also revealed that DSICs do deliver individual contributions to service innovativeness, although they can correlate/interact at the same time.

The overall implication of our modeling is that dynamic service innovation capabilities do seem to be relevant for the development of service innovations, but not so much for actually performing better than competitors (in a static setting). Even if we separate the construct of service innovativeness into its distinct dimensions, we do not find significant paths. The answer to our research question is thus that at a given point in time, dynamic capabilities are not related to *performance-enhancing* innovations. Several explanations for these findings are discussed. One of them is that dynamic capabilities are about survival on the long-term, rather than on excellent performance at a specific moment.

The main achievement of this study is the development of a procedure for both quantitatively measuring DSICs (and SIPDs) as well as analyzing them. Our survey-instrument can be used for follow-up studies for acquiring more and longitudinal data. With these kinds of data, specific groups of firms and causal relations can be studied in more depth, possibly resulting in observations of positive relations between DSICs and/or SIPDs with performance.
Identifying which (combination of) capabilities are successful is an important step towards the development of a Service Innovation management tool; this study aims to form a basis for recommendations on strategic use and building/attraction of dynamic service innovation capabilities.

Preface

The thesis presented here is my final work to complete the MSc program of Innovation Sciences at the Eindhoven University of Technology. I never regarded this last stage solely as a challenge to demonstrate the skills and knowledge I already acquired. Rather, I considered it as a possibility to learn more. One useful experience consisted of setting up my own investigation and (almost) independently exploring the possibilities for answering the resulting research question. Getting familiar with a (for me) new way of statistical analysis is another achievement that added to the fun I had in doing research. The study I did for this thesis certainly adds to my ambitions to keep investigating for at least as long as my current time-horizon stretches.

To start with, I want to express my gratefulness to my supervisors Carolina Castaldi and Koen Frenken. Both of them had the luck to get a child in the period I devoted to my thesis; I had the luck that they still had time to take a bit care of me. They and their useful advices were there when I needed them, but I certainly appreciate the freedom and trust I have been given. This freedom only could be fully exploited by the fantastic research-possibilities that were facilitated by third supervisor Pim den Hertog. By being able to participate in the wider UWS-project, I could develop and deploy a survey that matched my research question. Pim's advices on the account of focusing were valuable, but at the same time he supported me to make a start with investigating many of the aspects for which there is no place in this study. Together with my other supervisors, Pim put a lot of effort in constructing a PhD-trajectory, which I look forward for.

Other colleagues in the UWS-project were of great help as well. Dr. Carolien de Blok not only enabled the case-study, but also provided education on the methodological and interpretative part. Special thanks go to Dr. Alex Alexiev, who was a great source of advice throughout the whole deployment and analysis of the survey. His (always present) critical stance forced me to sharpen and sometimes revisit my arguments.
Although he was not directly involved in this thesis, I would like to mention that Prof. Dr. Faïz Gallouj contributed to the very emergence of this work. He inspired me to dive deeper into service innovation literature, and enabled a wonderful semester in Lille.

Having the possibility to share my thoughts with colleagues at Dialogic certainly helped me to gain clarity and guidance in my approach. During the full length of my TU/e-period, I also had many interesting discussions with my friends Arthur Vankan, Menno Driesse, Stijn Zegel, David van Kerkhof, and many more. Although these conversations were always pleasurable in the first place, they certainly served as a reflection that enabled me to get a better understanding of the complex concept of innovation. I hope that many of these conversations will follow.

Finally, I thank my parents Lambert and Viola, sister Paula and girlfriend Clara for the love and care they give me. Their remaining support mainly consists of enabling me to enjoy life intensely and in many ways, which motivates me to work even harder meanwhile.

Matthijs Janssen
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1 Introduction

Looking at modern western societies, one can state that services are everywhere. When it comes to business activities that deliver the biggest contribution to gross national products and employment, services overtook manufacturing already several decades ago. They are becoming increasingly dominant, whether it concerns countries with a high state of welfare or those that are developing. Due to their heterogeneous nature, we can find service workers on knowledge intensive jobs like consultancy and accountancy, as well as in tourism and food-provision. Clearly, this trend is not only observed in statistics; the ubiquity of services can be taken literally. Although we often are not aware of it, every day we encounter many experiences that are in some way the result of service activities. That we consume a service is evident when we order a dinner or ask for a trendy haircut. However, also in situations where services are less perceivable, they are often essential for achieving the experience we want. Take, for example, a car. Chances are high that it is functioning correctly not just because of the way it was produced, but also because it is being maintained by service providers who check it regularly. Moreover, between production of the car (involving knowledge and research that might have been offered by external specialists) and actually driving it we also find transportation after production, retail, insurance and maybe an attractive leasing contract or other financial construction that was offered to you. All those elements, and undoubtedly many others, are delivered by service providers. In fact, it is almost impossible to think of a product that is not partially the result of service activities (Bryson, in Gallouj & Gallouj 2010). Even traditional manufacturing companies like Xerox and IBM nowadays rely heavily on the services that they provide 'around' their technology or that replace their traditional products. Is it possible that such a ubiquitous phenomenon with such a socio-economic relevance is under-researched?

Oddly enough, the answer is yes. Despite their importance for so many facets of our society and economy, there are still major gaps in our understanding of what exact role services have. Similarly, how services develop or can be developed is far from clear. The stakes are high, but nevertheless there is a lack of strategic management theories for the development of new services (Nysveen and Pedersen, 2007). One reason is the mere fact that they are part of everything we consume; services are so heterogeneous that it proves difficult to cover them by theories that are broad and useful at the same time. Other characteristics of service products are intangibility, non-stockability and co-production with clients. Because of these idiosyncrasies, traditional economic and innovation theories are not always applicable to services. Moreover, many attempts to develop new services are unsuccessful (e.g. Smith et al., 2007). The key question in this study concerns the very innovation-process; how can the development of service innovations be managed?

Recently, Den Hertog et al. (2010) developed a conceptual framework (PdH-framework) which defines dynamic capabilities for managing service innovation (Dynamic Service Innovation Capabilities, or DSIC). To empirically verify this framework, some challenges that are idiosyncratic for dynamic capabilities will have to be tackled. The notion of 'dynamic capabilities' (DC) introduced a paradigm that is currently dominant in the field of management, and which we will adopt here (see section 2.3). Instead of achieving competitive advantage by having a valuable set of resources, firms are said to increase and sustain their fitness by using their capabilities to continuously reconfigure their resources and adapt their routines. However, the relation between capabilities and firm performance is far from clear. One point of debate is the nature of DC; is their effect direct or mediated by other factors such as competences? And does each firm have its own unique capabilities, or can we

find communalities that can be used to develop a framework of 'common' dynamic capabilities? In that case, what is the relation between those common capabilities? Are they all necessary for achieving enhanced performance? Are there situations in which some are more useful than others, or can we find characteristics such as 'equifinality', fungibility and substitutability (Eisenhardt & Martin, 2000)?

Validating theories is problematized by the lack of empirical research. Especially quantitative analyses are scarce. A structural problem that has been emphasized lately is that performance of a firm is often attributed to unique capabilities that are identified afterwards. Since this kind of case-studies frequently focuses on firms that are selected a priori on the basis of their success, proposed explanations are tautological and un-falsifiable. An approach that looks at the communalities between capabilities could solve this problem (Eisenhardt & Martin, 2000). Building upon a set of pre-defined and measurable capabilities (such as the multi-construct PdH-framework) would allow inter-firm comparison of capability-strengths. Quantitative analyses can then enhance our understanding of the relation with firm performance (Arend & Bromiley, 2009).

The aim of this research is (A) to measure DSICs in a quantitative way (using the PdH-framework), in order (B) to assess their linkages with performance enhancing service innovations. A typology of six service innovation performance dimensions (SIPDs) forms the second pillar of the PdH-framework; they reflect different dimensions that can occur in (even a single) service innovation. Our aims result in the following research question:

"To what extent do dynamic service innovation capabilities contribute to a firm's ability to develop performance-enhancing service innovations?"

In order to accurately and validly measure dynamic capabilities, a qualitative case-study will be performed. Firstly, a case-study can serve as an illustration of both the DSIC and SIPD concepts. Observed and missing capabilities/innovations will be discussed, but there is also place for critique on the PdH-framework.

Secondly, by conducting interviews in which the PdH-framework will be applied, we can enhance our understanding of its measurability. Moreover, insights on how to analyse and observe dynamic (service innovation) capabilities can contribute to the general literature that concerns the empirical struggles of the DCV (Priem, Butler, 2001). Once we have a better idea about what dynamic capabilities are and how they can be studied, we can move to definitional settlement around the DSIC and the development of a survey.
The results of the survey will allow us to do the quantitative research that can answer our research question and thereby fill gaps in both the service innovation literature (on the account of management instruments) and the DCV-literature.

The basis of the statistical analysis is the research framework shown below.

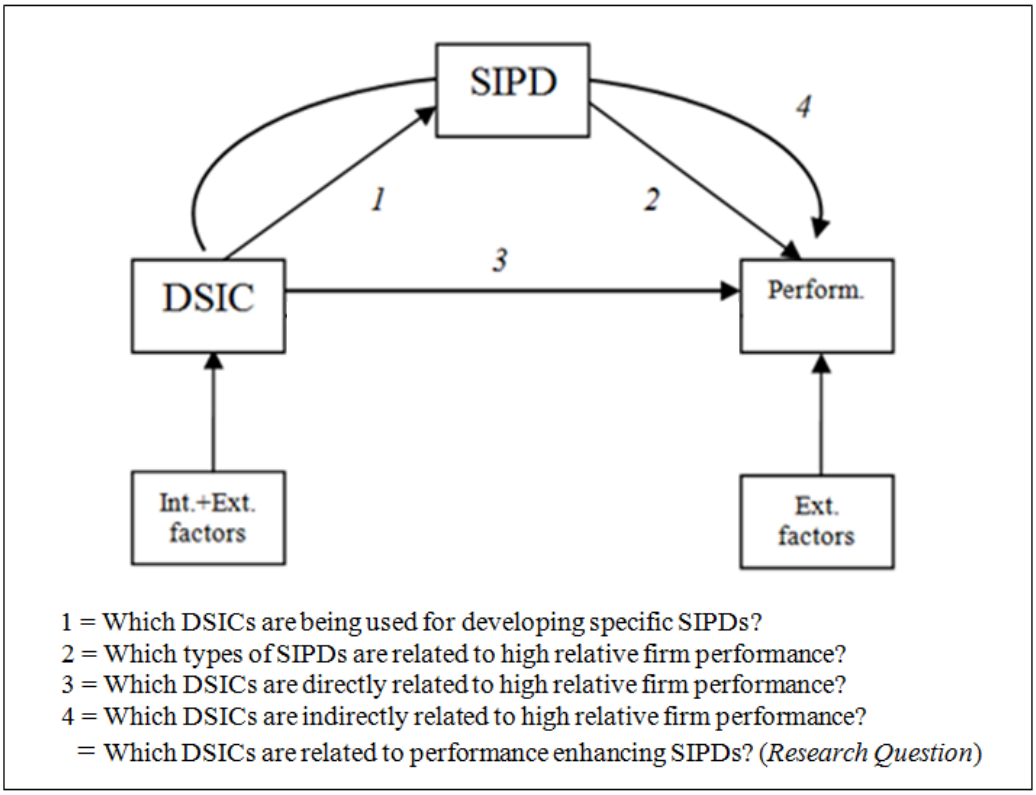

Figure 1: Research framework

In order to answer our research question, several sub-questions will have to be tackled. Point of departure will be the actual development of survey-questions that allow to measure the DSIC that a firm possesses, and the type of service innovations (SIPDs) it helps to create. Whether it is possible to draw meaningful conclusions out of survey-data and use it for models, will be investigated by the qualitative case-study. Interviews with managers could improve our understanding of how dynamic capabilities can be operationalized. Can we directly ask for them, or what indirect methods can we use to observe them? How do managers perceive their actions that we would conceptually link to dynamic capabilities? Are they seen as crucial for long-term survival, are they managed consciously in order to innovate, or is there no explicit awareness of the presence of processes that could help their firm in adapting to market changes?

Once we have an understanding about the possibilities to actually observe dynamic capabilities, we can use survey-data for studying the direct relation between DSIC and firm performance (traditional approach), but also the innovation-mediated relation. An attempt to identify configurations of capabilities that lead to performance-enhancing innovation is a theoretical contribution to the discussion about the nature of dynamic capabilities; the existence of patterns would partially contradict with the idea that each firm has its own unique capabilities, as well as with ideas about equifinality, fungibility and/or substitutability. Furthermore, quantitative measures of both Dynamic Capabilities and Service Innovation are rare. The conceptual Service Innovation-model by Den Hertog has not been tested quantitatively before, but allows us to shed more light on the understanding of capabilities that are being used in realizing SI-dimensions (of the six different SIPD-types), and especially those that are responsible for success.

Identifying which (combination of) capabilities are successful is also an important step towards the development of a Service Innovation management tool. The practical relevance is thus that this study can form a basis for recommendations on strategic use and building/attraction of dynamic capabilities (e.g. "If I want to realize a SI of type X, what capabilities am I lacking?").

Recently, DCV-scholars explicitly urged the need to use a mixed method procedure for studying dynamic capabilities (e.g. Helfat et al. 2007). Although it is certainly not common practice, many of the questions around its vague and conceptual nature are argued to require case-based methods such as from organizational studies (amongst others). As demonstrated, we follow this advice in order to enhance our understanding of the measurability and importance of dynamic capabilities.
Our both types of empirical data are acquired by participating in a wider project on open service innovation (United We Stand, UWS). The case-study (chapter 4) is based on six interviews (May-June 2011) about an innovation within a recruitment-office / HR consultancy firm. The data for our survey (chapter 5) could be achieved by adding questions to a survey that was also part of the United We Stand project and was deployed between May and July 2011. The target group consists of 5880 firms (10+ employees) that are localized in the Randstad. Included are both 'pure' service providers and manufacturing enterprises that engage in service innovation.

The survey-questions are an adaptation of the PdH-framework. The DC-variables and performance indicators are firm-level characteristics, innovation-characteristics will be studied at the level of the innovation-portfolio of the firm (past three years). Questions about performance contained a reference towards other firms in the same industry, making them a measure for relative performance or competitive advantage.

Both face-to-face interviews and statistical analyses ensured the validity of the scales.
If we succeed in correctly measuring the DSIC and SIPD-scales (using confirmatory factor analysis), we can start with providing descriptive about the differences between firms with different sizes and from different sectors. Co-occurrence analysis can then allow the search for meaningful relations between configurations of DSIC-SIPD (subquestion 1) and SIPD-Performance (subquestion 2). Finally, structural equation modeling (SEM) will be used to study the relations indicated in the proposed framework. This concerns the direct impact of DCs on performance (subquestion 3), as well as the innovation-mediated impact (subquestion 4).

The remainder of this thesis is as follows:
Chapter 2: Theory
Chapter 3: Research question
Chapter 4: Case-study
Chapter 5: Survey
Chapter 6: Discussion and general conclusions

2 Theory

This study relies on two lines of literature. One of them concerns innovation in services, which is the topic of this subsection and the one that follows. We will see that although services have a major role within many economies, there is still a lack of models that support the strategic management of service innovation. One recently proposed framework that has the potential to develop into a guiding tool, is based on insights from the other line of literature; the Dynamic Capabilities View (DCV). How this view can be applied in the context of services and which barriers should be overcome will be discussed in subsection 2.4. The figure below shows the set-up of the literature review.

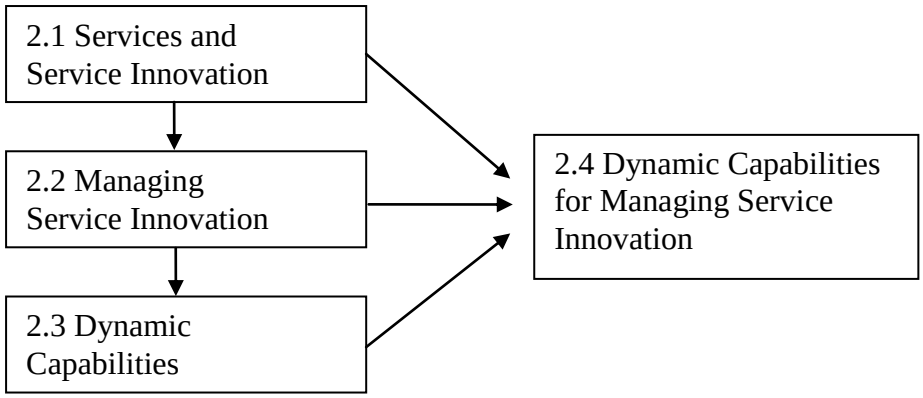

Figure 2: Structure of literature review.

2.1 Services and Service Innovation

The word 'services' can refer to several things. Sometimes, it is used for the *organizations* that produce non-material solutions or experiences. However, services can also be this *output* itself. In this thesis, the word 'services' is used for indicating the service-product, as delivered by service-providers. Essential characteristics of the service as a product are (Gallouj & Savona, 2009):

- Services are *non-material* or *intangible*. Of course, the delivery of services can make use of supporting technologies. The actual product that is being consumed by the customer, however, is an experience or solution. Note that the word 'product' in this thesis is used as any output of an economic activity; it can be both (material) goods and (non-material) services.

- Services are *produced and consumed simultaneously* and therefore *non-stockable / perishable* (Parasuraman, Zeithaml, Berry, 1985). A consequence of this simultaneity property is that it hard to distinguish products and processes, as is common in the production of goods.

- Services are often partially produced by the consumer him- or herself. This *co-production* can take many different forms. Consumers can be responsible for accurately describing their wishes (e.g. to the hairdresser), or engage intensively in the actual production (e.g. driving a rented car). An extreme form is self-service

(Gershuny, 1979), a form of service-delivery in which the provider is absent. Interaction is then often restricted to a technological interface. The active involvement of the consumer means that he or she is partially responsible for the quality of the final service.

Although these characteristics can be frequently observed, they are not necessary or sufficient. Some services rely heavily on a material component (online selling), some are stockable (a concert can be recorded) and some are entirely produced by the service provider (home delivery of products). Therefore, it is hard to come up with definitions that accurately cover all outputs of service-activities. The different definitions that have been proposed over the years indicate the vague nature of the broad service sector. Illustrative is also the fact that services are also known as the tertiary sector, which suggests that is a left-over category. In subsection 2.1.3, the fuzzy boundaries between industrial activities and service activities will be discussed in more detail.

The most successful attempts for defining services included the roles of the service provider, service users and the 'object' that is being modified. A widely accepted service-definition that links these elements was provided by Hill (1977, in [Illeris, 1996]):

"A service may be defined as a change in the condition of a person, or of a good belonging to some economic unit, which is brought about as the result of the activity of some other economic unit, with the prior agreement of the former person or economic unit".

These components are also graphically brought together in the famous service-triangle of service-research pioneer Jean Gadrey (1992):

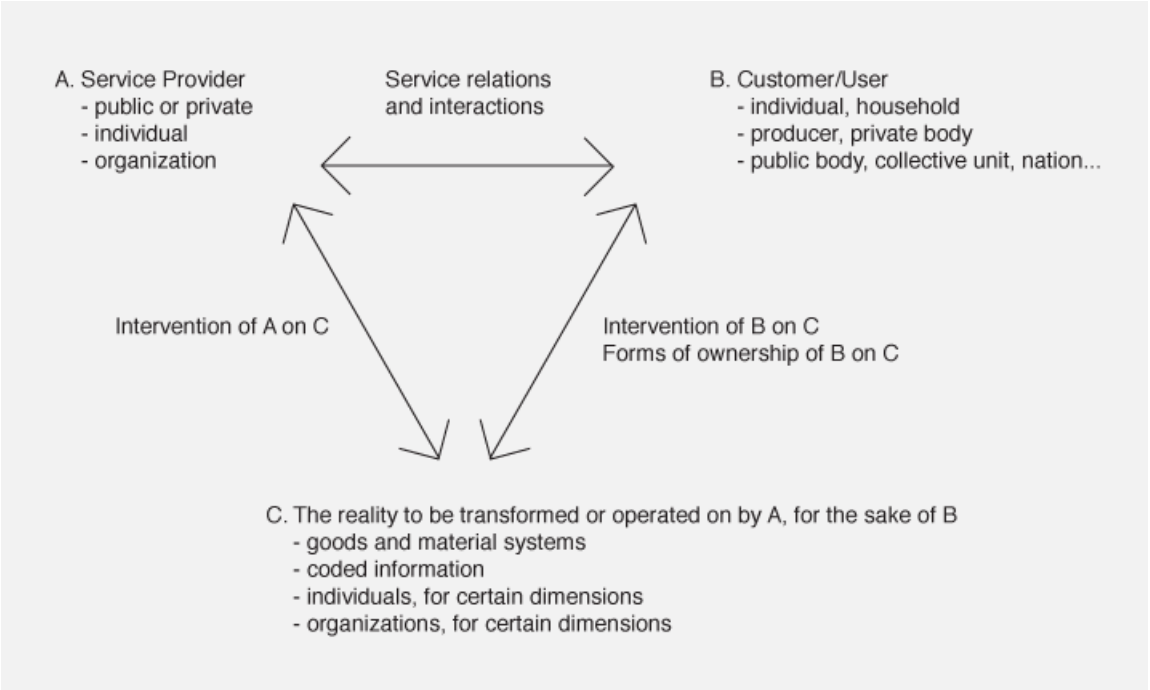

Figure 3: Service Triangle (Gadrey, 1992).

The service economy

Over the past century, the importance of services for society and economy grew dramatically. By the 1980s, services came to account for more than 70% of GDP in some western countries (OECD, 2005). Although differences between countries can be observed, the OECD still signals a growth. Nowadays, the service sector accounts for about 73% of aggregate production in EU economies, compared to a world average of 63% (CIA, 2010). Employment figures show a similar trend; most of the people these days are working in a service job.

Essential questions concerning the rise of services, are, amongst others: how did this trend emerge; what are the implications for employment (number and education), social equality and environment; do services only adopt or do they innovate themselves; what is the role of technology within services?

Background information on the growing importance of services within current economies is provided in Annex 1; this extensive discussion serves as a clarification of how the service economy developed and reports some debates that lie at the heart of service-literature. The annex concludes with thoughts on the desirability of managing service innovation. In the core of this thesis, we simply assume that service innovation and the *management of service innovation processes as a firm-level activity* should be promoted. Key argument is that, given the fact that so many firms are depending on service provision, renewal and improvement of their service offering is essential for a good performance and, in the long run, survival[1]. The discussion in the annex also includes the debates around (problems concerning stagnating) productivity in services. From a neo-Schumpeterian perspective on firm behavior, productivity growth is closely linked to innovation. However, the exact relation between services and innovation is not that clear. Before we jump to literature on service innovation management and new service development (NSD), we provide an overview of the different approaches that form service innovation literature.

2.1.1 Service innovation approaches

Despite the drastic implications of the rise of services, and despite the fact that early studies on the 'service economy' date from the 1930s, the last two decennia brought us many articles stating that innovation in services was a new and under-examined field of research (Gallouj & Savona, 2009). Too much research was said to be focused on innovation within manufacturing industries, disregarding the growing socio-economic importance of service activities. Although the suggested newness would be expected to fade after a while, it is true that it took many years before insights from service innovation were really getting adopted in policy and firm strategy (Rubalcaba et al. 2010). Even today, this inertia-overcoming process is far from completed, as can be concluded from all those policies and definitions that still take the traditional perspective of treating innovation as a technological subject (Gallouj & Djellal, 2010). This focus on technology is the first of three approaches that emerged as the service innovation research evolved.

[1] The evolutionary notion of survival will be addressed more extensively in section 2.3.

Technologist approach

The first theories on service innovation were offered by the technologist approach (Djellal & Gallouj, 2007). In this stream, scholars tried to make use of existing frameworks about innovation. The neo-Schumpeterian vision that is popular in studying technological change is simply extended to study innovation in services. Several different relations between innovation and services can be distinguished (see table below), but the technologist approach was mainly focused on just the adoption of technological innovation by services. After all, innovations used to be associated with technology, ignoring innovations of for example organizational nature. Empirical studies that were performed within this stream used to look at the impact (on productivity or required education-level) of technical systems that were introduced in service-firms. Especially the use of ICT got a lot of attention, since this form of equipment often accounted for the biggest impacts.

Substitution	Technology and service can replace each other.
Identity	A service can improve the usage of a certain technology.
Determination	A service can be based on the existence of a supporting technology.
Diffusion	Technologies can spread services, and vice versa.
Production	Service-providers can develop technologies, or help others to do that.

Table 1: Reciprocal relations between technology and services (Gallouj & Gallouj, 1996)

For many years, also surveys for innovative behavior were biased towards technology. Many service-providers did not recognize that they were engaging in service innovation, due to the restricted definitions. Another consequence is linked to the question of lacking productivity growth in services. Early growth-figures were based on traditional measuring-methodologies. Only later, researchers start to acknowledge that not all growth in services is captured by these old procedures.

Next to empirical investigations, the technologist approach also delivered theoretical work in the form of models. An important contribution to the understanding of the role of services within economy was done by Barras (1986, 1990), who tried to construct a service taxonomy by using the notion of technological trajectories. Barras pointed out that the product life cycle in service shows a reversed pattern when compared to product life cycles in industry. The traditional view by Abernathy and Utterback (1975) described how the maturation of markets was characterized by initial adoption/development of technology in order to differentiate products, followed by quality-improvements, and finally cost-reduction. According to Barras, service industries such as accountancy adopt technologies (notably ICT) in order to automate their processes and thereby reducing their costs. Once the organization is familiar with the technology, it starts using it to reduce the quality of their output. Finally, the technology will be used to do more radical product innovations, resulting in entirely new service solutions. This view has been criticized because of its specificity for certain sectors (accountancy) and technology (ICT), as well as its limited scope on innovation; it focuses solely on diffusion of technology and ignores innovation by service-firms themselves. However, its theoretical approach led to fruitful discussions on the relation between services and innovation. One of the results is the birth of an approach that offered more room for studying the innovations that were produced by services themselves.

The service-based approach

As the interest for service innovation grew, a different approach emerged. Instead of treating services just as other economic activities, it became time to acknowledge the idiosyncratic characteristics of services. In the discussion on definitions, it was already mentioned the most important ones are non-stockability, immateriality, simultaneous production and consumption, and participation of the consumer. By departing from the traditional product-based view, the differentiation approach allowed the development of theories that embraced the typicalities of services and thereby could really contribute to the understanding and management of innovation in services. In section 2.4 we will encounter a framework of service innovation performance dimensions (Den Hertog, 2010), which tries to capture the idiosyncrasies of service innovation. We will see that when service innovations are being believed to be essentially different from technological innovation, there are also implications for innovation management.

One contribution from service-base approaches concerned the differentiation between core services and peripheral services, graded by the extent that they contribute to the competitive advantage of the service provider. Theories on the actual relation between services and innovations where mainly local; the just provided patterns of developments within specific markets. Examples are Hollanders (1966) 'accordion-theory' and McNairs (1958) 'wheel of retail', describing the alteration between specialization-diversification and simplicity-complexity respectively. Another famous study concerned forms of innovation by consultancy firms, which was found to rely on an ad-hoc basis. Formalization is a typical example of a non-technological innovation that was not perceived by the narrow scope of the technologist approaches.
Despite these useful findings, the market-specific theories remained only interesting for a limited public. For those who wish to understand the essentials of the service-innovation relationship, local theories are not satisfying.

The integrative approach

Since science usually strives for generic theories instead of local ones, more and more attempts are being made to develop theories that would capture innovation in both industry and services. Another reason is that many firms engage in both activities, as was mentioned in the general chapter on the service economy. Many industry firms seem to realize that much more profit can be made out of the services around a product than on the product itself. Since production of goods often can be done cheaper in low-wage countries, price-competition will favour non-western countries. However, often it takes a lot of specialized knowledge of technology and customer needs to deliver high quality services. Not only do these very services allow firms to differentiate from competitors (and thereby increase market share), they also allow them to capture more of customers' expenditure. Management literature therefore signals a trend of switching to service-based models. Of course, many 'pure' service firms rely on technology, which adds to the observed mix of goods-based and service innovation. Instead of pointing to the co-occurrence of goods and services, one could also argue that the whole idea of making the distinction is erroneous. Those who speak from a product-service continuum even state that they are inseparable; it is all just a matter of degree.

Several schools within the assimilation approach build on each other's insights on service innovation, with the Lille-school being the most recent and well-known. In 1997, Gallouj and Weinstein presented a service-characterization that adapted an earlier idea of representing service delivery as vectors of characteristics. Figure 4 (below) shows a graphical illustration of a regular service, being a combination of consumer and supplier competences and technological and service consumption characteristics. This 'Lancasterian model' (making use of vectors) allows also for other configurations. A pure service, for example, does not have any technological characteristics at all. Self-service (as proposed originally by Gershuny), on the other hand, does not include any supplier competences. Additional elements can also be introduced. Windrum suggested the inclusion of competences of governmental bodies.

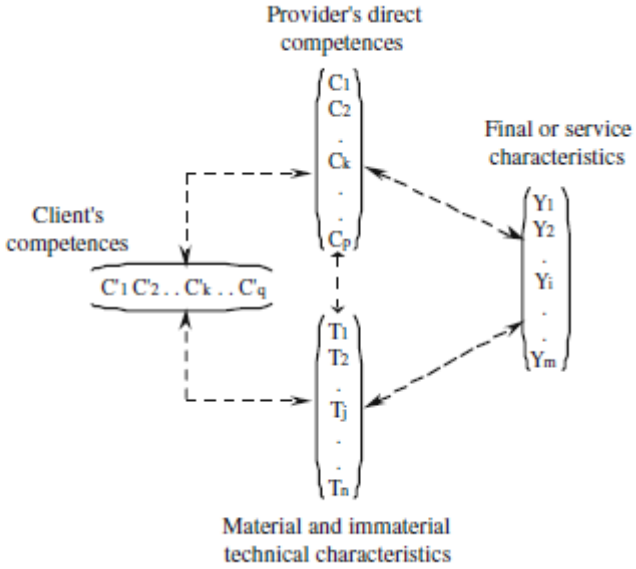

Figure 4: The characteristic-based model of service innovation (Gallouj & Weinstein, 1997).

From the perspective of the Gallouj-Weinstein model, innovation can take different forms. Competences/characteristics can be changed, added or deleted. These options result in a typology of innovation, as shown in table 2.

Type of innovation	**Change in characteristics-based representation**
Radical Innovation	Changes in all vectors
Improvement Innovation	Improvement of element within vector
Incremental Innovation	Addition/substitution of elements
Ad hoc Innovation	(not expressed in element/vector changes)
Recombinative Innovation	Recombination of existing elements
Standardization/Formalization Innovation	(not expressed in element/vector changes)

Table 2: Typology of innovation in the characteristics-based representation (Gallouj & Gallouj, 1996).

Although the work by Gallouj and Weinstein is a point of reference within service innovation literature, the strategic guidance it offers is said to be weak. In fact, the offer of service innovation management models is quite restricted as we will see in the next section. One reason is that, as we saw, the concept of services is vague due do its intrinsic heterogeneity, and also the notion of service innovation is subjected to many discussions. Service innovation research gets characterized by "ill-definition and mis-measurement" (Gallouj & Savona, 2009) hampering useful analyses. When it is not clear which activities or sectors concern services, and what exactly forms its' output, empirically testing of management models is a challenging task.

2.2 Managing Service Innovation

Now that the concepts of and relations between services and innovations are discussed[2], it is time to come to the main topic of this thesis; the management of service innovation. It should be clear that this does not only concern innovation by organizations that are classified as service firms; also manufacturing firms engage in service provision. Service innovation is thus not restricted to pure service firms, but stretches over all changes and improvements of service production (so-called 'servuction'). Given the fact that, for example, health services account for a major service industry, also the government is an important service innovator.

2.2.1 Organization of innovation

A logical point to start discussing the management of service innovation, is by providing statistics on what kind of firms engage till what extent in service innovation. Traditionally, innovation activities are measured by the extent a firm engages in research and development.

According to CIS-data from the mid-1990s, a quarter of the innovating service enterprises innovated on a continuous base. Innovation expenditures tend to be concentrated; the 10% most spending firms accounted for 80% of the innovation expenditure. Differences can also be found between sectors; some of them are investing much more than others, just like in industrial R&D. Software and telecommunications, for example, are for more R&D-intensive then services in transport. There are as well cross-national differences in expenditure on R&D.

In his 2003 publication, Bruce Tether discusses the sources and aims of service innovation and demonstrates how they differ per service sector. His research is based on the second edition of the Community Innovation Survey, undertaken in 13 countries. In the table below, he summarizes the main perspectives on innovation and technology in services as they developed over the years.

	Traditional, technology dependence	'Lille school's' interactive view	Strategic positioning (competition as a process)
Summary of conceptualisation	Innovation essentially dependent on the adoption of externally developed 'hardware' technologies.	Strong emphasis on interaction, especially with users. Innovations tend to be jointly or co-produced, especially with users.	Positioning and innovation through creative combinations of 'hard' and 'soft' technologies. Self determination of outputs and methods of provision
Source of innovation	Mainly developed by others (i.e. suppliers)	Developed jointly with others (i.e. customers)	Mainly developed internally
R&D	Rare – not usually necessary for adoption of standard technologies	May be undertaken, but not necessarily. (Often, R&D type activities are undertaken, but not recognised as such)	May be undertaken, but not necessarily. When undertaken reinforces internal creativity.
Nature of expenditures for innovation	Dominated by the acquisition of externally developed technologies	Mixed – includes internal activities and technological acquisitions	Mixed – includes internal activities and technological acquisitions
Collaborations for innovation	Rare, but most commonly with suppliers	Common, especially with customers	As needs be. Not necessarily confined to customers or suppliers
Sources of information (ideas) for innovation	Principally suppliers, but also competitors (copying) & trade fairs	Mainly customers (in combination with internal sources)	Mainly internal, but also customers and competitors
Aims of innovation	Primarily cost reduction. Some scope for extending service (time/space) availability	Principally oriented to quality and satisfying customers requirements	Wide variety. Reflects wide variety of strategic positions. (e.g., both cost saving and market expansion)

Table 3: Sources and aims of service innovation (Tether, 2003).

[2] Further context of service innovation and the service economy is set in Annex 1.

An interesting question is whether service innovation is really worth the effort; does it deliver an enhanced firm performance? The existence of a positive relation between innovation and performance is not surprising, but the direction is of course crucial. Cainelli, Evangelista and Savona (2006) showed that successful firms do not just have more possibilities for engaging in innovation activities (mainly investing in ICT), but that the resulting impact on growth and productivity is relatively large. By using data from CIS II as well, they thus demonstrate that innovation (in services) is a self-reinforcing mechanism of an endogenous nature.

One of the problems with using measurements like CIS data is that R&D within services seems to have different characteristics than industrial R&D (Hipp & Grupp, 2005). Therefore, traditional surveys that try to inventory the size of R&D-efforts are only reliable to a limited intent. According to Ian Miles, the concept of R&D (and the questions related to it) in commonly used survey instruments like the Oslo Manual (for the CIS) and the Frascati Manual are not defined well enough and focus too much on technology (Miles, 2007). As a result, R&D-activities in low-tech sectors are underreported, whereas high-tech sectors tend to overreport their efforts. The numbers on expenditure seem to show that there is an increase in R&D-activity, but Pilat questions whether this isn't just an 'artifact of improved reporting' (in Miles, 2007). If ways of sampling and measuring get modified to the nature of R&D within services, it is not an historical trend we are facing but a methodological improvement. Due to all those critics, recent versions of innovation survey manuals got revised in order to capture more of the idiosyncrasies of services and thereby close the 'innovation gap'.

A problem that stretches further than adopting good definitions, is that innovation is not only dependent on formalized R&D. Especially in the context of National Systems of Innovation (NSI), it is argued that many different factors contribute to the innovativeness of organizations (Freeman, in Archibugi & Michie, 1997). Already in the original technology-focused NSI literature, emphasis is put on the importance of innovation related system-elements like education, industrial structure, science and technology capabilities (!) and interactions within the innovation system. That especially service providers are able to innovate without doing formal R&D is shown/argued by Harrisson, Klein and Browne (in Gallouj & Djellal, 2010). They state that service organizations can engage in unusual forms of innovation, but that improvement can practically occur everywhere. Even non-profit organizations, the voluntary sector and social enterprises turn out to engage in some sorts of innovation. Typically, there are no specialized innovation departments; innovation processes rather stretch over many parts of the organization. This distributed character of innovation can be explained by the fact that 'ivory tower innovation' from dedicated departments is difficult in activities that involve interaction with clients. Innovation and service provision usually are not two processes that can be formed independently.

2.2.2 Service innovation management models

"Microeconomics is plagued by two major gaps: the absence of appropriately full treatment of either the services or of entrepreneurship. In each case, the evident importance of the subject is inversely proportional to the space it is assigned in the literature."

With this statement, William Baumol opens the 'Handbook for Innovation and Services' by Gallouj and Djellal (2010). It might be already worrying that research on services and entrepreneurship are both scarce in relation to their socio-economic relevance, but this also suggests that research on the combination of services and entrepreneurship is even more

lacking. Indeed, there are not many models that guide entrepreneurs and enterprises in their efforts to develop new services.

How to manage service innovation is the central topic of research on New Service Development (NSD). This line of literature originates in multiple sources (Menor et al., 2002). One of them is *service management*, which is essentially based on optimizing the quality of the service. It includes tactical insights on the account of service production and delivery, quality measurement and maintenance, customer contact, human resource management, pricing, etcetera. Especially service marketing proves to be a service management issue that is closely related to the renewal of the service offering. Due to the characteristic intensity of interaction with customers, service providers are often well aware of the needs of their clients. Marketing departments are responsible for adapting the service output to the market trends they observe, which is essentially an act of service innovation.
Richard Normann (1984) was one of the pioneers who developed service management into service innovation management. He describes four forms of service innovation: social innovations, technical innovations, network effects and reproduction innovation (more on this in the next chapter). It is evident that also his work on the creation, reproduction and refinement of service business systems is all about service innovation. So, service management certainly delivered useful insights in the challenge of extending the service portfolio.

Other contributions to NSD come from the literature on *service innovation*, as discussed extensively earlier. In the beginning, these studies were mainly concentrated on adoption, but later it got acknowledged that service providers innovate themselves as well. (Sundbo, 1997). Service innovation literature contributions are characterized by the fact that they mainly developed abstract theories; Menor et al. mention the model by Gallouj and Weinstein. Whereas service development has a more tactical management approach, service innovation mainly describes "the strategic implications for offering new services". In our search for service innovation instruments, the management oriented NSD-literature certainly deserves some extra attention.

New service development literature studies both the processes that lead to new services, as well as their performance and antecedents. De Jong and Vermeulen (2003) classify research on NSD by their evolutionary stage. The first step is about managing key activities in the NSD process within a firm, being followed by the second step of creating a climate for continuous innovation. Chances for long-term survival are expected to rise when a firm is able to introduce multiple innovations. The fact that service innovation is often characterized as an *ad hoc* activity does not imply that this is also the optimal way. In contrary, it is believed that firm performance can profit from (formal) organization of the new service development processes. The NSD literature provides insights on how managers should organize their organization in order to improve the rate and quality of innovative efforts.

NSD is partially influenced by the practical and linear approach of New Product Development, and thereby a technologists approach. Adaptations of practices from operational management resulted in a spectrum of specific NSD-management models. The 'quality function deployment tool', for example, is applicable in both goods and services production. Service blueprinting is a technique which is already more specific for services. By mapping all the actions, actors and interrelations between them, one can easily analyze weak and strong spots within the service delivery. The common wisdom that the development of new services asks for an integral approach (e.g. Normann, 1984), inspired Edvardsson and

Olsson in their creation of the ‘service prerequisites model’ (Smith et al., 1997). When developing a new service, there has to be alignment between the service concept (utility and benefits provided to the customer), the service process (chain of activities for producing the service) and the service system (available resources). Smith et al. (2007) argue that successful design of new services can be achieved when combining a holistic approach with a high level of precision in service design and the development process. Decisions which tools to deploy should be based on a perspective that covers all elements of service delivery, as well as all stakeholders involved.

Despite all the (mainly descriptive) literature on new service development, general frameworks or management models that offer strategic and practical guidance are scarce. As Nysveen and Pedersen (2007) write in their extensive literature research of ‘Service Innovation Methodologies’: “Very few contributions conclude with explicit implications for service innovation methodology. Much of the literature is based on industry specific case studies lacking in external validity”. Much of the NSD work concerns financial services, which is only a sub sector of services (De Jong and Vermeulen, 2003). Next to the common limitation s in generalizability, Nysveen and Pedersen conclude that, although service innovation is frequently being argued to differ from product innovation, the service innovation literature says little about how it could guide prescriptive service innovation methodology literature. The descriptive findings on service innovations still need to be transformed into prescriptive recommendations.

Our conclusion so far is that service innovation and NSD-literature is lacking frameworks that allow for management purposes. We now turn to the literature on strategic management in general, and explore the possibilities of applying this in the service context.

2.3 Dynamic capabilities view

2.3.1 Development of the literature

Nowadays, dynamic capabilities fulfill a central role within (strategic) management and organizational theories. Over the course of the last two decennia, they partially replaced the paradigm that uses Porters value chain for explaining a firm's competitive advantage. The dynamic capabilities view (DCV) states that economic performance of a firm can be explained by looking at assets such as its resources, capabilities (i.e. skills) and especially its capacity to reconfigure both. However, the exact nature of dynamic capabilities, as well as their causal relation with firm performance, are still a huge point of debate. In this thesis, dynamic capabilities do not figure solely as a tool to manage service innovation. The aim of this research is also to contribute to the DCV-literature. In order to explain the exact questions that will be studied, a clarification of the Dynamic Capability View is essential.

From the perspective of the firm, strategic management is a matter of utterly importance. In fact, how to maintain or increase market share, can be regarded as a purely existential question. As evolutionary economics would state, survival is all that counts. However, also before the rise of evolutionary economics, many theories have been developed in order to explain how some firms could capture more market share and profit than others. Over the course of its existence, several paradigms have dominated the ideas on how to research and deploy strategic management. A good example is the earlier mentioned technologists approach for explaining the emergence of the service economy. Since classical economic theories were founded on the production function (Y = K +L), this shaped also the neoclassical perspective that dominated at the period of Clark, Fisher and Fourestié. Neoclassical economics introduced the role of technology in the production function, and thereby also influenced the ideas on the service economy. We already saw how the technologist approach had a very narrow idea of innovation, and ignored all those non-technological elements that are typical for service production and service innovation.

Neoclassical economists used to focus on the way firms transform their labor and capital into products; most other production factors that were relevant for a firms processes were thought to be commodities. The idea that resources are easy to acquire is typical for traditional theories about industrial organization. In the 1950's, Edith Penrose was one of the first to link firm performance to the specific characteristics of the resources they possessed. Initially, the focus of this Resource Based View (RBV) was on factors that were internal to the firm. Only in the 1980's, economists also started to take into account the external resources a firm has access to (a key contributor here was Wernerfelt, 1984). Despite its origins in the early Penrosian views, the RBV started to emerge from this period on. This is remarkable, because in that period micro-economics and management studies were dominated by theories that looked especially on the external context a firm was operating in. Economists in that era believed that strategic management should be based on the practice of positioning a firm explicitly in its environment. Michael Porter is well-known for his value chain theory and five forces model that aim to identify the strengths and weaknesses of a firm, relative to the industry in which it is active. This kind of insights on competitive advantage still forms the basis for many publications on strategic management in present times; firms should search industry opportunities given the assets they have access to. By acknowledging that resources can be rare and valuable instead of common, ideas about the driving force behind organizational success could change views on industrial organization.

What we see in this very global description of theoretical developments within management studies, is shifts between focus on internal factors and external factors. The resource based view as explained by Teece et al. (1997), mainly focused on the uniqueness of a firm's assets, whereas industrial organization and value chain theories mostly looked at opportunities related to the characteristics of a firms industry. The emergence of evolutionary economics can be regarded as hybridization of internal and external views. An important insight is that industrial dynamics are both restricting a firm's behavior as well as the consequence of the actions taken by firms. Authors such as Nelson and Winter (1982) proposed a theory of the firm in which both its own choices and the external environment of a firm matters for explaining its performance. In evolutionary economics the fitness of a firm was said to depend both on its own characteristics as well as the selection-criteria of the market, although those latter are hard to know. So, although dynamic capabilities are usually related to evolutionary economics, they can be understood best by discussing in more depth the views where they originated from.

Resource Based View and Dynamic Capability View

If we talk about the resource based view, what exactly are those resources? Helfat and Peteraf (2003) define them as "an asset or input to production (tangible or intangible) that an organization owns, controls or has access to on a semi-permanent basis". Competitive advantage can especially be achieved by the firm when its resources meet the VRIN-criteria; valuable, rare, inimitable and non-substitutable. The underlying assumption here is that resources are heterogeneously distributed across competing firms and are imperfectly mobile. Strategically managing its assets allows a firm to deliver higher quality products and/or lower costs than firms who do not have such resources at their disposal. Therefore, the heterogeneity of resources is said to persist over time (Wang & Ahmed, 2007, pp. 32).

Essential is that a firm manages its resources strategically and is indeed able to actually create value in such a way that it can not be imitated by competitors. Although the proposed definition of resources already includes intangible assets, some scholars argued that there should be more emphasis on the importance of competences for optimally configuring resources. The main reason was that it remained unclear how firms can achieve *sustainable* (long-term) competitive advantage, given the fact that some markets tend to be highly dynamic these days. Just having the right type of resources and resource configurations does not guarantee a firm that it will also be successful in the future. Changes in consumer preferences or available technology can destroy the strength of the position a firm holds. On this point, the static RBV was accused to deliver insufficient explanation.

From the 1990s, a stream of strategic management emerged that tried to resolve some of the questionable issues within the RBV. Instead of focusing on the stock of internal resources, the Dynamic Capability View assigned competitive advantage to the ability of a firm to "integrate, build and reconfigure internal and external competencies to address rapidly changing environments" (Teece, 1997). The dynamic capabilities view tried to overcome the earlier mentioned shortcoming of the RBV by stating that resources might be important in static markets, but competencies are crucial for long-term performance in dynamic situations. These competencies are different from routines that firms employ to do their regular business; essential for dynamic capabilities is that they refer to the ability to alter these so-called zero-order capabilities. Later we will see that the abstract distinction between organizational routines and higher order capabilities remains a subject of discussion. Here, it should be clear that dynamic capabilities are closely related to a firm's capacity to innovate.

This innovation can both concern the output (be it goods or services), as well as the organizational structure of the enterprise.

Before entering the discussion about the exact nature of dynamic capabilities, it is important to explain why dynamic capabilities can be placed within the field of evolutionary economics. Although the (initial) focus of the RBV was on characteristics on the firm-level, relations with environmental conditions have been integrated in (enhanced versions of) the DCV. Distinctive for the evolutionary perspective is that firm specific capabilities can be regarded as the genes of a firm, determining how the firm will behave. Since the future options of a firm are limited by their present capabilities (genes), the development process is said to be path-dependent. The conception of genes that manifest themselves in the appearance and behavior of a firm (its phenomenology) matches with the biological notion of evolution. Offspring from a firm, e.g. spin-offs, is said to inherit a part of the gene-set of the mother company. Although those spin-offs often can not access the resources of the firm it stems from, they frequently turn out to have higher survival-chances then regular start-ups. So, according to authors as Klepper (2002), inherited capabilities/routines (genes) can be hold (partially) responsible for leading a firm to successful performance.

Unlike in biology, firms are able to change their genes, possibly in an attempt to imitate the gene-set of a successful competitor. In fact, evolutionary economists believe that the main function of a manager is to change the genes of a firm in order to create a valuable set of resources. This means that dynamic capabilities are all about a firm changing its own gene-set (and not just its own behavior). To understand how strategic management from a DCV-perspective should be deployed, it is crucial to make a distinction between 'technical fitness' and 'evolutionary fitness'. Technical fitness indicates how well a firm can perform a certain task. A modern interpretation of this notion takes the word 'technical' very broad; it can be any activity a firm is performing. Evolutionary fitness is then how much certain activity contributes to the strengths of a firm. Here, the preferences of the selection-environment are taken into account: a firm can be very good in some function (e.g. the production of a good or feature of a good) and have a high technical fit on that account, but if it is not valued by the market, the evolutionary fitness of that good remains low. Strategic management for long term survival should thus be focused on the development of the right capabilities in order to be able to continuously adapt. As Helfat et al. point out, (dynamic) capabilities can not have a negative technical fitness themselves, but sometimes they can have a negative interaction with each other that lowers the resulting evolutionary fitness of a firm's processes.

To conclude the brief discussion about the emergence of the DCV within micro-economics and strategic management, it might be wise to relate it back to the view in which it originated. Since the DCV is more an addition to than a total departure from the RBV, both streams evolved in parallel. The two complementary lines of literature criticized each other and at the same time adopted each other's insights, which led economists to synthesize a combined view, noted as the RBV/DCV. The RBV is bounded to moderately changing markets, whereas the DCV mainly stretches over environments that change with a higher velocity. This harmonization, however, does not at all imply that the resulting view consists of 'perfect' scientific theories that were consistent, clear, accurate and predictive, etcetera. In fact, the RBV/DCV still seems to be in its infancy and consensus between researchers happens to be rare.

2.3.2 Detailed description of dynamic capabilities

The vague and abstract nature of dynamic capabilities led to many discussions of *what they are* exactly, *why they are important* and *how they should be managed*. Easterby-Smith et al. (2009), in their review article, state that the first two issues are 'interrelated and key to developing, testing and applying the dynamic capabilities construct fruitfully'. 'Fruitfully' can be interpreted in serving both descriptive theories and prescriptive guidance, which brings in our last issue (management). In between we will also discuss the empirical evidence for their existence.

What they are (nature)
Just like the RBV, the DCV suffers from vagueness with respect to the core of its theories. Let us start with investigating some extra definitions:

- Dynamic capability is *"the learned and stable pattern of collective activity through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness"* (Zollo and Winter, 2002).
- *"A dynamic capability is the capacity of an organization to purposefully create, extend or modify its resource base"* (Helfat et al., 2007).

It has to be acknowledged that these definitions still leave ample room for discussion. An important question is for example; where does this capacity reside? One could say that dynamic capabilities are not processes themselves, but that they are embedded within processes. The subtle difference here is that one can not say: this process *is* a dynamic capability. Rather, one would say this process or these processes contain or constitute a certain dynamic capability. Another interesting notion is that dynamic capabilities seem to 'consist of patterned behavior that companies can invoke on a repeated rather than an idiosyncratic basis' (Helfat et al., 2007, pp. 3). A capability that is only performed during one project or the production of one product thus does not count as a dynamic capability. Excluded is also behavior that entirely relies on talent. However, the behaviorist dimension within evolutionary economics also says that dynamic capabilities are the results of decisions. Therefore, they should be studied by both looking at organizational units as well as individual managers. This makes the exclusion of talent troublesome, because it sounds plausible that some capabilities are embodied in processes that are only performed by a very select number of individuals in an organization.

Remarkable is also the two different objects in the definitions above; dynamic capabilities can be used for changing routines and the resource base. Confusion can arise because of the broad use of the notion 'resource'; this can relate to only material, financial and cognitive inputs, as well as to a set of sources that also include routine-like *skills* within a company. Here, we enter the discussion about different hierarchical levels within the notions of resources and capabilities. The most accepted idea is that some of the processes within a company are based on 'normal' capabilities for transforming the resource base into valuable output. In contrast to these routine-like zero-order capabilities, firms can possess capabilities that are placed higher in the hierarchy. Most scholars state that it dynamic capabilities are a first-order element that can be used for altering lower order capabilities. However, some others claim that there are more levels to be discriminated. For example, Wang and Ahmed (2007) state that the zero-order level reflects the resources of a firm (in the material/financial/knowledge sense), possibly delivering static competitive advantage by

meeting VRIN-criteria. The first-order then accounts for the routine capabilities ('competences' in the RBV) to restructure and recombine those resources to actually deliver a product or a service. 'Core capabilities', one order higher, are defined as "a bundle of a firm's resources and capabilities that are strategically important to its competitive advantage at a certain point". These competences are also static, but more important than the regular capabilities of the first order. They are used to strategically combine the resources, but are nevertheless prone to market dynamism. A common danger is that firms increase their strengths on competences or outputs that are becoming less and less relevant; the so-called competency-trap. Finally, in the third-order, we then find the dynamic capabilities that allow an organization to cope with the changes in its environment. Although it can not be denied that there is some logic in this more differentiated alternative, we link up with the mainstream DCV by distinguishing zero-order resources and operational capabilities on the one hand, and first-order dynamic capabilities on the other hand. This view implies that dynamic capabilities can also change themselves, which resembles the evolutionary idea of genes that do not just have an impact on the phenomenology of a firm, but also on the gene-pool itself.

Regardless its place in the proposed hierarchies concerning the various levels of capabilities, one could try to define a distinct *set* of examples of specific dynamic capabilities. However, those specific examples are often identified on only an ad-hoc and anecdotic basis. Especially in the early years of the DCV, new dynamic capabilities were introduced with each case study that had been done. "Existing qualitative research has revealed a plethora of firm- or industry-specific transformational mechanisms", as Wang and Ahmed state. Examples of medium to highly specific dynamic capabilities are knowledge management capabilities, acquisition capabilities and drug development capabilities. Notably this last type of capability is much too specific to serve general theories.
Therefore, DCV-scholars started to emphasize the need for insights on the relations between all the DCs that were reported. Eisenhardt and Martin (2000) pointed at the existence of 'commonalities in key features, idiosyncrasy in details'. At a general level, dynamic capabilities are said to have elements in common between firms and sectors, but at individual cases they tend to have specific characteristics. The exact form of the dynamic capabilities that are present in a firm are considered to be evolved out of those that were present earlier, and developed through learning processes. The firm-specificity of dynamic capabilities is thus a consequence of their path dependent development, which also means that the possibilities for other firms to imitate them are limited.[3] Drnevich and Kriauciunas (2011) argue that dynamic capabilities contribute especially to firm performance when they are heterogeneous, i.e. unique, customized, idiosyncratic and/or specific to a firm.

In a famous article by Eisenhardt and Martin (2000), this heterogeneity and some DCV-critiques are being questioned. They deny that dynamic capabilities are vague, tautological endlessly recursive and non-operational. In fact, they claim that 'dynamic capabilities are a set of specific and identifiable processes such as product development, strategic decision making and alliancing'. For each of these common capabilities, there are good and bad ways to execute them. When successful ways are widely applied, the use of that 'best practice' can give dynamic capabilities a more homogeneous character than usually assumed. Moreover, uniqueness is being questioned by arguing that firms may have different starting-points and development trajectories, when it comes to dynamic capabilities, but in the end they can achieve capabilities with the same key attributes. This 'equifinality' is not contradicting with

[3] To link back to the earlier introduction of evolutionary economics; the limited possibilities for imitation brings the analogy closer to biology, where genes can not be copied at all.

path dependency, given the fact that the development trajectory can vary for each firm. Highly interesting is also their conception that the routines that underlie a dynamic capability are substitutable. Form and details can differ, 'as long as the important commonalities are present'. The somewhat similar notion of 'fungibility' implies that these commonalities are relevant even industries that differ in their activities.

If there are really common characteristics within dynamic capabilities that stretch over a range of industries, it should be possible to develop a framework of distinct general dynamic capabilities. In order to disaggregate dynamic capabilities into their component parts, several main component factors have been proposed. Wang and Ahmed (2007) write about adaptive capabilities, absorptive capabilities and innovative capabilities. More well-known is the recently proposed framework of Teece (2007), consisting of abilities to *signal* the market, *seize* opportunities and *reconfigure* the organization. He bases these fundamental dynamic capabilities on common dynamic capabilities for *idea generation, market disruptive capabilities, new product development, marketing,* and *new process.* Another example is provided by Ambrosini, Bowman and Collier (2009), who build on the multi-order idea by stating that '*incremental* and *renewing* capabilities utilize and leverage the current resource base, but *regenerative* dynamic capabilities evaluate and adapt the overall portfolio'. In some cases, e.g. Protogerou & Caloghirou (2008, Druid) and Agarwal & Selen (2009), statistical analyses like factor analyses on survey data have been used to abstract underlying dimensions that are supposed to reflect distinct capabilities. Something similar was also done by Avlonitis et al. (2001) in the context of financial services, although it was not based on the DCV literature. These frameworks will be discussed in more depth in subsection 2.4.1.

Why they are important (outcomes)

At a very general level, dynamic capabilities are held responsible for a firm's ability to adapt its resources and competences to the changing environment. For the development of convincing theories not only clear definition of dynamic capabilities is important, but also the exact link with performance and competitive advantage. In their review of DCV-literature, Arend & Bromiley (2009) show some of the most well-known representations of how dynamic capabilities work.

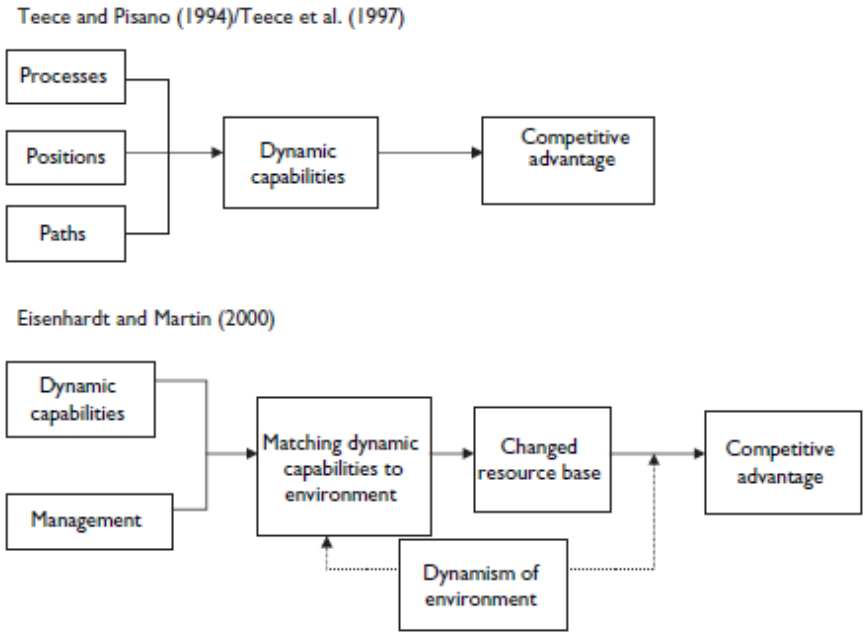

Figure 5: Frameworks for dynamic capabilities; see also figure 6 (Arend & Bromiley, 2009).

A fundamental difference between the visualizations is that in the original ideas of Teece (not the 2007 work), dynamic capabilities were directly the cause of competitive advantage. Later, many scholars acknowledged that the performance enhancing impact of dynamic capabilities was partially or totally mediated by their influence on other assets. An example was the visualization of the model by Eisenhardt and Martin on the previous page, stating that dynamic capabilities only affect competitive advantage through the alteration of resources and lower order capabilities. Something similar is stated by Helfat and Peteraf (2003), who also observe that the power of dynamic capabilities lies in their ability to change ordinary capabilities that really create value. Here, we can clearly see how the RBV and DCV complemented each other. Teece himself adapted his earlier work by proposing a model in which he distinguishes three main dynamic capabilities of which some ('create') have an indirect effect and some ('deploy' and 'protect') have an indirect effect on competitive advantage.

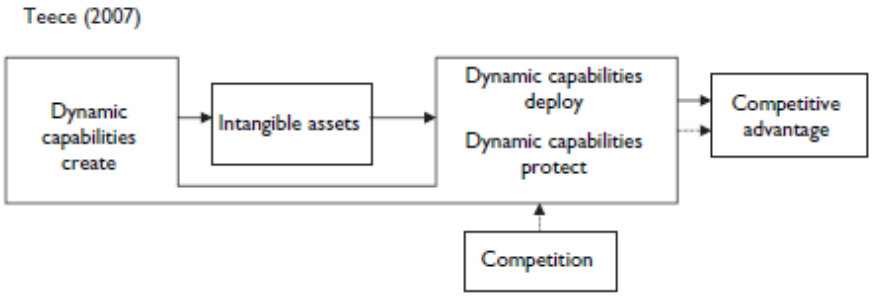

Figure 6: Another framework for dynamic capabilities; (Arend & Bromiley, 2009).

Slightly more advanced is the stylized model provided by Zahra et al. (2006), who also try to separate the existence of dynamic capabilities from their effects. They try to take into account the factors that are relevant for capability formation and performance, as well as 'various managerial and entrepreneurial activities and processes associated with the evolution of these capabilities'. In fact, their starting point is entrepreneurial activities that influence resources, skills and learning processes. These factors, as well as the dynamic capabilities, accordingly have an impact on the organizational knowledge and substantive capabilities (i.e. 'ordinary' zero-order capabilities) that influence performance. Zahra et al. thus accept the view of Helfat and Peteraf (2003) that it are these resulting substantive capabilities that finally create value.

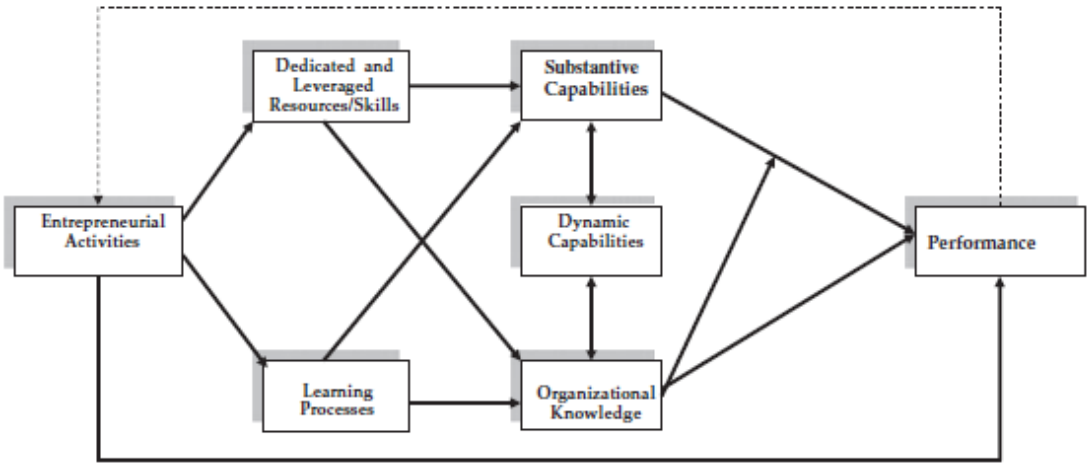

Figure 7: Alternative dynamic capability framework (Zahra et al. 2009).

The empirical evidence

Let us have a closer look now at the empirical research on dynamic capabilities. Many studies look at the behaviour and performance of a particular case. If this firm has above-average results, explanations are often found in the skills it possesses. When a firm has capabilities to acquire or reshape resources and organizational structures, this can allow her to meet the new demands of the permanently changing markets. This kind of flexibility is also essential for its ability to adopt (new) technologies that can improve the quality of the firms output, or the development of new products and services. Unfortunately, this kind of research does not deliver solid theories. By identifying unique skills of a successful firm and calling them dynamic capabilities, a *tautological* argumentation is introduced. Unless the existence of those capabilities is compared with the capability-set of other firms in similar conditions, it is impossible to draw strong conclusions. A similar critique has been given on the RBV, that was unclear in the measurement of VRIN-criteria, and often seemed to state that assets where apparently VRIN when a company was performing well. According to Eisenhardt and Martin (2000), tautology arises when one attributes superior performance to unique resources every time a firm is studied. The solution then lies in looking at the impact of the dynamic capabilities. In their case, a *functional relationship* with resource manipulation is proposed. Not the dynamic capabilities themselves lead to superior performance, but the renewed resource configuration that results out of their use.

Another lively point of debate within (empirical) DCV-research is which dependent variable to choose in statistical models. Ray, Barney and Muhanna (2004) state that firm performance is a highly aggregated dependent variable which is certainly interesting but maybe not optimal for testing theories. They suggest that resource-based logic (using resources and capabilities as synonyms) can be examined better by looking at the effectiveness of business processes; 'actions that firms engage in to accomplish some business purpose or objective'. Dynamic capabilities influence not directly firm performance, but can be used for improving business processes (Den Hertog, 2010). This strategic perspective emphasizes that firms can have different strengths in various activities. Only some business processes lead to competitive advantage, whereas others have a less positive impact on performance.[4] The set of capabilities that form the independent variables in the study by Ray et al., are service climate, managerial IT knowledge, technology resources in customer service and investment in customer service. The determinative impact they have on business processes is said not to be unidirectional; existent business processes also influence the development of resources and capabilities.

Unfortunately, the empirical grounding for DCV, including the hypothesized link with firm performance and competitive advantage, is scarce (E&M, 1106). One factor that is hampering research is the earlier described troublesome operationalization of the DC-concept. When researchers have to rely on empirical studies that are solely anecdotic, generalizing results becomes very dangerous. Quantitative studies on dynamic capabilities have been done, but often they use weak proxies (e.g. patents for 'technological capability'), a small number of firms and/or a specific sector. Actual measurement of pre-defined capabilities is rare. Moreover, the capabilities that are being used differ often per study. Another example of this is the capability-based framework for open innovation by Lichtenthaler and Lichtenthaler (2009); their 'integrative perspective' turns out to be focused solely on capabilities that are related to knowledge management.

[4] Note that something similar was already encountered in the distinction between technical fitness and evolutionary fitness.

Some successful empirical studies that have been done question the applicability of the DCV; does it also hold in stable markets? Drnevich and Kriauciunas (2011), amongst others, show that the ability to restructure and reorganize resources is especially relevant in dynamic markets, as the name of the theory suggests[5]. However, Eisenhardt and Martin (2000) and Ambrosini et al. (2009) argue that also in environments that change with a modest velocity, owning dynamic capabilities contributes to competitive advantage.

How they should be managed

Whereas the general ideas behind the DCV might be appealing, we already ran into some problems of both conceptual and empirical nature. The purpose of strategic management is providing insights that can be used for enhancing a firm's performance. Unfortunately, the DCV has frequently been criticized for not being enough 'down to earth'; operationalization of the view are very scarce. According to Helfat et al. (2007), this is partially due to the fact that the DCV originates in economics and industrial organization, which has a strong focus on the content and conceptual elements. Only later the subject of dynamic capabilities was picked up by organizational science and psychology, which brought in more focus for the actual processes and interactions in which dynamic capabilities are said to be located.

When entering a discussion about management, we have to acknowledge the consequences of lacking insights on the account of what dynamic capabilities are exactly and how they are related to performance (previous two sections). Investigating the DCV in more detail seems to be a prerequisite for formulating management recommendations. Therefore, at this point we are very restricted in our attempts to describe how managers should deal with dynamic capabilities.

We saw already that according to the RBV, firms can use their mix of resources, processes and capabilities to deliver a value proposition that is preferably inimitable. When market dynamism causes the resource advantage to disappear, managers should initiate a reconfiguration to achieve again a unique position. Since the RBV does not say anything about the ability to transform and reconfigure, the DCV tries to fill in this gap in strategic management. Dynamic capabilities of a company reflect the ability to appropriately configure the right skills and resources in constantly mutating situations.

The *key role of strategic management* is thus to intentionally direct these assets towards a configuration that is aligned with occurring market developments. Only when an organization is able to continuously adapt to changing environments, it can survive the treat of being pushed out of the market by firms that are more fitted to the new environment. To relate this to the earlier discussion of evolutionary perspectives; it is not about being the strongest (technical fitness), it is about being the fittest in an evolutionary sense. However, characteristic for evolutionary economics is also that one can not really know the criteria of the selection environment. Being restricted by many forms of 'bounded rationality', firms can only try to adapt in the right way. Note that one part of the definitions of dynamic capabilities was not discussed intensively before; they are said to be in *pursuit of improved effectiveness* (Zollo and Winter, 2002) and about *purposeful creation, modification and extension* (Helfat et al., 2007). Whether the changed resource base really leads to a higher evolutionary fitness is not relevant, as long as managers attempt to achieve that.

[5] To be clear: 'dynamic' in dynamic capabilities does not directly refer to the application in dynamic markets; it indicates the flexibility of altering lower order capabilities.

According to Peteraf and Maritan (in [Helfat et al., 2007), managers are responsible for the right 'asset orchestration' (see picture next page). This means that they should develop and deploy the processes that have an internal fit, i.e. the processes should support each other in constituting a certain dynamic capability. Part of the management of dynamic capabilities is discarding resources/processes in case they have a negative interaction effect on the other processes. This can occur especially given the presumed path dependency of capabilities; processes that used to be essential can turn into a 'competence trap' as the market is changing.

Besides avoiding conflicting processes, managers usually are also occupied with diminishing the costs of a firm's activities. The number of studies that devotes explicit attention to the costs of developing and deploying dynamic capabilities is relatively low. This is not surprising if we consider the fact that the relation with benefits is still far from clear. However, studies that investigate the relation between the presence of dynamic capabilities and net firm performance should certainly take into account that a positive effect of deploying dynamic capabilities can be reduced by the costs of developing and maintaining it. Zollo and Winter (2002) are known for their work on 'contingency factors', answering the question under which circumstances investments in the development of dynamic capabilities is wise.

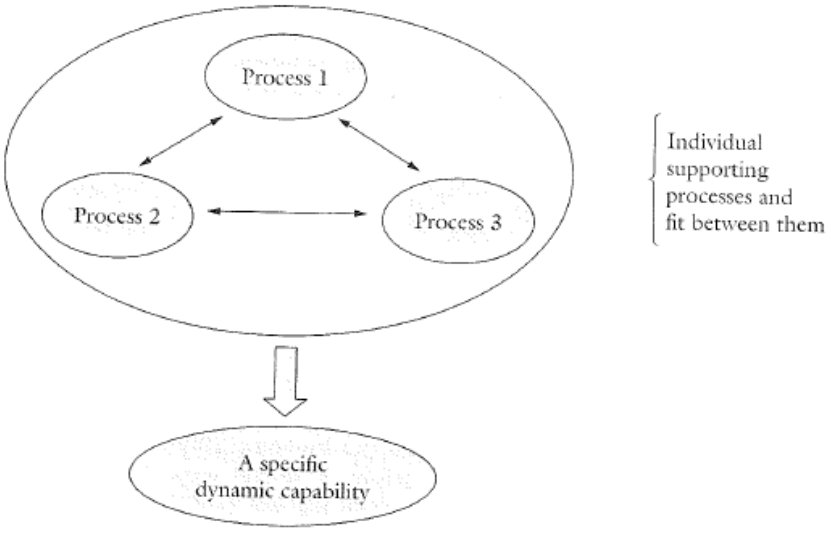

Figure 8: Dynamic capabilities and processes (Peteraf and Maritan, in [Helfat et al., 2007, pp.41])

Next to renewal, recreation and reconstruction of resources and capabilities for rebuilding competitive advantage within the firms existing market, dynamic capabilities include the ability to direct core competences towards successfully finding new markets (Peteraf and Maritan, 2007). Not all the action should be devoted to internal issues, deploying them in a different surrounding can already lead to success. Moreover, in certain environments, firms can actively shape their environment by using their dynamic capabilities. This means that it is not all about adapting to, but also about influencing external factors. Another subject that is less treated in the literature is the relevance of dynamic capabilities in maintaining the status quo. When environments are changing, it can be quite a challenge to keep processes the way they were. Think for example of a firm that has to scan the market continuously in order to find suppliers that deliver the desired input. If the environment of suppliers is highly dynamic, the firm needs to have an intelligence function that secures the availability of required resources.

Conclusion
The table below aims to summarize the description of dynamic capabilities.

Dynamic Capabilities (DC)	
What are they?	- Competences that enable a firm to adapt to market changes. - DCs are higher order constructs that are essential for reconfiguring a firms' resource base (including routines). - There is no consensus in ideas where exactly DCs can be found. Are they located in people or embedded in processes?
Why are they important?	Current practices of an organization can become outdated when the market changes. DCs help firms to achieve sustainable competitive advantage.
Empirical evidence for their existence and importance	- Empirical evidence is scarce. Many studies are anecdotic (sector or firm specific) and tautological. - Relation with competitive advantage is not demonstrated extensively, partially because of problems with measuring DCs.
How should they be managed?	- Managers should focus on the development of processes that constitute DCs. - Developing and maintaining DCs can be costly. Disregarding them can be wise.
Research gap	- Cross-sectional studies of DCs are scarce. Due to unsettled definitions and anecdotic studies, comparisons and general insights are missing. - DCs are rarely measured quantitatively. - Once measured, relationships with innovation and performance can be studied. (- DCs in a service context are underexplored)

Table 4: Summery of literature review on dynamic capabilities.

All in all, there are many points of critique on the DCV. It gives circular definitions which are overly inclusive and elastic, identification occurs on a post-hoc basis, the relation with firm performance is unclear, etcetera (for a full listing of critiques, see Priem and Bulter, 2001; Arend & Bromiley, 2009). In order to become a coherent theoretical framework with practical management applications, the DCV must be based on clear definitions, be able to make non-trivial predictions, be supported by empirical studies and give guidance for dealing with dynamic competition. "A lack of clarity concerning basic understandings can limit fruitful conversation, impede progress on the theoretical front, and prevent empirical work from cumulating", as Di Stefano et al. (2010) phrases it.

This research has ambition to provide more clarity in the empirical quantitative measurement of dynamic capabilities, as well as their relation with firm performance. Many critiques on the DCV have been uttered, but satisfying answers are still lacking. The ideas about how to measure dynamic capabilities have not been applied fruitfully, which hampers further analysis in their occurrence and relevance. Our ambition is to break out of the endless discussions about their definitions, by selecting a framework that allows the retrieval of information about the processes that underlie the dynamic capabilities a firm possesses. Since the DCV will be used for studying service innovation management, the next subsection will discuss the inter-section of the two subjects.

2.4 Dynamic capabilities for managing service innovation

2.4.1 Selecting a framework

An important conclusion of the review on service innovation literature was that a clear model for management purposes was missing. The dominant views within strategic management were reviewed in the previous section. Here, it became clear that the DCV is far from a well-tried theory, also in our focus-area of innovation. Our conclusions concerning important shortcomings for engaging in convincing quantitative empirical research, can be summarized as the *lack of a multi-construct framework of pre-defined measurable dynamic capabilities.* Only with such a framework, insights in the presence of dynamic capabilities can truly be used for assessing a (preferably causal, but at least correlative) relation with firm performance. Therefore, also the development of a useful tool for strategic management is dependent on the availability of a framework that allows the measurement of a firm's ability to optimize its resources and competences.

The higher-order construct of dynamic capabilities is believed to be a composite of distinct sub-dimensions. The presumed existence of (and urge for) an over-arching framework of specified dynamic capabilities follows the idea of their process-embedded nature and of communalities (Eisenhardt and Martin, 2000).When selecting an appropriate candidate for measuring a set of distinct dynamic capabilities for managing service innovation, three criteria will have to be met:

1. Traditionally, the DCV presumed that dynamic capabilities are linked to firm performance. Later contributions pointed out that the capabilities themselves might be relevant for sustained competitive advantage but do not deliver any direct advantage; it is the adapted resource base that results out of the deployment of the dynamic capabilities (Helfat et al., 2007). This is in line with traditional innovation literature demonstrating that innovation often has a positive impact on performance (e.g. Mariesse and Mohnen, 2003; Cainelli et al. 2006). Thus, the framework of dynamic capabilities should be directed towards continuous *innovation*.

2. The framework should be *complete*, meaning that it should capture all the capabilities that are relevant in optimizing the resource base for introducing better processes and/or products. Sets of dynamic capabilities that are essential for only a specific aspect of innovation can certainly be interesting, but do not match with the broad scope of this thesis.

3. The framework should be *applicable in a service context*. When talking about innovation, this implies that the dynamic capabilities should be defined on the basis of their importance for achieving service innovation. Preferably, the framework provides explicit guidance for how to apply it in a service context. Transforming general frameworks (not service specific but neither excluding services) for making them applicable to service innovations is an elaborative task which asks for expertise and thorough validation.

In the literature we can find some already existent sets of dynamic capabilities. We will discuss them here in more detail, and match them with our criteria.

- Teece himself proposed a set of dynamic capabilities in 2007, obviously based on earlier work such as his 1997 article with Pisano and Shuen. The table below shows that processes that are relevant for achieving sustained competitive advantage can be grouped into three dynamic capabilities: sensing, seizing and transforming. Sensing is about noticing what is going on in the market, whereas seizing concerns activities that focus on turning ideas into optimized products that can generate revenue. This is similar to March's notion of exploration and exploitation (1991). However, the activities within all of the dynamic capabilities can also be grouped into a class of value creation and a class of value capturing (Katkalo, Piletis and Teece, 2010). This includes sensing and seizing, as well as the transforming capability that denotes the ability to actually reconfigure the assets within an organization.

A common critique on the DCV is that it is too conceptual and abstract. By defining more specific activities, Teece aims to provide insight in processes that are essential for achieving sustainable competitive advantage and business performance. The three capabilities themselves might still sound very general and hardly original. When we look for example to the general model of the Innovation Value Chain (Hansen and Birkinshaw, 2007) we see many similarities. 'Idea generation' can perfectly be done by seizing the market, 'idea conversion' relates to the development of viable (exploitable) products and 'idea diffusion' matches perfect with implementing a selected idea in the organization. Of course there are some differences between these two models, but it illustrates how obvious the three capabilities might seem. Therefore, it is interesting how Teece (in his 2007 article) tried to include some micro-foundations that can make the DCV more hands-on and applicable in strategic management purposes. Unfortunately for us, it is not focused on innovation (criterion 2), and certainly not on service innovation (criterion 3).

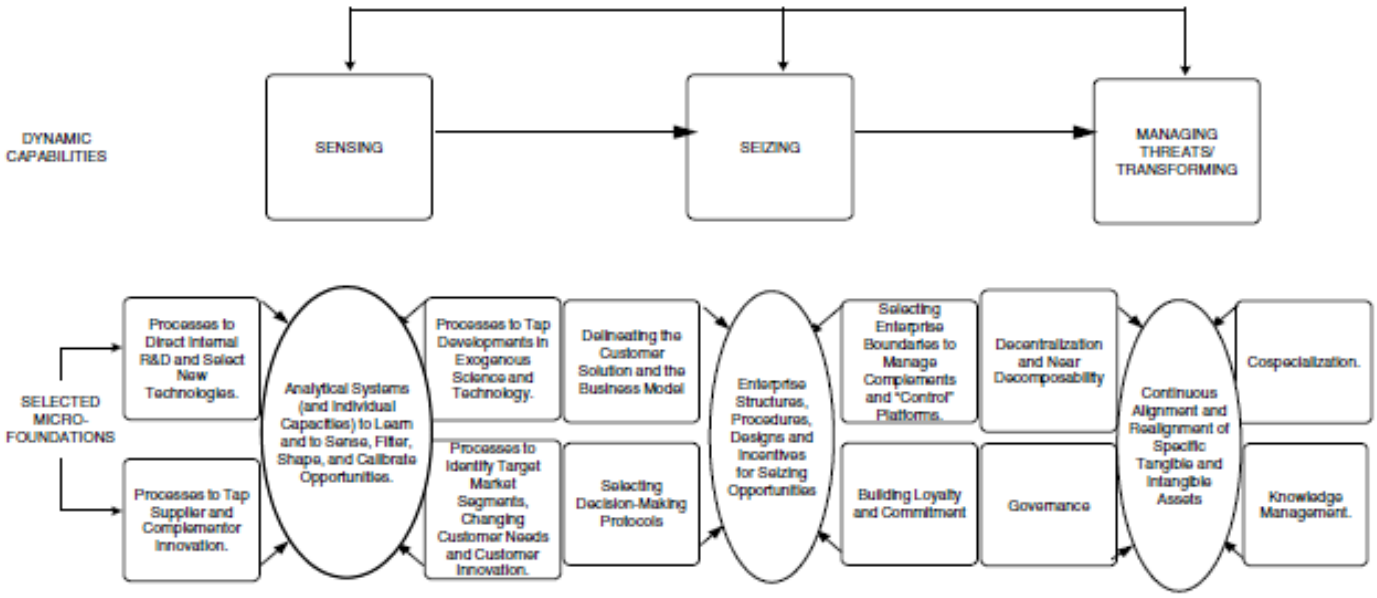

Figure 9: Foundations of dynamic capabilities and business performance (Teece, 2007).

- Inspired by the 1997 work of Teece, Pisano and Shuen, a set of four main processes was proposed by Bowman and Ambrosini in 2003. They argued that dynamic capabilities comprise reconfiguration, leveraging, learning and integration. As the name suggests, reconfiguration relates to processes that aim to transform and recombine resources. Leveraging is straight forward as well, in the sense that it refers to "the replication of a process or system that is operating in one area of a firm into another area, or extending a resource by deploying it into a new domain". The learning capability enables organizations to perform tasks more effectively and efficiently. It includes activity such as experimentation and reflection. The last capability, integration, concerns "the ability of the firm to integrate and coordinate its assets and resources, resulting in the emergence of a new resource base".

In the more recent work by Ambrosini, Bowman and Collier (2009), it is argued that capabilities can be grouped into three different hierarchical levels. Firms in a stable environment can rely on incremental dynamic capabilities that help them to change their resource base, but in more dynamic environments it can become crucial to also possess higher order renewing dynamic capabilities that have a more radical impact on the renewal of resources. On top of these two levels, we find regenerative capabilities that are relevant for adapting the (renewing) capabilities themselves, instead of the lower order resources. Note that these three levels do not constitute a framework of capabilities that are essential for being innovative; it is simply another theoretical contribution to the discussion about hierarchies. Here, we are interested in the main processes from 2003.

Despite this set of four dynamic capabilities does not explicitly refer to innovation, it clearly has a focus on optimizing the resource base in order to cope with (or anticipate) changes in the environment. Thereby, this model approaches more our first criterion then the model by Teece (2007). It is more or less equally complete (criterion 1), which also means that one could argue again that the framework is too general to provide applicable insights in which capabilities to develop and deploy in which situations. At least it is clear that this framework doesn't meet our service criterion neither.

- A framework that was already mentioned briefly is the 'capability-based framework for open innovation' by Lichtenthaler and Lichtenthaler (2009). If we consider open innovation to be a specific kind of innovation, we can argue that the first criterion is met but that the scope is too narrow (criterion 2). Another reason why the framework has not the breadth we are searching for, is that the authors only look at knowledge management dynamic capabilities. The six 'knowledge capacities' they identify are all directed towards managing internal and external knowledge in open innovation processes. They are: inventive, absorptive, transformative, connective, innovative and desorptive capacity. Note that they are not called capabilities, but capacities. This implies that there is only one dynamic capability (knowledge management capability) which consists of several lower order capacities. Here we could enter again the discussion about the different orders within the resource- and capability hierarchy, but let us just note that it is a nice example of a framework that consists of several sub dimensions. It is not applicable in our situation anyway, given the restriction to knowledge management. Moreover, it is based on the traditional ideas of innovation, which are highly biased towards technology and manufacturing (criterion 3).

- Also Protogerou, Caloghirou and Lioukas attempted to define a general set of general dynamic capabilities, which they presented at the Druid conferences of 2005 and 2008. Although their work has not found its way yet to journals, it is interesting because of the broad scope they take (criterion 2). By deploying a surveying amongst 275 Greek firms, they

try to measure items that are part of latent dynamic capability constructs. These constructs consist of three underlying factors; coordination, learning and strategic competitive response.

Despite fulfilling the criterion of proposing a set of distinct dynamic capabilities (three in this case), the model of Protogerou et al. does not involve service innovation (criterion 3). Rather, they hypothesize that dynamic capabilities influence a firm's competitive advantage indirectly by enhancing the firm-specific functional competences they possess. In our opinion, it is very tricky to first measure DC by their underlying processes, and then link them to competences. The nature of dynamic competences is already fuzzy, so the distinction between underlying processes and resulting competences is maybe only a theoretical one. In reality, processes and competences can be so intermingled that it might be impossible to truly separate them in a structural analysis. Therefore, we prefer to stick to our assumption that dynamic capabilities can be used for developing (service) innovations that 'embody' a firms' reaction to the changes in its environment (criterion 1). Since there is similarity in the focus on mediating effects, the article by Protogerou et al. is a nice example of using structural equation modeling for exploring relationships.

- The first model that meets our third criterion (service specificity), has recently been proposed by Ordanini and Parasuraman (2011). They tested the model below, which presumes that dynamic capabilities are relevant for developing service innovations, which in turn lead to firm performance. Unfortunately their model does not purely consist of different dynamic capabilities that together explain innovation (criterion 2), but combines specific dynamic capability (of customer orientation) with other antecedents of service innovation (collaborative competences and knowledge interfaces).

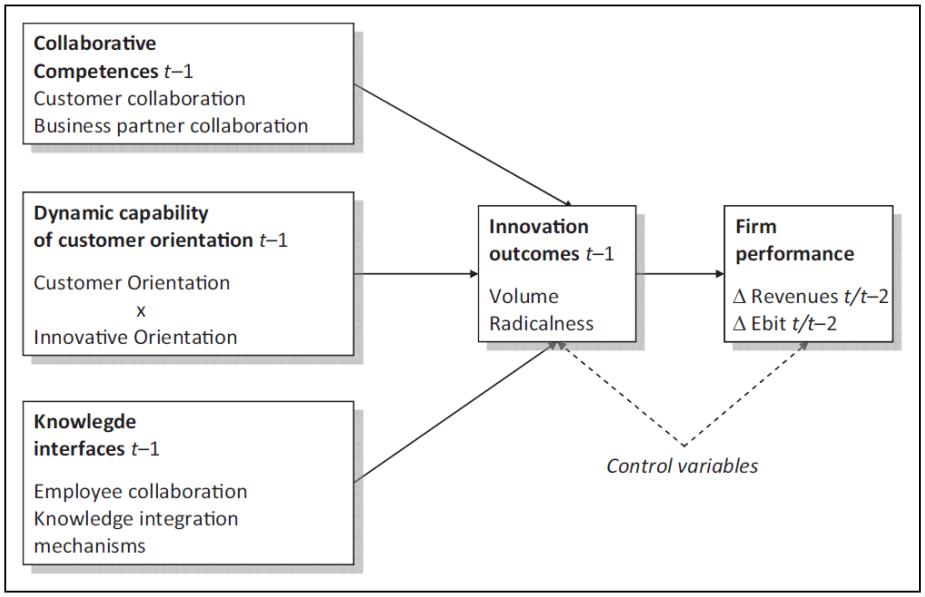

Figure 10: Ordanini and Parasuraman's model for service innovations (2011).

- Agarwal and Selen (2009) did another highly interesting study that uses dynamic capabilities for explaining the achievement of 'elevated service offerings' (ESO). They define an ESO as "a new or enhanced service offering that can only eventuate as a result of a collaborative arrangement, one that could not otherwise be delivered on individual organizational merits" (pp. 432). They explicitly focus on innovation that can be implemented through partnering-arrangements, which is not necessarily the scope of this research. So, although they use the DCV for explaining innovation within a service context (criterion 1 and 3), they only look at a subset rather than trying to capture all the aspects of service innovation (criterion 2). Since this is only a minor change in scope, their study can serve as inspiration for the similar ambitions of this thesis. Especially the methodological part will prove useful. The 2009-article reports a study that was performed in only a single firm, which denotes a difference with our broad unit of analysis that contains all the forms of service innovation we can discriminate. However, the way Agarwal and Selen develop a set of measured dynamic capabilities that can be used in a structural model seems applicable in both the narrow and broad context.

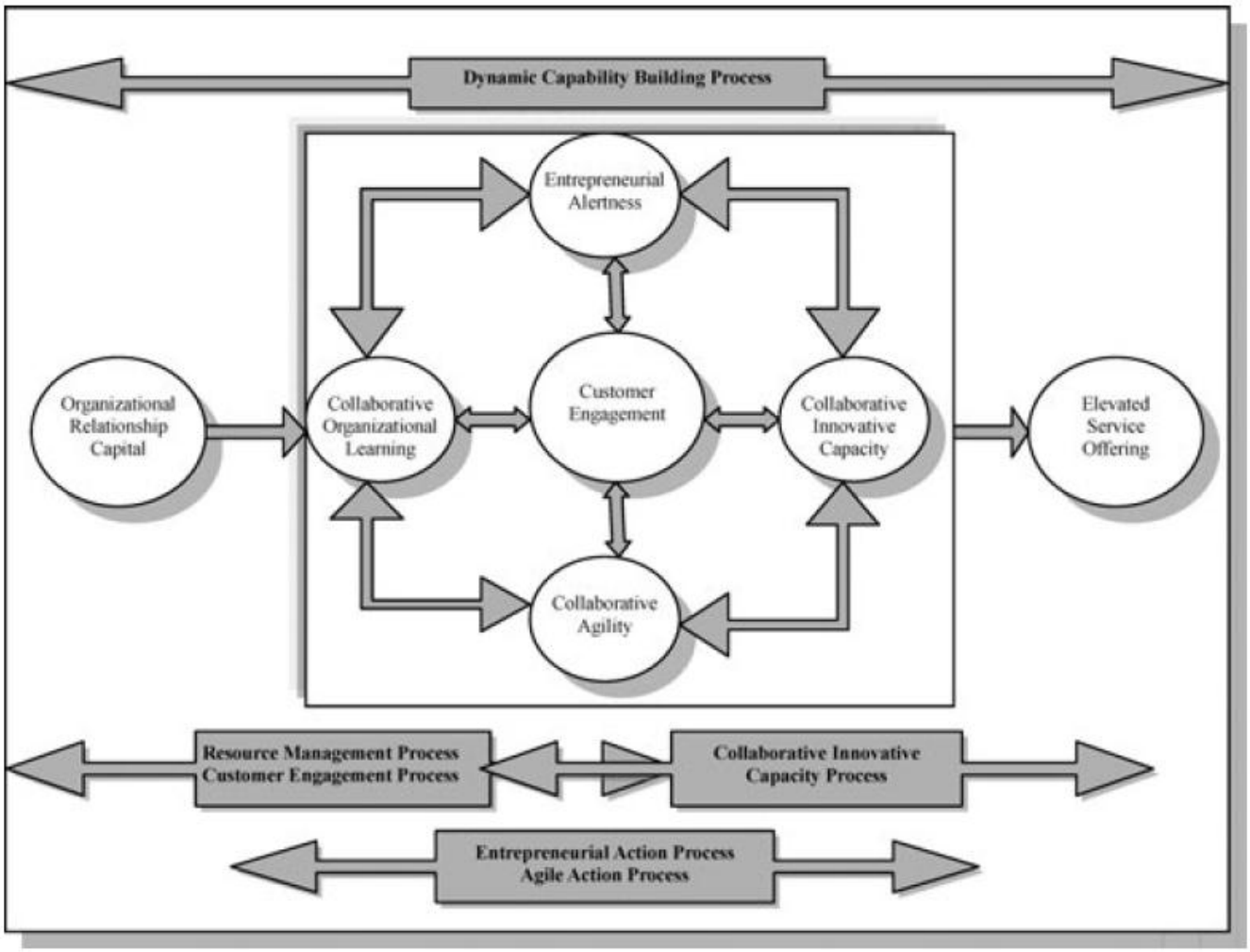

Figure 11: A dynamic capability-building framework for elevated service offerings (Agarwal & Selen, 2009)

- In our discussion about the New Service Development literature, we already mentioned the work by Avlonitis et al. (2001). They developed a framework that includes different types of 'NSD Process Activities'. Although they do not position them as dynamic capabilities, there are reasons why this framework is interesting in our selection procedure. The table below shows the different NSD Activities and measurement items:

1. *Idea generation and screening activities (Cronbach's Alpha = 0.836)*
- Systematically collecting ideas about the service to be developed.
- Initial screening of the service idea-the first review of the venture.
- Translating the idea into a full service concept.
- Translating the service into business terms (i.e., market share, profitability, satisfaction of needs).
- Exploring the performance implications of the new service on other company service (e.g., cannibalisation)
- Exploring the business implications from the development of the service (e.g., in operating/delivery systems).

2. *Business analysis and marketing strategy activities (Cronbach's Alpha = 0.901)*
- Identifying market characteristics and trends.
- Conducting a complete market study-research of customer needs and preferences, purchase process etc.
- Analysing competitors in detail-number, power, products.
- Identifying the target-market for the service.
- Identifying «appeal» characteristics that would differentiate the service from competition.
- Developing a program for «service positioning».
- Preparing a complete marketing plan for the service—pricing, distribution, promotion.
- Assessing time, human resources, investment requirements and setting the performance objectives of the service.

3. *Technical development activities (Cronbach's Alpha = 0.824)*
- Deciding on the final service specifications.
- Determining the operating/delivery process procedures that would support the service.
- Inspecting and adjusting the operating/delivery systems that would support the service.
- Building a service «prototype».
- Executing operating tests of the service «prototype» and conducting the necessary adjustments to procedures and systems.

4. *Testing activities (Cronbach's Alpha = 0.807)*
- Executing service tests within company's personnel.
- Executing service tests within potential customers.
- Evaluating the results of service testing and conducting appropriate adjustments to the service (specifications, procedures).

5. *Launching activities (Cronbach's Alpha = 0.835)*
- Finalizing the marketing plan of the service.
- Promoting the service to frontline personnel.
- Designing service manuals for the frontline personnel.
- Organizing training seminars for the frontline personnel.
- Launching the service in the marketplace-promoting, distributing, selling.
- Receiving feedback from customers regarding the service.
- Taking «corrective actions» regarding service launching.

Figure 12: New service development activities; items and reliability (Avlonitis et al. 2001).

Despite its origins in NSD literature rather than the DCV, the presented set has a lot of potential of figuring as a useful framework. The five activities account for a wide range of innovation related activities. Its completeness scores well on our second criterion, but unfortunately the article states that they only concern product innovation. This implies that our innovation-criterion is met partially, because theoretically there is no reason to exclude process innovation in our attempt to measure dynamic capabilities for service innovations. One could say that process and product are hard (or even impossible) to distinguish in services, but Avlonitis et al. explicitly position their framework as 'a topology for product innovativeness' (2001). Moreover, the completeness turns out not to be fully met if we consider the fact that this study, like many NSD-research, is only designed for the context of financial services. Our third criterion contains a preference for frameworks that stretch the full scope of service activity.

- The last framework we introduce has been developed by Pim den Hertog et al. (2010) and is shown below. A closer look at this framework learns that, like in earlier cases, many capabilities are very similar to capabilities or activities that we encountered in other candidates. We browsed several lines of literature that all seem to identify and define their own dynamic capabilities and higher order DC-frameworks. Sometimes capabilities show up under slightly different names or different definitions, whereas others disappear out of the frameworks. Since frameworks can be defined for studying different domains, it is not a matter of convergence and consensus. In our quest for a framework that allows us to measure dynamic capabilities for service innovation, the ambition is to find the best-fitting framework (the right mix of capabilities) rather than an absolutely optimal set.

Despite the similarities to frameworks that were already more or less rejected, there is enough originality in the framework below to be a good candidate for our further research. In fact, it meets our criteria of capturing all elements of innovation, as well as being suited to services. The 'PdH-framework' consists of two pillars; a typology of service innovations, and a set of dynamic capabilities. Both were built on theoretical and empirical literature, and will be discussed in the next subsection.

Figure 13: PdH-framework: an integrated framework for the strategic management of service innovation (Den Hertog, 2010).

The table below shows the multi-criteria analysis of dynamic capability based frameworks that were found in the literature. Since there is only one candidate that fulfills all our criteria, it is obvious that we will proceed with explaining and applying the Den Hertog framework. However, it is also important to note that there is not a single framework that really meets our first criteria. This implies that even if we were not specifically interested in the service context, applying the PdH-framework (in a service context of course) would have been a logical choice for analyzing the measurement of DCV. The frameworks by Teece and Bowman and Ambrosini are not entirely excluded, but a lot of steps would have to be made for transferring them into measurable sets of capabilities. As we will see, the PdH-framework gives us clear guidance on what kind of processes actually underlies the dynamic service innovation capabilities.

Framework:	*Criterion 1: Innovation*	*Criterion 2: Complete*	*Criterion 3: Service specific*
Teece (2007)	Not explicitly	Yes	No
Ambrosini, Bowman and Collier (2003, 2009)	Not explicitly	Yes	No
Lichtenthaler and Lichtenthaler (2009)	Yes	No	No
Protogerou, Caloghirou and Lioukas (2005, 2008)	No	Yes	No
Ordanini and Parasuraman (2011)	Yes	No	Yes
Agarwal and Selen (2009)	Yes	No	Yes
Avlonitis et al. (2001)	Only product innovation		Too narrow; only financial services.
Den Hertog, Van der Aa, and De Jong (2010)	Yes	Yes	Yes

Table 5: Overview of multi-criteria analysis for selecting an appropriate framework.

2.4.2 Dynamic service innovation capabilities

(A) Signaling user needs and technological options

Just like the work of scholars like Teece, the PdH-framework (2010) includes a dynamic capability for keeping up-to-date of market developments. This 'intelligence function' is especially relevant in dynamic markets, but even firms in stable markets can be innovative by being aware of changes in their own and adjacent markets.

The signaling capability consists of two elements, related to the old distinction of forces that have a market-pull or a technology push effect. Changes in user needs can be an increase or decrease in demand for a certain product, as well as new demands for product-improvements or even the introduction of more radical innovations (although rare). An organization that is able to stay aware of how consumers use its product and what they would like to see, can alter its output and thereby create more fidelity. From marketing studies it is known that better (and longer) relations with customers are often more profitable. Next to satisfying existing customers, companies can signal the needs of potential users to increase sales. Close and systematic interaction with different kind of users is an essential element of signaling. Creating a good image of what the market wants can be done by employing (marketing) instruments like client-profiling, joint experimentation, trend analysis in client groups and account-management.

The second signaling capability concerns technological options. Being familiar with the latest technologies can be useful inspiration for modifying the services a company provides. Just like in the case of users, it might be smart to look beyond the own market. Technologies that are used in other markets can offer attractive possibilities for reshaping the delivery of a firms' services. One of the characteristics of services is the intensiveness of the interaction with clients, which sometimes offers room for automation. Knowledge about modern technologies is often essential for adaptation and renewal of the interaction-process. Statistics show that most of the technology investments of services go into ICT. The ICT-department thus has an important role in technology-scanning. This signaling capability can also reside in business development departments.

Actually, the word 'signalling' is incorrect, since it is supposed to have an inward rather than outward direction. Instead of giving signals, this capability is essentially about 'sensing'[6]. To avoid a lock-in of an incorrect term, we will use this latter term in the remainder of this study. Another question we pose is the relevance of the word 'technological'. Do firms only have to look at technological options, or at all the possibilities to renew their services? Following Sidhu et al. (2007), we could opt for distinguishing sensing that concerns demand (i.e. user needs) and supply (in general, so not just technology)[7]. This matches quite well with the 'customer orientation' and 'competitor orientation' by Menguc and Auh (2006). In the following, we express our doubts on the technology focus by using brackets; Sensing (technological) Options.

[6] The explanation for this erroneous label is probably that it is a 'false friend' in Dutch language; the word 'signalling' in Dutch does have a receptive meaning.

[7] Sidhu et al. also define a third category: geographical search. This aspect is not relevant here.

(B) Conceptualising

Having a rough idea for a new or improved service is often not enough for starting the actual delivery. First, initial ideas about needs and possibilities have to be processed into more crystallized ideas of how to produce the service and which final characteristics it should have. The development of a detailed service concept and how to produce it is a dynamic capability that asks for creativity and inventiveness. It is important that new service offerings match with existing strategies and practices, or that transformations are possible. Furthermore, the new service configuration should also be aligned with issues like "target audience, intensity and forms of customer interaction, organization of the delivery system, partners needed to bring about the service, pricing and revenue models" (Den Hertog, 2010) and so on.

The conceptualization can concern new ideas, but also service concepts that already existed in other arena's or even within the firm. Target of this process is the development of a new value proposition that is attractive to clients. Due to their intangibility , services are hard to describe accurately. Customers can thus have difficulties in a priori assessment of the service quality. Therefore, evaluating ideas for new services asks for close interaction with clients already during the development (and not just during the actual delivery). Co-innovation with different types of clients (and colleagues) is essential during experimentation with prototypes of the service concept, but also in other conceptualization processes.

Next to their intangible nature, conceptualization practices like designing, prototyping and testing of new service concepts are often also characterized by minor possibilities for codification. The development of new services thus often asks for active participation of involved parties, since other forms of communication are limited. According to Den Hertog (2006), these development processes are mostly in the hands of an interdisciplinary project team. Especially when the new concept covers competences that reside in multiple departments, finding management support is another important task that such a team can have. Involving different departments usually also means overcoming organizational resistance. However, the transformation of rough ideas can certainly benefit from a wide range of perspectives. Part of this dynamic capability is thus the creation of an open-minded and entrepreneurial organization with an innovative culture.

(C) (Un-)bundling capability

The fact that new service concepts can be developed by recombining (new and) existing service elements, means that an organization has to be able to create attractive service configurations. Bundling service activities can result in value propositions that offer a new value proposition to the client. In fact, having this capability allows a firm to serve different type of clients. Insights in the needs of existing and potential clients can be used for segmenting the market. The challenge for the company then is to offer different services that meet the particular needs of these segments. Offering unique service experiences and solutions is easier when a firm is able to enrich and blend service activities. However, bundling different service elements often asks for unbundling of existing service concepts first. Simply adding service concepts is not enough for delivering customized services; the art is to only take essential elements and transform them into a new configuration. So, although the name of this capability suggests that we are facing two contradicting elements, bundling and unbundling seem to go hand in hand.

Some contradiction can be found, but only in the result of this capability. To be specific; bundling and unbundling activities can deliver the basic varieties of 'full services' and specialized services. The first type has a 'one stop shopping' character, which means that the service aims to meet a wide range of complementary user needs. KLM, for example, tries to extend her service from transporting people between airports, to transferring people from door to door. The flight service thus gets extended with for example car rental and cab-service. Travel companies even go further, by combining whole packages of services (transport, accommodation, activities) into an all-inclusive holiday.

The opposite of the integrated formula is specialization; instead of recombining service elements, the service is 'stripped down to the bare essentials'. This can be based on the desire to offer tailor-made solutions that demand total personalization. Another possibility is developing standardized services, that can be easily combined into a customized formula. This form of modularity is essentially a mix of unbundling and then bundling service elements. The ability to make strategic decisions in finding a balance between combination and specialization is an important part of the (un)bundling capability.

(D) Co-producing and orchestrating

Where goods usually only provide a means to achieve a desired goal, services aim to provide the full experience or solutions someone wants. As noted before, the service concept can consist of a combination of different elements. In many situations, a single service provider is not able to deliver al those elements itself. Therefore, both the development and final provision of a service often cross the boundary of the individual firm. This means that a firm has to be able to find useful partners and build strong and wide networks. Often, this goes hand in hand with maintaining relations in order to set up sustainable collaboration with network partners.

Co-innovation and co-production also asks for managing capabilities that are related to distribution of tasks over the different alliances. These alliances can be providers of other services or goods such as supporting technology, but it concerns customers as well. This originates in another service-characteristic; the active participation of the client. Orchestrating coalitions thus also includes the division of tasks between provider and user.

(E) Scaling and stretching

Once a new service concept seems to be successful, a firm might want to increase its provision. Due to their intangible nature and human component, it can be hard to deliver services in a uniform way. To scale up the provision of service, a firm faces the challenge to standardize and codify something which is essentially abstract. An important part of service innovation management thus concerns the scaling and stretching capability, which enables a firm to introduce an (ad-hoc) innovation at a larger scale.

On the one hand, firms have to find a way to internally distribute knowledge and skills that are essential for a new service. Firm-wide adoption of a service that was for example tested in an experimental setting, can be achieved by cross-fertilizing processes. On the other hand, the launch of a new service also needs to be communicated to external parties, notably the market. The commercialization element asks for marketing capabilities on the field of branding. Strategic construction and use of brand names increases the value of service, since it as an important attribute that customers use to evaluate service quality. As discussed

before, the intangibility of services makes this more difficult than in case of products that can be assessed by examining specifications. Moreover, investing in branding is also useful since established service brands can open doors to new markets. As Den Hertog (2010) notes, stretching of service activities is something that has to be consistent with overall firm strategy and logical for (potential) clients.

(F) Learning and adapting

The last dynamic capability that is part of the PdH-framework, concerns the ability to reflect deliberately on the management of service innovation. Learning from experiences is crucial for adapting innovation processes to changing environments. To continuously improve innovation activities, a firm needs to engage in systematic monitoring and evaluation of all activities that are related to renewal and reconfiguration a firms' service portfolio. Note that this capability concerns not the routine-like service delivery, but the actual innovation efforts a firm performs. Therefore, it can be called a meta-capability. Some scholars probably might want to attribute a higher-order to this capability (see subsection X), since the reflection is directed towards the other dynamic service innovation capabilities.

Den Hertog states that this capability is important for the management to decide whether to follow a closed and centralized innovation process, or to support an open and distributed innovation culture. Gathering information about successful and failed service innovation efforts is a precondition for a critical reflection and drawing conclusions for organizational adaptations.

2.4.3 Service innovation performance dimensions

The second pillar of the PdH-framework is a typology of forms of service innovation. Since these are the results of innovation efforts, they can be called innovation performance dimensions. The six dimensions (6D) are an extension of the earlier 4D-model by Den Hertog (2000), and build on typologies of service innovation forms like the one by Normann (1984) that was mentioned before. Again, the extension is based on both theory as well as empirical insights.

Given their idiosyncratic characteristics, service innovation dimensions are significantly different from (pure) technological innovations. Of course technology can play an important role in new services, but innovation can also stretch intangible elements such as changes in organization-structure and models. Earlier it was already mentioned that the distinction between process innovation and product innovation is very difficult in services, because they are produced and consumed at the same time. Services are said to be consubstantial, which means that the process and the product are inseparable because they are essentially the same. With respect to the application of innovations, it seems more logical to make a distinction between front-office activities (visible for the customer) and back-office activities (internal). Let us now discuss the six different dimensions (Den Hertog, 2010) that can occur in a single (discrete) service innovation.

I. New service concept

A new service concept is an innovation that offers a new experience or solution to a consumer's problem or need. It was already mentioned several times that such a solution can be organized by combining existing service concepts or parts of them. Note that taking elements implies that they are not the smallest entity in the innovation context; service concepts are advanced and well-developed creations that contain thought-out details about how to be delivered, who to aim at, etc. Another difference with rough ideas is that a good service concept is aligned with strategy and existing business processes.

II. New customer interaction

Service innovation can refer to more than just the final solution or experience that is provided. Another aspect is the way it is delivered, which is (as discussed) a part of process and product at the same time. An example of a change in service delivery is a new way of interacting with the customer. Since customers have an important role in the actual production of the service, there are many reasons for optimizing the interaction with the service provider or the service itself. In fact, interaction can have several functions; communication (of information), co-design, customization, co-production and co-innovation.

Within the provider-customer relationship, we can find two basic modes for distributing activities amongst them. Some initiatives from the provider are aimed to take over tasks from the client. Den Hertog describes how staffing agencies can expand their services by offering in-house services, interim professionals, recruitment and selection services and human resource services. Another possibility is that more tasks are shifted towards the client, which can lower the costs of the service and gives the customer more control (and therefore possibilities to personalize the service and enhance satisfaction). The extreme form of co-production is self-service, in which the role of the supplier is minimal. This kind of processes demands an interface that enables the customer to take full control, whereas the first type of relationship asks for interfaces that give information and power to the service-provider. ICTs offer many possibilities to support the interaction, which means that many new forms of customer interaction have a technological component.

III. New value system or business partner

In the description of the (co-)producing and orchestrating capability (4), it was already mentioned that services are often a combination of elements that are provided by different actors. One of the service innovation performance dimensions consists of modifications in the joint production of services. Such an architectural improvement often appears in situations where service providers try to bundle service functions. The innovation can also be a change in the way an existent innovation is produced, like a redistribution of tasks. Outsourcing activities to coalition partners can for example result in more specialized solutions. Other reasons for changing the role of parties within the value chain can originate in strategic insights of how to optimize the value system. In financial difficult times, outsourced activities can be easily divested. Sometimes it might be attractive to include external parties in the service delivery because they are more innovative and suffer less from organizational resistance.

IV. New revenue model

Apart from changing the way how a service is produced, a firm can also improve the way its revenue is generated. New models can affect financial streams, both in size and in timing. For example, services be offered on a unitary basis (repair of your car in case of a single problem) as well as on a continuous basis (maintenance contract). A service provider can aim to increase its turnover, to redistribute it, to stabilize it (more evenly over time). New models can also influence outgoing streams in order to reduce costs and enhance profits. Especially when multiple actors are involved in the service production, finding the right revenue model might be a real challenge.

V. New delivery system: Personnel, organization, culture

Changing the way a service is delivered contains more than modifying customer interaction and the value system. Also innovation in internal processes can result in improved service provision. Two varieties can be distinguished, the first being an adaptation of the notion of organizational innovation. In this dimension we find new organizational structures, (inter)personal capabilities and skills. Policies for creating an innovative culture can support a firm-wide engagement in the development of new services. This organizational component of service innovation can thus refer to changes in the service delivery system itself, as well as changes in the way a company develops new services.

VI. New delivery system: Technological

Finally, there is the dimension that deserved most of the attention of the technologists approach. As mentioned before, especially ICTs have an enormous impact on service innovation. Other technologies are used as well (e.g. in transport sectors), but ICTs offer such a wide range of applications that they are found everywhere. Even the most lagging service sectors adopt ICTs for both back-office activities (communication, administration) and front-office activities (customer-interaction like e.g. payment, reservation or communication)

2.4.3 Relations within and between DSIC/SIPD

Although it was mentioned only briefly now and then, one can think of many relations within and between the two pillars of the PdH-framework. The aim of the framework is that the capabilities and dimensions are together covering the notion of service innovation, but individually distinct. Some of them might show some overlap, and it is certain that many of them are closely related to several others.

Just like Den Hertog, we assume that there is more consistency within capabilities than between them. For example, activities that are related to signaling user needs and technological options (A) are expected to have more in common with each other than with activities that are directed towards conceptualization (B). However, it seems obvious that conceptualization is fed by signals that are observed by using the first capability. Two points have to be made here.

First, the model does not state that service innovation follows a linear pattern in which all of the capabilities have to be deployed sequentially. The circle weakly suggests some order, but stronger claims are intentionally omitted. Some of the capabilities have to be used on a

continuous basis, like learning and adapting. There are many examples of innovation processes that are characterized by simultaneous use of capabilities, or that followed an alternative (non-linear) order. Imagine a scenario in which a firms 'unbundles' (decomposes) a service to standardize and therewith stretch it, possibly while conceptualizing new ideas into concepts that the service provider and a network partner can add to the resulting core services. Finally, one can think of many cases in which successful (e.g. performance-enhancing) innovations where produced by firms who were very weak at one or more of the capabilities.

This brings us at the second point. The framework aims to give insight in the dynamic capabilities that are essential for developing successful innovations. However, if following a strict order over capability use is not necessary, the question rises if it is possible to achieve the delivery of successful new services by using (or possessing) only a couple of the capabilities. In other words, can we state that it is *necessary* to have all capabilities if one wants to produce good innovations? Of course it is impossible to state that possession of all of them is *sufficient* for delivering good innovations, since many external factors can influence the process and results. However, knowledge about the importance of individual capabilities would be really helpful for coming to management recommendations. Since this also relates on a notion of success, it seems wise to start with observing figures about the very presence of dynamic service innovation capabilities.

Having insight in how often a certain capability is present in an organization is an interesting point of departure. From there it is a small step to search for relations between the capabilities. Are there certain combinations that occur significantly more than others, like Den Hertog suggests? The same questions can be asked for service innovation performance dimensions. How often do they occur (relatively), and can we find certain patterns of co-occurrence? Next to looking at links within the pillars, our understanding of service innovation can be enhanced by studying the interrelations between the two pillars. Again, this can be one-dimensional (are some individual capabilities significantly related to individual service innovation dimensions?) and multi-dimensional (are some combinations of capabilities significantly correlated with one or more specific service innovation dimensions?).

In the table on the next page, adapted from Den Hertog 2010, one can find several hypothesized links within DSIC (column 2) and between DSIC and SIPD (column 3). The author states that these hypotheses are not very strong, and that further empirical tests of his recently introduced framework are welcome. Investigating the links would also answer to the recent statement of Brian Loasby (2010), who stated that dynamic capabilities 'do not function as isolated units but in particular combinations'. The decomposability of a system like dynamic capabilities is argued to be limited, since their effectiveness depends on their relationships between each other and with external situations (like innovation dimensions).

Dynamic SI capability	Most relevant other dynamic SI capabilities	Most relevant SI performance dimensions
Signalling user needs and technological options	▪ Conceptualizing capability (b) ▪ co-production and orchestrating capability (d) ▪ (un)bundling capability (c) ▪ Scaling capability (part of e)	User needs: ▪ new service concept Tech. options: ▪ new delivery system: technological dimension ▪ new customer interaction
Conceptualising (service design)	All other 5 dynamic SI capabilities	All 6 performance dimensions of SI
Unbundling and bundling	▪ conceptualising capability (b) ▪ co-producing and orchestrating capability (d) ▪ stretching capability (part of e)	▪ new service concept ▪ new value system/business partners ▪ new revenue model
Co-producing and orchestrating	▪ (un)bundling capability (c) ▪ scaling & stretching capability (e)	▪ new value system/bus. partners ▪ new revenue model
Scaling and stretching	Scaling: ▪ co-producing and orchestrating capability (d) ▪ learning and adapting capability (f) Stretching (additionally): ▪ conceptualizing capability (b) ▪ (un)bundling capability (c)	Scaling: ▪ new delivery system: technological dimension ▪ new delivery system: organizational dimension ▪ new service concept Stretching: ▪ new service concept ▪ new customer interaction
Learning and adapting	All other 5 dynamic SI capabilities	All 6 performance dimensions of SI

Table 6: Hypothesized links between DSICs and SIPDs

3 Research question

3.1 Summary of literature

Modern economies became service-based. Especially when added value comes from knowledge, service activities are much more profitable than manufacturing, which is essentially all about costs.
If firms, regions or countries want to remain competitive, they have to be able to improve their service-production. Unfortunately, service innovation management has no good model that can provide guidance.

Options for service innovation management can be found in strategic management, with the DCV being dominant nowadays.
However, the DCV does not offer a good theory for explaining the link with firm performance and empirical research is weak since it focuses on anecdotic case-studies. Results are tautological, and the lack of a multi-construct model of pre-defined capabilities hampers measurement and, therefore, modeling studies and performance-analysis. A consequence is that the DCV is also not specific enough to provide strategic insights.

The PdH-framework is useful since it provides a set of six capabilities that together aim to cover the range of activities that are essential for purposeful resource changes. Since it is developed specifically for service innovation, the framework is perfectly applicable in our domain of interest.
Although the conceptual framework is based on empirics, it is not really tested yet. Understanding in the performance-enhancing potential from DSIC is lacking.

3.2 Resulting research question

The main research question that is abstracted from the gaps in both the service innovation as DCV literature is then:

"To what extent do dynamic service innovation capabilities contribute to a firm's ability to develop performance-enhancing service innovations?"

In order to answer this question, we first should investigate the possibility of actually measuring dynamic service innovation capabilities. A quantitative study can help us to observe patterns in certain behavior of firms. Asking whether firms engage in processes that can be linked to the existence of dynamic capabilities, can provide data that can be aggregated to a general view on the occurrence of dynamic service innovation capabilities. However, given the vagueness surrounding the whole concept of dynamic capabilities, it might be wise to combine a quantitative study with more in-depth and detailed information. In fact, Helfat et al. (2007) call for integration when it comes to the usually separate use of either content-based analysis (theoretical and analytic) or process-based research (qualitative, case-studies and interviews).

Detailed knowledge about the perception of dynamic capabilities can shed light on the boundaries of measuring them by using quantitative methods. Therefore, the empirical study consists of a mixed method approach, divided over two complementing parts:

Part A: Measurement of DSIC and SIPD.
Given the vagueness that is surrounding the nature of dynamic capabilities and therefore also dynamic service innovation capabilities, this study should start with exploring the extent to which they can be measured. Two methods will be used:

- *Case-study*. A qualitative approach in the form of several interviews allows for in-depth analysis of the presence and recognition of dynamic capabilities within organization, as well as the service innovation performance dimensions they develop when producing new or enhanced services. The analysis can also be used as guiding principles for operationalizing the PdH-framework into a survey instrument.

- *Survey*. Can we define items that together measure dynamic capabilities? And if yes, what are the characteristics of these dynamic capabilities? Which ones occur more frequently than others? Can we also measure service innovation performance dimensions? Developing a survey instrument can help us answering these questions.

Part B: Testing of a model concerning the role of DSIC and SIPD in firm performance.
If we succeed in developing a valid survey instrument and acquiring meaningful (*survey-)*data about DSIC, SIPD and relative firm performance (compared with other firms in the same industry), a structural model can be tested. The model is based on the findings within DCV literature; it tries to overcome shortcomings and uses recent insights. To be specific, the aim is to demonstrate that dynamic (service innovation) capabilities only have an indirect effect on firm performance, since their power lies in their ability to create (service) innovations that are in turn responsible for the real value creation that leads to competitive advantage.

The table below summarizes the mixed method approach. Measuring DSIC and SIPD (Part A) can be regarded as a prerequisite for modeling relations (Part B). Reporting descriptive measurements can be regarded as a first step in modeling (discussing the variables), but we argue that it is still an element of the initial attempt to actually get a quantitative grip on the ill-defined and vague notion of dynamic capabilities.

	Case-study: qualitative	**Survey:** quantitative
Part A Measuring DSIC/SIPD	How realistic is it to ask managers about the present dynamic capabilities? Can experienced researchers observe DSIC, or do we find important limitations in measuring them?	Can we find patterns in the processes that we believe to be part of the DSIC and SIPD-constructs? How are the DSIC/SIPD distributed over different firms?
Part B Modeling the relations DSIC/SIPD/Performance.	(Unfortunately, the relations could not be part of our case-study)	Can we find statistical evidence for the hypothesized mediating relation of SIPD on DSIC-Performance? What other patterns do we observe?

Table 7: Mixed method approach for analyzing DSIC

3.3 Introducing the framework

The figure below, visualizing the relations to-be-investigated, supports the explanation of our research ambitions.

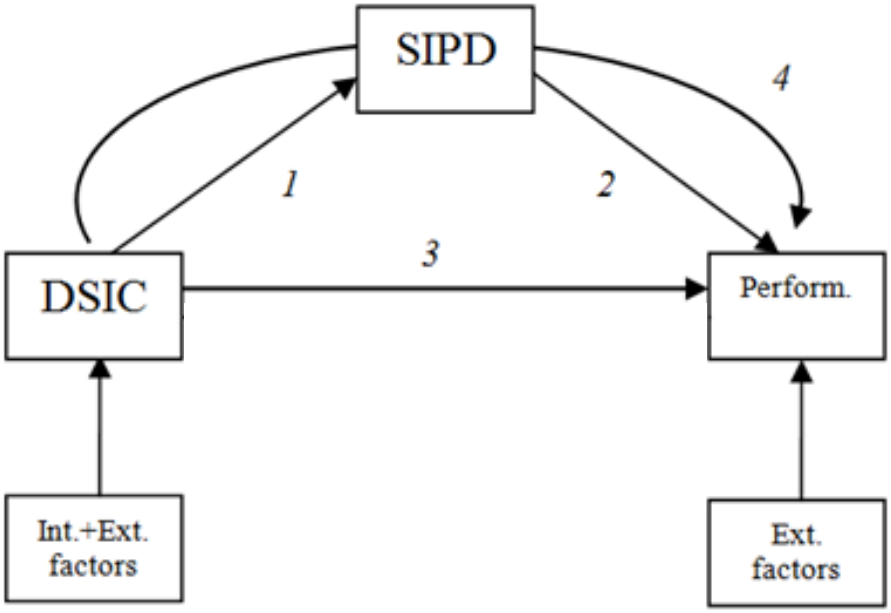

Figure 14: Research framework

Part A is focused on the frequencies in which DSIC and SIPD occur and co-occur (data 'within the boxes'). When possessing measurement data, we can answer questions like: do service firms have more DSICs than non-service firms? Are there differences between big and small firms?

Part B refers to the arrows between the boxes. Relationships between the occurrence of individual DSIC and configurations of DSIC will be related to the occurrence of individual SIPD and configurations of SIPD. Arrow 1 relates to the table of hypothesized links within and between DSIC and SIPD.

Another element of Part B is the exploration between the occurrence and co-occurrence of SIPD in relation to relative firm performance (arrow 2). This will give insight in the extent to which (combinations of) SIPDs led to improved performance. Since we are mainly interested in competitive advantage, we look at firm performance as compared with other firms in the same industry.

Finally, the main DCV theory will be tested; does the availability of DSIC lead to a better firm performance? The classical view of a direct link (arrow 3) gives insight in the relation between the amount, variety and combinations of DSIC on the one hand, and relative firm performance on the other hand. In subsection 5.3.1, however, we will pose our hypothesis that dynamic service innovation capabilities only affect firm performance through the creation of service innovations (arrow 1 + 2 = arrow 4).

4 Case-study

In order to enhance our understanding of to which extent DSIC and SIPD can be measured, a case-study is performed. Besides serving as illustration for the Pdh-framework, the aim is to investigate how well DSIC and SIPD can be recognized by researchers familiar with the topic and by managers who are supposed to manage them. By holistically studying the presence of DSIC, we can learn lessons that might help us in our attempts to develop a survey-instrument. In case we find measurement-problems that are hard to overcome, at least we are more aware of the limitations of our quantitative ambitions.

4.1 Method

In the context of the United We Stand research program on open service innovation, several case studies are being performed between beginning 2010 and February 2012. Active participation in one of them resulted in the case that will be described here.

Vitae, a recruitment and seconding company from the Netherlands, agreed to collaborate in a case study that could help them understanding how to improve their service delivery. After a specific case was selected on the basis of a list of project-criteria (see Appendix 1), several interviews were arranged with employees that are related to the three different companies that are relevant in the innovation under study.

A total of 5 interviews and a final presentation (which delivered useful feedback) were performed in March and June 2011. Each time, the same interview-guide was followed in order to collect information on all the topics of interest. Most interviews took 1.5 hour to conduct. The table below shows the justification of the data collection:

Interview		
#	*Date*	*Affiliation interviewee(s)*
A	18-04-‘11	Manager Innovation Vitae
B	17-05-‘11	Account manager Vitae
C	19-05-‘11	Director EP
D	23-05-‘11	Former procurer Tata
E	30-05-‘11	Account manager Vitae
F	09-06-‘11	Branch manager Vitae: presentation and verification of findings

Table 8: Justification of data collection for case-study.

In the post-visit stage, transcripts of the recorded interviews were made and non-relevant data was cancelled out. The data analysis that followed aimed to reduce the material to its relevant core and served as an exercise of abstraction. First, the texts in the transcripts were coded on the basis of the topic they were related to (Miles and Huberman, 1994; Kvale 1996, p. 193). How the data was condensed by coding the transcripts is shown in the example of a conceptually ordered display below.

	Interviewee 1	Interviewee 2	Interviewee n	Summary
Topic 1a	[quote x, y, z]			
Topic 1b	[quote m, n, x]			
Topic 2				
Topic 3a				
...				

Table 9: Example of coding matrix for condensing data.

Text fragments could refer to different categories. In order to make sure that the coding occurred correctly, usually the two involved researchers checked and discussed each other's work. The resulting matrix (topics on the rows, interviews in the columns) delivered a 'chain of evidence' that could be used for interpretation and checking for consistency in the interviews. Per topic, a summery was made. This summery includes notions about the consistency or contradictions in answer, and serves as the basis for the case description and further analysis.

4.2 Results

4.2.1 Case description

Actors

Vitae is a Dutch personnel agency for the recruitment of permanent staff and temporary professionals. Each year Vitae seconds approximately 4,000 candidates for permanent employment. Out of the approximately 1,750 Vitae-employees, there are 1000 Vitae Interim Professionals primarily active in the fields of engineering, finance and management office support. Vitae is the only Dutch company that offers recruitment services in combination with interim professionals. The company was founded in 1986 and has ten offices in the Netherlands. Since January 2008 Vitae is part of the international firm Manpower Inc., but still operating independently. Our primary focus is on innovation within Vitae, but in this case-study the new service comes from collaboration with a party that will be introduced next.

EversPartners (EP) is a consulting engineering agency that started in the '70s as a consultancy agency for concrete and steel constructions. Over the last decades, different disciplines were added to the firms' consultancy portfolio, notably construction engineering and retail construction. In this period, the company grew to about 100 employees. EP is now active in construction within the markets of industry, retail, utility, housing, healthcare and education. She also engages in restoration, reconstruction, building maintenance and data management (concerning digitalization of drawings and the like). The combination of capacities allows EP to take big orders and to manage complex projects.

Finally, there is Tata Steel (formerly Koninklijke Hoogovens and Corus). This enormous firm is the client that consumes services (delivered by Vitae and EP), including especially the service that was innovated and will be studied here. Tata Steel produces and distributes high-quality steel for a wide range of applications. The Dutch branch, mainly located in Ijmuiden, is part of the concern Tata Steel Europe (the single biggest steel manufacturer of Europe) and in the end also from Tata Steel Group (fifth biggest steel manufacturer in the world). With its 5000 employees, Tata Steel is regarded as a conglomerate of many semi-independent 'working units'.

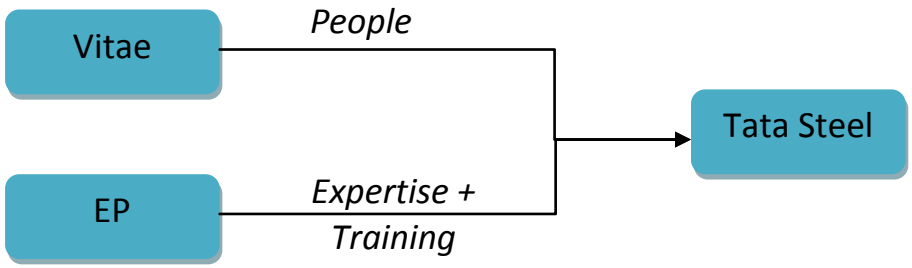

Figure 15: Innovative collaboration of Vitae and EP towards Tata Steel.

Service innovation

The innovation under study concerns a deal between Vitae and EP. For many years, EP was providing engineering services to Tata Steel. In many projects, EP engineers are stationed within one of the 'working units' of Tata. Since people with technical education are scarce, Tata often tried to adopt these persons by offering them a permanent job at Tata. Although this practice intensified the relation between EP and Tata, EP was suffering from the fact that she was losing her employees (and thus valuable expertise). Each time she send engineers to Tata, there was a risk that they would not return. Vitae, on the other hand, frequently but unsuccessfully has been trying to acquire Tata as a client. Because there were (very good) relations with EP, Vitae noticed that EP could be her entry-ticket to Tata.

Given the fact that Vitae and EP already had a close connection and discovered that they were sharing many philosophies and values, they could develop an innovative service offering towards Tata. Their construction relies on the idea that Vitae could help EP to create a flexible shell around its core of engineers. Whenever Tata gives an order to EP, some core-employees of EP are accompanied by seconded employees recruited by Vitae. During the project at Tata, these Vitae-people receive an on-the-job traineeship from the EP experts. At the same time, they can get familiar with Tata's complex organization and culture. In case Tata starts asking the 'EP'-employees to make a switch to Tata, it are the Vitae-people that can be re-seconded and not the 'real' EP-employees.

Initially, it was EP who got a framework-contract with Tata, meaning that they were one of the preferred suppliers that automatically would get orders (without too much negotiation each time). However, in 2007, Tata recognized that she needed more supporting technical people. She decided to issue a tender, asking recruitment agencies to come with an offer for delivering the right people. Vitae participated in this tender, but insisted on maintaining their close collaboration with EP. Because Tata was only searching for people, she needed to be convinced of the added value the Vitae-EP collaboration could deliver. Skepticism towards 'paying double margins' needed to be overcome by demonstrating that the innovative construction could help Tata to perform better and evade costly errors in her processes. In the end it is not clear how impressed Tata was with the innovative deal, but because EP was already a preferred supplier, Vitae (with EP) was one of the winners of the tender. For the last four years Vitae and EP together delivered people that were praised because of their expertise and experience. As far as Vitae and EP know, their collaborative approach is quite unique within the recruitment branch. Next to providing a total solution, the construction helps Vitae and EP to generate more orders for each other and thereby for themselves. In the next sub section, we will discuss the innovation (processes) in more depth.

4.2.2 Observation of SIPDs

To illustrate the PdH-network, observations concerning both the different DSICs and SIPDs will be reported here. We do take the framework as a starting point for discussing the presence of the capabilities, but will critically reflect on it at as well. In order to clarify the case, we will start with framing it by using the SIPDs.

SIPD 1: New Service Concept

The service that Vitae and EP offer together has only a minor extent of newness. There are certainly persons within the client that do notice how the coupling of people and expertise delivers a valuable combination, but they are mainly facing improved quality of an existing service. That Vitae found a way of delivering employees that have more expertise and experience than the ones they used to recruit and second before, is a part of their internal business. This can also be drawn from the fact that Tata holds only a contract with Vitae, what implies that she is not interested how Vitae takes care of business as long as she performance sufficient. Vitae and EP do aim to use their collaboration for developing new solutions for problems they observe at their client, but so far they combined existing services into a service concept that is better rather than new. From the perspective of Vitae and EP (and according to them, also for the entire recruitment branch), the innovative construction they developed is a improved way of creating value for themselves.

SIPD 2: New Customer Interaction

In this case there is no significant change in the way Vitae and EP communicate with their client. Although the channels for having contact with Tata remain the same, we do observe a difference in the distribution of tasks amongst service provider and consumer. Tata tries to find suppliers for different services: she has an engineering department which is hardly connected to the procurement of people. Neither is there a lot of interaction between the different working units within Tata, which results in costly delays and errors. By bundling people and expertise, Vitae and EP try to offer employees that are not restricted to any of the distinct departments. Those employees can use their broad expertise for project management that does not suffer from communication errors that are characteristic for the troublesome interaction within Tata's departments. So, Vitae and EP try to take over project management by offering experts with an integral perspective (EP) that also have access to the required people to do the work (Vitae).

SIPD 3: New Business Partner

Clearly, this service innovation is based around a new type of partnering within the recruitment (and engineering) branch. Vitae is using EP for getting access to a new client, as well as for enhancing her service offering. Approaching a engineering agency to acquire the right training and client-specific knowledge is said to be an innovative step, although there is no changes in what both the partners do. Instead of really modifying their own processes, the change is in the fact that they operate together. Although the core of this innovation is in the bundling of activities, both parties emphasize that it is also important to maintain their own identity. It should stay clear that two different types of organization contribute to the service, without starting to be regarded as one supplier. Behind the scenes, Vitae and EP distribute some tasks as if they were one organization. For example, the administration for all the employees that are seconded at Tata is mostly done at EP. Thereby, the new business partner also safes Vitae some effort. Another interesting aspect of role-distribution is also that both parties deliver each other extra orders by using their networks within the client firm. Since

Vitae considers the innovation as successful, she tries to extent it to other collaborations with similar business partners.

SIPD 4: New Revenue Model
Changes in the revenue models of Vitae and EP are only small. Initially, EP used to be the party with a contract with Tata while she was using people of Vitae. Later, Vitae got the tender and delivered people that went through a training from EP. A remarkable aspect of the construction is that the parties agreed to split the margins by half. Instead of trying to calculate who contributed what, they agreed to rely on their trustful connection and use a fifty-fifty revenue model.

SIPD 5: New Delivery System: Personnel, Organization, Culture
In order to make the bundling of people and expertise work, several organizational modifications had to be done. Apart from some changes in the supporting administrative tasks, we see that Vitae came up with a dedicated account manager that is stationed in the client firm. By being physically present, this person can take care of the seconded employees and signal opportunities for delivering extra services.
Also, Vitae appointed an employee for collaborating with EP towards other clients than Tata. This person tries to extent the construction to other clients.

SIPD 6: New Delivery System: Technological
Technology only has a supporting role in this case study. The administration and finance departments of Vitae and EP do use software to keep track of all the seconded employees and process the salary procedures. However, this is certainly not a factor that was enabling the innovation. Rather, existing administrational processes were a barrier that had to be taken. Even aligning to new procedures was more an organizational change than a technological change.

4.2.3 Observation of DSICs

DSIC A1: Sensing user needs
The ability to understand what the customer really wants is deeply embedded in the culture of Vitae and EP. All the interviewees are univocal when it comes to the essentiality of frequent interaction for building close relationships and trust. Instead of doing what a customer orders, Vitae/EP have a culture in which one tries to discover the real need. Often, there is a discrepancy between what the user says he wants, and what he actually needs. Sometimes it is less attractive for Vitae/EP to fulfil that actual need, but on the long term it can prove successful since a strong relationship has a value as well. If the customer feels understood by an honest supplier, he is more likely to give more orders.
The ability to signal user needs is shown by an assertive attitude, which involves asking questions and critically discussing the provided answers. A process-element related to this capability, is that Vitae prefers to place a dedicated account manager within the client organization. This person then has the possibility to engage in interaction with both the detached employees it has to take care of, as well as with the different type of users. When the client is a big organization, such as Tata Steel, there are many potential clients. Due to its physical presence, the account manager can easily approach managers that can become new clients.

Interesting is that we seem to encounter to different types of ‘sensing user needs’. One of them has a quality-focus and concerns observing a customer’s explicitly expressed needs and

the actual underlying needs (that might be different). The other one is more about finding markets, i.e. sensing (new) needs amongst potential users. The first capability relies on frequent interaction with existing customers, whereas the capability to find new needs is related to building a network within a user organization. By interacting with different individuals and departments, latent needs can be observed and used in an offer to solve them with the provision of a service. Hence, we argue that this way of sensing is more quantity-focused. Using such a capacity enables a firm to attract more orders that do not necessarily concern the delivery of a new service, but it can also involve the delivery of an existing service to a new user (possibly within an existing client).

A more subtle appearance of this last version of 'sensing user needs' can be found in EP-policies concerning employee in- and out-flows. Whereas some employers do not like training employees that might exit the firm soon, EP believes that there is value in giving them proper education. Although there is a chance that the trained employee switches to a competitor, it is also possible that he or she moves to an organization that later turns out to need the kind of services EP provides. When the employee has a role in deciding which supplier will get the job, EP will have a good chance if that employee is familiar with the quality of EP. This open attitude seems out to be an effective way of sensing user needs, in the sense that history provides us several examples of employees that approached EP for an order. The open attitude towards employees moving to competitors is built on the belief that those competitors sometimes need to rent additional capacity. Again, they (might) approach EP if they are aware of EPs business. Earlier we saw that creating sympathy amongst clients is a way of acquiring orders on the long term, but the same seems to hold true for employees.

The second version of sensing user needs can be described as finding new demand, and making demand to find you. Instead of an intelligence-function, we are looking at a capability that is embedded in pro-active policy. It is acknowledged that this version is more subtle then other efforts for investigating what the market wants, but that is exactly why this unexpected result is so interesting to mention here. Apparently, dynamic capabilities can be observed in processes that are not all part of a toolbox of best-practices. Later we will discuss further the methodological implications for studying dynamic capabilities.

Another finding from our case-study is that sensing user needs is not just about finding out what the market wants. A dynamic capability needs to be employed on a continued basis, in order to be permanently aware of how the market changes. Dynamism can also be found in the fact that the PdH-framework is not linear, but includes feedback loops. In this capability, we noticed the importance of monitoring how well a solution is received by the customer. Vitae and EP were assertive in their sensing ('thinking together with the clients'), but had shortcomings in evaluating the reactions of the customer. By interviewing the client-side as well, we discovered that Tata was not always that happy with Vitae and EP trying to push through all their innovative ideas. Since the supply of people is not related to Tata's business of making steel, they are not that interested in possible improvements on that account. If suppliers just deliver the quality they promise, Tata is satisfied.
Sensing user needs in this case thus includes the ability to observe how different individuals within Tata react to the ideas from Vitae/EP. Some end users (managers of departments) might be interested in ways of optimizing processes, but others simply do not like suppliers pretending to know better than Tata itself. Procurement employees within Tata have their own preferences as well, as we described above. Since needs within a user can be dispersed over several individuals, the capability to signal them could try to capture this diversity.

DSIC A2: Sensing (technological) options

Technology has only a very minor role in this case. The administration of which employee works where (and the resulting payments) certainly relies on software technology, but it has just a supporting role in the seconding business.

Earlier, we argued for an extension of this sub-capability towards sensing non-technological options. In a service organization like Vitae, keeping track of the activities of competitors is much more relevant than following technological possibilities. Of course, also other sources can be used for staying updated with respect to both technological and non-technological changes in the supply-side of the market (and even non-business related markets).

DSIC B: Conceptualizing

Ideas that are generated, for example by discovering user needs, need to be transformed into a real service concept. Vitae and EP don't like to write 'endless reports', but maintain a flexible organization that can make quick decisions. When a joint brainstorm (Vitae and EP) delivers fruitful ideas about how to improve a service, employees want to take action without further delay. Frequently asking for client feedback should help them optimizing the idea. Experimental is especially the example in which Vitae and EP participated in a tender together, knowing that Tata was only searching people and not knowledge.

Whether we can also find a conceptualizing capability for more radical innovations than the examples of minor improvements is difficult to state. Within Vitae there does not seem to be a department that is dedicated for developing new services, although formalization can be observed in the fact that one of our interviewees was officially responsible for innovation. Vitae has an organizational structure that can be described as a non-hierarchical network. Another way they do devote attention to innovation is by making some employees 'web-entrepreneurs'. In order to prevent that a successful idea disappears into the organization, Vitae makes the key-developer of the service responsible for taking care of it. The web-entrepreneur has to make sure that other colleagues try to apply the same solution as well. This shows us some original processes with respect to the dynamic capability of conceptualizing ideas.

However, there are certainly some shortcomings as well. Remarkable is that the whole construction with EP and Tata was rarely seen as an innovation. Rather than a clear concept, it was an anecdotic (ad hoc) deal. In that sense, the capability to recognize a potential service innovation was only present to the extent that we were invited to study it. In the final presentation of the case study, Vitae expressed to be surprised with their own blindness for the 'thing' they want to copy. Although Vitae (and EP) conceptualized some ideas into a model (bundling labor with expertise), they could not turn the successful service into a clear-cut concept.

Another element of conceptualizing is aligning new business with existing business. Vitae states that they "keep matching their activities with the core business and focus of Vitae, because they cannot adapt to all the wishes of clients". New ideas do not necessarily have to become embedded in clear-cut innovations (process or product), Vitae seems to incorporate them in its vision and company culture. That this is effective for business can be drawn from the interview with Tata. Apparently, Vitae won a big tender partially because Tata was impressed with the way Vitae makes ideas concrete by embedding them in a strong philosophy on what they do. Admittedly, this is a fuzzy way of conceptualizing ideas because it does not result in distinct concepts. However, it is important to note that conceptualizing can be done in different (subtle) ways.

DSIC C: (Un)bundling

Bundling refers to combining different service concepts into a single offering. In our case-study, it is clear that labor and expertise are the two services that are being coupled. Remarkable is that the bundling does not occur within one organization. Vitae delivers the labor (by attracting and selecting employees) and EP provides the expertise by training the employees. For that reason, bundling is closely related here to the dynamic capability of coproducing. Note that the difference between bundling and coproducing is not simply a matter of internal or external activity. Bundling is more on the content of the service (developing a solid offering) whereas coproducing refers to the organizational aspect of bringing agents together.

Whether Vitae is successful in her bundling attempts is hard to say. On the one hand, the individuals who are involved are continuously trying to convince their surroundings that value is created by coupling the two services. Illustrative is the fact that Vitae insisted to bring EP along in the tender, whereas Tata was only searching labor. On the other hand, it is also illustrative that in the second tender, Tata is again just searching for people. This means that the procurement department still does not seem to see the advantages of the bundle, which could imply that the combination is not that strong (at least it is not self-explanatory). We should be careful with drawing conclusions here, because the interviews also revealed that Tata's evaluation of the innovation is not homogeneous (as mentioned before). Procurement may make a clear distinction between people and expertise, but the real users of the service (i.e. managers of departments) are reported to give positive feedback on the quality of the people that are delivered by Vitae. This could indicate that the combination is valuable, but not explicitly recognized by the client.

Next to the fact that these contradicting signals are hard to interpret, it is very dangerous to analyze a (firm-wide) dynamic capability by looking at soft evidence from a single case. In the next sub-section we will discuss in depth the possibilities of measuring dynamic capabilities. Here we can only add that Vitae and EP both show more activities that are part of bundling. For example, they aim to customize their service for different market segments within Tata. The working-units can be very different in their specialism and preferences. Vitae and EP are not offering different modules of their service[8], but do try to incorporate the specifities of the clients in the way they deploy their services. It is hard to express this in terms of bundling and unbundling, but some sort of customization seems to be involved in the service delivery. An example would be the way how Vitae and EP do not simply take orders, but are proactive in providing solutions for the client-specific problems they observe. They inform the clients about how a project could be managed, and then hope to receive an order for doing that. Usually, an order for project management also results in a need for additional people (Vitae) with relevant expertise (EP).

DSIC D: Coproducing and orchestrating

Obviously, this case involves some extent of coproducing and orchestrating. However, the close relationship between Vitae and EP is not necessarily the result of a strong dynamic capability. Since the connection depends highly on the individuals that are involved, the collaboration says only a little about how well both the companies are in creating productive alliances.

[8] In fact, by insisting on only accepting orders together, Vitae and EP are far from operating in a modular way.

Within the Vitae-EP relation we observe that there are several processes that aim to maintain the trust and closeness. Frequently, meetings are organized for updating each other on how the business is going and which new opportunities are spotted. Sometimes, Vitae organizes a training for the employees she seconds or want to second at Tata. These meetings occur in the building of EP, which offers the possibility for EP-employees to join these trainings as well.

The dynamic capability of coproducing and orchestrating also refers to the ability of a firm to find new partners and make agreements that result in actual collaboration. Making new alliances is something what EP and Vitae could do individually, but they also do it together. Since Tata needs other types of expertise then what EP can offer, they try to find an additional partner. So far, attempts have failed because other organizations do not share the long term visions of Vitae and EP and are mainly interested in profit-rates and other financial issues. Creating a win-win situation indeed is a key issue for successful collaboration, but a shared philosophy has an even higher importance to Vitae and EP. It is not clear whether this makes their coproducing weaker or stronger. On the one hand they expressed a strong vision about how a partnership should look, but on the other hand this makes them less flexible. Especially EP admits that it does not engage too much in actual coproduction with other parties. In some occasions she is member of a wide alliance, but that is more administrative then that there is really coproducing services or even service innovations.

DSIC E: Scaling and stretching

One could say that Vitae is actively trying to stretch her innovation, given the fact that she took initiative in participating in this research. Her main interest was to learn how to scale up the 'Tata-case', but earlier we already discussed that a clear vision on the model was still lacking. Only after the final presentation, Vitae totally realized that it was all about bundling people and expertise, and even asked us for an appropriate name for their innovative construction.

It is not true that Vitae and EP did not engage in any stretching at all. Remind that Tata is such an enormous organization that it actually can be regarded as a collective of different partially independent working units. By continuously extending their networks, Vitae and EP could acquire more and more orders for themselves and for each other. Especially the physical presence of an account manager proved essential for developing close contacts that could result in new business.

In case one wants to deliver the service innovation also to other clients, a scale problem can arise when it comes to the account manager. Although such a person is essential in maintaining relationships and creating trust with clients, its primary task is taking care of the employees that are seconded. If the number of seconded employees is low, it is a huge investment to place a dedicated account manager as well. The importance of personal relations thus seems to be a bottleneck for scaling up the innovation. For Vitae, the need of a critical mass of orders from a client is a vicious problem. One way of breaking the circle is by creating enough internal support for investing in a new account manager. Convincing the own organization is an essential part of scaling and stretching. Now that Vitae is taken over by Manpower, she will have to use this capability for convincing the new management that the construction is beneficial (on the long term). Stretching includes also the effort of involved individuals to persuade colleagues to create constructions that are similar to the one we find at Tata. This is already done by the account manager that is now active in Tata himself: he actively tries to convince others to follow his approach.

There are different frames when we state that Vitae can stretch the innovation internally. It can be within the Vitae-EP relation (finding new clients, other than Tata or other working units within Tata), but a different perspective is within one Vitae-affiliate or all the Vitae-filiations in the Netherlands. An attempt for this has been made by replacing a key individual from Amsterdam to Rotterdam. The aim was to let this employee use her experience to copy the construction to an entirely new client and new partner (no EP). Whether this attempt will be successful is not known yet.
Internal stretch can also refer to the overarching organization of Manpower. The fact that Manpower took over Vitae also means that Vitae now has access to more relations that might be interested in the bundle of people and expertise. Our interviews did not reveal that Vitae was active on using that possibility, which contributes to our impression that Vitae is still struggling with how to scale up her service innovation.

DSIC F: Learning and adapting
The frequent meetings between Vitae and EP indicate that their innovation is evaluated continuously. Monitoring strengths and weaknesses on a permanent basis is a clear element for learning and adapting, but it is not possible to generalize these case-based processes to a firm-wide impression of the capability. A dynamic attitude of Vitae is found in the quote that "the surrounding is changing, and the organization is changing, so you always have to keep watching your business and what needs to be adapted". Of course, such a attitude needs to result in action before we can state that Vitae has strengths on the account of learning and adapting. An example of such actions is that performance of different activities is evaluated weekly, and that managers are participating in conferences that help them to reflect on their own approaches.

4.2.3 Measuring DSICs
In this subsection, we critically reflect on the possibilities of analyzing DSICs in general. In addition to our interviews for the case-study, we also draw upon DCV-literature and pre-tests that were conducted in order to validate our survey-instrument.

"We do not engage in innovation, but we do improve our products on a frequent basis"

The quote above was retrieved from one of our interviews, conducted with the manager of a medium-sized firm. One might note that the quote sounds contradictive. However, there is only a contradiction when improving a product is essentially the same as being innovative. Here we arrive at a definition question; is every improvement (be it in processes or products) an innovation? Essential for innovation is that there is some newness in the idea, product, process, etc. which is being developed. Moreover, it should get diffused.

Take a service for example. If an action concerns a change in the service delivery then it is only likely when it proves to have some sort of fitness. A technical fitness would be that an organization acknowledges the functional superiority of the renewed service, whereas an evolutionary fitness would be that the service simply leads to more success (whether the underlying cause is known or not). A mere change is thus not enough, but is an improvement sufficient for being an innovative service? If the service is successful, then it is likely that it becomes adopted throughout the firm and/or that its delivery gets extended to other markets. In both cases one could signal some amount of diffusion, which indicates that the diffusion-criterion is quite weak. The same holds for newness; this depends on who you are looking at. If improvements would only be innovations when they are new to the world, many creative

efforts (such as R&D) suddenly would get excluded from being innovative when it turns out that the product they come up with already exists somewhere. New to the market would already allow things to be innovative when they are not entirely new, but adapted from other contexts. Finally, we can narrow down to new to the firm or even new to the person. If the criterion for newness takes such a specific reference, we have to conclude again that many activities can be regarded as innovations. The point that is being made here, is that it is far from easy to draw a line between 'normal practice', 'routines' and accidental actions on the one hand, and innovative activity on the other hand. However, this distinction is crucial when one wants to separate non-innovative from innovative firms (using binary or gradual scales). This is a problem for every scholar who is studying innovation, but certainly when one wants to analyze innovation as a mediating factor.

Whether the quote is contradictive or not, at least it is clear that the speaking manager did not totally acknowledge that some processes within his firm can be regarded as innovation. Improvements and innovation are perceived to be related issues, but unless the manager is aware of the debate about the nuances around the boundaries of innovation, he separated them because he believed them to be different. Another option is that he did not have a clear image of the notion of innovation. For us it does not matter if he had a wrong or absent idea about innovation, what matters is that we have to be aware that some people might underestimate their firms' innovative behavior. Recall that in the Bruce Tethers' table on page 12, we could already read that R&D in services is performed but often not recognized as such. We also saw that it took decades before widely used survey manuals changed their definitions of innovation so that it includes service innovation. Here, we witness that vagueness can still occur amongst respondents. When research is conducted in which respondents have an active role (such as in interviews or in surveys), it is important to realize that respondents do not always have an understanding of the subject you are researching. For surveys we can expect a self-selection bias; if we want to study the subtle forms of service innovation because they are underreported, there is a change that people do not respond because they themselves think they do not engage in innovation. Interpreting this as a confirmation of non-innovative behavior would be a mistake. We can state that the case-study did provide insights that are useful when deploying a survey on the same topic, since it revealed which theoretical concepts might be unclear or misunderstood by respondents.

Let us dive deeper into the issue of using interviews for measuring innovation and related behavior such as dynamic service innovation capabilities. The illustrative quote demonstrated that it might be difficult to directly ask for abstract concepts.
In the literature around the RBV/DCV it is frequently reported how problematic it is to conceptualize the theory into something that can be analyzed empirically (e.g. Priem and Butler, 2001; Williamson, 1999; Hoopes et al. 2003).
Directly asking for a concept that still has no consensus in its definition is obviously difficult, which implies that it unwise to try in a survey. A solution would be to explain the chosen understanding of the subject thoroughly, but even this is quite ambitious to do in an interview and especially in a survey. Another option is then to ask indirectly for the processes that are related to the DC (following Eisenhardt and Martin, 2000; Helfat et al. 2007). Those processes can be more distinct and clear-cut, and the respondent does not have to know to which theoretical construct they belong. The selection of processes could be based solely on theory, but in the interviews we also asked the interviewee(s) to give examples of processes that indicate the presence of a certain dynamic capability (after that construct was explained). The previous section showed that besides direct answers, also observations by the researchers revealed processes that contributed to a dynamic capability in an unexpected fashion.

A problem when asking about the presence of a dynamic capability is to get a full picture of all the processes that are related. Interviewees give a story about the presence of the capability in a certain case, but are not tempted to discuss how far their capability stretches over the entire organization and other cases. The presence and strength of a capability can be captured better when the interviewer asks for other relevant processes, departments, projects, etc., but like in all interviews, it is advised to interview different employees for getting a consistent picture. When testing a conceptual framework, another strategy is also possible, as mentioned above. Instead of trying to explain a construct (such as a DSIC) and then encourage the interviewee to mention all the processes that could be relevant, a less open approach is possible as well. In case one already identified the processes that underlie a capability, the strengths of these processes can be evaluated in order to assess the presence of a DSIC.

Related to the problem of partial coverage of processes that are related to dynamic capabilities, is tautology in measurement. In the DCV literature we find tautology when success of a firm is attributed to the special features it has, but also in distinguishing capabilities and innovations we find tautology. If a described capability is closely related to a certain project; answers can take the shape of: yes (apparently) we have this capability because we did this innovation. For example, one can state to have a capability for sensing technological options because the firm recently adopted a new software method[9]. This relation is the opposite version of: we could do this innovation because we possess this capability. In the DCV-literature, there are wide discussions about the bidirectional relation between emerging dynamic capabilities and developing innovations. Although one can have the belief that they both influence each other, this does not imply that they should be used for measuring each other. Analyzing the relation can only be done if they are measured independently. A solution here is again to ask for specific processes and to decouple this from certain projects. Doing case-based interviews for analyzing firm-wide capabilities is thus a dangerous practice. The pitfall of over-generalizing can be partially evaded by not only interviewing several individuals, but by also studying multiple cases within the same organization. For a survey, consistency could be checked by addressing multiple (sufficiently knowledgeable) employees within one organization and asking them about the firms' entire innovation portfolio rather than specific cases.

When analyzing dynamic capabilities, one might wish to make a distinction between those that are *present* and those that are *actually used*. It sounds natural to say that a capability cannot be used if it is not present, but it can be present without being used. Not being used would mean that processes that constitute the capability did not result in any changes in the resource base and routine-like capabilities during the period under study. However, this conception would bring us back to the tautology-issue. Can we measure the presence of dynamic (service innovation) capabilities even if they did not result in an alteration? The answer seems again to (1) decouple innovations from capabilities and (2) decompose capabilities into processes that are not necessarily recognized to be part of a theoretical construct. A firm can state to be strong in developing and following marketing plans, even if it did not introduced a new product in the last period. The fact that there was (for example) not much possibility for marketing because there were no products to launch, does not imply that the marketing capability is weak. More difficult is the situation when there is no budget. One could state that a firm has the ability to perform successful marketing campaigns but

[9] This example was provided by EP, who started using with a software package that allowed them to collaborate better with other firms by easily sharing designs and other architectural information.

there is no money, but another perspective is to say that all in all, the firm is not able to engage in strong marketing practices (regardless the reason of the weakness). Both views concern the technical fitness of (processes related to) a dynamic capability, but our interest goes out to measuring the actual or 'net' strength. Therefore, if a firm fails to recognize the importance of investing enough in marketing, we would state that this part of the 'scaling and stretching capability' is weak (even if the firm possesses the right expertise).

DSIC	**Used**	**Not used**
Present	DSIC that are productive/active	DSIC that are currently not active, or not permanently
Not present	Not possible (?)[10]	Absent and therefore unused DSIC

Table 10: Conceptual categorization for characterizing different appearances of DSICs.

If we would accept the possibility of present but unused dynamic capabilities, this influences the way they should be analyzed (both in measurement as well as in relation to performance). When stating that a certain dynamic capability contributes to an innovation, it is essential to know whether the underlying processes where really being performed (e.g. "we *do* analyze the actual use of our services) or that in reality a firm only has the ability to do so without actually performing the processes in the period under study (e.g. "we *can* analyze the use of our services").

A question that follows from the distinction between productive and unproductive dynamic capabilities is how valuable they are when not being used. It is possible to imagine that the underlying processes of a capability are not being used, but need to be present for activation in case the market changes. After all, dynamic capabilities are about being able to cope with changes in the environment. An example, inspired on our case-study, would be the dynamic capability of sensing technological options. Underlying processes would be staying updated about new technologies by using different sources and looking at competitors. Maybe technological options are not relevant in the current business of recruitment, so this skill might seem not to be present and neither to be valuable. However, it is possible that new technologies appear (e.g. administrative software or platform software that allows new forms of recruiting and allocating employees) that have a significant impact on the recruitment business. The firms that are successful in coping with this change (whether it is induced by innovations from recruitment firms themselves or external suppliers) might be the ones that are able to signal (and react to) the change first. In that hypothetical case, firms who keep track of software development in their own and adjacent markets might be the survivors by benefiting from a sensing capability that was not useful or productive for a while. From this perspective, management is about (continuously) possessing the right dynamic capabilities.
When we do not accept that dynamic capabilities can be present but not used (saying that they are only present when used), management suddenly would take a slightly different shape: it becomes more a matter of maintaining a dynamic capability or activating/ developing it at the right time.

[10] See our discussion on next page, concerning the use of DSICs that are not present within the own organization.

The implication for our research is that we have to be aware of (and consistent in) the perspective we take. In an explorative interview-based case study it might be possible to analyze the presence of dynamic capabilities by looking at present and used abilities on the one side (what a firm actually does), as well as inactive/unproductive abilities on the other side (including also processes that a firm currently doesn't do, but is able to do perform whenever necessary). In a survey that aims to quantitatively analyze relations with innovation and performance, it is wise to either take a view that does not capture this nuance or otherwise to look only at processes that are really being active and productive (thus disregarding the present but unused ones). Apart from practical considerations (it might be complex to measure the two kinds of processes distinctively), this is merely a theoretical issue. In our belief, dynamic capabilities are about a firm's ability to cope with environmental changes. Hence, our preference goes out to an approach that fully investigates the ability of an organization to perform certain processes. This means that we would like to phrase our questions in both a factual and conditional mode (mixed). By measuring with a Likert-scale, it should be possible to capture both the strength and the value/productiveness of a process.

In our attempt to measure the DSIC of 'sensing technological options', we encountered a problem that is related to the issue of 'not used but maybe present'. Because technology was not relevant in our case-study, it turned out to be difficult to generate insight in this dynamic capability. The fact that sensing technological options was not relevant in the innovative deal towards Tata, does not imply that there are no processes on this account. As mentioned before, there is a caveat when using one particular case to investigate firm-wide capabilities. Looking at the whole innovation-portfolio should give a better view on the capabilities that are present.

As opposed to the risks of not capturing DC that are present but not used, there is also a chance of over-reporting dynamic capabilities. Our case-study showed that via indirect arguing, there turn out to be many possibilities of identifying dynamic capabilities. In some of these cases, we have to ask ourselves if we are not generating 'false hits'. An example is the dynamic capability of stretching and scaling up. Vitae participated in the case-study because she was eager to learn how she could copy the successful model she was deploying at Tata. In a direct sense, Vitae seemed to be weak in scaling up the innovation towards other clients or with other partners. However, one could also argue that Vitae possessed a certain strength given the fact that she was able to attract external investigators that might deliver useful insights and recommendations. The fact that Vitae is able to attract external resources indicates that apparently, she is able to activate processes that help her to extend her innovation. That the 'expertise' does not come from within the firm does not necessarily matter, since in the end we can observe a positive strength when it comes to Vitae's stretching capability. In fact, one could argue that is illustration of the lower left cell of our presence/use matrix; Vitae uses DSICs it doesn't have. Another ambiguous example from our case-study is the collaboration between Vitae and EP. Could this successful cooperation between the two parties emerge because of the coincidentally close relation between the individuals involved (based on personal affection and trust)? In that case, Vitae did not need to rely on a cooperative dynamic capability, but was just lucky with the circumstances (i.e. personal relations) that favored collaboration. However, from another perspective we could say that apparently Vitae is good in facilitating the emergence of trustful relationships, or even of attracting employees that have the right skills and personality (and maybe even network) to build intense connections. In the second case, the success of the collaboration suddenly can be attributed to the presence of a dynamic capability.

Using similar reasoning can give us more examples of situations in which we can have contradicting considerations concerning the presence and relevance of a dynamic (service innovation) capability. Taking a too flexible perspective can lead to a very or maybe even overly inclusive stance towards observing dynamic capabilities (something similar is argued by Williamson, 1999). When a weakness (not being able to stretch) can be measured as well as a strength (using creative methods for learning how to stretch), a concept is unclear.

On the one hand we argue against too much indirect reasoning when measuring dynamic capabilities. Especially in a survey, questions should be narrow enough for not including too many possibilities of 'finding a hit'. On the other hand, when questions are too narrow, there is the risk of excluding original and unforeseen ways of possessing a dynamic capability. In attempts to define processes that constitute DSICs, the balance between the two extremes should be kept in mind.

An interesting aspect of dynamic capabilities is their stability over time. Illustrative is the observation that Vitae did not use to reflect too often on their deal with Tata. They admitted to improve their service by frequently meeting EP. However, thorough evaluations by taking a step back seemed to be missing. Only for the last months, Vitae considers itself to engage in processes that are part of the 'learning' DSIC. By engaging in our case-study, several individuals were encouraged to take a critical look at their innovative construction with EP, as well as other activities concerning innovation. Can we say that Vitae suddenly developed or activated a dynamic capability there used to be missing? Or are we looking at a project-based activity that is not representative for the full organization, and neither for the full length of the project it emerges from? What if Vitae stops reflecting one month after the results from our research are delivered? The question here is how dynamic or static DCs are. One the one hand they refer to structural behavior of an organization, but on the other hand they are able to transform all resources and capabilities, including themselves. When measuring them, one should be careful in explicitly mentioning a period in which the dynamic capability (or its underlying processes) should be assessed. Asking general questions might be the best option, since it is illusive to think that a respondent can remember how well a certain process was present on a certain moment or within a given period.

In our conception of the DCV, dynamic capabilities are embedded in several constituting processes. However, our case-study suggested that in small firms, certain individuals can be entirely responsible for specific processes. Within EP, for example, much of the orchestrating action appeared to come from the director. Further questioning showed that in reality there are many people within EP that engage in collaboration. However, in firms that do not have 100 but 20 employees, it is possible that all the processes relating to a DSIC really reside in a single person (or really small number of individuals). When there is a lot of overlap between persons and processes, the role of personal factors such as talent suddenly becomes really big. As we saw in our introduction of the DCV, part of the definition of dynamic capabilities is that they essentially refer to the capacities of an organization. Explicitly excluded is 'some sort of innate "talent"', since it 'does not derive from the patterned experience of the individuals involved in the decision making or deployment of the capability' (Helfat et al. 2007).

Of course, the personal characteristics of managers are really influential when it comes to the extent an organization possess a certain capability. Some capabilities can reside in this person, but mainly they are a consequence of the action a manger takes to control the behavior of (a part of) the firm as such. Whether an organization is good in conceptualization

does not depend entirely on the creativity of an 'innovation manager', in the end there are many ways in which other employees influence the strength of the relevant processes. In the example of the 'orchestrating manager' that is really clear. Although there might be one person who is officially responsible for all the action an organization takes towards external parties, there probably are many employees who engage in contact with external persons. As our case study showed, even informal contacts can suddenly turn out to lead to new orders, collaborations, etcetera.

Only when an organization is really small, it is possible that a dynamic capability resides fully in a single person. Our advice would be to look at companies that have at least 10 employees.

As we see in the last issue, scale is relevant. Comparing the DCs within small firms with DCs in big firms is not easy. The discussion above showed that there are many reasons why it is difficult to say whether a DC is present or not, but it is even more tricky to state how good a firm is in performing a DC. A question that arises is: good relative to what? Competitors in general? Firms in general? The idea of communalities suggests that DCs are common in all kind of firms (Eisenhardt and Martin, 2000), but what about the extent to which they are performed? Our idea is that in absolute terms, bigger firms probably will have more and more intense actions that constitute processes belonging to a certain dynamic capability. For example, when a small firm considers itself to be active in experimenting, this might in reality concern less experiments (in number, or shorter, or with less participating users) than a big firm that says it experiments only to a minor extent (but in absolute terms is more active). And when an employee of a small firm spends two days a week on research, how does this compare to the R&D department of a big company? One could argue that bigger firms do need to do more (in absolute sense) to reach the same relative level of activity. A big firm can have all kind of departments that are crucial when it wants to reorganize itself, but it could be the case that it needs more departments exactly because it is so big. Smaller firms might be more flexible, and thus need less capacity to perform equally. When smaller firms want to deliver a service innovation that has a huge impact on its firm performance, a small improvement might have the same percentage impact as many innovations for a bigger company. Obviously this reasoning is speculation, but it must be clear that measuring the strength of the presence of a DSIC needs to be interpreted in a relative way. Because it is already hard to make a respondent give an estimation of the strength of their own processes, it is much more difficult to make them compare it with their perceived strengths of competitors or bigger firms. Therefore, a subjective self-assessment might be the best option, asking for a firm's abilities without the need to compare them with others.

A final notion concerns the idiosyncrasies that we can find in the processes a firm relates to a DSIC. We already observed how open questions or too broad questions can lead to false hits, and how personal traits can have a strong influence in capabilities that should represent patterned behavior. When using a general framework, there is a permanent risk of using concepts that are too abstract. To make the DCV, and especially the PdH-framework, more down-to-earth and applicable, a balance have to be found between general ideas about dynamic (service innovation) capabilities and actual processes that constitute them. Given the wide variation one can observe in the deployment of processes that are part of a dynamic capability, we do not wish to develop an extensive list of activities an organization can or has to engage in when wishing to develop a certain dynamic capability. Rather, we aim at an intermediate level of *functional processes.* As argued several times, we believe that dynamic capabilities can be deconstructed in several of those processes. How exactly a firm performs

a function is information that is too detailed for research that has a scope as wide as ours; service innovation within all organizations that engage in service activities. The aim is to identify to what extent a functional process is performed, so that we can aggregate this to an evaluation of the higher order DSIC-construct. Which exact practice is underlying the functional process is not considered to be relevant here, although it is certainly an interesting topic for further operationalization of the PdH-framework. Here we start making the transformation from framework to functional process, the step from functional process to actual practice remains open.

The illustration below shows our view on functional processes. An organization has the possibility to engage in a wide variety of actions that help it to improve its service delivery. For managers, this poses the problem of deciding on which process to 'bet'; given the fact that processes have costs, a balance has to be found. If managers take individual functional processes as a starting point, they have freedom to choose specific practices that contribute to these processes (due to path dependencies, this freedom is usually restricted by the assets and skills a firm acquired already). Our belief is that a higher order perspective should be taken; the perspective of dynamic capabilities. Using a general framework of dynamic capabilities can lead to a more structural approach. Finding universal relations between functional processes, innovation and performance might be difficult because of to the wide variety of service activities. However, a broad perspective that is based on the concept of dynamic capabilities might reveal linkages between these common concepts (DSICs), specific types of service innovations (DSICs), and maybe even performance. This will be tested in the quantitative part of this study, which is the following section.

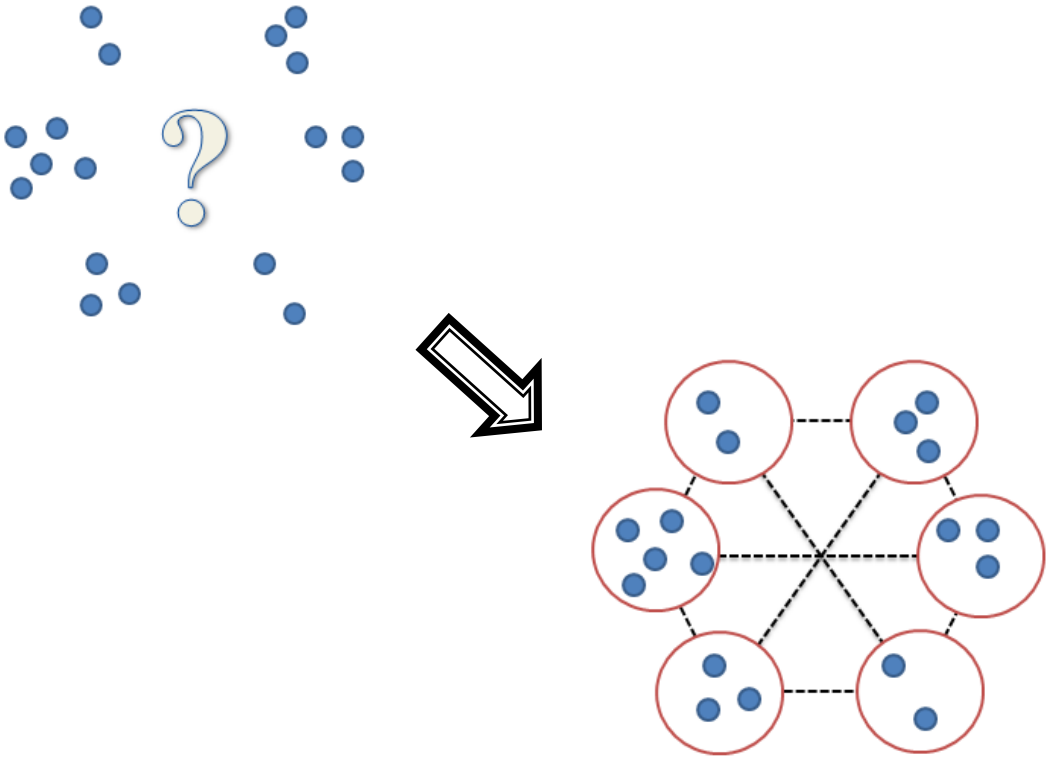

Figure 16: By taking the perspective of dynamic (service innovation) capabilities, structural linkages might be revealed that can be useful for normative implications on the account of strategic management. This figure is based on a synthesis of the PdH-framework (Den Hertog, 2010) and our ideas about functional processes that underlie them (inspired by Peteraf and Maritan, 2007).

4.3 Conclusions

By conducting interviews around a service innovation, we obtained data for quantitatively testing the PdH-model. Especially on the account of DSIC, many caveats and restrictions were identified. Where possible, we provided solutions or recommendations for further analysis, be it qualitatively (more interviews) or quantitatively (developing a survey instrument, as in the continuation of our empirical study).

- Although the PdH-framework is grounded in both empirical and theoretical research, it remains conceptual until it is extensively tested itself. On the basis of our case-study, several critiques were uttered that can help us to operationalize (or even improve) the DSIC and SIPD concepts.

- Innovation is fashionable; the impression is that nearly everyone is shouting to be innovative. At the same time, some companies might feel that they miss this trend and do not engage in innovation. Especially amongst small-size service providers, there might be a feeling that innovation is just another fancy buzz-word used by the big guys. Another perception might be that innovation is about technology. So, first of all, research for service innovation should try to overcome the ignorance amongst firms that do not recognize their own innovative activities. This can be done by avoiding *too much emphasis on innovation*, and instead invite interviewees or respondents to provide insight in the way they improve their organization and service activities.

- Where innovation might be a very general term, dynamic capabilities and DSIC are essentially abstract and conceptual. Asking people to assess the strengths of their DSICs is considered to be impossible. In line with Eisenhardt and Martin (2000) and Helfat et al. (2007), we argue that *underlying processes* should deserve the attention. Instead of looking at really concrete and specific processes, we choose an intermediate position by defining *functional processes.* These types of processes are at an abstraction-level in which we only look till what extent a function is performed, regardless the actual practice that is being used in specific cases.
In a survey, measurement items should represent these processes, without the necessity that the respondent is aware of the construct (DSIC) it is part of.

- When analyzing firm-wide dynamic (service innovation) capabilities, do not take a single case as point of departure. Preferred is to take *multiple cases*, or better, look at the entire *innovation portfolio* to maintain distinction between certain processes and (resulting?) innovations.

- Given the vagueness of DSIC and even their underlying processes, it might be difficult to obtain valid data. In order to be sure of consistent response, try to ask *multiple respondents per organization* and compare their answers.

- From the idea that dynamic capabilities refer to processes that enable an organization to cope with environmental changes, it is not logical to make a hard distinction between used capabilities and those that did not happened to be productive in the period under study. Questions should be aimed at the presence and/or strength of processes that are *being performed* or *could be performed* (both).

- Make questions for functional processes *not too narrow, but not too broad* neither. Firms can be creative in the way they perform a certain function, but false hits by too wide questions (allowing for indirect reasoning) should be avoided.

- Dynamic capabilities are not stable over time; they can change themselves as well. *Longitudinal research* would not only contribute to insight in how dynamic capabilities operate and have an impact over time (a chronological element is part of their nature, since they concern change), but would also reveal how dynamic they are themselves. For this purpose, *developing a survey instrument* would be very useful.

- Do not address *firms that are too small*; personal aspects can become too influential when measuring a capability that should reflect an organizational characteristic. Dynamic capabilities are about patterned behavior, which does not include traits like talent.

- It is difficult to ask from people that they *compare* the presence or strength of their firms processes with those in other firms. The measured strength of the presence of a DSIC needs to be *interpreted in a relative way*.

5 Survey

The aim of the survey is to shed light on service innovation amongst a wide spectrum of organizations that possibly engage in this presumably underreported activity. Instead of asking directly for innovative behavior, we try to measure activity that we believe to be elements of overarching concepts as we find them in innovation literature. In subsection 2.4, it was argued why the PdH-framework suits our intentions. We will measure both the six dimensions of service innovation (Service Innovation Performance Dimension, SIPD) and the six dynamic capabilities that are relevant for achieving service innovation (Dynamic Service Innovation Capabilities, DSIC). When the measurement of Den Hertogs conceptual model succeeds, we can proceed with testing a structural model that assumes service innovation to mediate the firm performance enhancing effects of DSICs.

In our survey-design, we will closely follow the lessons that were learned from the case-study. Whenever we are not able to overcome identified problems, at least we understand better the quality and validity of our data, and thereby are aware of the limitations of our quantitative approach.

5.1 Survey Design

Context
The survey was conducted as a part of the United We Stand project, just like the case-study. By having access to the so-called Collis-database, we could retrieve functions of employees in firms that were located in our region of interest (North-Wing of the Randstad). Since we are asking for innovative behavior at the firm-level, we decided to direct our survey to managers that are positioned high in the hierarchy of their firm and likely to be knowledgeable about the topics within our questionnaire. The dataset provided us functions, names and addresses, which implied the use of a written survey. That we did not have email address to our disposal did not mean that we did not use electronic means for surveying; a digital version of our questionnaire was available via NetQuestionnaire. On 19 May, we sent out a batch of 5880 envelopes containing the survey, a personalized letter and a marked retour-envelop. The sample was chosen on the basis of criteria that served to have 70% of the sample receiving one survey, 20% receiving two surveys and 10% receiving three surveys (sent to different directors and managers). In order to enhance our response follow-up phone calls were made in June. These actions also served to make sure that our sample was representative for the population we studied, i.e. the sizes and sectors of firms in our region of focus.

The survey itself was designed by four researchers that were occupied with the UWS-project, having backgrounds in service innovation or management of innovation. Due to different interests, the survey consisted of varied elements that were related to the management of (open) service innovation.
Although most of the questions in the survey were adapted from existing scales, we tested the whole list. Face-to-face discussions with about 10 researchers and pre-tests with representative respondents (covering different types and size of organizations) delivered useful comments on how to improve the clarity of the items. Comments concerned things like unknown words, unclear phrases, comments on the length of the list, and questions about what to do when a question was not relevant for the respondents' situation.

By the end of June, we collected 204 responses, accounting for only 3,5 % of our sample. This low response can be attributed to several reasons.

First, our non-response analyses showed that our data-base with contact information was not up to date. Many people turned out to be no longer active in an organization, and sometimes the organization itself was inactive or had changed addresses.

Secondly, many firms do not consider themselves to be innovative (e.g. small firms) or service deliverers (e.g. manufacturing firms). Both these threats were already identified in our case-study, but apparently our letter could not convince all potential respondents that they actually were important for our study. During the non-response analysis, and written in the physical response, we encountered several people saying that they thought themselves not to be interesting for research on (open) service innovation. This is remarkable, because during this non-response analysis we also browsed websites of many different firms; most of them were found to include both the word 'service' and 'innovation', although only sometimes together. If we look at the data, we see that almost every responding company considers itself as service-dominant. This could indicate that services are truly widespread (with respect to sectors), supporting the notion of a service dominant logic ("services are everywhere"). However, it can also be explained by the fact that non-service firms were more likely to ignore our survey.

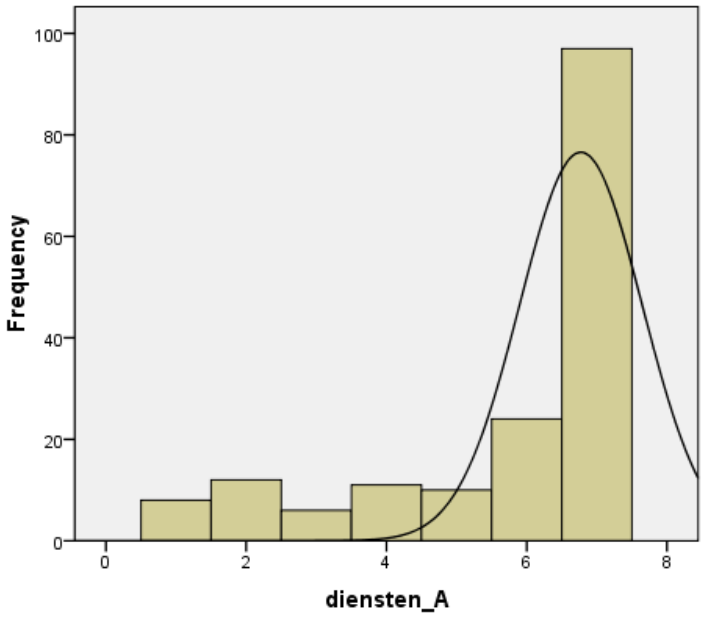

Figure 17: diensten_A = "To what extent does your turnover come from service provision?" (n =204).

To check whether traditional beliefs about service sectors and non-service sectors hold, an interesting addition is a cross-tabulation of service-activity-responses and the sector an organization belongs to.

The table on the next page shows the response (+distribution) per sector (n = 198/204). Note that we did not aim to have equality between the classes; we wanted a sample that is representative for the region of our focus. The answers that are displayed (diensten_A) again belong to the question whether a firms' turnover mainly comes from services.

			diensten_A							
			1	2	3	4	5	6	7	Total
ind_cat	A Landbouw	Count	1	0	0	1	1	0	0	3
		% within ind_cat	33,3%	,0%	,0%	33,3%	33,3%	,0%	,0%	100,0%
		% of Total	,5%	,0%	,0%	,5%	,5%	,0%	,0%	1,5%
	C Industrie	Count	2	4	1	1	1	4	8	21
		% within ind_cat	9,5%	19,0%	4,8%	4,8%	4,8%	19,0%	38,1%	100,0%
		% of Total	1,0%	2,0%	,5%	,5%	,5%	2,0%	4,0%	10,6%
	E Utilities: Water, afval-	Count	0	0	0	0	0	1	3	4
		% within ind_cat	,0%	,0%	,0%	,0%	,0%	25,0%	75,0%	100,0%
		% of Total	,0%	,0%	,0%	,0%	,0%	,5%	1,5%	2,0%
	F Bouw	Count	0	0	1	4	0	3	8	16
		% within ind_cat	,0%	,0%	6,3%	25,0%	,0%	18,8%	50,0%	100,0%
		% of Total	,0%	,0%	,5%	2,0%	,0%	1,5%	4,0%	8,1%
	G Handel: Detailhandel	Count	2	0	1	1	1	1	0	6
		% within ind_cat	33,3%	,0%	16,7%	16,7%	16,7%	16,7%	,0%	100,0%
		% of Total	1,0%	,0%	,5%	,5%	,5%	,5%	,0%	3,0%
	G Handel: Groothandel	Count	4	6	5	6	3	3	4	31
		% within ind_cat	12,9%	19,4%	16,1%	19,4%	9,7%	9,7%	12,9%	100,0%
		% of Total	2,0%	3,0%	2,5%	3,0%	1,5%	1,5%	2,0%	15,7%
	H Vervoer en opslag	Count	0	0	0	1	1	3	10	15
		% within ind_cat	,0%	,0%	,0%	6,7%	6,7%	20,0%	66,7%	100,0%
		% of Total	,0%	,0%	,0%	,5%	,5%	1,5%	5,1%	7,6%
	I Logies-, maaltijd- en drankverstrekking	Count	0	0	0	0	0	2	2	4
		% within ind_cat	,0%	,0%	,0%	,0%	,0%	50,0%	50,0%	100,0%
		% of Total	,0%	,0%	,0%	,0%	,0%	1,0%	1,0%	2,0%
	J Informatie en communicatie	Count	1	1	0	1	0	2	3	8
		% within ind_cat	12,5%	12,5%	,0%	12,5%	,0%	25,0%	37,5%	100,0%
		% of Total	,5%	,5%	,0%	,5%	,0%	1,0%	1,5%	4,0%
	K Financiele instellingen	Count	1	1	0	0	0	1	8	11
		% within ind_cat	9,1%	9,1%	,0%	,0%	,0%	9,1%	72,7%	100,0%
		% of Total	,5%	,5%	,0%	,0%	,0%	,5%	4,0%	5,6%
	L Verhuur van en handel in onroerend goed	Count	0	1	0	0	1	0	2	4
		% within ind_cat	,0%	25,0%	,0%	,0%	25,0%	,0%	50,0%	100,0%
		% of Total	,0%	,5%	,0%	,0%	,5%	,0%	1,0%	2,0%
	M Advisering, onderzoek en overige specialistische zakelijke dienstverlening	Count	0	1	0	1	4	5	40	51
		% within ind_cat	,0%	2,0%	,0%	2,0%	7,8%	9,8%	78,4%	100,0%
		% of Total	,0%	,5%	,0%	,5%	2,0%	2,5%	20,2%	25,8%
	N Verhuur van roerende goederen en overige zakelijke diensverlening	Count	2	0	0	0	0	1	6	9
		% within ind_cat	22,2%	,0%	,0%	,0%	,0%	11,1%	66,7%	100,0%
		% of Total	1,0%	,0%	,0%	,0%	,0%	,5%	3,0%	4,5%
	P Onderwijs	Count	0	0	0	0	0	0	1	1
		% within ind_cat	,0%	,0%	,0%	,0%	,0%	,0%	100,0%	100,0%
		% of Total	,0%	,0%	,0%	,0%	,0%	,0%	,5%	,5%
	Q Gezondheids- en welzijnszorg	Count	0	0	0	0	0	1	6	7
		% within ind_cat	,0%	,0%	,0%	,0%	,0%	14,3%	85,7%	100,0%
		% of Total	,0%	,0%	,0%	,0%	,0%	,5%	3,0%	3,5%
	R Cultuur, sport en recreatie	Count	0	0	0	0	0	1	1	2
		% within ind_cat	,0%	,0%	,0%	,0%	,0%	50,0%	50,0%	100,0%
		% of Total	,0%	,0%	,0%	,0%	,0%	,5%	,5%	1,0%
	S Overige dienstverlening	Count	0	0	0	0	0	1	4	5
		% within ind_cat	,0%	,0%	,0%	,0%	,0%	20,0%	80,0%	100,0%
		% of Total	,0%	,0%	,0%	,0%	,0%	,5%	2,0%	2,5%
Total		Count	13	14	8	16	12	29	106	198
		% within ind_cat	6,6%	7,1%	4,0%	8,1%	6,1%	14,6%	53,5%	100,0%
		% of Total	6,6%	7,1%	4,0%	8,1%	6,1%	14,6%	53,5%	100,0%

Table 11: Cross-tabulation of importance of service provision and sector.

Not surprisingly, the three responses we get from agriculture (class A) show us that the primary sector is not really active in service production. Next to the answer of 1 (total disagree) we find a 4 and a 5 that might look intermediate, but are still under the high mean of 5,76. More than one third of the industry (class C) states to be very active in service production, but there are also many companies that respond to do that only to a very minor extent. Almost none of the other companies disagree with the statement that they produce services. Exceptions are: retail and especially wholesale (class G). Although they are often considered to be service activities, respondents from these sectors state not to get the majority of their sales out of turnover. The two low responses in Information and Communication (class J) can be explained by the fact that some of these firms simply sell computers, which is similar to retailing. More interesting is that 9 of the financial institutions get their turnover out of services, but there are also two that state not to engage in services at all. A similar pattern can be observed in class N: rental of personal property and other business services.

5.2 Measuring DSICs & SIPDs

5.2.1 Method

Measurement items

The PdH-framework was operationalized by carefully transforming the descriptions for DSICs and SIPDs into individual items. Content validity was achieved by frequent interaction with the main author behind the framework, ensuring that the identified measurement items truly represent the constructs of interest. Other inspiration for identifying and phrasing correct items was found in original work on which the PdH-framework was based, as well as similar research. Noteworthy are especially Agarwal and Selen (2009) and Avlonitis et al. (2001). Although these studies had a different focus and used different capabilities, they surveyed for processes that correspond to a certain extent with the ones we want to measure in the PdH-framework.

With respect to the type of questions that form our items, note again that we follow the idea that capabilities are common construct that are embedded in processes (e.g. Eisenhardt and Martin, 2000; Helfat et al. 2007). Where dynamic capabilities are abstract concepts, processes can be really concrete. As mentioned in the conclusions of our case-study, our interpretation of processes has an intermediate perspective. This means that we ask for the presence of certain *functions.* We are not interested in the specificities of how certain tasks are performed. Rather, we focus on the extent to which they are present in the organization. That the PdH-framework allows such an operationalization is suggested by the 'key prescriptive questions to assess firm level dynamic service innovation capabilities' he proposed (Den Hertog, 2010, pp. 231). For each DSIC, Den Hertog asks whether there is a systematic approach/strategy in place to perform a number of functions that are typically part of that DSIC. In other words, the question is whether firms systematically perform actions that are related to functions that underlie the DSIC. The systematic activity corresponds with the patterned behavior that was argued to be essential for dynamic capability constituting processes.

In our survey, we posed formative questions in which the items represent the associated underlying processes and together aim to measure a DSIC. Also for SIPDs, we used several items to measure the same construct. The number of items differs per construct, depending of the complexity of the capability it is constituting. Dynamic capabilities that are simpler (to understand or in the range of functions they cover) need less items to be measured with. Since we standardize all our data, it is not problematic that some constructs will be an aggregation of more items than others. To check whether items really belong to the construct we associate it with, component reduction analyses are deployed in SPSS (version 17). These calculations search for patterns in the respondents data, and try to identify underlying dimensions. When several items load high on a component, this means that there is a latent factor we could try to interpret. In case all of these items are part of a DSIC or SIPD we defined *a priori*, the interpretation will be straight-forward.

The final phrasing of all the items can be found in the survey in the annex. Choosing for a 7-point Lickert-scale ranging from "strongly disagree" to "strongly agree" is a common practice in this kind of research (see e.g. Protogerou et al. 2008).

5.2.2 Results

Dimension reduction of DSIC

A first step in our analysis is determination of the extent to which we succeeded in measuring different dynamic service innovation capabilities. Crucial here is that our items show convergent reliability on a construct we can interpret, but that they are also sufficiently discriminative, indicating different underlying dimensions. The development of our measurement-scales thus occurs by applying principal component analysis (PCA).

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,896
Bartlett's Test of Sphericity	*Approx. Chi-Square*	2848,13
	df	406
	Sig.	,000

Table 12: KMO-test for sampling adequacy.

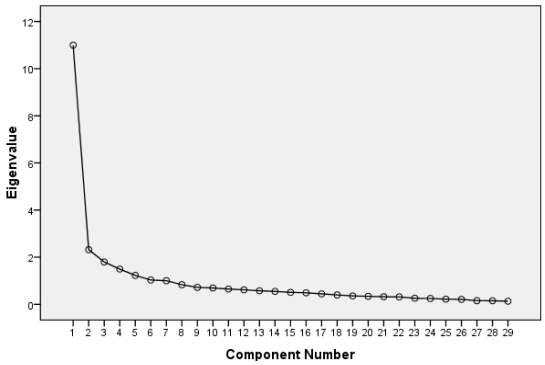

Fig. 18: Scree plot of data reduction.

The high KMO-value of our DSIC-items tells us that principal component analysis is allowed; a value of .896 is nearly 'superb', according to the .9 threshold by Hutcheson and Surfriniou, 1999, p. 224-225.

According to the scree plot, there is one single dimension that mainly underlies all the different dynamic capabilities. However, this single component explains only 37% of the variance; the following components still contribute significantly to the amount of variance that can be explained. When using (Varimax) rotation, the distribution becomes more equal; the first component then is only explaining 15% of the variance.

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	10,998	37,925	37,925	4,557	15,713	15,713
2	2,317	7,991	45,916	3,859	13,308	29,021
3	1,796	6,192	52,108	3,445	11,880	40,901
4	1,494	5,152	57,260	2,724	9,393	50,294
5	1,224	4,222	61,481	2,222	7,663	57,957
6	1,030	3,553	65,034	2,052	7,077	65,034

Table 13: Total variance explained by components resulting from PCA with eigenvalue >1. (n = 204).

The matrix below shows to what extent our processes, captured by 29 items, are part of distinct underlying dimensions (possibly the hypothesized DSIC-constructs). Throughout this whole analysis, factor-loadings smaller than .40 are suppressed for the sake of clarity. Although the component table shows our items in a grouped order, they were partially mixed in our questionnaire. This contributes to the validity of observed patterns.

	Component					
	1	2	3	4	5	6
DSICA1					,698	
DSICA2						**,755**
DSICA3						**,713**
DSICA4						**,512**
DSICA5		**,768**				
DSICA6		**,682**				
DSICA7		**,680**				
DSICB1		**,651**				
DSICB2					,747	
DSICB3	,541	,434	,408			
DSICB4	**,642**					
DSICC1	**,781**					
DSICC2	**,774**					
DSICC3	**,629**					
DSICC4		,644				
DSICC5	**,660**					
DSICC6	**,572**					
DSICD1				,419	,541	
DSICD2				**,757**		
DSICD3				**,811**		
DSICE1	,444			,468		
DSICE2			**,690**			
DSICE3			**,767**			
DSICE4			**,823**			
DSICE5					,723	
DSICF1	,403					
DSICF2			**,703**			
DSICF3		,513				
DSICF4	,427					

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

Table 14: Rotated component matrix (n=204).

A first observation is that all the reversed items drop out of all our factor-analysis (component 5). Apparently, this way of framing questions drastically lowers the chance to observe statistical patterns in the response. Asking a negatively framed question ('we have problems with…') invokes a response that is not exactly mirrored to responses to similar but un-reversed questions. A reason to maintain reversed items in a survey instrument is to keep the attention of a respondent.

Let us concentrate at the items that show up in the other five components.

Some items do not clearly belong to a single dimension. Notably B3, D1 (already eliminated) and E1 have cross-loadings that make their presence confusing. When we want to identify separate underlying dimensions, items with cross-loadings that also are quite low (below .70) and/or have small differences between the values of the cross-loadings can be eliminated from further analysis. In fact, all items that have loadings that are not near or above the commonly accepted threshold of .70, do not clearly show a pattern that could indicate an underlying dimension (see key references by Agarwal and Selen, 2009; pp. 449). In our analysis, this includes items F1, F3 and F4. Finally, we have some items that load sufficiently high on a dimension, but are difficult to interpret since it is not the capability we expected them to belong to.

- F2: *"Our organization reflects purposeful on innovation activities it engaged in".* This item is found to be related to items E2, E3 and E4, concerning policy for scaling and stretching. Since reflecting on innovation and policy for the market introduction of innovations are two essentially different aspects, we see no theoretical grounds for identifying a capability that consists of both these activities. Rather, we suspect that the statistical similarity can be attributed to the fact that question F2 was posed right after E2, E3 and E4.

- B1: *"We are innovative in the invention of new services."*
  Just like our previous item, this item seems to load high on a dimension that contains items that were questioned sequentially. A5, A6 and A7 concern sensing supply, which is different from own invention of new services.
  For both F2 and B1, we decide to exclude them from further analysis on the basis of their unclear meaning. For both the entire DSICs F (learning) and B (conceptualizing) we have reasons to accept that they cannot be measured in the same way as our other DSICs, as we will argue below.

- C4: *"Our organization is good in creating integrated or specialised solutions"*. Why this item has variance that shows common patterns with A5, A6 and A7 is not clear. Possibly, our question for the (un)bundling capability of an organization was perceived as ambiguous, since it seems to consist of two elements. We consider them both as acts of (un)bundling, but the respondent might be confused by the combination of two contradicting aspects. At least it is clear that it shouldn't be part of the dimension that consists of other C-items.

- B4: *"We align new service concepts with existing business processes".*
  The situation of this item is similar to the previous one. Here, however, we could give a meaningful interpretation for the fact that it seems to belong to the C-items. In a way, aligning new service concepts with existing business processes is also bundling. The object is different from the original notion of bundling (concerning recombination of new services), but the relevant capability might be the same. On the other hand, B4 is also an item that precedes the items it is statistically associated with, and we already announced that the whole conceptualizing (B) capability was dropped from our refined framework.

The reason why we are not surprised that a component analysis does not reveal dimensions of Conceptualizing (DSIC B) and Learning (DSIC F) is that they might be too vague to operationalize into discrete processes. Let us start with the latter: processes that can be used for reflecting on other capabilities turn out not to have an underlying dimension that is

distinct from the other capabilities themselves. An explanation would be that these processes are actually part of the capabilities they help to reflect on. (e.g. evaluating sensing processes). In the case that 'learning and reflecting on innovation' and 'conceptualizing ideas into service innovations' have a distributed character, which matches with the common ideas about innovation in services (see section 2.2.1), the items indeed would not show up as a distinct dimension. Recall also the hypothesized links between DSICs (see section 2.4.3), in which we find that both DSIC B and F are expected to be linked to *all the others.* Again, this suggests that finding a distinct dimension is inherently difficult.

For the other items, they seem to underlie the capabilities that we predefined. Bundling and unbundling (DSIC C) is measured quite consistently, as well as coproducing and orchestrating (DSIC D). In the case of scaling and stretching (DSIC E), the three remaining (high-loading) items are slightly emphasizing the marketing aspect of that capability, but we can consider it as sufficiently distinct. Only the sensing capability (A) shows another interesting story; it turns out to consist of two distinct (sub-)capabilities. This is in line with our findings of the case study; becoming aware of user needs involves processes that are entirely different from those related to following the developments on the supply side of the market. Also in the table with hypothesized links, we find that sensing user needs is expected to be linked to other SIPDs than sensing technological options. Something similar was expected for other capabilities that might seem to have a dual nature, but for them no evidence was found in our case-study and neither in the data.

Instead of using all the items in a structural model, we choose to use only the items that load significantly on the component that we interpreted as an original (directly stemming from the PdH-framework) or redefined capability. The table below shows the formed constructs, as a result of the EFA on our diverse set of service innovation process items. Evidence for discriminant validity (unidimensionality) is derived from the EFA itself, whereas convergent validity can be drawn from the Cronbach's alpha (all well above 0,7). The scales thus seem to be sufficiently reliable for use in structural models.

Items in factor	***Interpretation of factor***	***Acronym***	***Cronbach's alpha***
A2, A3, A4	Sensing user needs	SEN1	,810
A5, A6, A7	Sensing options	SEN2	,843
C1, C2, C3, C5, C6	(un)bundling	BUN	,866
D2, D3	Coproducing and Orchestrating	C&O	,847
E2, E3, E4	Stretching and scaling	S&S	,783

Table 15: Characteristics of our redefined DSIC (n=204).

The next table shows the result of a principal component analysis (Varimax rotated, so still orthogonal) if we enter only the items that are part of our newly defined DSICs. Remarkable is that with a threshold of eigenvalue > 1, four instead of five components are produced. The two dimensions of 'sensing user needs' and 'sensing options' that seemed to be distinct in our initial analysis, are now part again of the same overarching capability. Therefore, they can indeed be regarded as two 'sub'-capabilities rather than two entirely distinct capabilities. In other words: sensing user needs and sensing (technological) options are distinct from each other, but still show some above-average communality. When we instruct SPSS/PASW to come up with five components that underlie our remaining items, the right table shows that our five constructs are nicely generated. Since this fifth component is still explaining a significant amount of variance, and it was empirically found to be distinctive, we continue our analysis with a set of five DSICs.

	Component			
	1	2	3	4
DSICA2	,681			
DSICA3	,631			
DSICA4	,458		,431	
DSICA5	,731			
DSICA6	,786			
DSICA7	,727			
DSICC1		,791		
DSICC2		,716		
DSICC3		,728		
DSICC5		,763		
DSICC6		,600		
DSICD2				,818
DSICD3				,846
DSICE2			,709	
DSICE3			,821	
DSICE4			,830	

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

	Component				
	1	2	3	4	5
DSICA2				,834	
DSICA3				,727	
DSICA4				,613	
DSICA5		,768			
DSICA6		,743			
DSICA7		,789			
DSICC1	,789				
DSICC2	,722				
DSICC3	,744				
DSICC5	,751				
DSICC6	,563				
DSICD2					,834
DSICD3					,849
DSICE2			,724		
DSICE3			,841		
DSICE4			,802		

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

Tables 16 and 17: Rotated component matrices with 4 and 5 components (respectively).

Occurrence

To see which DSICs 'occur' the most frequently (score the highest), we used our selected items (per construct) to calculate the sum-scores and the average scores for all capabilities. E.g. SensingUserNeeds = DSICA2+ DSICA3+ DSICA4 / 3.

Since some cases have missing data, we only look at a subset of responses in which we had answers on *all the remaining DSIC-items*. For the SEM-analysis in Part B it is crucial that all our constructs are based on complete items, so we also filter on availability on SIPDs (these tend to be complete anyway) and performance. The remaining subset of n = 169 will be the basis for the rest of this analysis.

Calculation of the averaged sum scores resulted in the table below. According to these statistics, the differences in means are significant. Sensing (Technological) Options occurs the most, followed by (Un)Bundling and Sensing User Needs. The two least occurring (or less strongly occurring) capabilities are then Coproducing & Orchestrating and Scaling & Stretching. They also have the highest standard deviation, suggesting that the differences on their scores are relatively high between firms. Observe that all the means are above 4 (middle of our Likert-schale), probably indicating moderate over-estimations in the self-perception of respondents. Differences in the means all turn out to be significant (table included in appendix 3.1).

	N	Range	Mean	Std. Deviation	Variance
SensingUserNeeds	169	6,00	4,6193	1,33199	1,774
SensingTechOptions	169	6,00	5,0592	1,33449	1,781
BundlingUnbundling	169	6,00	4,7408	1,16345	1,354
CoproducingOrchestrating	169	6,00	4,4941	1,50593	2,268
ScalingStretching	169	6,00	4,3195	1,46762	2,154
Valid N (listwise)	169				

Table 18.: Descriptive statistics of DSIC occurrence, based on averaged scores (n = 169)

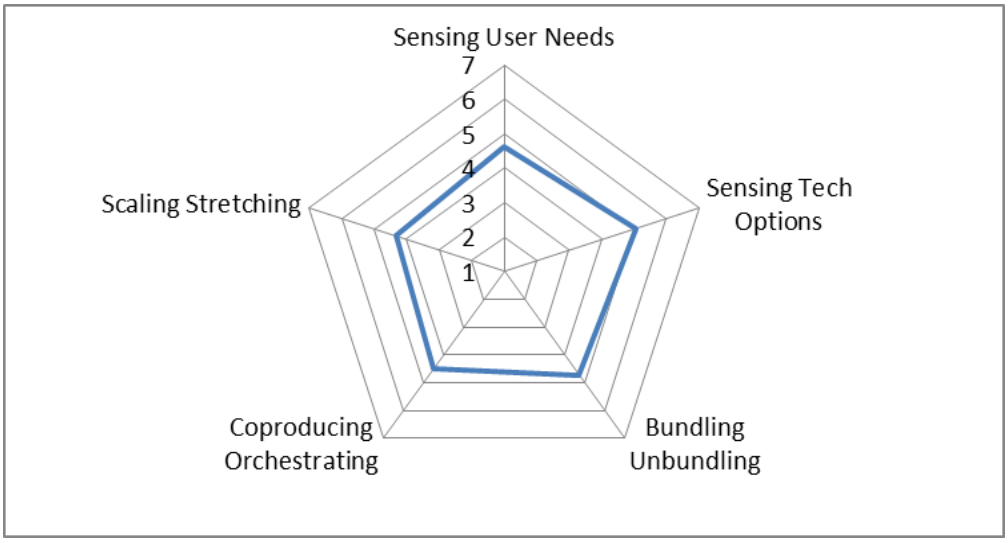

Fig 19: Radar-diagram for mapping DSICs; here applied on total sample (n=169).

One interesting subject to check, is whether this occurrence of DSICs differs between service-delivering firms and non-service firms. Since we already observed that almost everyone is relying on service provision, we classified our respondents into one class with those who answered that their turnover does not at all come from services (8 firms reported a 1) and one class with all the rest. Comparison of the means indicates that those companies that do not at all acquire their sales out of service also have less (strong) service innovation capabilities. Since there are so few firms reporting a 1, we did an ANOVA (not shown here) to check if those differences in means are statistically significant. Except for Scaling and Stretching, this is indeed the case.

Services		Sensing User Needs	Sensing Tech. Options	Bundling Unbundling	Coproducing Orchestrating	Scaling Stretching
Yes	Mean	4,7039	5,1097	4,8298	4,5932	4,3582
	N	161	161	161	161	161
	Std. Dev.	1,28236	1,27844	1,06142	1,43419	1,40364
No	Mean	2,9167	4,0417	2,9500	2,5000	3,5417
	N	8	8	8	8	8
	Std. Dev.	1,23121	2,03491	1,69958	1,62569	2,43609
Total	Mean	4,6193	5,0592	4,7408	4,4941	4,3195
	N	169	169	169	169	169
	Std. Dev.	1,33199	1,33449	1,16345	1,50593	1,46762

Table 19:Comparison of DSIC-occurence in firms that state to mainly get their turnover out of services, and those who do not at all engage in services (n=169).

Another way of distinguishing between service firms and non-service firms is by following sector-based typologies in the literature. Over the year, many taxonomies for classifying service sectors have been proposed (for an extensive overview, see Cook et al., 1999)[11]. A well-accepted method is based on the NACE-classification. Usually, industry classification consider NACE groups G to O, P or Q as service sectors (Rubalcaba, Di Meglio and Pyka, 2010), but recently the European Commission argued to include utilities like network services (Glückler and Hammar, forthcoming).[12] To enable the possibility of comparing our observations with standard service research, we stick to the common classification, resulting in the table in Appendix 3.3. Non-services contains both agriculture (group A) and manufacturing classes, services consists of group G to Q, as well as R (culture, sports and recreation) and S (other services).

According to the ANOVA-analysis, none of the differences is statistically significant. This is remarkable given the previous conclusion that non-service firms possessed less (strong) DSICs. An explanation would be that service provision crosses the boundaries of traditional sector classification, as is argued in the service dominant logic. Even in agriculture and manufacturing we have firms that rely highly on service provision, as we saw already in the first descriptions of our survey.

Another distinction we can make relates to our question how to compare the strength of capabilities between small and big firms. By separating the respondents into three categories (<50, 50-250, >250), we can compare those groups. Our data (appendix 3.3) shows that when it comes to perceptions of the respondents, there are not really patterns or remarkable differences. Bigger firms seem to be stronger in Sensing User needs and especially Coproducing and Orchestrating. For Sensing (Technological) Options and (Un)bundling, both small and large firms have higher means than medium firms, whereas this latter group scores highest on Scaling and Stretching.

An ANOVA-Test (see appendix 3.4) reveals that the variance within groups is not significantly lower than between groups. However, when looking at the standard deviations, we observe that these are systematically lower for medium-sized firms. Small firms are more heterogeneous when it comes to the perceived strengths of their capability-underlying processes. For each of the capabilities, there are small firms who score relatively a bit lower and small firms that score higher. This is not the case for big firms; they tend to be heterogeneous in their heterogeneity. For both the sensing capabilities there seem to be relatively big differences in the response, whereas for (un)bundling, scaling & stretching and especially coproducing and orchestrating, these differences seem to be a bit smaller.

[11] One way for grouping services is based on the *object* of the service; maintenance interactive, task interactive or personal interactive (Miles and Margulies, 1980). Schmenner (1986) categorized firms by the level of interaction and customization versus the labour intensity of services, whereas Laksmanan proposed one year later his distinction between service dispensers, task-interactive services and personal interactive services (Lakshmanan, 1987). Miozzo and Soete (1990) used Pavitts 1984-taxonomy for categorizing industries according to the trajectories of technical change they follow.

[12] Which letter belongs to which NACE-class can be retrieved form the table on page 67.

Dimension reduction SIPD

In the dimension reduction of items concerning service innovation performance dimensions, we will follow the same procedure as we did for DSICs.

The scree plot below indicates that respondents do not distinguish that much between different service innovation dimensions. One component has a eigenvalue of 6,15; accounting for already 43,9% of the variance. Since the KMO is again well above common thresholds like .5 and even .7, at least we can say that factor analysis is suitable.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,837
Bartlett's Test of Sphericity	*Approx. Chi-Square*	1202,11
	df	91
	Sig.	,000

Table 20: KMO-test for sampling adequacy.

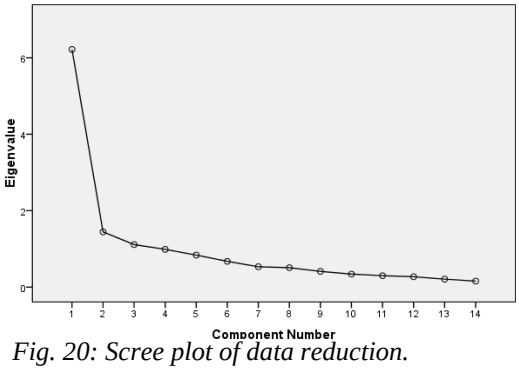

Fig. 20: Scree plot of data reduction.

If we maintain the standard extraction threshold of Eigenvalue >1, three components will be extracted (their composition is shown in annex 3.5). However, the scree plot also shows that additional components still explain some variance. Since we are going to use Varimax rotation again, we can also look at the explained variance by the rotated components. This implies that we don't set the initial Eigenvalue at 1, but that we check when the rotated eigenvalue drops below 1. It turns out that this happens when we extract six components, accounting for about 80% of the explained variance.

	Initial Eigenvalues			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6,150	43,931	43,931	2,461	17,580	17,580
2	1,478	10,560	54,491	2,252	16,083	33,663
3	1,131	8,081	62,572	2,097	14,980	48,642
4	,977	6,975	69,547	1,866	13,329	61,971
5	,827	5,906	75,453	1,531	10,938	72,910
6	,682	4,868	80,321	1,038	7,411	80,321

Extraction Method: Principal Component Analysis.

Table 21: Total variance explained after dimension reduction of all the SIPD items (n = 169).

On the next page, we find the table that shows the loadings of the SIPD items on different components. Like in the case of DSICs, we will follow several steps to decide which items to remain or exclude, and how to interpret the resulting components. Since there were no inversed questions in the SIPD items, we do not find again a component that exists solely of these items.

	Component					
	1	2	3	4	5	6
SIPD1A	,749					
SIPD1B	,845					
SIPD1C	,724					
SIPD2A				,884		
SIPD2B				,854		
SIPD2C						,886
SIPD3A					,791	
SIPD3B					,727	
SIPD4A		,645				
SIPD4B		,757				
SIPD5A		,811				
SIPD5B	,424	,475	,554			
SIPD6A			,824			
SIPD6B			,842			

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Table 22: Rotated component matrix (n = 169).

The first impression that comes from this table is that the items tend to load on several clearly distinct dimensions. Questions 1A, 1B and 1C collectively measure a dimension that we described (a priori) as New Service Concept. The items 2A and 2B have very similar variance as well, but item 2C is a loner in the last component. Since it is there alone, we cannot really interpret it as a separate dimension.
If we look at the exact content of the questions, item 2A and 2B both concern changes in communication and contact with clients, whereas 2C is about a redistribution of tasks between provider and consumer. Apparently this last element is not a part of the New User Interaction SIPD. Therefore, we will exclude it from further analysis.
Component 5 consists nicely of items 3A and 3B, which have loadings well above .7. More difficult to interpret is the second component. Item 4A, 4B, 5A and 5B all show up here. In other words, New Revenue Models don't seem to be that different from New Organizational Delivery Systems after all. There might be conceptual subtleties, but empirical data shows that respondents do not distinguish between these dimensions. The findings might thus imply that new revenue models always come with changes in the organization and culture of a firm, and vice versa. If we take into account the loadings of the items, we might be more careful in our interpretation. Item 5B turns out to load (quite low) on as much as three components. Because it confuses the distinction between dimensions, it might be wise to delete it, thereby remaining both New Service Concept and New Technological Delivery System as two clear SIPDs (1 and 6, respectively).

Although item 4A (renewal of role of external partners) does not load very high, there is sufficient theoretical ground to maintain it. The table on the next page shows the convergent validity of the redefined SIPDs. The fourth (combined) factor has a Cronbach's alpha that amply exceeds 0.7. Moreover, the reliability of the scale would decrease if that item was deleted.

Items in factor	*Interpretation of factor*	*Acronym*	*Cronbach's alpha*
1A, 1B, 1C	New Service Concept	NSC	.834
2A, 2B	New Customer Interaction	NCI	,808
3A, 3B	New Business Partner	NBP	,703
4A, 4B, 5A	New Revenue Model (+ Org. Delivery System)	NRM	,805
6A, 6B	New Technological Delivery System	NTDS	,860

Table 23: Characteristics of our redefined SIPDs (n=169).

Occurrence of SIPD

Besides using these components for saving the values into factors, we can also choose to use it for guidance to calculate SIPDs ourselves. Like we did for DSICs, this can be done by adding up the scores for items that turn out to be present in a certain dimension. For comparability, these sums can then be turned into averages.

	N	Range	Mean	Std. Deviation	Variance
ServiceConcept	169	6,00	4,7396	1,43023	2,046
CustomerInteraction	169	6,00	4,3462	1,50099	2,253
BusinessPartner	169	6,00	3,8876	1,53310	2,350
RevenueModel	169	6,00	3,4349	1,47758	2,183
TechDeliverySystem	169	6,00	4,7811	1,80426	3,255
Valid N (listwise)	169				

Table 24: Descriptive statistics of SIPD occurrence, based on averaged scores (n = 169)

The observed differences in occurrences of the service innovation dimensions are significant (see Annex 3.6), so interpretation worthy. New Revenue Models and New Business Partners turn out to be less present in innovation portfolios of our respondents. The most frequently/strongly reported dimension is New Technological Delivery System, which matches with the observation that (especially) ICTs have a major role in service innovations. Remarkable is that also the highest variance occurs in this dimension. Apparently, there are wide differences in the extent that new technologies are used in service innovations.

Like in the case of DSICs, differences per firm size are not found (table included in annex 3.7). Probably this can also be attributed to our unevenly distributed sample. Firms that reported not earn most of their turnover out of services have an innovation portfolio that contains significantly less New Service Concepts, New Revenue Models / Organizational Delivery Systems (both at .05-level) and New Business Partners (.01-level). Again, these findings are restricted to the respondents own perception on the nature of the activities of their organization. If we compare the means for service and non-service sectors on the basis of NACE-classification, no significant differences are found (see annex 3.9).

Correlations between DSICs and SIPDs

One arrow in our research framework represents the correlations between DSICs and SIPDs. The overall structure of the framework will be tested in the modelling that is core of Part B. Here, we can already check the hypotheses that Pim den Hertog posed. Since our redefined constructs are still very similar to the original framework (only two DSICs are removed, one DSIC is split up, and one SIPD disappeared from the set), it makes sense to empirically verify the hypotheses regarding the DSIC and SIPD concepts.

So far, we used summed and averaged scores to express the presence of DSICs and SIPDs in a respondents' firm. The main reason was that the resulting values are very intuitive and therefor easy to interpret. However, the factor-analyses we did also attribute weights to items that belong to a component. To be exact on the correlations, we will base these calculations on the factor-scores that were generated by SPSS. Note that we use Varimax rotation, which implies that the dimensions are orthogonal (and distinctive). Oblique rotation resulted in almost exactly similar results. However, correlations between DSICs will be part of the modelling. For now, we stick with the more common orthogonally rotated factors, implying that we will not look at correlation within the DSIC and SIPD concepts (these are 0 by definition). This is not at all problematic, since the focus is on between-correlations anyway.

		NSC	NCI	NBP	NRM	NTDS
Sensing User Needs	Correlation	,180*	,170*	,043	-,037	-,101
	Sig. (2-tailed)	,019	,027	,579	,629	,193
	N	169	169	169	169	169
Sensing (Tech.) Options	Correlation	,125	,151*	,095	-,019	,553**
	Sig. (2-tailed)	,105	,049	,219	,809	,000
	N	169	169	169	169	169
(Un)bundling	Correlation	,298**	,083	,119	,190*	,136
	Sig. (2-tailed)	,000	,284	,123	,013	,077
	N	169	169	169	169	169
Coproducing Orchestrating	Correlation	,182*	-,087	,393**	,184*	,087
	Sig. (2-tailed)	,018	,263	,000	,017	,258
	N	169	169	169	169	169
Scaling Stretching	Correlation	,182*	,277**	,013	,079	,091
	Sig. (2-tailed)	,018	,000	,871	,309	,237
	N	169	169	169	169	169

Table 25. Pearson correlations between DSICs and SIPDs.

The correlation matrix shows that not everything is related to everything; there actually are some interesting correlations. In interpreting them, we use the table of hypothesized relations as suggest by Den Hertog (2010); see page 42.

For Sensing User Needs, Den Hertog hypothesized that it is mainly correlated with New Service Concept. Table 25 shows that this is the case in our data; NSC has the highest value. Moreover, there is also another significant SIPD; New Customer Interaction (NCI). Although this correlation was not explicitly predicted, it can be explained by the fact that Den Hertog expected it to be correlated with Sensing (technological) Options, which happens to be the other part of the original DSIC 'Sensing user needs and technological options'. The fact that we are looking at sub-capabilities can thus explain the correlation of NCI with both Sensing User Needs and Sensing (technological) Options.

Indeed, Sensing (technological) Options is significantly correlated with New Customer Interaction (NCI), as Den Hertog predicted. Moreover, this capability turns out to be highly correlated (also high significance) with New Technological Delivery System (NTDS) as well. One could state that this finding is not surprising, given the role of technology in both concepts (the DSIC and SIPD), but at least the intuition is now confirmed (or strictly speaking; is not unconfirmed). Technological options often refer to new ways of using ICT to modify the interaction with clients, hence the two correlations.

The (Un)bundling capacity is correlated mostly with the SIPD of New Service Concept. Den Hertog attributes this correlation to the logic that bundling is essentially about combining existing concepts into a new one. Often, he writes, this also involves the introduction of new business partners (value systems) and revenue models. This first SIPD (NBP) is not found to have a significant relation with bundling, but New Revenue Models (NRM) certainly does.

Also Co-producing and Orchestrating is expected to be related with New Value System/Business Partner (NBP) and New Revenue Model (NRM). Cooperation with other parties can lead to the involvement of a new business partner within the renewed service, which also lead to a change in the financial construction. Both these correlations turn out to exist in our data, especially the first one is strong and significant. Additionally, we find that co-producing and orchestrating is reported to occur more in firms that introduce new service concepts (NSC). Possibly, this implies that new service concepts are often the result of collaboration between different parties, which would be an interesting finding in the context of open service innovation.

Finally, Scaling & Stretching is correlated with the introduction of new ways of customer interaction (NCI). According to Den Hertog, mainly stretching is crucial in the context of innovative ways of customer interaction. He also notes that both scaling and stretching are required when one develops a new concept (NSC), which has a positive and significant correlation value as well. The presumed correlation between Scaling & Stretching and New Technological Delivery System (NTDS) is not observed in our data.

Apparently, some dimensions are related to more capabilities than others. The SIPD 'New Service Concept' has a very general notion, and is indeed linked to as much as four out of five DSICs. The dimensions of New Value System/Business Partner and New Technological Delivery System, on the other hand, seem to be more specific.

Figure 21 (next page) is an adaptation of our earlier presented synthesis of the PdH-framework and ideas about functional processes. The initial representation was entirely conceptual; this one is improved by the availability of empirical findings. Note these are based on the general results of a cross-sectional study; both the identification of DSICs and SIPDs, as well as the linkages, might change when looking at a specific sector, firm, region, etcetera. An interesting challenge would be to develop DSIC-configurations for this kind of specific circumstances.

Although the number of dots (representing functional processes) matches with our items, we make no hard claims on this account. Analyses proved that a number of items belongs to concepts that we interpreted as certain dynamic service innovation capabilities, but it might be possible to define other processes. So far we did not fully investigate the structure within DSICs and within SIPDs, so the black lines are only indicating that there is some structure between the dynamic service innovation capabilities.

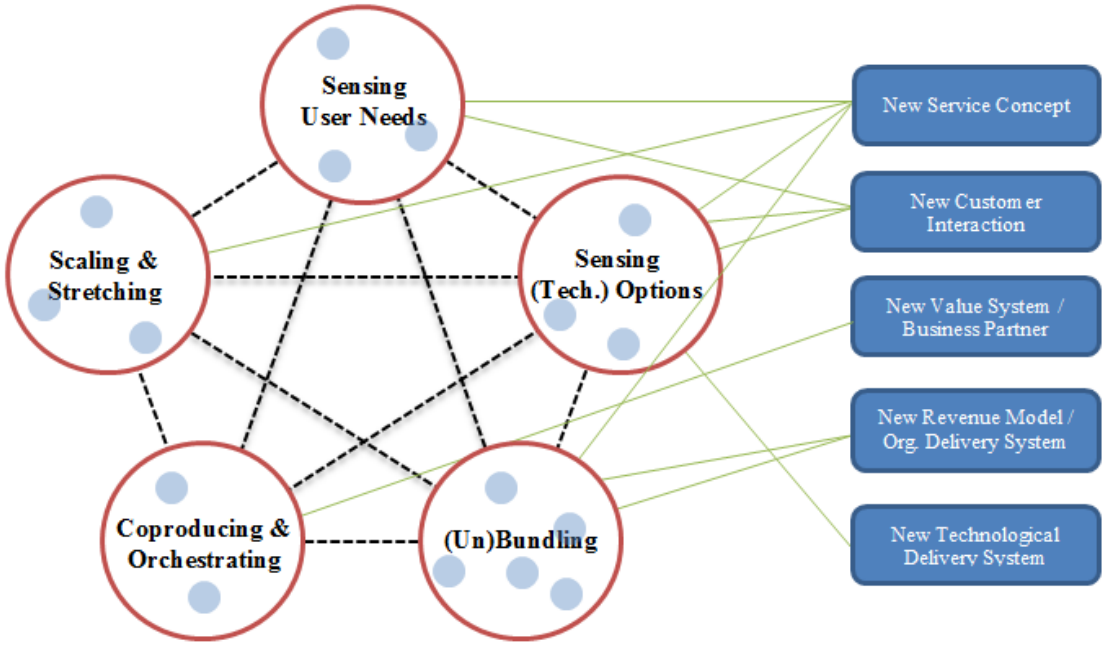

Figure 21: Conceptual model of a dynamic capability view on functional processes, enhanced with theorized and empirically demonstrated linkages between dynamic service innovation capabilities and service innovation performance dimensions.

All in all, our data seems to match very well with the hypotheses by Den Hertog (2010). Because our refined set of variables misses two DSICs and one SIPD (compared to the original framework), we could not test for them. The remaining constructs all behave more or less as Den Hertog expected them to do. Now that we studied this single 'arrow' from our research framework, it is time to look at the others as well.

5.3 Modeling DSICs & SIPDs

5.3.1 Hypothesis

Our research question is aimed at the exploration of the relations between dynamic service innovation capabilities, service innovation and relative firm performance. Where traditional DCV-literature tends to relate dynamic capabilities directly to competitive advantage, we are interested in the role of innovation. In our view, dynamic capabilities (also in the service context) *only* lead to enhanced performance when they result in innovation. The mere presence of the capabilities is not enough for outperforming competitors; crucial is that they result in new or adapted processes and products. The exclusivity of this relation implies that we hypothesize not just some mediation, but full mediation.

This reasoning is in line with work by authors such as Ray, Barney, and Muhanna (2004), who argue for not taking firm performance as the dependent variable when studying dynamic capabilities. Indeed, the choice for business processes, or competences (Protogerou et al., 2008), is an improvement since they reflect direct 'objects' of the use of dynamic capabilities. However, business processes and competences are conceptually dangerously close to capabilities. Moreover, they still do not deliver value to a firm, since processes/competences are only prerequisites for the actual products that enter a market.[13] Therefore, we prefer innovation as a mediating variable for the relationship between dynamic capabilities and relative firm performance. Recently, a study with a similar structure was performed by Ordanini and Parasuraman (2011), looking at 'innovation outcomes'. All of these studies presume fully mediation as well. Most important is probably the guiding work by Pim den Hertog. In his thesis, he draws a 'research model for the service innovation management concept' (Den Hertog, 2010, pp. 234). This model also includes an indirect path from DSIC via SIPD to firm performance, without assuming any direct relation between DSICs and firm performance.

Hypothesis: *The influence of dynamic service innovation capabilities on relative firm performance is fully mediated by the innovations they enable to create.*

5.3.2 Method

The core of our data-analysis is the evaluation of relations between several constructs. A common way of assessing the impact and significance of one variable on another is applying regression analysis, but in our case we choose to use structural equation modeling (SEM). This method is based on covariance analyses, and is preferable when investigating relations between *constructs* rather than ordinary (directly measured) variables (Hoijtink, De Jonge, 2007). There are two reasons why we consider SEM to be most suitable for testing our framework and resulting hypothesis.

[13] In a service context, processes can be really close to products. However, the studies we mention are general and thus include industries in which processes are internal and unrelated to the product that is finally evaluated by customers.

First, normal regressions do not allow parallel relations like mediation effects (which are both dependent and independent variables at the same time). Second, a regression analysis does not allow for measurement errors in the variables; it simply assumes that that all variables are measured perfectly. SEM solves this by extending the (possibly parallel) regressions with a factor model (or measurement model). This assumes that measured items are indicators for a construct ('latent variable', contrasting to observed variables) we are interested in. By including both the original items and the higher order constructs they load on, structural equation modeling controls for the reliability of the items (and thus the resulting construct). The items also will get a factor-loading, which implies that the statistical relevance of the items in relation to the latent variable is balanced. We can interpret them as weights.

The illustration in annex 3.10 shows our input model. The reason that observed variables (rectangles) also have an error-term is that only a part of their variance is related to the latent variable; there is a piece of 'own variance'. The other variance is called 'communality', this variance is explained by the construct. A higher communality indicates that the items are better in measuring the same. This element of SEM is called confirmatory factor analysis. On the basis of theory, certain factors are grouped under the same construct. If we run the model on our data, we get output (consisting of tables/matrices and a graphical output model, in which we can check how well our items are measuring the constructs.

What should be clear by now is that SEM combines confirmatory factor analysis (the 'measurement model') and regression analyses (the 'structural model'). However, you might notice that we already performed measurement analysis in the previous part of this study. The reason for that was that we consider an exploratory factor analysis to be stronger than confirmatory factor analysis. In the latter one merely checks if items indeed belong together (convergence validity), whereas EFA is entirely data-driven in its identification of underlying dimensions. If this procedure indeed finds dimensions we can interpret, what happened to have been the case, this is strong evidence that these dimensions are truly there and essentially different from each other (discriminatory validity). Another important reason is that in our regressions we are not using an existing model of which we only need to confirm that we measured it correctly (the CFA-part).[14] Instead, our measurement model itself is already new. This implies that dimension reduction is crucial for analyzing which items belong to which capabilities. Recall that in our case, two capabilities were not measured, and a third was split in two sub-capabilities. Without EFA, we would have entered a model that is far less accurate in resembling our data-structure.[15] However, on the basis of the component analyses (part A), we identified a number of items that apparently relate to five dimensions that seem to underlie our data. These items and constructs now form the basis of our SEM-model. Since we do not have the possibility of running this model on new data, it is likely that we will find that these items will turn out to be good indicators for our constructs. In other words; since we did already a hard statistical test for 'finding' constructs, it is probable that our soft test will reveal the same results.

Combining EFA and CFA/SEM is not uncommon; a similar study is done in the already introduced work by Agarwal and Selen (2007). They also perform EFA to redefine their set of capabilities and identify which items (i.e. processes) belong to which capability. A difference is that they use these results for a model that they run on different data. Given the fact that we do not possess an extra data-set (yet), we cannot copy this final step. Otherwise,

[14] The articles by Ordanini and Parasuraman (2011) and Menguc and Auh (2006) are examples of studies that only need to perform a CFA for checking if items indeed belong to the construct they are theoretically related to.
[15] This analysis is included in the Appendix.

the conclusion of the previous paragraph would not hold; a CFA would not automatically confirm the earlier EFA because they both involve different datasets. The unavailability of extra data is no problem for our analysis; it only suggests a clear way of enhancing the validity of it. What should be kept in mind is that the CFA-part of our SEM-analysis is not so interesting since it already builds on the extensive study in Part A. Therefore, the focus will now be on the structure between the constructs.

5.3.2 Variables

DSIC
In the argumentation for the use of SEM, we just described that we will use the results of our measurement analysis as the input of our SEM-model. The items that were found to load high on a dimension that we could interpret as a distinct DSIC, will be entered as observed variables. The five identified DSICs will then be the latent variables that are exogenous in our model. In our survey, the questions were referring to the *current presence* of the specific functional processes.

SIPD
In a similar analysis as the exploration of DSICs, we also found five measured service innovation performance dimensions. However, there were also reasons to believe that SIPD is a single dimension itself rather than a group of different dimensions: the first component in our PCA accounted for already 44% of the variance. Reducing the six dimensions into one might be beneficial for our analysis, because it requires less data which makes the resulting model probably more accurate. Since the emphasis of our research is on DSICs (rather than SIPDs), there is no theoretical objection to starting with a simplified model. Our questions whether the influences of DSICs are indirect or indirect and which ones are the most important, remains the focus of our research. Therefore, we can accept the consequence that, when studying the effects of DSICs, we will no longer distinguish between the different service innovation dimensions.

The slight singularity as indicated by the PCA, legitimises the use of a single construct for 'service innovativeness'. The chosen method for operationalizing service innovativeness is by simply taking all the items that have a loading > .7 in our initial component analysis.[16]

[16] The threshold of .7 is common in analyses that aim to identify which items belong together.

As the table demonstrates, these items are distributed over four different SIPDs. The items that turn out to be the most similar can be given a meaningful interpretation by looking at the SIPD they originate in. To a certain extent the component matrix implies that in service innovations, new service concepts (SIPD1) often are combined with new revenue models (SIPD4), as well as with organizational and technological changes within the organization (SIPD5 and 6)[17]. Intuitively we can say that the dimensions of New Customer Interaction and New Business Partner are specific elements of some service innovations (thus occurring more incidentally), rather than common aspects. Although we cannot make hard claims here, we accept the ensemble of those four items as representative for common service innovations. Since we asked our respondents the extent to which these dimensions were present in their innovation portfolio of the *past three years*, we regard the resulting construct as 'service innovativeness'.

	Component
	1
SIPD1A	,685
SIPD1B	**,719**
SIPD1C	**,757**
SIPD2A	,469
SIPD2B	,532
SIPD2C	,560
SIPD3A	,668
SIPD3B	,649
SIPD4A	**,767**
SIPD4B	,595
SIPD5A	**,711**
SIPD5B	**,700**
SIPD6A	,695
SIPD6B	**,698**

Table 26: Initial Component Matrix of SIPDs (n=169).

This resulting construct is both exogenous (it is built on observed variables) and endogenous (in our model it is predicted by DSICs). In SEM-analyses, it is common to call it endogenous when it is not 6ntirely exogenous.

Relative Firm Performance

Also for our measurement of firm performance, we rely on survey data. Due to its complex multidimensional nature, this construct is not easy to measure objectively. As Protogerou et al. (2005) note (when quoting several well-accepted references); "the use of subjective performance measures is a common practice in strategy related research when financial statement data are unavailable or they do not allow for accurate comparisons amongst firms". Moreover, they state that literature shows how objective and subjective measure tends to correlate, that data from SME's is criticized for being unreliable, and that 'perceived performance scales permit comparisons across firms and contexts".

The relative performance of firms was questioned by the following items, involving both a profit element and a market share aspect:

"In comparison with your primary competitors,"
perfA = *"… our organization achieved a higher return on equity in the past year".*
perfB = *"… our profit grew faster in the past year".*
perfC = *"… our turnover grew faster in the past year".*
perfD = *"… our market share grew faster in the past year".*

Indeed, we are only interested in 'performance' from an economic (market) perspective. In service literature it is common to look also at quality-related issues as customer satisfaction or strategic outcomes (e.g. Tether, 2003), but these are not of primary interest for the DCV, a line of literature to which we also hope to contribute.

[17] Note that SIPD 5 was not found as a distinct SIPD when we performed a rotated analysis.

5.3.3 Results

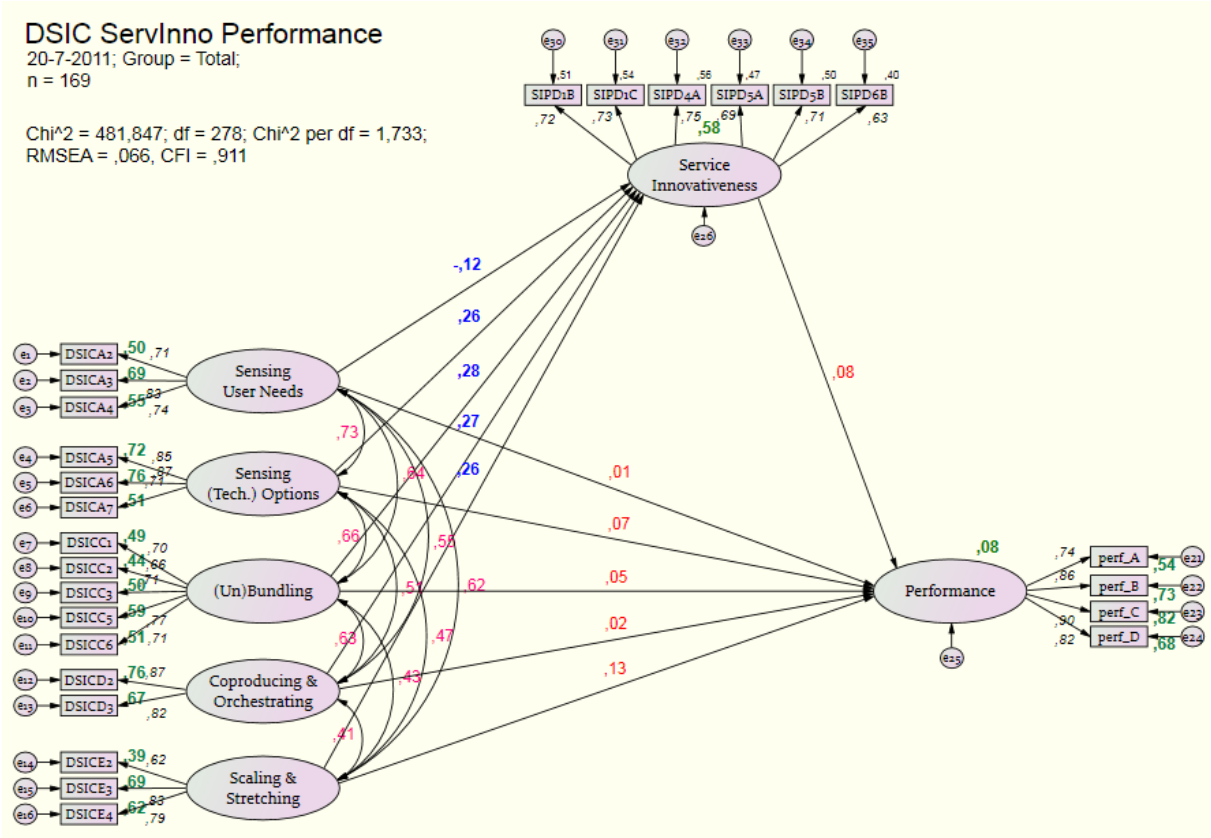

Figure 22: Graphical output-model of SEM-analysis.

By using AMOS 18, we developed the model above. The calculations that are attached to the graphical output show that the model fits our data structure quite well. The Chi-squared per degree of freedom is 1.72, which is below the acceptability threshold that some authors position at 2 (e.g. Byrne, 1989, p. 55) and others at 3 (Carmines and McIver, 1981, page 80) or up to 5 (Marsh & Hocevar, 1985). Another indicator is the comparative fit index (CFI) that should be close to 1 (Bentler, 1990). A CFI-value of 0.911 looks reasonable as well. Finally, we can also look at the RMSEA. Ideally is should be between 0.0 and 0.05, but values between 0.05 and 0.08 (like the 0.066 we find) are also accepted. On the basis of these model fit indicators, we can conclude that our model seems to be sufficiently accurate in resembling the structure that underlies our data.

Apart from the model fit, we can also look at the significances of the paths. Regression estimates (the path coefficients in figure 22) can be positive or negative, but if they can be attributed to chance, they are meaningless.

This table provides the unstandardized regression weights, as well as indicators for their statistical significance. At a .05-significance level, four paths turn out to be significant, all of them being effects from DSICs on service innovativeness. So, not only have path coefficients towards performance a low value, they also seem to be insignificant.

			Estimate	S.E.	C.R.	P
ServInno	<---	SEN 1	-,132	,161	-,817	,414
ServInno	<---	SEN 2	,236	,114	**2,071**	**,038**
ServInno	<---	BUND	,346	,149	**2,319**	**,020**
ServInno	<---	C & O	,239	,093	**2,572**	**,010**
ServInno	<---	S & S	,275	,110	**2,500**	**,012**
PERFORMANCE	<---	ServInno	,082	,159	,515	,607
PERFORMANCE	<---	SIG 1	,015	,218	,069	,945
PERFORMANCE	<---	SIG 2	,069	,157	,438	,661
PERFORMANCE	<---	BUND	,067	,204	,331	,741
PERFORMANCE	<---	C & O	,016	,127	,129	,898
PERFORMANCE	<---	S & S	,152	,152	1,005	,315

Table 27: Regression weights for SEM-model (unstandardized)

If the DSICs, except sensing user needs, are truly the only significant ones, we can conclude that within service innovation, the most important performance-enhancing dynamic capabilities are: (un)bundling, coproducing & orchestrating, scaling & stretching, and sensing (technological) options. The fact that sensing user needs is not significant could suggest that innovation is 'pushed' into the market rather than that it follows demand. However, the opposite could be the case as well. Because it is inherent to services that customers are highly involved in the production/consumption of the service, their needs will reach the firm anyway. Although certain 'sensing user needs'- processes can be distinguished (constituting our DSIC of sensing user needs), it is possible that they are not strictly necessary for developing service innovations that fulfil new user needs. As for the other significant paths, their standardized coefficients are all more or less equal, implying that they have a similar correlation with service innovativeness.

Since the path between service innovativeness and performance is positive but not significant, we actually cannot state that these capabilities are performance-enhancing. Our data only shows that they are innovation-enhancing. Or to be more accurate: the perceived presence of dynamic capabilities is correlated with our measure for service innovativeness. However, a remarkable finding was *that firms that are more innovative are not performing significantly better than their competitors*. One explanation could be that we are only looking at correlations within a static frame (snap-shot). As we discussed in our variable description, involving a time-lag was difficult since it implies asking respondents to give a reliable estimate of the presence/strength of certain processes three years ago. If we would repeat our study and acquire longitudinal data, we could investigate to what extent the strength of dynamic capabilities changes over time (or with what speed, which patterns, etc.). This is a question in itself that already deserves a lot of attention (see also the conclusions of the case study). With the current data, we only study whether the presence of dynamic capabilities is correlated with higher innovativeness and better performance at more or less the same moment. Note that performance was measured over the last year, and service innovativeness is based on items that consider a firms' innovation portfolio over the past three years. Although dynamic capabilities are measured as a static/present phenomenon (indeed, a contridictio in terminis), there still is some chronological correctness in our model.

The fact that we do not find a significant path for innovativeness on performance can also be interpreted in a different way. Besides the possibility of a time-lag (current innovativeness leads to future performance improvement), the absence of a relation can be attributed to the fact that dynamic capabilities are not only said to be linked to competitive advantage, but also to *survival* (as discussed extensively in the theoretical part of this study). Being dynamic

implies being able to adapt to changes in the market. A firm that possess the ability to cope with dynamic environment does not necessarily have to perform better in a static setting; there might be competitors who have a bitter fit in the current setting. However, the point is that when changes occur, firms know how to transform their selves so that they stay in business. In other words, dynamic capabilities perhaps are not about who is running the fastest now, but about who is still running tomorrow. Again, verification of this conception asks for longitudinal data. A useful result of this study is at least that this avenue for further research is enabled by the development of measurement-scales and a specific theoretical model.

Although significances are guiding, it might be interesting to look at the output concerning direct and indirect effects. The matrix below also suggests that *the effect of DSIC on relative performance is mediated* by their effect on service innovation. The standardized direct effects on performance are much lower than the impacts on Service innovativeness, which itself also has a positive path-coefficient towards Performance. If we compare the direct and indirect effects (table below), one can observe that the indirect effect seem to deliver an important addition to the direct effect (and thereby deliver an essential contribution to the total effect). The capability coproducing and orchestrating is fully mediated by service innovativeness, for (un)bundling the distribution is more even. In the cases of sensing (technological) options and especially scaling and stretching, the indirect effect is smaller than the direct effect. Finally, for sensing user needs, the mediation seems to be negatively related to the direct effect.
Again, the validity of these impressions needs to be supported by the statistical significances (concerning direct paths), which showed that only between DSICs and service innovativeness something is going on.

	Sensing User Needs	*Sensing (Tech.) Options*	*(Un)-Bundling*	*Coproducing & Orchestrating*	*Scaling & Stretching*	*Service Innovative-ness*
ServInno (Direct)	-,121	,259**	,284**	,266**	,256**	
Performance Direct	,013	,070	,052	,017	,132	*,076*
Performance Indirect	-,009	,020	,022	,020	,019	
Performance Total	,004	,090	,073	,037	,151	*,076*

*Table 28: Standardized effects. ** = significant at the .05-level (only relevant for direct effects).*

The finding that all the direct relations between the DSICs and firm performance had a very low absolute coefficient and were all insignificant, suggests that we might want to look at a model in which Service Innovativeness is totally mediating the impact of DSICs on performance (rather than partially). The refined model in annex 3.11 shows that all the model fit indicators improve slightly. Four out of five DSICs remain significant, with Sensing User Needs still being insignificant.

Our initial finding was that although the traditional DCV presumes that dynamic capabilities have a continuous positive influence on both innovativeness and performance, our analysis does not provide evidence for that hypothesis. This was already an interesting result, given its contradiction with the continuous impact. The data shows that dynamic service innovation capabilities were correlated with service innovativeness, but that innovativeness in turn was not related to extraordinary performance. When doing a slightly altered analysis in which

only five non-significant paths with low coefficients are removed, we witness a radical change in our output. Suddenly, innovativeness turns out to be highly significant. An explanation for this radical change is that now all variance is forced to follow a single path, which inevitably has to become significant.

Additional analyses

Although enough analyses are performed for answering the research question of this thesis, the availability of measured DSICs and SIPDs allows for many extra analyses. Trying not to lose ourselves, we only include those that are directly related to the earlier steps.

Correlations within DSICs

To start with, we readdress the correlation-analysis from Part A. For studying the link between DSICs and SIPDs, we retrieved a correlation from SPSS. Investigating the linkages between DSICs themselves can only be done if we construct oblique rotated factors, which we didn't use. However, the constructs in the SEM-analysis rely only on a couple of items, and therefore do not possess orthogonal characteristics (with respect to each other). The graphical output already showed that, not surprisingly, the two sensing sub-capabilities had the highest correlation. In the table below, unstandardized covariances for all the DSICs are shown. Here we also see immediately that the two sub-capabilities relate more to each other than to other capabilities. Another finding is that all the correlations are positive. This is line with the earlier described ideas by Peteraf and Maritan (2007), saying that conflicts can occur between underlying processes, but not between the capabilities themselves. Of course, it would be interesting to investigate this in more detail then by just looking at a broad cross-sectional study such as the current. When more data is available, correlations within specific sectors etc. can be studied.

			Estimate	S.E.	C.R.	P
Sensing_(Tech.) Options	<-->	(Un)Bundling	,871	,158	5,498	***
(Un)Bundling	<-->	Coproducing &_Orchestrating	,856	,160	5,359	***
Coproducing &_Orchestrating	<-->	Scaling &_Stretching	,620	,165	3,761	***
Sensing_(Tech.) Options	<-->	Scaling &_Stretching	,699	,167	4,189	***
Sensing_(Tech.) Options	<-->	Coproducing &_Orchestrating	,913	,185	4,940	***
(Un)Bundling	<-->	Scaling &_Stretching	,483	,128	3,775	***
Sensing_(Tech.) Options	<-->	Sensing_User Needs	1,094	,187	5,847	***
(Un)Bundling	<-->	Sensing_User Needs	,720	,142	5,059	***
Coproducing &_Orchestrating	<-->	Sensing_User Needs	,839	,171	4,903	***
Scaling &_Stretching	<-->	Sensing_User Needs	,785	,167	4,688	***

Table 29: Covariances between DSICs.

DSIC: unidimensionality / interaction

Another measurement-subject that we can readdress now that we extend our analysis with SEM-models, is the unidimensionality of our DSIC-scale. The principal component analysis revealed already that there is not a single underlying dimension that captures all DSIC-variance. Here, we verify this by checking if our SEM-model improves if we consider the dynamic service innovation capability as a single characteristic. This perspective can also be considered as an interaction effect of all the individual DSICs.

Maybe the independent dynamic service innovation capabilities are not significant, but what about a construct including all of them? It is not unlikely that DSICs only influence performance when they complement each. In order to check this possible synergy, the model below was constructed. The model does not really fit our data; the Chi^2/df is just below the acceptable value of 3 and the RMSEA is well above .08.

Again, the path from DSIC towards service innovativeness is significant. More interesting is that finally the direct path between DSIC and Performance is significant. However, it is just below the .1-level (which is a looser criterion than the more common .05-level), and not that valid given the bad fit of the model. Still, it suggests that DSICs do have an interaction-effect to some extent. Individually they only contribute to service innovativeness, but together they might increase the competitiveness of an organization.

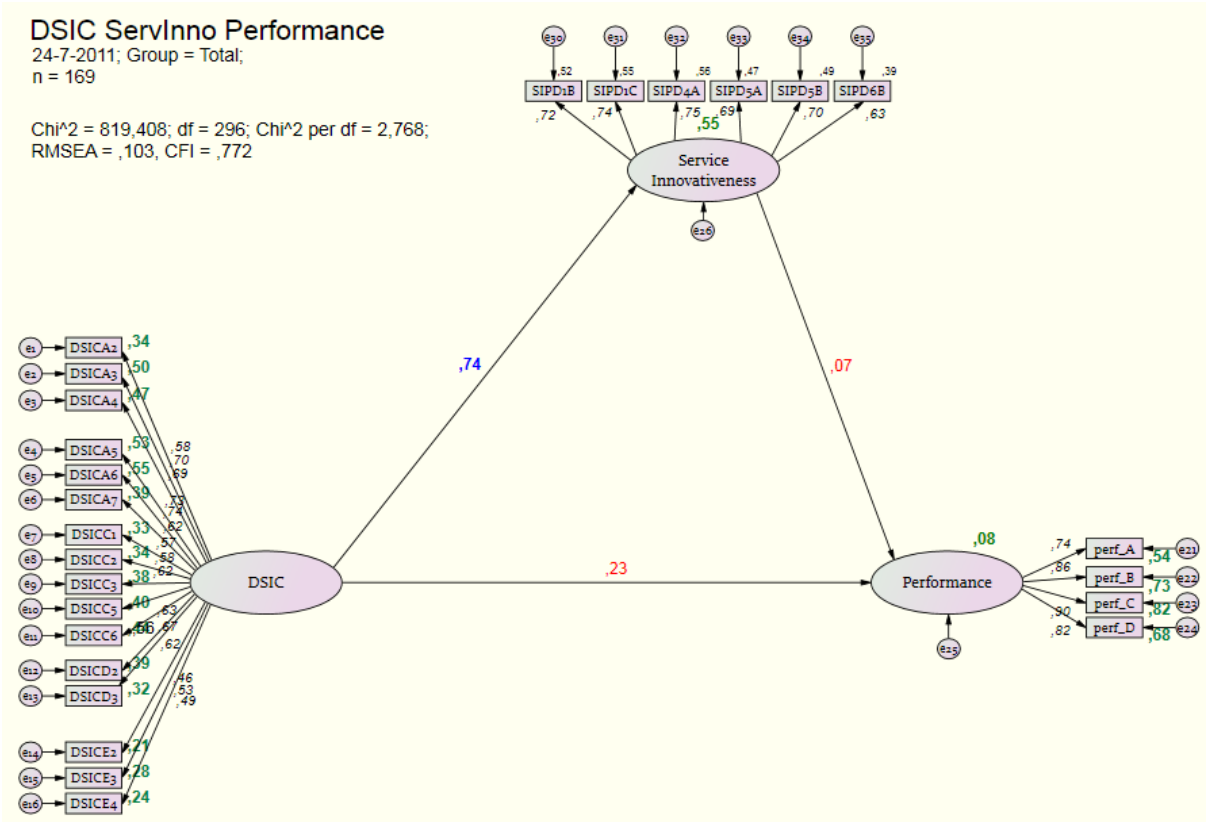

Figure 23: Standardized output of model with a single DSIC-construct.

			Estimate	S.E.	C.R.	P
Service Innovativeness	<---	DSIC	,985	,158	**6,224**	***
Performance	<---	Service Innovativeness	,074	,151	,494	,622
Performance	<---	DSIC	,330	,201	**1,648**	**,099**

Table 30: Regression weights of model with a single DSIC-construct.

One can also think of another but similar test for checking whether a structure with five DSICs really gives a better view on the data than a general overarching construct for dynamic capability (just like we did with the 'service innovativeness' construct). By modifying our original structure so that all the co-variances between the DSICs are set at 1, we actually transform them into a single dimension rather than 5 different ones.

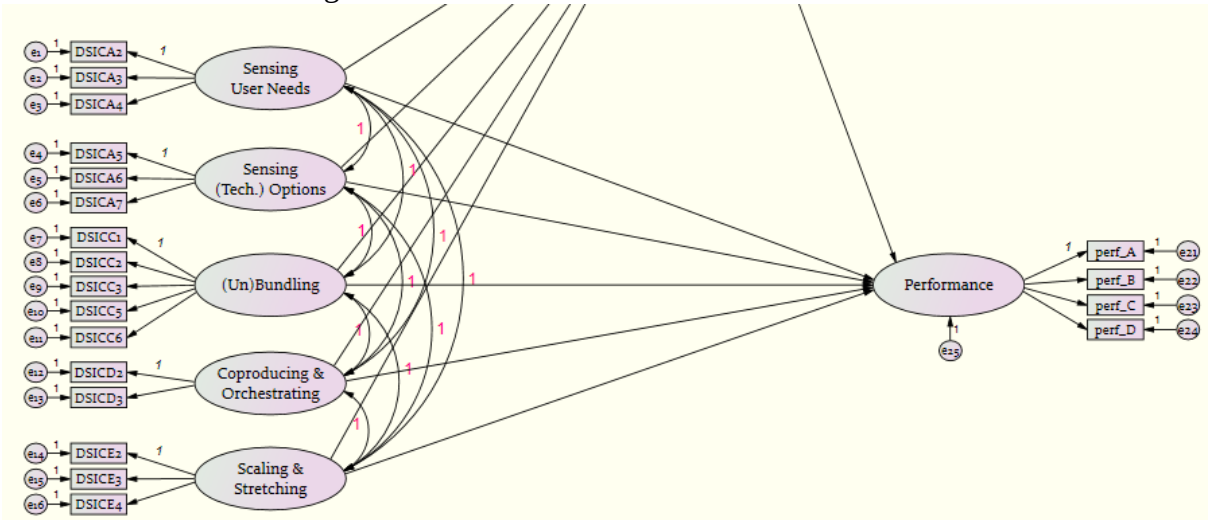

Figure 24: Input of SEM-analysis with all covariance between DSICs fixed to 1.

The new model (below) is also slightly worse than the original; the RMSEA and the Chi-squared per degree of freedom are a tiny bit higher, and the CFI is slightly lower. This means that a structure with different DSICs better resembles the patterns in our data, although the difference is small.

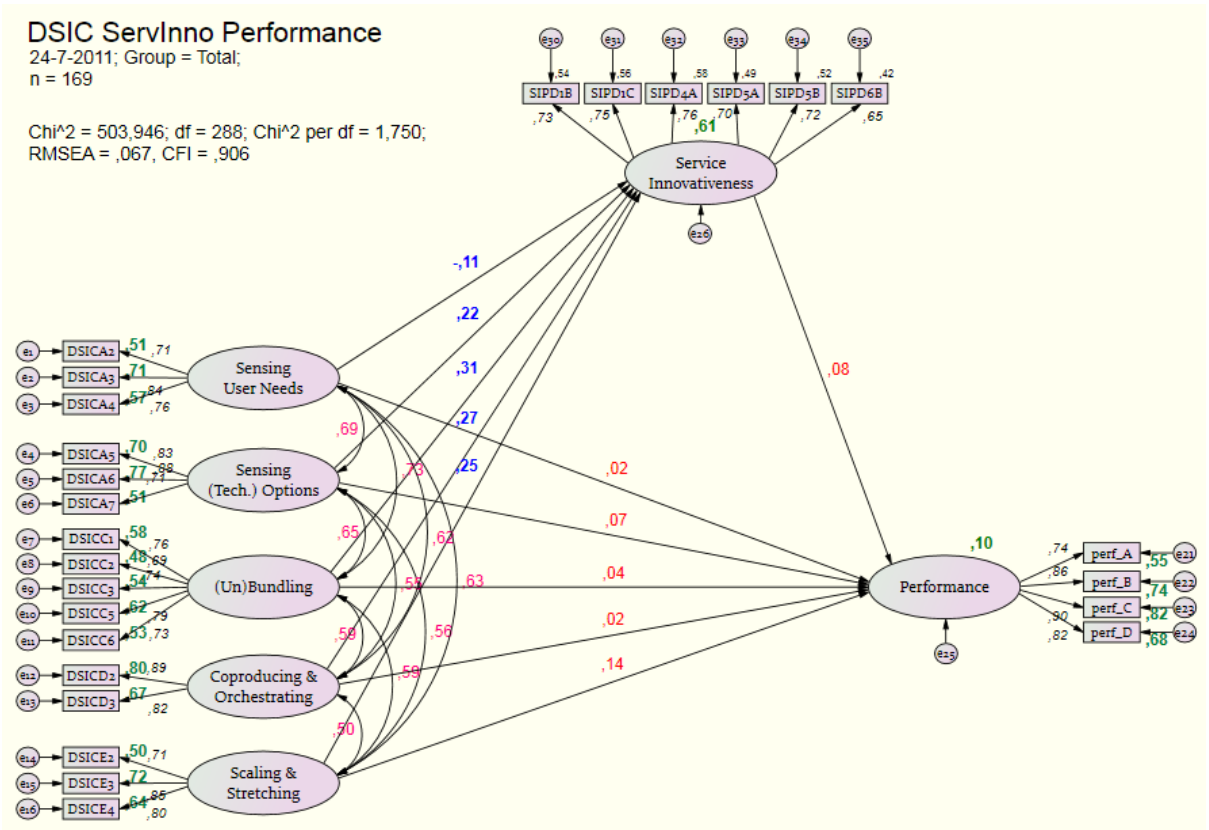

Figure 25: Standardized output of SEM-analysis with all covariance between DSICs fixed to 1.

The figures in annex 3.12 basically tell the same story: a model in which the capabilities are allowed to correlate freely is better than a model in which the covariances are set to 1.

Instead of fixing all covariance values to 1, we can also set them on 0, which basically implies the removal of the paths. Here, we assume that the DSICs are totally independent dimensions.
As we see, the model fit drops drastically. The path coefficients from the DSICs to ServInno are all very significant, except Sensing User Needs (like in all our earlier analyses). Paths towards Performance are still insignificant. These results imply that DSICs are not operating totally independent from each other, something which was already suggested by the relatively high covariances.

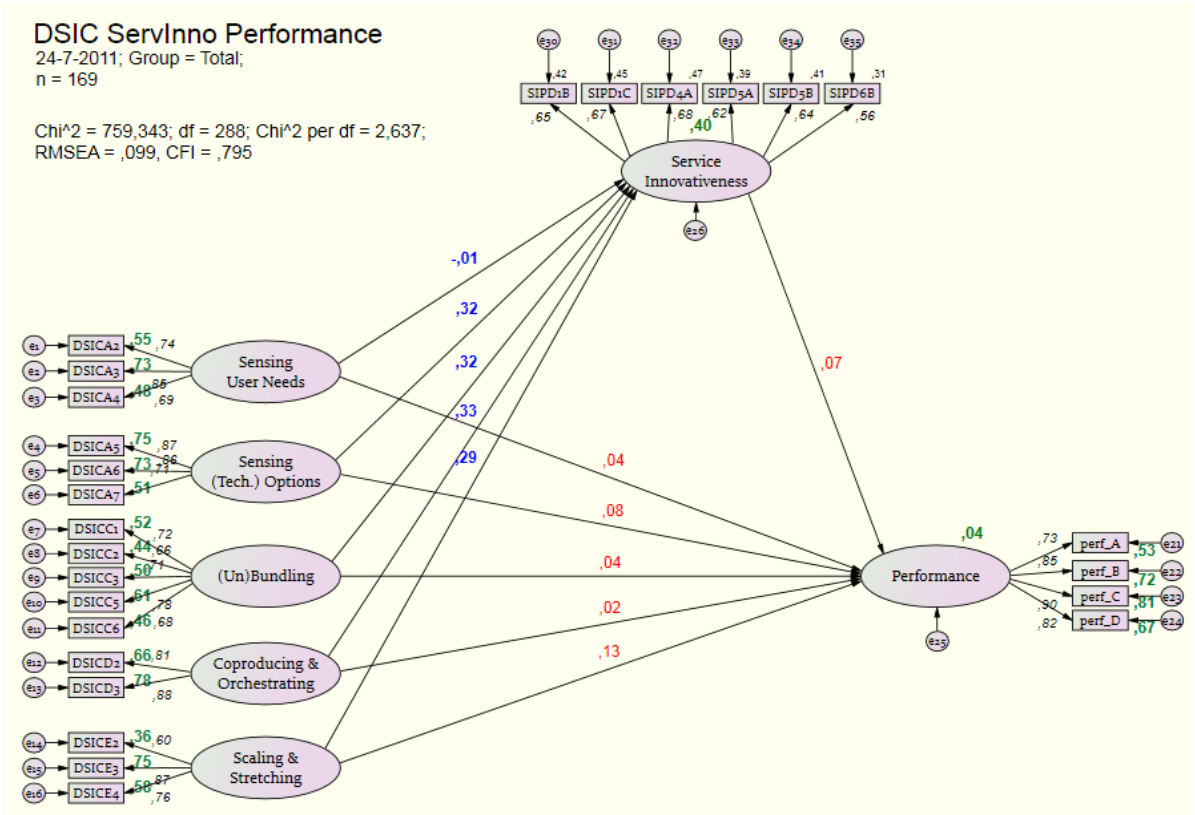

Figure 26: Standardized output of SEM-analysis with no covariance between DSICs.

			Estimate	S.E.	C.R.	P
Service_Innovativeness	<---	Sensing User Needs	-,005	,070	-,077	,938
Service_Innovativeness	<---	Sensing_(Tech.) Options	,239	,064	**3,741**	***
Service_Innovativeness	<---	(Un)Bundling	,312	,087	**3,576**	***
Service_Innovativeness	<---	Coproducing & Orchestrating	,270	,073	**3,699**	***
Service_Innovativeness	<---	Scaling & Stretching	,274	,085	**3,232**	**,001**
Performance	<---	Service Innovativeness	,087	,160	,544	,586
Performance	<---	Sensing User Needs	,047	,096	,492	,623
Performance	<---	Sensing (Tech.) Options	,074	,091	,819	,413
Performance	<---	(Un)Bundling	,055	,121	,450	,653
Performance	<---	Coproducing & Orchestrating	,021	,100	,205	,838
Performance	<---	Scaling & Stretching	,150	,116	1,295	,195

Table 31: Regression weights of SEM-analysis with no covariance between DSICs.

Selection of Performance-indicators

A principal component analysis revealed that the four performance items in the survey were very similar. However, they are not exactly the same. Recall that only the first two items are about the profitability of the firm, the other two questions concern relative growth in turnover and market share. One can argue that these latter two are essential for stabilizing a firm's position and securing its existence in the future. The first two, in contrast, are more about how good a firm is in the present situation; those who keep a share in an organization expect it to flourish by making profit. From that perspective, we might want to repeat our analysis on only the first two indicators of performance: the ones that tell us how healthy and competitive a firm is.

The output below indicates that the removal of two items hardly changes any result. The coefficient for service innovativeness is very small now, but due to its statistical insignificance that change is not important.

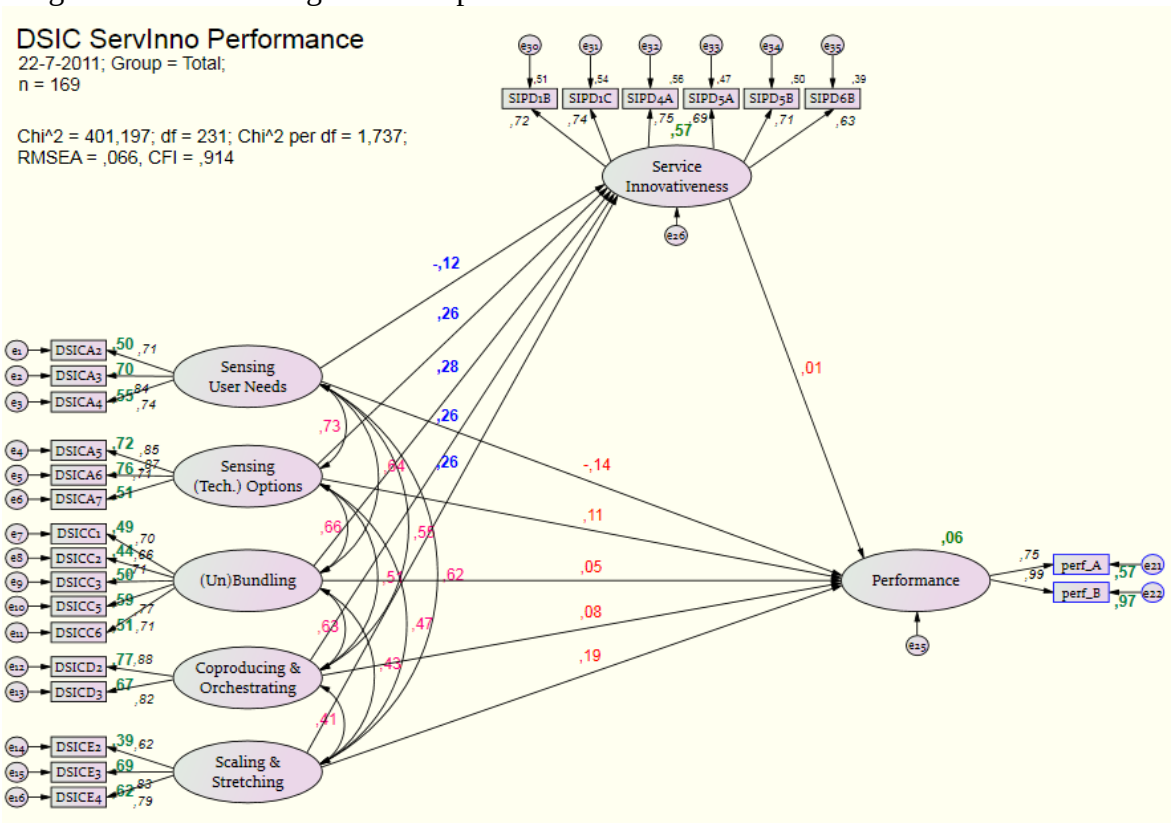

Figure 27: Standardized output of SEM-analysis with only two indicators for performance.

			Estimate	S.E.	C.R.	P
Service_Innovativeness	<---	Sensing_User Needs	-,130	,161	-,808	,419
Service_Innovativeness	<---	Sensing_(Tech.) Options	,236	,114	**2,067**	**,039**
Service_Innovativeness	<---	(Un)Bundling	,347	,149	**2,326**	**,020**
Service_Innovativeness	<---	Coproducing &_Orchestrating	,237	,093	**2,565**	**,010**
Service_Innovativeness	<---	Scaling &_Stretching	,275	,110	**2,497**	**,013**
Performance	<---	Service_Innovativeness	,015	,159	,092	,927
Performance	<---	Sensing_User Needs	-,171	,226	-,760	,447
Performance	<---	Sensing_(Tech.) Options	,109	,161	,679	,497
Performance	<---	(Un)Bundling	,069	,205	,335	,738
Performance	<---	Coproducing &_Orchestrating	,075	,129	,584	,559
Performance	<---	Scaling &_Stretching	,223	,166	1,345	,179

Table 32: Regression weight of SEM-analysis with only two indicators for performance.

Market Dynamism

A point of debate within the DCV is whether dynamic capabilities are only relevant for firms that operate in dynamic markets, or also for those who are active in static markets. Since we asked respondents to indicate the dynamism of their own markets, we can actually study whether our model differs for different type of environments. The fourth item that we used to measure the perceived market dynamism was reversed, hence the transformed variable in the tables below.

		dyna_A	dyna_B	dyna_C	dyna_Drev
N	Valid	167	168	168	168
	Missing	2	1	1	1
Mean		5,14	4,38	5,43	4,7381
Std. Deviation		1,599	1,757	1,396	1,82543
Variance		2,558	3,086	1,948	3,332

Table 33: Descriptives of four variables for market dynamism.

A principal component analysis (annex 3.13) reveals that there is one underlying dimension, in which the reversed item loads to the smallest extent. The histogram below shows the distribution of the saved factor scores that come out of the component analysis.

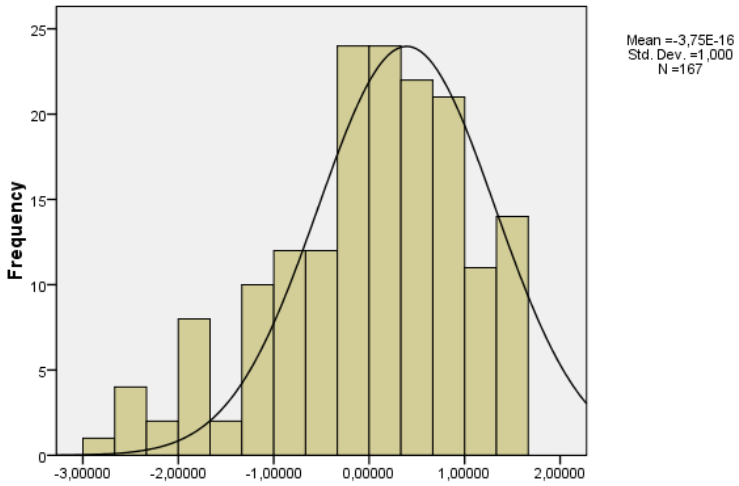

Figure 28: Histogram of Market Dynamism factor scores

We can use this data for distinguishing between low and highly dynamic environments. One option is to use relative criteria; for example, we can make two or three equal groups of those who score the lowest (static environment, middle (moderate dynamism) and highest (highly dynamic markets). Another possibility would be to take an 'absolute' criterion. When using the standardized factor scores, we can classify all the firms that score below a certain negative threshold as operating in static markets, and firms that score above the positive equivalent of that value as active in dynamic markets.

Due to our limited amount of responses in the current phase of this research, we do not possess enough data to run a multiple group SEM-analysis. The criterion of a 4:1 ratio (cases : variables) is not met, which means that the output produced by AMOS is not valid (even if the model fit seems sufficient). However, we identified a clear research avenue for further research. Analysing whether DSICs have a different role within static and dynamic markets certainly contributes to the understanding of the concept.

SIPD-based model

Instead of studying the relation between different DSICs and service innovativeness, it is also possible to link one overarching measure for dynamic service innovation capability to the different service innovation performance dimensions. In order to do so, we first need to develop this general DSIC-construct. One possibility is to do a dimension reduction in SPSS and instruct it to come up with one component. The matrix below demonstrates that only the inversed items have a loading of less than .4, and are therefore not shown.

	Component
	1
DSICA1	
DSICA2	,609
DSICA3	,697
DSICA4	,691
DSICA5	,714
DSICA6	,733
DSICA7	,626
DSICB1	,628
DSICB2	
DSICB3	,732
DSICB4	,700
DSICC1	,619
DSICC2	,588
DSICC3	,673
DSICC4	,661
DSICD1	
DSICC5	,650
DSICC6	,697
DSICD2	,613
DSICD3	,612
DSICE1	,681
DSICF1	,732
DSICE2	,507
DSICE3	,579
DSICE4	,550
DSICF2	,708
DSICE5	
DSICF3	,638
DSICF4	,698

Table 34: Unrotated component matrix of all DSIC items.

We can save this factor, and accordingly use it in AMOS. However, in doing so, we need to specify the measurement error, which is 1-α.

The Cronbach's alpha from all our variables is: 0,923.

1 - 0,923 = 0,077. This should be the fixed error-variance for the factor-item that measures our construct of DSIC:

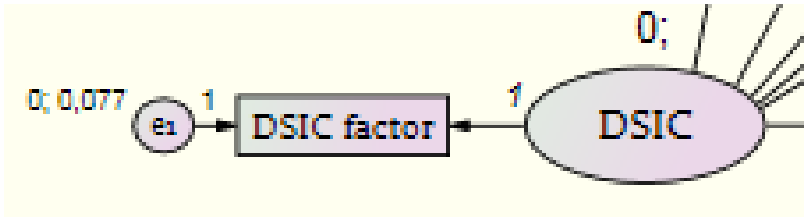

Figure 29: Specifying the measurement error in Amos

Our SIPD-based structure looks as shown in the illustration below. Since there were five cases that did not have complete data on the new SIPD-items that are introduced, n = 164.

Clearly, this model has a much lower fit than our previous one. The RMSEA is not below the threshold of .08, although the Chi^2 / df is lower than 3. The general DSIC construct is measured with a reliability of 0,92, which was our Cronbach's alpha. The paths towards all the SIPDs are significant and positive. However, none of the paths towards performance are significant. Again, we must conclude that the processes we measured are only linked to service innovations, not to relative performance.

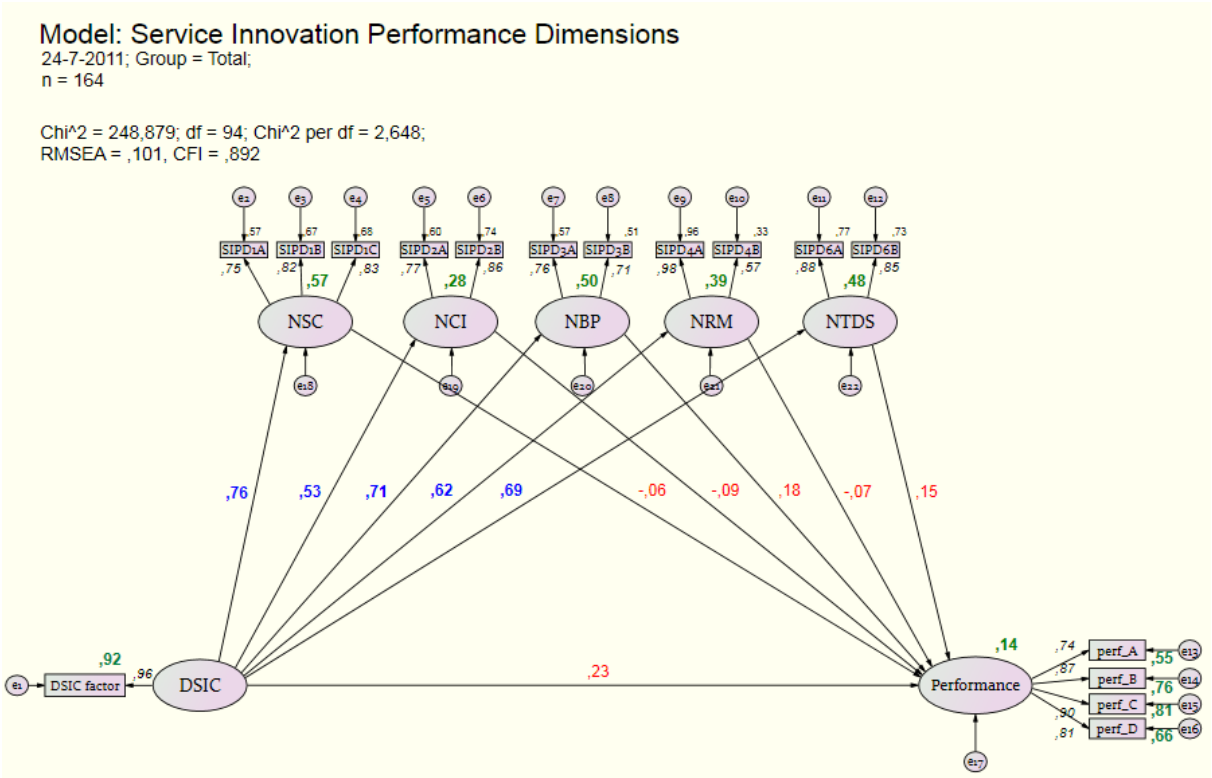

Figure 30: Graphical output of SIPD-based SEM-model (n=164).

			Estimate	S.E.	C.R.	P
NRM	<---	DSIC	1,035	,112	**9,229**	***
NSC	<---	DSIC	1,006	,111	**9,077**	***
NCI	<---	DSIC	,706	,129	**5,458**	***
NBP	<---	DSIC	,924	,120	**7,690**	***
NTDS	<---	DSIC	1,253	,136	**9,197**	***
Performance	<---	NRM	-,055	,088	-,630	,529
Performance	<---	DSIC	,318	,332	,959	,337
Performance	<---	NTDS	,113	,096	1,176	,240
Performance	<---	NBP	,186	,164	1,135	,256
Performance	<---	NCI	-,091	,109	-,832	,405
Performance	<---	NSC	-,065	,154	-,425	,671

Table 35: Output of SIPD-based SEM-model (n = 164).

Reversed model

A significant aspect of our study is the independent measurement of innovation capabilities and the innovations themselves. We aimed to achieve independence by using questions, focused on common *processes*, which could be answered without associating them with specific innovations. It is possible that a firm wants to realize an innovation that possesses specific dimensions, and therefor starts to build a certain (related) capability.[18] However, in that case, the chronological and causal order is still that the desire to develop a certain service innovation leads to the building of a DSIC, which in turn leads to the actual development of the service innovation with the desired characteristics. What we tried to avoid, is that our survey response is the result of a reversed thinking process, in which a responding firm answers to have certain processes *because* it developed service innovation (performance dimensions) that these processes are associated with. The design of our survey tried to avoid this possibly subconscious link, but still it can be interesting to look at a model in which the creation of SIPDs leads to the developments of DSICs, that then lead to firm performance. The evidence below shows that a reversed model is slightly worse than our normal model; if we compare it with the model fit values from our original analysis we observe that all of them are less significant. The paths leading to Performance, both direct and indirect, are still far from significant (table adopted in annex 3.14). However, a look at the regression paths between service innovativeness and the capabilities shows that *all of them* are significant and have a positive value.

Like in all our previous analyses, we can only conclude that DSICs and SIPDs are significantly related to each other, but not necessarily to performance.

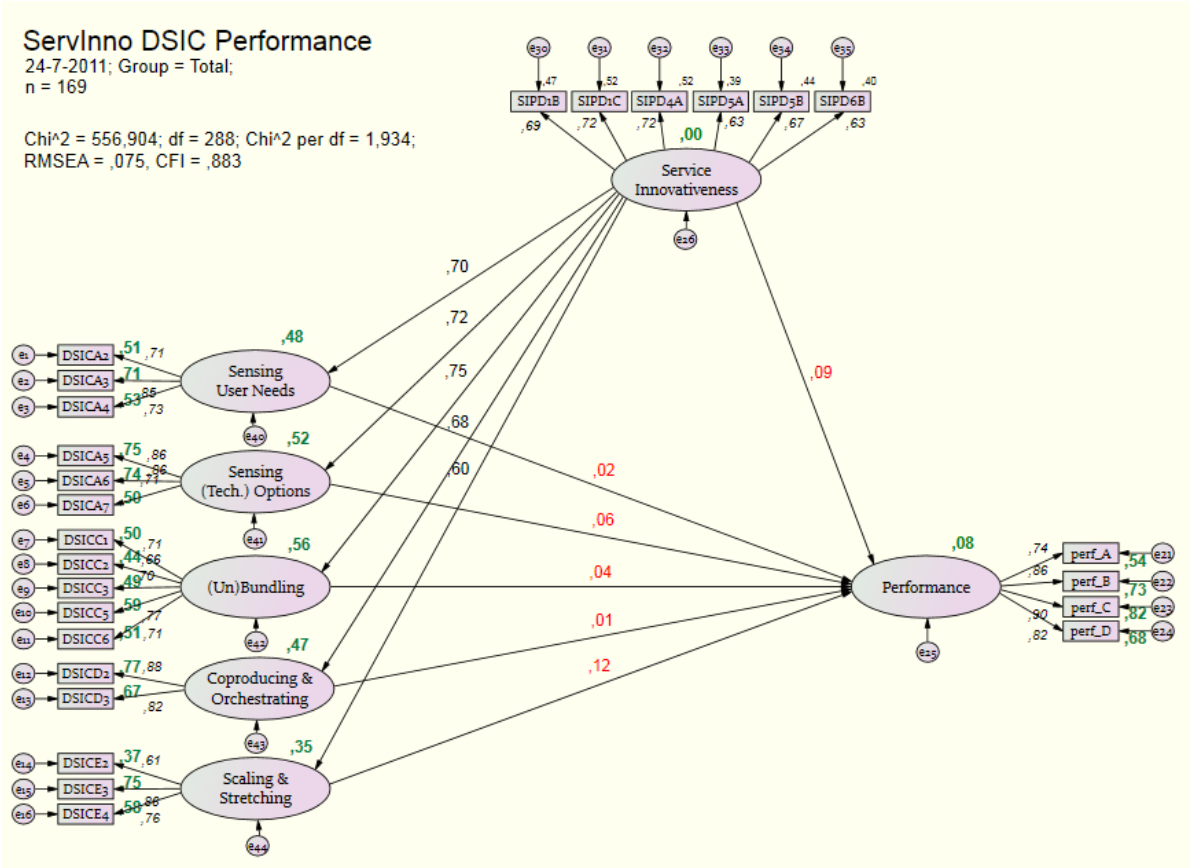

Fig. 31: Reversed model; DSICs mediate the relation between service innovativeness and performance.

[18] Of course, the strategic managers in a firm do not necessarily have to think in terms of the PdH-framework, it is just the perspective we take.

5.4 Conclusions

Part A: Measuring DSICs and SIPDs

By looking at functional processes, we measured DSICs independent from each other and also independent from specific innovations. A principal component analysis resulted in a redefined set of DSICs that could be measured accurately (respecting criteria for reliability and validity) and that showed convergence into distinctive constructs. The exploratory factor analysis also showed that the original DSICs 'Conceptualizing' and 'Learning' did not possess discriminative attributes. This can be explained by the common belief that they both have a very distributed character, which indeed implies that both these capabilities will probably not be found as a distinct dimension. Rather, they are embedded in all the processes a firm has. The other DSIC-items load on the dimensions they theoretically belong to. Sensing User Needs and (Technological) Options is divided in two sub-capabilities that are different from each other, but still have a bit more in common with each other than with the other capabilities.

This leaves us with a scale for investigating five capabilities. All of them can now be measured quantitatively, which offers a plethora of possibilities for further research. On can think of comparisons between individual firms, sectors, sizes, etcetera.
First analyses in this light demonstrated that non-service firms (categorized by their own response) tend to have lower presence of capabilities. Our cross-sectoral study, which happens to be rare in the DCV-literature, did not show significant differences between service and non-service sectors (based on NACE-classes). As for size, small firms do not necessarily report to have less or weaker DSICs, but they are found to be relatively heterogeneous in the DSICs they possess.

SIPDs were analyzed in a similar way. About 45% of the data on service innovation performance dimensions can be captured by a single component. This implies that not too much difference is perceived between the different dimensions. For this reason, we used a single construct of 'Service innovativeness' in our SEM-analyses. However, when looking at the rest of the variance within the SIPD-data, we could observe different underlying dimensions. Only 'New Delivery System: Personnel, Organizational & Culture' is not distinct enough in our data; at least one of its items turns out to be highly correlated to the DSIC of 'New Revenue Model', which could also mean that they tend to imply each other.

The availability of DSIC and SIPD-measures allowed us to study co-occurrences between them. The hypothesized links from Pim den Hertog turned out to be present in our data, thereby delivering empirical support to the conceptual framework. Occasionally there was one significant correlation more or less, but in general these could be explained as well. Insight in the correlations provides us with empirical evidence that can be useful when answering questions such as: "which capabilities do I need when realizing a service innovation of a particular dimension?", or "which type of service innovations can I develop when possessing this set of capabilities?". Although we did not find causal relationships, we can state that when a firm developed innovations that contain dimension X, it is likely that this firm has the capabilities Y and Z. Loasby's claim that particular capabilities are related to particular innovations (2010), is thus confirmed (or at least not unconfirmed).

Part B: Modeling DSICs and SIPDs

Next to DSIC and SIPD, our framework also involves relative firm performance. By using SEM, we tested to what extent the effect of DSIC on performance was mediated by service innovativeness. This analysis resulted in a significant model in which four out of five (redefined) dynamic capabilities had a significant positive correlation with service innovativeness. However, none of the DSICs has a significant relation with performance and neither does service innovativeness, which could also be concluded from several additional analyses. These extra analyses also revealed that DSICs do deliver individual contributions to service innovativeness, although they can correlate and interact at the same time.

The overall implication of our modeling is that dynamic service innovation capabilities do seem to be relevant for the development of service innovations (as the name suggests), but not so much for actually performing better than competitors. Even if we separate the construct of service innovativeness into its distinct dimensions, we do not find significant paths.

The traditional idea that the presence of more or more diverse dynamic capabilities leads to (or at least is correlated with) better firm performance, is not confirmed by our data. The answer to our research question is thus that at a given point in time, dynamic capabilities are not related to *performance-enhancing* innovations. Neither the paths from DSIC to performance, nor from SIPD to performance were significant, which implies that service innovations might improve the 'technical fitness' of an organization without leading to evolutionary fitness (as measured by appropriated competitive advantage). Another possible interpretation is that innovations and/or DSICs come with a cost, which happens to be an under-examined aspect of both DSICs and innovation. To what extent technical fitness can be equaled to innovation and to what extent costs do indeed play a role remains speculation. What we can conclude is that, based on our analyses, service innovations do not seem to mediate the effect of DSICs on performance, they are the results themselves.

So, whereas tautological studies identified capabilities on the basis of extraordinary performance, we managed to show that a firm can have many capabilities without necessarily also performing better. The chances that it is innovative are higher, but higher (service) innovativeness does not automatically imply that firms are more successful than their competitors *at the same time*. One could ask if a cross-sectional study is appropriate for studying a dynamic phenomenon. Our answer would be that the aim of this study was to pick up the challenge of measuring dynamic capabilities and, if successful, start with assessing the relations with service innovativeness and performance in a static setting. Indeed, a logic next step is a longitudinal study in which the focus perhaps is not on relative firm performance, but on survival. Whether a firm is outperforming its competitors is maybe not that relevant; what counts in the end is if that firm possesses the capabilities to adapt itself to changing environments, thereby surviving shake-outs that can occur.

Research of this kind would ask for panel data, which is extremely rare in DCV literature (given the fact that the very measurement of dynamic capabilities was already not common). A case-study helped us to develop a survey instrument that can be deployed regularly and in a wide variety of contexts; now that we possess a tested survey instrument for studying DSICs at a certain moment, we also obtained the possibility of studying them over time. The first steps for quantitatively and empirically analyzing both the dynamism and value of dynamic capabilities are taken.

6 Discussion and general conclusions

6.1 Contributions

Theoretical contributions

The analysis that was performed here is based on a literature review concerning service innovation and strategic management. These themes were brought together in an attempt to solve research gaps on both accounts; service innovation faces the lack of adequate management instruments and strategic management has to cope with conceptual frameworks that are not tested sufficiently (see table 4, p. 26). A multi-criteria analysis of frameworks served to evaluate which framework fits best to our ambitions. De PdH-framework, with its integrative perspective on the management of service innovation, meets the criteria of being complete and focused towards innovation and services.

Operationalization could occur on the basis of an interview-based case-study (completed by a literature survey), leading to new insights on the concept of dynamic capabilities. A theoretical contribution was made by distinguishing four possible appearances; dynamic capabilities can be used or unused, combined with present or not present (table 10, p. 58). We also argue that dynamic capabilities consist of *functional processes*; patterned activities that enable an organization to perform a certain function, regardless the specific practices they use (see also figure on page 81).

Next to studying the nature of dynamic capabilities themselves, we discussed their relation with performance. Our conclusion was that, for achieving competitive advantage, dynamic capabilities need to result in something that can be valued by the market. This is typically a renewed process or product; an innovation.

On the basis of theoretical achievements, we could actually develop a survey that enabled the empirical investigation of hypothesized relations (see below). The main finding is that dynamic (service innovation) capabilities affect (service) innovation without enhancing relative firm performance. This is explained by the presumption that dynamic capabilities mainly serve to help a firm adapt without necessarily making it the best performer at a given moment. Whether this conception is true, remains to be tested in more depth.

Methodological contributions

In line with recommendations that were urged recently, a mixed method approach was taken in our study of dynamic capabilities. Once a framework was selected, a ‘content-based’ (case-study) application led to a better understanding and critical reflection on its main concepts. One should be warned when attempting to measure dynamic (service innovation) capabilities; not just the objective measurement is difficult, already the very identification of dynamic capabilities can be tricky business. Several conclusions were drawn that aim to help any case-study for dynamic capabilities. Most important are the use of pre-defined capabilities (preferably part of a coherent framework), focus on underlying functional processes and (cross-) validation by firm-wide investigation. Only when dynamic capabilities are measured strictly independent from innovation and performance, the relation between these three concepts can be analyzed.

The qualitative part of this research enabled us to develop a survey instrument for measuring dynamic service innovation capabilities and service innovation performance dimensions at a wider scale. After processes were measured, principal component analyses and scale reductions proved the discriminatory and convergent reliability (respectively) of our operationalized DSICs and SIPDs. Validation of the survey instrument ensured the further use of the obtained data, as well as the survey instrument itself. Using structural equation modeling was found to be an appropriate method for analyzing (parallel) relations.

Empirical contributions
First of all, the case-study delivered an illustration of the PdH-model. The discussion that followed from the qualitative measurement can inform other attempts to measure DSICs and SIPDs in a content-based setting.
Then, there is data that was generated by deploying a large-scale survey (unfortunately having a low response so far). The descriptive characteristics of this data shed some light on the under-examined aspects of service innovation, notably amongst SME's. Of main interest are the DSICs that firms possess, as well as the SIPDs that occur in their innovation portfolios.
Finally, empirical insights are retrieved from our statistical analyses. Hypothesized links between DSICs and SIPDs were mainly confirmed. The mediating effect of service innovations on the relation between DSICs and performance were not found; DSICs only seem to relate to service innovativeness.

Management recommendations
When engaging in the business of strategic management, some discussion on management recommendations can not be neglected. The ultimate goal of this study was to identify which paths should be taken in the pursuit of competitive advantage. By linking dynamic (service innovation) capabilities to innovation and relative firm performance, we hoped to shed light on powerful combinations of competences and product renewal.

Correlation analyses revealed linkages between DSICs and SIPDs. If we truly managed to measure both constructs independently, some extent of causality is suggested by these results. However, strictly speaking we only witness that certain capabilities and innovations occur at the same time; that these innovations are the result of these capabilities is what we assume. Unfortunately, the circumstances that enabled our case-study did not offer sufficient room for also analyzing this relation in the qualitative part of this study. In case that our assumption of causality is correct, managers can inform themselves when aiming to develop an innovation that contains one or more dimensions. Do they already possess the associated capabilities, or should new ones be 'built'? An inverse logic can be followed as well; given the presence of certain capabilities, which type of innovations can be created? Of course, managers probably do not think in terms of dynamic capabilities; it is more likely that they express a firms' powers by looking at the processes it performs or can perform. Taking a DCV-perspective can help strategic managers to look with a more holistic view at the characteristics of their organization. Such a stance might then lead to the identification of possibilities that did not show up in process-based thinking.

Structural equation modeling, subsequently, enabled the identification of direct and indirect influences of dynamic capabilities. Significant relations with firm performance were not found, which does not imply we did not achieve useful information. Management should be aware of the fact that both dynamic capabilities and innovations come with a costs. Moreover, being innovative does not mean being better than competitors. What it could mean

is being more dynamic, but the fruits of that ability maybe can only be reaped when environments change at a high velocity. Further recommendations thus depend on studies that can or need to be performed on the basis of first steps that were taken here. Cross-sectional studies on dynamic capabilities (such as the present) might be rare and therefor valuable, but the downside is that some variance might be equaled out by the variety of sectors and activities we are looking at. In-depth analysis with a more narrow scope can probably increase the understanding of processes and capabilities that are dominant and/or successful in a particular set of firms (showing similarities in firm- and/or market-specific characteristics).

The ambition is thus to provide more insights in service innovation management. Recent frameworks like the one by Gallouj & Weinstein (1997) are broad but conceptual, thereby remaining far from management reality. Operationalization of the PdH-framework for service innovation should revitalize the service-based approaches (demarcation approaches) by providing a framework that is applicable in all elements of service innovation. Maybe its integrative perspective does not stretch over technological innovation as well (like in the synthesis approach), but it is already highly ambitious by aiming to capture all the dynamics of service innovation, regardless the type of firm it originates in (so also including manufacturers, governmental institutions, etc.). In the first place, studies like the present help to obtain descriptive knowledge about the functional processes, dynamic capabilities and service innovations that occur. The challenge is to convert this knowledge, accordingly, into normative implications about which steps to take when aiming for competitive advantage (given the current conditions and characteristics of a firm). Whether we can come up with recipes for success is a positivistic thought, but analyses like SEM apparently enable the identification of paths that used to be successful. What we attempt with our holistic view, taking dynamic capabilities rather than (functional) processes as a focus, is to find these paths and interpret them. Once these paths are found we can return to the underlying processes and make the DCV more down to earth (what organizational scientists urge economists to do). This step is big, given the freedom of an organization to choose practices that contribute to the development of a dynamic capability. As Eisenhardt and Martin (2000) wrote; there can be communalities in key features (i.e. dynamic capabilities), but there remains idiosyncrasy in details.

6.2 Limitations and further research

What should be kept in mind is that the statistical element of this study is based on a rather limited data-set. Although there are enough cases to perform valid SEM-analyses, many additional studies would require more data. Our intention so far was to make a first step in measuring and modeling dynamic (service innovation) capabilities and service innovation performance dimensions. On this basis, other possibilities open up as well. As we just mentioned, empirical data can be gathered for studying in more depth the DSICs and SIDs in specific firms, sectors, regions, periods, etcetera. Cluster analyses might be interesting method for dealing with this data; can we distinguish certain groups of service innovators on the basis of DSICs they possess and SIPDs they develop?

A key issue will remain the interpretation of survey-data that is typically based on Likert-scales. How well can managers estimate the presence of a process? Our case-study revealed a certain unavoidability of subjectivity in assessing the strengths and presence of processes. What, who or which period do respondents compare with, whilst scoring how good their organization performs on the account of ‘personalizing new service concepts’? In the present

study, we accepted that respondents had the freedom to evaluate processes on the basis of their own standards. Key argument was that functional processes can be performed in many ways; more restrictive questions might generate more accurate responses, but can also exclude activities that do contribute to the presence of a certain capability. Given the normal distributions of our response, we accepted that objectivity was not fully obeyed. In fact, we believe that objectivity in this matter is illusionary; evaluation of the strength of processes is always based on comparison. What is important, is that respondents score the actual ability to perform a functional process, not the desired strength.

So, in order to perform additional studies, validity and reliability of the data has to be ensured. A first step is to further link qualitative and quantitative research, for example by confronting respondents with their scores and performing triangulation and consistency checks. Improvement of the quality of our survey instrument can also be achieved by running SEM-analyses (notably the CFA-element) on different data than the set that was used for the initial EFA to come up with the redefined scales (split data is used in Agarwal and Selen, 2009). In our analyses we did not discuss how well the items in SEM where measured, because we knew already on forehand that they would match our constructs. This was not problematic, but for new tests it might be wise to check whether our EFA-findings hold. If yes, the survey can be deployed in more situations, allowing for more cross-sectional and paneled research.

By possessing measures for the DSIC and SIPD constructs, more analytic research avenues can be addressed as well. For example, debates about the *development* of dynamic (service innovation) capabilities can now be enhanced with a quantitative perspective that actually measures the dynamic capabilities a firm possesses at a certain time or period. One could also investigate whether firms that engage in explorative innovation have other capabilities than those who focus on exploitative innovation. A first start was already made with incorporating the dynamism of environments within structural analyses; do DSICs only matter in dynamic markets, or also in more static/moderate conditions? As soon as enough data is available, it will also be possible to run a full model, in which all the DSIC-constructs as well as all the SIPDs take part (instead of using a single measure for service innovativeness). This easy step would lead to more insight in the performance-enhancing effect of SIPDs. Maybe service innovativeness as a whole was not found to relate with performance, but what about individual SIPDs? Like we argued before; in a context where SIPDs happen to be correlated with performance, management recommendations can be based on the identification of successful paths from DSICs to SIPDs and performance (looking at direct effects) and especially from DSICs to SIPDs to performance (looking at indirect effects as well).

The fact that we did not find any significant path so far is not necessarily a disappointment. Obviously, if all variables and analyses are valid it can be a useful conclusion to be aware of the fact that innovations do not always lead to competitive advantage. However, we also argued that performance-impacts can be leveled-out by our cross-sectional sample. The availability of more data not only enables the inclusion of the different SIPDs in our models (which could already lead to significant paths that can feed management-instruments), but could also help us to perform studies that are devoted to firms that show similarities in a number of (firm- and or market-specific) conditions. Focused analyses can result in positive relations between SIPDs and performance and guide management in these specific types of firms. Our generic tool for measuring or mapping (e.g. in a radar-diagram) DSICs can thus be used for developing management recommendations in specific industries as well, acknowledging the acclaimed heterogeneity between service-delivering firms.

Finally, how to overcome causality-problems can be summarized into several recommendations. First of all, it has already been noted that is helpful to obtain data that possess correct chronological characteristics. In the present study the chronological order is imperfect since dynamic capabilities were measured in the present situation. This can be solved by asking these firms for their performance at different moment in time that are yet to come. Even better would be to do a follow-up that also measures the (changes or stability of) DSICs and SIPDs themselves; this would allow for constructing causal relations in several directions. A dangerous point on this account could be that performance is not a result but a cause of the emergence of DSICs or SIPDs (which remains statistically unclear in correlation-based analyses). In the present study, this danger is not as great as it is in many other studies for innovation and performance. The reason is that we do not look at input (figures) for R&D, but rather measure capabilities and innovations that were truly realized (and thus are on the output-side). We cannot just accept a reversed hypothesis saying that a better performance automatically leads to the development of more or better capabilities. Neither can we fully support that the presumed (but not found) effect from service innovativeness to relative firm performance should be inversed, although is widely acknowledged that well-performing firms can take more risks and can thus engage more in innovation. Panel data would allow the study of these cycles, thereby enhancing our insights in the causal mechanisms that underlie the observed correlations.

Given the nature of dynamic capabilities, measuring them over time while having a constant measurement procedure is a prerequisite for fully understanding the role they have in strategic management and successful firm behavior. Our contribution here is the development of both a procedure for measuring DSICs and SIPDs, as well as analyzing them. Note that follow-up surveys (required for collecting a unique asset like longitudinal data) can generate a higher response-rate when they are specific for our subject and thus less lengthy than the one we deployed in the UWS-project.

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Appendix I: The growing importance of services

The goal of this appendix is to provide background information of the role that services became to play in modern societies. Instead of simply accepting that service innovations should be encouraged and managed, we can take a closer look at the phenomenon of services and service innovation and nuance our opinion about the extent that service innovation processes should be optimized.

The moment that developed countries are really said to have entered a phase of 'deindustrialization' lies typically in the second half of the 20th century. Services became dominant already in the 1950s in the UK and USA, whereas France and Japan followed around 1973 and 1980 respectively (Gallouj & Djellal, 2010).
One way of discussing the shift towards service-orientated economies is by distinguishing explanations from consumer markets and those from producer (professional) markets.

The statistician Engel observed already in 1857 that rich households are willing to spend relatively more on service consumption then less wealthy households. This income elasticity of services is known as 'Engels law'. Fisher, in 1935, tried to explain the high growth-rates of services (compared to other sectors) by combining insights from the economist Malthus. Fisher argued that the hierarchy in consumer needs is related to the consumption of the output of different kind of industrial activities. Primarily, people want to basic needs like food, clothing and housing. When these needs are met, they start consuming products that are less necessary (e.g. entertainment, travel). Since the amount of food one can consume is limited, richer people will have to more capital for products that give them non-necessary experiences. According to Fisher, also secondary-level needs (consisting of mainly manufactured goods) have a ceiling. Therefore, societies will consume more services as they get richer.

Instead of looking at the demand-side, Clark found an explanation at the supply-side (1940). He noted that as economies progressed, activity was shifting away from agriculture and manufacturing, which is also illustrated in the graph below. More and more people were observed to be active in a heterogeneous set of occupations that were called the tertiary sector. According to Clark, the shift was caused by the fact that labour productivity in the secondary and tertiary sector was higher than in the primary sector. Therefore, employing human capital in higher sectors was more attractive for employers (and through good wages also for employees).

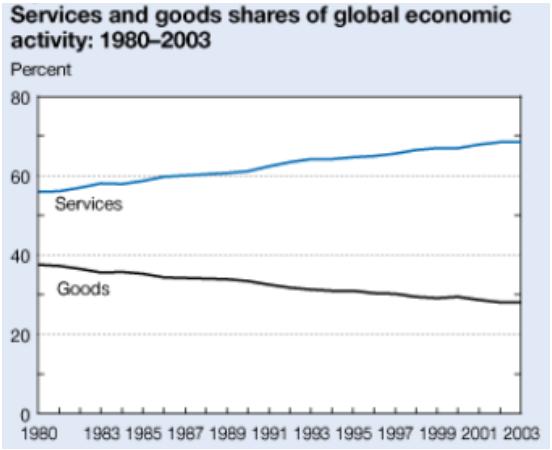


Figure A1.1: Increasing gap between services and goods (World Bank, 2006)

Fourastié, on the other hand, claimed that productivity growth in the tertiary sector was lower than in the other sectors (1949). In fact, he went as far as defining the sectors by their growth rate. Instead of defining services by the common characteristics they share or simply as not-agricultural and not-industrial, Fourestié clustered those activities that were demonstrating a slow productivity growth. He stated that thanks to technological progress, a constant need for products from the primary and secondary sector can be met by a smaller labour force. Therefore, more people will eventually work in the tertiary sector.

A different explanation was proposed by Skolka, Gershuny and Gershuny and Miles. They argued that when households possessed more capital, they were able to buy more goods. With these goods, people produce their own services; think of using your vacuum cleaner to tidy your own house instead of renting cleaning service. However, for expert services they were still dependent on professional suppliers. Since the services that remained on the market ask for well-educated knowledge workers, also the price level of services increased. If productivity is measured by taking product (service) value as output, and human effort (salary) as input, we see indeed that higher wages lead to lower productivity. It is important to note that services can be produced by private and public organizations, but also by the consumer himself. Capturing self-service or other activities that can reside in the informal economy is intrinsically difficult, but their role within economic systems is significant (Gershuny, 1979).

The growing importance of services is also based on increased service consumption by firms, something which became the topic of research after several decennia of household-studies. Services that are delivered in professional markets are called producer services and include sub-sectors such as retail, transport, cleaning, leasing and 'business services'. In this last category we find knowledge intensive activities like accounting and consultancy. One (contested) explication for growing employment and output of producer services during the last century is that many firms started outsourcing activities. In many domains, business is getting increasingly complex. The high rate of developments within technology and market needs led to the emergence of a knowledge society that is characterized by differentiation and specialization. As a result, firms need to have more and more knowledge not just about their core products, but also about activities that stretch over issues like marketing, advertising, product innovation (R&D), knowledge and material acquirement, regulatory frameworks, etc. Managing the access to and the actual use of all these forms of knowledge is a complex task. A reaction to this trend is that firms leave some of their activities to external specialists. Since markets are said to be more dynamic, externalization also helps to reduce the risk of investing on the wrong competences. If it were only service firms themselves who externalize, we would only observe an internal shift within the tertiary sector. However, manufacturing industries also engage in this option to outsource or complement their internal activities.

Next to outsourcing (or externalizing), we also observe other shifts in activities. Many western countries import goods from low-wage countries, but actually export services.
Another explanation for the above average growth of employment in producer services, is again related to the fact that they are said to suffer from low productivity growth. The natural way to compensate this is by employing more people. Let us have a closer look at the arguments for and against claims of low productivity.

Productivity growth and economic performance

Apart from searching for valid explanations for the growth of services, one can also wish to take a more prescriptive perspective (like our aim to *manage* and not just *explain* service innovation). An essential question then is whether this development is desirable or not. Given the complex interrelationships between service economy and subjects like employment, equality, sustainability, globalization, etcetera, it is perhaps very hard to actually make global analysis about the goodness or badness of the observed trend. However, studies for the impacts of service growth in specific fields are possible. An example of such a domain is the line of literature that investigates how a service economy can contribute in environmental preservation (e.g. Gadrey, 2010). Formulating normative statements about the growing importance of services thus depends highly on the perspective one takes. The environment is obviously a global issue (although it can also be studied at smaller scales), but those kind of studies differ from the ones that take e.g. a nation, a region, a company or an individual as unit of analysis. The aim of this thesis is to provide understanding and recommendations for strategic management at the *firm level*. However, for the broader picture it is interesting to know whether there are also other parties (instead of just service providers) that can benefit from possibly (hopefully) enlightening results. Hereby, we arrive at one of the most debated subjects within service economy and service innovation literature; the question of productivity and contribution to economic performance. The unit of analysis here is an economic system, which can also be a national system of innovation (cf. Lundvall, 1992).

An early and influential theory on the further implications of service dominance for economy was proposed in the 1960s by economists and Nobel-prize winner Baumol and his colleagues (Gadrey & Gallouj, 2002). Agriculture and manufacturing industries were said to have an ever increasing productivity thanks to improvements in technology. However, given the importance of human factors in service delivery, productivity in the tertiary sector can be expected to stagnate. Adoption of technology (which is characteristic for the limited scope on service innovation within the technologist approach) can only contribute to a small amount of growth, but the performance of humans is limited. Costs within services can not be expected to decrease since the not-decreasing amount of human effort has to be paid. In fact, increasing wages result in higher costs, what means that the productivity (with respect to used financial capital) would get lower over time. The structural problems of this seemingly ever increasing productivity gap came to be known as the ‘cost-disease’ of services. Since personal interaction is argued to be so important for service delivery, the possibility for enjoying economies of scale is very modest.

Other reasons why services are said to have limited possibilities for productivity growth are given by Sven Illeris (1996, pp. 56-57). When service activities are aimed at specific customers with unique characteristics, scaling up the service is difficult. Combining personalisation and standardisation is said to be intrinsically problematic. The important role of the service user also implies that productivity is dependent on the skills of the customer, and not just the provider. If we look at the co-production element, we also see that the need for personal interaction is hampering productivity growth. The fact that producer and consumer often have to be simultaneously at the same location, means that producers are facing planning problems of maximally using capacity. Sometimes they also have to travel to customers, what takes time as well. Moreover, when proximity is required, it can also result in ‘local markets’ that are less subjected to pressure from competition (e.g. hairdressers). Reduced competition is also a consequence of the fact that service are hard to evaluate a priori, which makes people have preferences for services they are familiar with (due to high

switching costs). Firms that experience low levels of competition have fewer incentives to increase their productivity. This argument is also applicable in the context of public services (e.g. health care), although they might be exposed to other types of dynamics.

Fortunately, there are also several reasons why the situation is not as hopeless as suggested. The first one relates to the fact that service research suffers from *problems around the measurement* of productivity. Whereas in technology it can be easy to measure inputs and outputs, the characteristics of services lead it to be extremely complex. There are several factors that make it difficult to cover everything that enters and leaves the process of service production. Some of them are:

- Subjectivity: how good is the output of a particular teacher? Do we just count hours, or do we try to evaluate and incorporate quality?
- Temporality: When do we measure the value of a delivered service? Can we immediately evaluate the advice of a consultant, or do we have to reflect on it a year after the implementation?
- Co-production: how can we measure the output of a consultant if his performance depends highly on the contribution of the consumer?

Furthermore, the distinction between direct output of a service delivery and the final (long-term) outcome can result in entirely different calculations of productivity. The productivity of a doctor can be measured by the number of patients he treats in a week, but also by counting the ones that are actually cured (and how well they were cured). Maximizing one of these productivity-measures can reduce the other one.

A second reason is that in reality there seem to be *possibilities for increasing productivity*, as can be concluded from productivity-statistics that were published after Baumol coined his 'cost disease' (Baumol and Bowen, 1966). The productivity problem is only structural when one assumes that services always demand intensive personal interaction. However, the adoption and development of technologies like ICTs proved that the nature of many type of services can be changed. Instead of looking at retailing formula's that involve more or less employees, one can also sell products on-line, and thereby excluding different type of service workers from the process. The availability of possibilities to substitute people for technology allows firms to enjoy economies of scale. Thereby, a structural difference between manufacturing (where more efficient or better technology replaces inferior technology) is eliminated.

The last reason why the cost-disease is not something that has to be cured, is that *services can actually do significant contributions to economic progress*. Perhaps they do not always experience productivity growth themselves, but one should not underestimate the positive influence that they can have on other sectors. Instead of treating services as a lagging sector that totally depends on manufacturing industries, some economists are convinced that it is the tertiary sector that provides the knowledge that is essential for the development and survival of those manufacturing industries.[19] This last perspective usually tries to de-homogenize the tertiary sector for pointing out the roles of different individual service sectors or (at a more specific level) service activities. So-called knowledge intensive business services (KIBS) have been characterized as the 'secondary knowledge infrastructure' since they provide specialized knowledge parallel to the research output from universities. Some scholars claim that KIBS function as engines in complex socio-economic systems in which knowledge

[19] The paradigmatic notion of 'service economy' is based on the fact that services are accounting for such a large part of GDP and employment. Another paradigm typifies modern economies as 'knowledge economies', given the presumed importance of knowledge for almost every type of business.

forms a key asset (e.g. Den Hertog, 2000). Even for many manufacturing firms, the most valuable resource is technological know-how and client information. Therefore, the secondary sector is said to be dependent on service sub sectors such as consultancy, accountancy, commercial research and financial services. The figure below (OECD, 2005) shows the relations between the output of services and manufacturing and its distribution over domestic demand and exports (based on 1997 data). From this graph we could conclude that services do not float entirely on manufacturing, since they deliver almost as much as they receive (8,5% versus 10,6%).

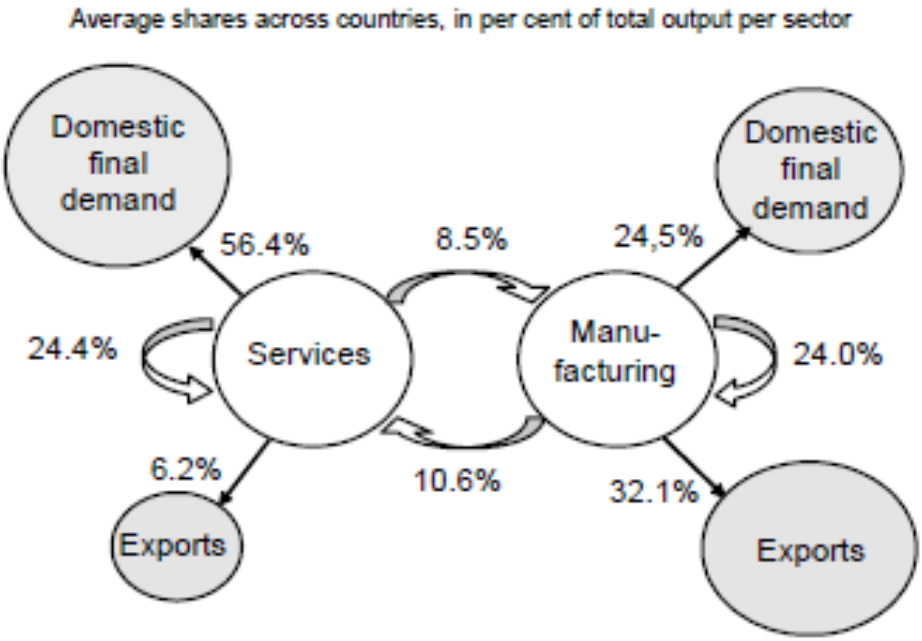


Figure A1.2: Shares of demand components in total output of services and manufacturing, (OECD, 2005).

Now that the role of services within economy is discussed from a macro-level perspective, it is time to come back at the firm-level focus of this thesis. In fact, firm-level behaviour provides another major reason for explaining how we could arrive in a service-dominated economy: many firms could and can enhance their profits by becoming more service-oriented (Normann, 1983). Were industrial activities are often focused on delivering many and cheap products, service are essentially based on fulfilling customer needs. When a firm is able to adapt its output to individual user needs and thereby deliver more added value, it can often capture more profits. An important point is thus that the emergence of services is partially found in manufacturing industries that shift towards service provision. Instead of selling products, they lease them and sell additional services like insurance and maintenance. Given the fact that knowledge is often a firm's key asset, the challenge is to develop a business model that enables the firm to create and capture value. Since competition on labour and capital can be fierce, especially when low-wage countries are active on the market, competition on knowledge (including knowledge about clients) can be more attractive.

So, not only can firms capture more value by producing services, they also experience less pressure from similar firms. There are numerous cases of manufacturing firms that shifted towards a service-oriented business model. Classic examples of successful applications of the service dominant logic are IBM, Xerox and General Electric. An implication of this trend is that it is hard to talk about service sectors and manufacturing sectors; the borders are hazy (as is discussed repeatedly throughout the thesis).

In sum, we can state that there are different, sometimes conflicting, opinions about the role of services within economic systems. Some authors think that services are epiphenomena that emerge around the motor of manufacturing industries, others argue that services account for the major part of economies and that they deliver significant contributions to the primary and secondary sector. By discussing subjects as productivity, we hoped to provide some food for thoughts on the determinacy of services. Was it inevitable that services became so ubiquitous in the past century? Individual firms might have a choice in deciding to which extent they engage in service provision, but can they resist the general trend of service dominance? Should all firms try to switch to service provision and start developing service innovation? Should governments encourage this? Reflecting upon these questions might enable a better understanding of the significance of developing instruments for the management of service innovation. However, since want to keep a focus in this thesis, further discussions about the morality and desirability of the support of service innovation processes are not included. As noted, this study starts with the assumption that service innovation in firms should be promoted, and aims to make a start for the development of tools that enable this. .

Appendix II: Case-study protocol

1. General aim of the research

The project on open service innovation in Northwing of the Randstad (Greater Amsterdam Metropolitan Area) aims to deepen the theoretical and practical understanding of how service firms jointly innovate in what are called open innovation processes/settings. Open innovation (Chesbrough, 2003) is a buzz word used to indicate that firms increasingly do not innovate in isolation, but jointly with third parties, including their customers and so benefit from external knowledge sources on the one hand and use internal knowledge sources more effectively. Innovation, thus, is an activity that increasingly needs to be managed across organizations. Current analyses of open innovation concentrate on typical high tech and manufacturing cases (in the Netherlands Philips and DSM are well known cases), but hardly on service firms even though numerous service firms introduce new service concepts, interact in novel ways with their customers and design new service experiences and service solutions with clients and other partners. In the project we aim to investigate what actually happens during joint innovation projects in service organizations. As such, we aim to gain insight into the forms, structure and management practices involved in open service innovation as well as the dynamic capabilities that are attached to the successful execution of this phenomenon.

The level of analysis thereby is the open innovation project. By gathering data on many OI projects that take of have taken place in service organizations we aim to gain detailed insight into the phenomenon of open innovation, its characteristics, specifics and (management) practices.

2. Research design and setting

Study purpose:

We aim to gain insight in the phenomenon of open innovation in a service context.

More specifically, we aim to gain insight into the process of OI, the forms and practices of OI used, management issues related to OI and **dynamic capabilities** required for OI, all in a service context.

As such, we aim to build a more integrative understanding of open innovation that explains how the design, organization and management of open innovation may connect to a service context.

Core research question:

How does open innovation take shape in service settings?

Subquestions:

Does open innovation exist in service settings?

If yes:

What does it look like?

- What forms of open service innovation can we identify?
- What open innovation processes take place between service firms and what do they look like?
- How is open service innovation organized and managed?
- What is required to make open innovation in service settings work? Put differently, what are crucial management capabilities to manage processes of open service innovation?

Case study approach:
The main purpose of this research is to build a better understanding of the concept of open innovation in service settings. We can therefore characterize this study is theory building rather than theory testing.
We selected the case study research as the appropriate research method for our empirical study. Case study research has been identified as a good way to develop theory, when compared to other research methods such as survey research, experiments or quantitative modeling (Eisenhardt 1989, Meredith 1998, Voss et al 2002, Zomerdijk 2005). More specifically, we identified the following strengths of the case study research:

- Case study research is particularly appropriate for area's where research and theory are at their early, formative stages (Benbasat et al 1987, Meredith 1998). This particularly applies to our focus on increasing understanding of open innovation beyond high tech and manufacturing contexts.
- Case study method allows a phenomenon to be studied holistically (Yin 2003), which leads to a relative full understanding of the nature and complexity of the complete phenomenon of open innovation and its related dimensions and aspects.
- The case method is particularly appropriate for practice based problems where the context of action is critical (Benbasat et al 1987) since it allows the phenomenon of interest to be studied in its natural setting (Benbasat et al 1987, Meredith 1998). Since it is exactly the service context that we are interested in and how this context affects the phenomenon of open innovation, this research method is particularly appropriate for our research. We expect the organization, design and management of open innovation practices to be related to or influenced by the specificities of a service context / environment.

3. Conceptual and operational definitions

Open innovation:
Open innovation (OI) is defined as systematically encouraging and exploring a wide range of internal and external sources for innovation opportunities, consciously integrating that exploration with firm capabilities and resources and broadly exploiting those opportunities through multiple channels (West and Gallager, 2006, p.320). Thus, OI goes beyond the *creation* of innovations and also incorporates *value generation* through innovation exploitation.

Service innovation:
Service innovation concerns the organization of a new solution to a problem of a more efficient solution to an existing problem (Gadrey et al., 1995). As such, service innovations generate value from new service products or by increasing effectiveness and efficiency of the focal firm's operations. A new service experience or service solution that consists of one or several of the following dimensions: new service concept, new customer interaction, new value system/business partners, new revenue model, new organizational or technological service delivery system (Den Hertog et al, 2010).
Characteristics of service innovation (Den Hertog, 2010):

- New service experience or service solution
- Reproducible
- Intentional and (to some extent) systematic effort
- Certain degree of newness
- Introduced and diffused to the market with (some) success.

Open service innovation:

- The embracement of external knowledge sources in conjunction with internal knowledge sources to develop and commoditize new services (Almirall & Casadesus-Masanell, 2010)

- Collaborative development which includes the broad concepts of leveraging all external sources of ideas, technology and innovation to drive internal growth. (Cooper & Edgett, 2007)

Combining all of the above definitions, in our view, open service innovation is:
The (intentional effort of) embracement of all external knowledge sources of ideas, technologies, and innovation in conjunction with internal sources to (collaboratively) develop and commoditize new (and reproducible) service experiences or service solutions.
Dimensions of innovation (SIPDs): dimensions or areas where service innovation can take place in a business, thereby leading (individually or in combination) to (re)new(ed) service functions that change the service offered to the market (Den Hertog et al, 2010)

- Service concept: the service offering that describes the value that is created by the service provider in collaboration with the customer.
- New customer interaction and role of customers in value creation
- New value system or set of business partners: actors involved in jointly co-producing a service innovation
- New revenue model
- New delivery system - personnel, organization, culture: the organizational structure of the company itself.
- New delivery system – technological
- New business model

Constructs to measure in case study research:
Innovation form: the appearance of open innovation, how and through what activities firms work together to create open innovations in both collaborative / governance forms and actual collaborative innovation practices.
Innovation management: How the innovation development and commercialization are organized and dealt with in daily practice. So how the innovation is organized, where in the organizational structure it is placed, how decision making takes place, etc.
Dynamic service innovation capability (management capability, organizational routine): those hard to transfer and imitate service innovation capabilities which organizations possess to develop, (re)shape, (dis)integrate and (re)configure existing and new resources and operational capabilities. Organizational competencies, routines and processes to manage the process of service innovation. (Den Hertog et al, 2010)
Dynamic capability: the firm's ability to integrate, build and reconfigure internal and external competencies to address rapidly changing environments (Teece et al 1997). Based upon highly firm specific managerial and organizational processes (or routines) and shaped to a considerable degree by its specific asset position.
Operationalization of constructs:
Form
Information sources (Laursen & Salter)
Types of cooperation and cooperation partners (Laursen & Salter)
Stages and activities in the innovation process (Hansen & Birkinshaw, Johnston et al 2000)
Innovation modes and practices (Rohrbeck et al, Dahlander & Gann)
Information sources (Laursen and Salter)
Value generation sources (Dahlander and Gann)

Management
Management of project in daily practice
Dealing with strengths, weaknesses, opportunities and threats
Outcome monitoring
Formalization of process and relationships
Decision making
Dynamic Capabilities
Type of capabilities (Den Hertog et al)
'Owner' of capabilities: which partners contribute what
Importance of capabilities throughout innovation process

4. Case selection

Case selection criteria

When selecting a case study / innovation project take into account the following criteria and check these with the organization interested in participating in the UWS project:

- Project has to be about a real innovation
- Project has to be about service provision
- Project has to be developed (at least partly) together with partners
- Project has to be developed by at least one firm active in service industry or manufacturing firm in transition towards service provision
- Project has to be in later stages of innovation process (i.e. far beyond idea generation, preferably already implemented in / by focal firm)
- One of the firms has to reside in greater Amsterdam or greater Utrecht area
- Focal firm has to have a certain degree of experience / familiarity with open innovation
- Interviewer has to get access to interviewees from focal firm side but also from partner firm side.

To be able to publish case based research, it is often important to state whether cases were selected for literal or theoretical replication. For literal replication, state that all cases were in the same geographical area, were all focusing on and had experience in open service innovation, etc. In general, it is also important to create a database of cases with broad backgrounds so you can work towards theoretical replication. To this end, select cases from / with:

- Various service industries
- Various firm sizes: SME vs large firms
- Variation in national / internationally operating service firms

5. Conducting case research

The case research as a whole can be subdivided into a pre-visit stage, the data collection stage, a post-visit stage and a data analysis stage. Each of these stages is discussed below.

5.1 Pre-visit stage/ data collection preparation

This stage takes place before the actual data can be collected. It concerns contacting a potential case provider, getting acquainted and providing and getting all the essential information for doing the case study at this focal firm.
Steps to be taken include:

- Get into contact and find person responsible for innovation

- Call person and check interest in participating in UWS: explain project briefly, check whether firm would have interesting innovation projects and try to arrange face to face meeting.
- Send invitational letter and confirm meeting. Send *UWS pitch* with letter / email.
- First meeting serves to get introduced to each other (to this end, always bring some prints with you with the *UWS pitch*, the *Chesbrough 2010 (HBR*) article and the *AMSI leaflet* on executive education), to fully explain research project, what is in it for the focal firm (reflection on projects and innovation, how this works within the organization and how OI is done compared to other case studies that we conduced). Emphasize that we want to build a bring-and-take relationship. Also important in this meeting to clarify and check the case selection criteria. Try to come up with a suitable case study and make arrangements on the future steps to take.
- Check required confidentiality. If appropriate, state we are willing to sign a (non)disclosure agreement
- Make arrangements on key informant, when and how to reach this person, what this person is going to do for you (e.g. arrange company and case documentation, arrange and inform interviewees etc.)

Once a suitable case has been identified, write a case description based on publicly available information. This description, or synopsis, includes information on both the focal firm and on the specific case (i.e. open innovation project). Try to answer the following questions:

Guiding questions that serve as input for case synopsis:

- What industry is the focal firm in?
- How is the firm organized?
- What are the firm's primary products and services / main business lines?
- Who are the firm's most important customers in its main business lines?
- Who are the firm's most important competitors?
- How can you characterize the overall firm strategy? How to characterize strategies of different business units?
- How important is innovation in the focal firm? Why, what environmental / firm characteristics contribute to this?
- What is the particular project/ innovation developed by means of open innovation? What is it about, how and why was it developed, with whom, etc.
- Who are the partners that the focal firm cooperates with in this innovation development: describe these firms briefly along the questions stated above.

Some statistics are also useful:

- How many employees does the firm have? How did this number develop over the past years?
- What is the firms annual turnover? How did this number develop over the past years?
- How long is the firm in business?
- What is the perceived market the firm operates in (local, regional, national, international)? Which of these geographical regions was the firm's largest market, in terms of turnover (2007-2009)?
- Client satisfaction rates, turnover, efflux of employees, etc.
- Etc.

5.2 On-site data collection

Interviews

Interviews are conducted following the interview guide that was developed for United We Stand. All questions in the guide should be addressed during each interview, however, the focus of each interview might differ slightly depending on the position of the interviewee. The questions do not have to be covered in a particular order, make sure the interview primarily has a logical flow. Questions 'missed' along the course of the conversation have to be asked at the end of the interview.

Besides the questions stated in the interview guide, students are encouraged to add some own questions to the guide to be able to explore a topic to their particular interest in more detail, to be worked out in their master thesis.

Interviews should be recorded, with permission of the interviewee. Recorded interviews should be added to the case study database.

After each interview, the interviewer and student fill out the summary contact form in which the first insights from the particular interview are captured. In addition, students have to produce an interview transcript after each interview. The transcript contains all the information that was gained during the interview, worked out in detail (however, not necessarily literally). Transcripts should be added to the case study database.

Documentation

Students are expected to gather documentation on the case company and the open innovation project. This documentation is used to gain additional information and/or to verify the information gathered during the interviews.

Examples of relevant documentation are: annual reports, websites, minutes of meetings, presentations, project plans, handbooks, etc.

Observations

Observations give a rich picture of the processes and practices used by the case organization and in the innovation project and might be obtained when being at the company site for general visits, tours or during meetings and regular workdays. During each observation visit, notes should be taken and worked out shortly after the visit to ensure you capture most of the things that have been observed.

Field notes

We encourage students to keep additional field notes. Field notes are a running commentary about what is happening in the research, involving both observed patterns and analysis (preferably separate from one another). Even prior to formal data analysis, it is important that the researcher is sensitive to the emergence of patterns observed in the case. Therefore, it is often useful to record ideas, impressions, etc. as soon as they occur and certainly before formal analysis takes place. The noted can include your own comments on problems and ideas that arise during the fieldwork and that will guide your further research. Field notes should be added to the case study database.

5.3 Post-visit stage

5.3.1 Early steps in analysis

Data collection and data analysis are iterative stages of the qualitative research process.

Early analysis of the data, that commences when data collection is still ongoing, helps the researcher to go back and forth between thinking about the existing data and generating

strategies for collecting new, often better, data. It can be a healthy corrective for build-in blind spots. It makes analysis an on-going, lively enterprise that contributes to the process of fieldwork (Miles and Huberman, 1996, p. 50).
Methods for early analysis used in this research are:

- Contact summary sheets: to reflect on the main concepts, themes, issues and questions, in order not to get lost in details of interview transcripts and fieldnotes
- Document summary sheets: to reduce and clarify documents gathered.
- Codes and coding
- Memo'ing
- Case analysis meetings
- Interim case summaries

5.3.2 Development of case narrative
On the level of the case / OI project, a case narrative has to be constructed from the data collected and analyzed. To this end, interview transcripts, documents, field notes and the outcomes of early analysis tools and methods are collected and summarized along the main topics of interest to our research.
A report or case narrative should be produced as soon after the visit(s) as possible. It includes a description of the case (the open service innovation project investigated). In addition, it contains all notes and documents categorized by research variable and organized into a coherent text within each category. It also includes any reflections by the researcher about case-study questions attempting to integrate the available evidence and to converge upon facts of the matter or their tentative interpretation. The narrative should be added to the database.

Besides the main issues that need to be addressed with respect to the United We Stand project, each student might add two to three additional subjects to the case narrative format that address the specific research questions proposed in his or her master thesis.

5.3.3 In-depth case analysis
Different phases of data analysis might overlap, the same way as data collection might overlap with data analysis as described above. The early analysis methods described in section 5.3.1 as well as the case narrative constructed as described in 5.3.2, all ultimately serve and provide input for deeper *within and cross case analysis*, to be described in this section. Because of the close relations and iterations between various analysis stages, the description of the data analysis process given below overlaps partly with the methods of early analysis that were already covered in section 5.3.1.
Data analysis has two main aims:

- Reduction of data: reduce the material and data to its (relevant) core.
- Abstraction: transcend the concrete situation to make sure that your research produces information that is also relevant to others but the interviewees.

During the reduction and abstraction, the research question continuously forms the starting point. Based on this research question, you should ultimately come to a listing or description of aspects that are important in the light of your research question and certain relations between these aspects.
The various phases of the analysis stage are characterized by increasing reduction and abstraction, whereby the problem statement / research question continuously forms the starting point for the analysis.
Qualitative analysis can often be characterized as rather whimsical. There is no standard, linear method or procedure. You continuously try to explain the phenomena you found. This

explanation often has to be adapted because it, when applied to new material and data is not completely satisfactory. This continues until you have achieved maximum results.

Analysis stages:

1. Cancel out non-relevant text fragments (but always save the complete transcript in a separate file for later consultation)
2. Categorize text fragments and generic coding
3. Reduce and classify codes
4. Form core codes
5. Develop explanations, development of model and start developing theory

More concrete, the following steps can be used for reduction and abstraction:
Case analysis on the basis of matrices and different levels of analysis.
Per case / OI project. (Miles and Huberman, 1994, chapter on Conceptually ordered displays. Also: Kvale 1996 on qualitative analysis - condensation, p. 193)

1. produce interview transcript
2. code the transcript (divide the transcript into fragments and assign labels to these fragments (words, sentences or paragraphs) that are about similar constructs or topics. Also: place irrelevant parts of the interview in a separate document)
3. Summarize the quotations per code, per interviewee (level 0). The summary contains the central theme of the quotation:

Interviewee 1			
Code N	quotation 1…n	Summary of quotations concerning code N	
Code M	quotation 1…n	Summary of quotations concerning code M	
…			
Interviewee 2			
Code N	quotation 1…n	Summary of quotations concerning code N	
Code M	quotation 1…n	Summary of quotations concerning code M	
… etc.			

4. Produce a conceptually clustered matrix. This is a matrix that on the horizontal axis displays the code(s) and on the vertical axis, all interviewees who said something about this code are displayed. The display provides the summaries of the quotations per interviewee. (level 1)

Example of scheme:

	Code N	Code M
Interviewee 1	[summary, identification of theme(s) and key quotes]	[summary, identification of theme(s) and key quotes]
Interviewee 2	[summary, identification of theme(s) and key quotes]	-
Interviewee x	[summary, identification of theme(s) and key quotes]	[summary, identification of theme(s) and key quotes]

(for comparison among groups of respondents during within-case analysis, you could already cluster the interviewees according to 'interviewee type', e.g. employees from the focal firm, employees from various partner firms, customers, managers, etc. Or when doing cross-case analysis, use the determinants to cluster cases and start the analysis). Preferably use the conceptually clustered matrix for a small number of related codes (/clear conceptual themes) and related questions. It is important to interrogate the summary/key theme in terms of the specific purpose of the study (i.e. what does this statement tell me about open innovation)

5. The conceptually clustered matrix provides the input for a thematic conceptual matrix. Based on the summaries per informant, the researcher produces a summary of all informants' commentaries for each code (or, per group of informants, e.g. different parties involved in the open innovation project). These summaries are displayed by using a thematic conceptual matrix. On the horizontal axis, a particular theme or a number of related themes are stated. On the vertical axis each code involved in this theme is displayed with the number of quotations between brackets to show the amount of underlying quotations that led to the summary. (level 2) (look up details in Miles and Huberman, 1994!).

…	…	…
Code N [#]	[code summary]	
Code M [#]	[code summary]	

Kvale: Tie together the essential, non-redundant themes of the entire interview into a descriptive statement. In the end, you have condensed the expressed meanings into more and more essential meanings.

Interview Questionnaire (in Dutch)

INTRODUCTIEVRAGEN OVER DIENSTENINNOVATIE

1. Hoe belangrijk zijn nieuwe dienstenervaringen en oplossingen binnen Vitae?
2. Wat zijn volgens u de belangrijkste veranderingen in de manier waarop met diensteninnovatie wordt omgegaan binnen Vitae (vergeleken met 2-3 jaar geleden) en welke veranderingen verwacht u voor de komende 2-3 jaar?

PROJECTBESCHRIJVING

3. Kunt u de Tata-case kort beschrijven?
4. Hoe past de Tata-case binnen de strategische doelen van Vitae?
5. Wat was de strategische motivatie om open innovatie aan te wenden?
6. Welke (typen) samenwerkingspartners zijn actief betrokken bij de Tata-case?
7. Welke rol speelde elke partner in de Tata-case; wat draagt elke partner bij?
8. Hoe heeft het feit dat werving en selectie een dienst is de manier waarop de Tata-case is ontwikkeld en gecommercialiseerd beïnvloed?

VORM (PROCES EN TOEPASSINGEN)

9. Hoe is de Tata-case tot stand gekomen, welke fasen heeft u hiertoe met uw partners doorlopen?
10. Hoe heeft de Tata-case zich in de loop van het innovatieproces ontwikkeld?
11. Welke middelen en praktijken zijn gebruikt om het innovatie proces meer open te maken?
12. Welke informatiebronnen zijn gebruikt om de Tata-case te ontwikkelen?
13. Hoe is het initiële idee voor de Tata-case meer concreet gemaakt tussen de partners?
14. Welke factoren hebben samenwerking vergemakkelijkt tijdens de ontwikkeling van de Tata-case?
15. Op welke manieren wordt waarde gegenereerd door de Tata-case en hoe wordt deze geïnternaliseerd binnen Vitae?

MANAGEMENT

16. Hoe hebben de relaties met de partners zich ontwikkeld in de loop van het innovatieproces?
17. Hoe zijn de relaties / samenwerkingen geformaliseerd?
18. Hoe is het open innovatie project in de dagelijkse praktijk gemanaged?
19. Waar in de organisatiestructuur is het innovatieproject geplaatst?
20. Hoe vindt besluitvorming plaats?
21. In welke mate worden de uitkomsten van het innovatieproces gemonitoord en geëvalueerd?
22. Hoe zou u vanuit het perspectief van open innovatie reflecteren op de Tata case, gebruik makend van een SWOT analyse?
23. Puttend uit uw ervaring in de Tata-case, welke belangrijke lessen kunt u ons meegeven met betrekking tot het management van open innovatie processen en projecten (in vergelijking met meer gesloten projecten)?

ORGANISATIEROUTINES (vul de checklist in met de geïnterviewde)

24. Welke organisatieroutines zijn belangrijk geweest in het creëren en uitrollen van de Tata-case?
25. Vul tabel organisatievaardigheden in.

AFSLUITING
Is er nog overige informatie die u graag wilt delen, die niet aan bod is gekomen in dit interview? Bij welke andere personen die bij de Tata-case betrokken zijn zouden we waardevolle interviews kunnen afnemen? Mogen we het interviewtranscript opsturen ter goedkeuren en, indien nodig, terugkomen met aanvullende vragen?

Aan het eind van het interview moeten we een gevoel hebben voor de volgende onderwerpen:
Hoe dynamisch is de bedrijfsomgeving van de Tata-case /Vitae?
In welke mate is de Tata-case onderdeel van de core business van Y?
Hoe zou je de mate van nieuwheid van de Tata-case karakteriseren?
Welke dienstendimensies zijn gewijzigd / is op gefocust om de Tata-case te creëren?
Welke elementen van de Tata-case zijn nieuw gecreëerd, welke zijn op een nieuwe manier gecombineerd?

Organisatievaardigheden (Dynamic Capabilities)
Definitie: Die moeilijk over te brengen en imiteren vaardigheden die organisaties bezitten om bestaande en nieuwe middelen en operationele vaardigheden te ontwikkelen en (her)configureren. Organisatiecompetenties, -routines en processen die nodig zijn om het diensteninnovatieproces te managen (Den Hertog et al, 2010)

- Vanuit uw ervaring in de Tata-case, welke organisatievaardigheden heeft een organisatie nodig om continu en op een duurzame manier zijn diensten te kunnen innoveren?
- Zijn specifieke routines benodigd voor het genereren van ideeen? Voor het doorontwikkelen ervan? Voor commercialisatie?

Dynamische innovatie vaardigheden die gebruikt zijn bij diensteninnovatie	*Aanwezig*	*Mate van belangrijkheid in:*		
	Ja / Nee	*Idee generatie*	*Door-ontwikkelen*	*Commercialisatie*
Signaleren van gebruikerswensen Klanten begrijpen en ver van tevoren hun (potentiële) behoeften waarnemen door actief met deze klanten te interacteren.				
Signaleren van veelbelovende technologische ontwikkelingen Opmerken van veelbelovende technologieën die de diensteninnovatie mogelijk kunnen maken of kunnen vergemakkelijken				
Conceptualiseren Omzetten van ruwe ideeën in een concreet en levensvatbaar dienstenaanbod of dienstenconcept.				
Bundelen (ontbundelen) Het maken van slimme combinaties van bestaande dienstenactiviteiten en -elementen om deze gezamenlijk op de markt te brengen (het uitkleden van diensten naar hun essentiële componenten om deze individueel op de markt te brengen).				
Co-produceren en orchestreren Deelnemen aan samenwerkingsverbanden en samenbrengen van verschillende partners om gezamenlijk nieuwe dienstenervaringen en –oplossingen te creëren.				
Opschalen en uitbreiden Vermogen om een nieuw dienstenconcept te repliceren en te verspreiden binnen andere onderdelen van de eigen organisatie en naar andere markten.				
Leren en aanpassen Vermogen om bewust te leren van de manier waarop met diensteninnovatie wordt omgegaan en, wanneer nodig, het complete diensteninnovatieproces aan te passen.				

Appendix III: Output figures and tables

A3.1 Occurrence of DSICs: One sample T-test for checking statistical significance of different means.

	Test Value = 0					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
SensingUserNeeds	45,084	168	,000	4,61933	4,4171	4,8216
SensingTechOptions	49,284	168	,000	5,05917	4,8565	5,2618
BundlingUnbundling	52,972	168	,000	4,74083	4,5641	4,9175
CoproducingOrchestrating	38,795	168	,000	4,49408	4,2654	4,7228
ScalingStretching	38,262	168	,000	4,31953	4,0967	4,5424

A3.2 Occurrence of DSICs: ANOVA-test for differences between firms that do not at all have their turnover mainly from service provision and those who do (based on their own response).

			Sum of Squares	df	Mean Square	F	Sig.
SIG1a * No_services	Between Groups	(Combined)	24,345	1	24,345	14,853	,000
	Within Groups		273,721	167	1,639		
	Total		298,066	168			
SIG2a * No_services	Between Groups	(Combined)	8,694	1	8,694	4,998	,027
	Within Groups		290,492	167	1,739		
	Total		299,186	168			
BUNDa * No_services	Between Groups	(Combined)	26,931	1	26,931	22,434	,000
	Within Groups		200,477	167	1,200		
	Total		227,408	168			
CandOa * No_services	Between Groups	(Combined)	33,392	1	33,392	16,042	,000
	Within Groups		347,602	167	2,081		
	Total		380,994	168			
SandSa * No_services	Between Groups	(Combined)	5,081	1	5,081	2,378	,125
	Within Groups		356,776	167	2,136		
	Total		361,857	168			

A3.3 Occurrence of DSICs: ANOVA-test for differences between firms that are registered in a service sector and those who don't (based on NACE-classification).

ServiceSector		Sensing User Needs	Sensing Tech. Options	Bundling Unbundling	Coproducing Orchestrating	Scaling Stretching
NO	Mean	4,7714	5,1714	4,8800	4,6857	4,1619
	N	35	35	35	35	35
	Std. Dev.	1,32786	1,38708	1,19430	1,67633	1,36332
YES	Mean	4,5796	5,0299	4,7045	4,4440	4,3607
	N	134	134	134	134	134
	Std. Dev.	1,33517	1,32419	1,15706	1,46084	1,49577
Total	Mean	4,6193	5,0592	4,7408	4,4941	4,3195
	N	169	169	169	169	169
	Std. Dev.	1,33199	1,33449	1,16345	1,50593	1,46762

A3.4 Occurrence of DSICs: Report and ANOVA-test for differences between firms of different sizes.

Size Categroy		Sensing User Needs	Sensing Tech Options	Bundling Unbundling	Coproducing Orchestrating	Scaling Stretching
<50	Mean	4,5586	5,1351	4,7477	4,3694	4,2492
	N	111	111	111	111	111
	Std. Dev.	1,37742	1,40373	1,21826	1,57352	1,48967
50-250	Mean	4,6989	4,8495	4,6387	4,6452	4,4624
	N	31	31	31	31	31
	Std. Dev.	1,30910	1,26444	1,17691	1,43871	1,61859
>250	Mean	4,9259	5,0000	4,7778	5,2222	4,1111
	N	9	9	9	9	9
	Std. Dev.	,90948	1,11803	,94045	,83333	1,36423
Total	Mean	4,6093	5,0684	4,7272	4,4768	4,2848
	N	151	151	151	151	151
	Std. Dev.	1,33708	1,35828	1,18939	1,52133	1,50328

N = 151; there are 18 missing cases for size.

			Sum of Squares	df	Mean Square	F	Sig.
SIG1a * size_cat	Between Groups	(Combined)	1,437	2	,719	,399	,672
	Within Groups		266,732	148	1,802		
	Total		268,169	150			
SIG2a * size_cat	Between Groups	(Combined)	2,022	2	1,011	,545	,581
	Within Groups		274,715	148	1,856		
	Total		276,737	150			
BUNDa * size_cat	Between Groups	(Combined)	,313	2	,156	,109	,897
	Within Groups		211,886	148	1,432		
	Total		212,199	150			
CandOa * size_cat	Between Groups	(Combined)	7,161	2	3,580	1,558	,214
	Within Groups		340,008	148	2,297		
	Total		347,169	150			
SandSa * size_cat	Between Groups	(Combined)	1,389	2	,695	,305	,738
	Within Groups		337,588	148	2,281		
	Total		338,977	150			

A3.5 Rotated Component Matrix from principal component analysis on SIPD-items, eigenvalue >1. N=169.

	Component		
	1	2	3
SIPD1A	,680		
SIPD1B	,682		
SIPD1C	,571		,420
SIPD2A			,872
SIPD2B			,843
SIPD2C			
SIPD3A	,531	,428	
SIPD3B	,460	,610	
SIPD4A		,711	
SIPD4B		,816	
SIPD5A		,775	
SIPD5B	,630	,428	
SIPD6A	,771		
SIPD6B	,767		

A3.6 Occurrence of SIPDs: One sample T-test for checking statistical significance of different means.

	Test Value = 0					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
ServiceConcept	43,081	168	,000	4,73964	4,5224	4,9568
CustomerInteraction	37,642	168	,000	4,34615	4,1182	4,5741
BusinessPartner	32,965	168	,000	3,88757	3,6548	4,1204
RevenueModel	30,221	168	,000	3,43491	3,2105	3,6593
TechDeliverySystem	34,448	168	,000	4,78107	4,5071	5,0551

A3.7 Occurrence of SIPDs: ANOVA-test for differences between firms of different sizes.

			Sum of Squares	df	Mean Square	F	Sig.
ServiceConcept * size_cat	Between Groups	(Combined)	,173	2	,087	,043	,958
	Within Groups		298,649	148	2,018		
	Total		298,823	150			
CustomerInteraction * size_cat	Between Groups	(Combined)	5,648	2	2,824	1,272	,283
	Within Groups		328,538	148	2,220		
	Total		334,185	150			
BusinessPartner * size_cat	Between Groups	(Combined)	1,030	2	,515	,219	,803
	Within Groups		347,745	148	2,350		
	Total		348,775	150			
RevenueModel * size_cat	Between Groups	(Combined)	2,331	2	1,166	,525	,593
	Within Groups		328,715	148	2,221		
	Total		331,046	150			
TechDeliverySystem * size_cat	Between Groups	(Combined)	3,023	2	1,512	,464	,630
	Within Groups		482,463	148	3,260		
	Total		485,487	150			

A3.8 Occurrence of SIPDs: Report and ANOVA-test for differences between firms that do not at all have their turnover mainly from service provision and those who do (based on their own response).

No_services		ServiceConcept	CustomerInteraction	BusinessPartner	RevenueModel	TechDeliverySystem
,00	Mean	4,7971	4,3354	3,9627	3,4938	4,8323
	N	161	161	161	161	161
	Std. Deviation	1,41233	1,51531	1,50474	1,46094	1,80446
1,00	Mean	3,5833	4,5625	2,3750	2,2500	3,7500
	N	8	8	8	8	8
	Std. Deviation	1,37725	1,23744	1,38229	1,38873	1,55839
Total	Mean	4,7396	4,3462	3,8876	3,4349	4,7811
	N	169	169	169	169	169
	Std. Deviation	1,43023	1,50099	1,53310	1,47758	1,80426

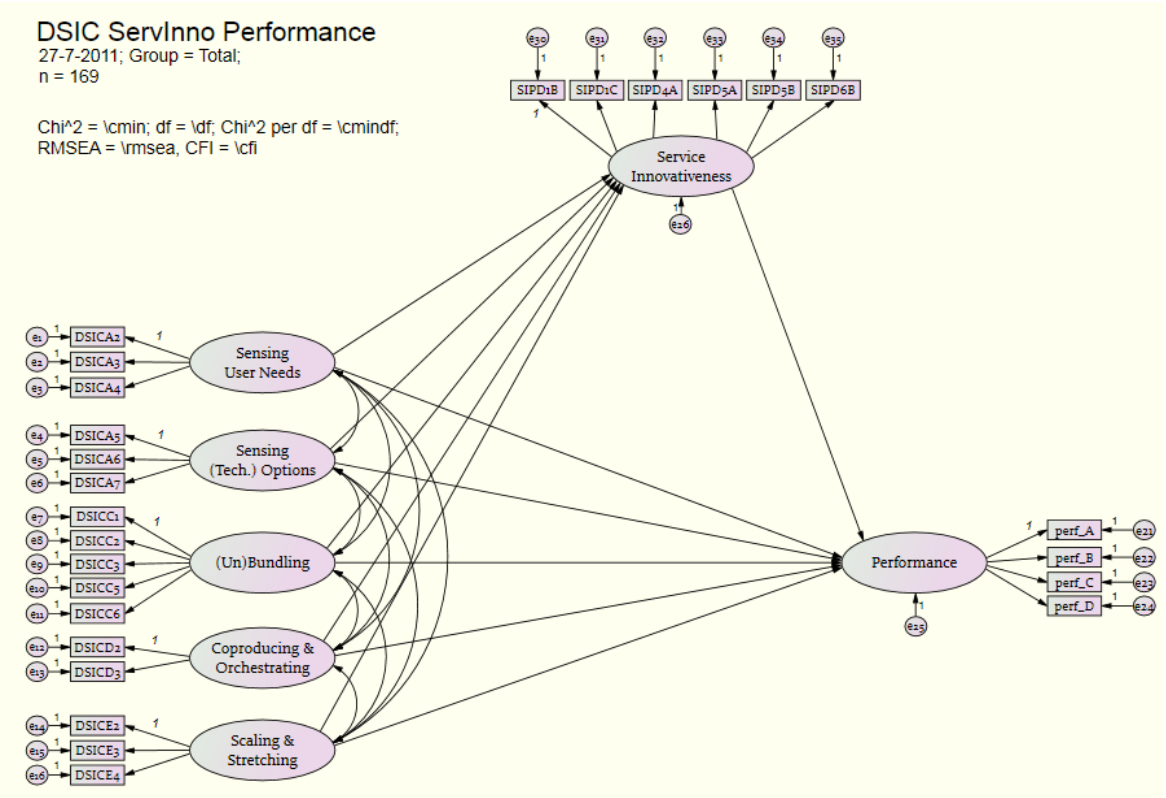
			Sum of Squares	df	Mean Square	F	Sig.
ServiceConcept * No_services	Between Groups	(Combined)	11,228	1	11,228	5,641	,019
	Within Groups		332,428	167	1,991		
	Total		343,655	168			
CustomerInteraction * No_services	Between Groups	(Combined)	,393	1	,393	,174	,677
	Within Groups		378,107	167	2,264		
	Total		378,500	168			
BusinessPartner * No_services	Between Groups	(Combined)	19,213	1	19,213	8,541	,004
	Within Groups		375,651	167	2,249		
	Total		394,864	168			
RevenueModel * No_services	Between Groups	(Combined)	11,790	1	11,790	5,546	,020
	Within Groups		354,994	167	2,126		
	Total		366,784	168			
TechDeliverySystem * No_services	Between Groups	(Combined)	8,927	1	8,927	2,771	,098
	Within Groups		537,972	167	3,221		
	Total		546,899	168			

A3.9 Occurrence of SIPDs: Report and ANOVA-test for differences between firms that are registered in a service sector and those who do not (based on NACE-classification).

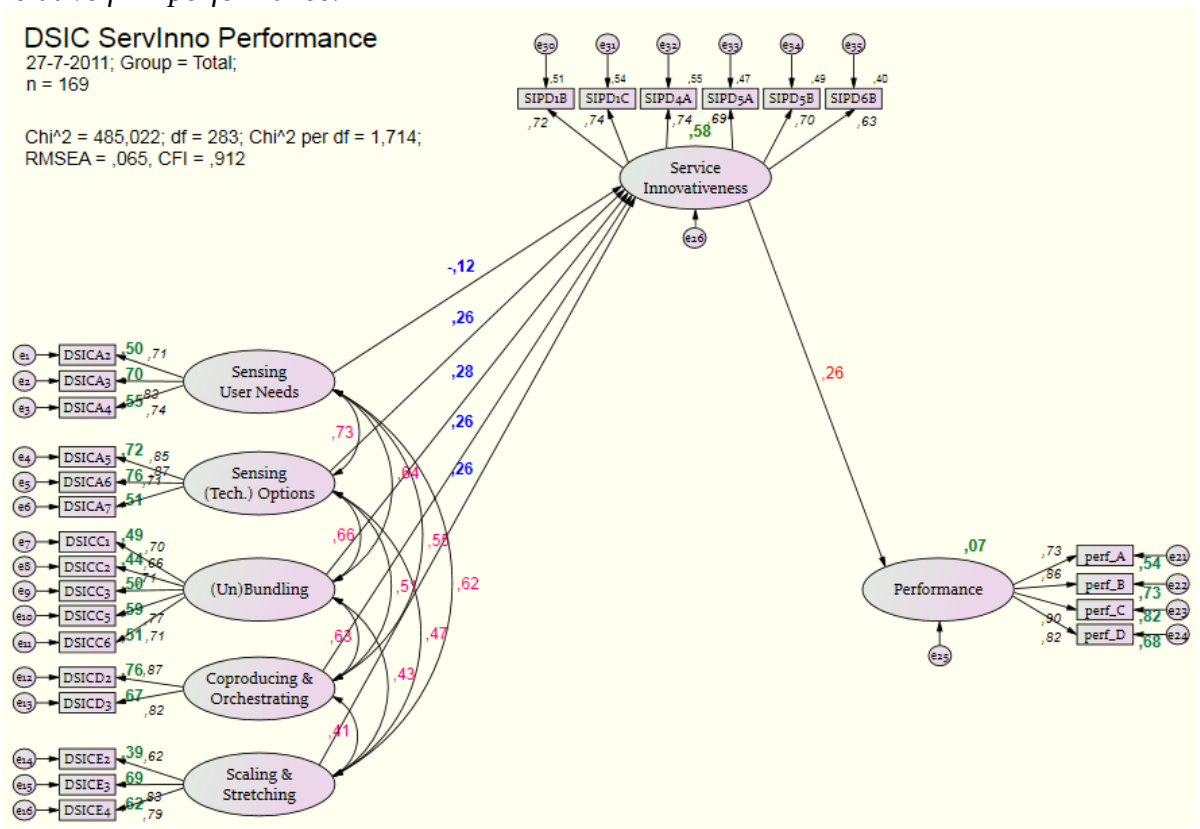
ServiceSector		ServiceConcept	CustomerInteraction	BusinessPartner	RevenueModel	TechDeliverySystem
,00	Mean	4,7524	4,1143	4,2143	3,6714	4,6000
	N	35	35	35	35	35
	Std. Deviation	1,63967	1,70245	1,58247	1,63574	2,01392
1,00	Mean	4,7363	4,4067	3,8022	3,3731	4,8284
	N	134	134	134	134	134
	Std. Deviation	1,37715	1,44468	1,51437	1,43360	1,75051
Total	Mean	4,7396	4,3462	3,8876	3,4349	4,7811
	N	169	169	169	169	169
	Std. Deviation	1,43023	1,50099	1,53310	1,47758	1,80426

			Sum of Squares	df	Mean Square	F	Sig.
ServiceConcept * ServiceSector	Between Groups	(Combined)	,007	1	,007	,003	,953
	Within Groups		343,648	167	2,058		
	Total		343,655	168			
CustomerInteraction * ServiceSector	Between Groups	(Combined)	2,373	1	2,373	1,054	,306
	Within Groups		376,127	167	2,252		
	Total		378,500	168			
BusinessPartner * ServiceSector	Between Groups	(Combined)	4,712	1	4,712	2,017	,157
	Within Groups		390,152	167	2,336		
	Total		394,864	168			
RevenueModel * ServiceSector	Between Groups	(Combined)	2,469	1	2,469	1,132	,289
	Within Groups		364,315	167	2,182		
	Total		366,784	168			
TechDeliverySystem * ServiceSector	Between Groups	(Combined)	1,447	1	1,447	,443	,507
	Within Groups		545,452	167	3,266		
	Total		546,899	168			

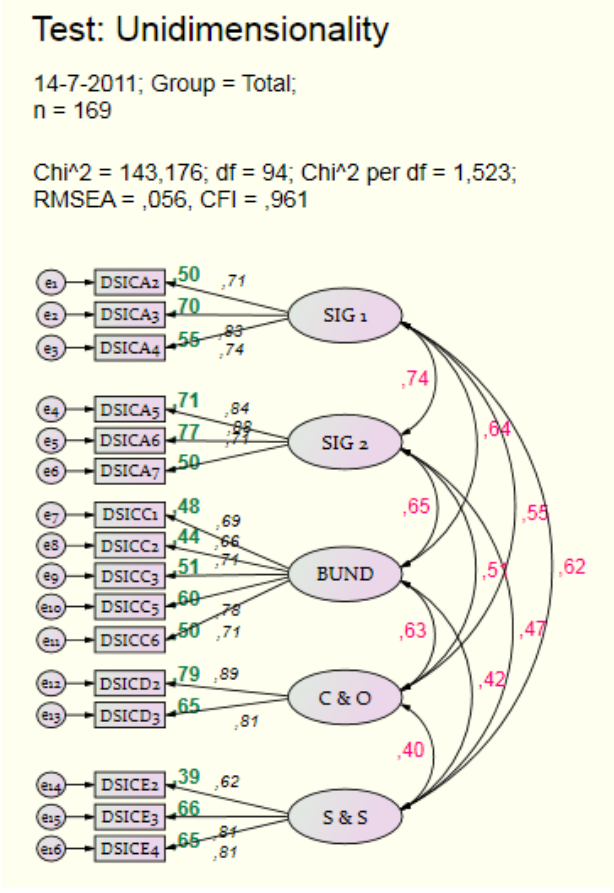
A3.10 Input-model for SEM-analysis (using AMOS 18).

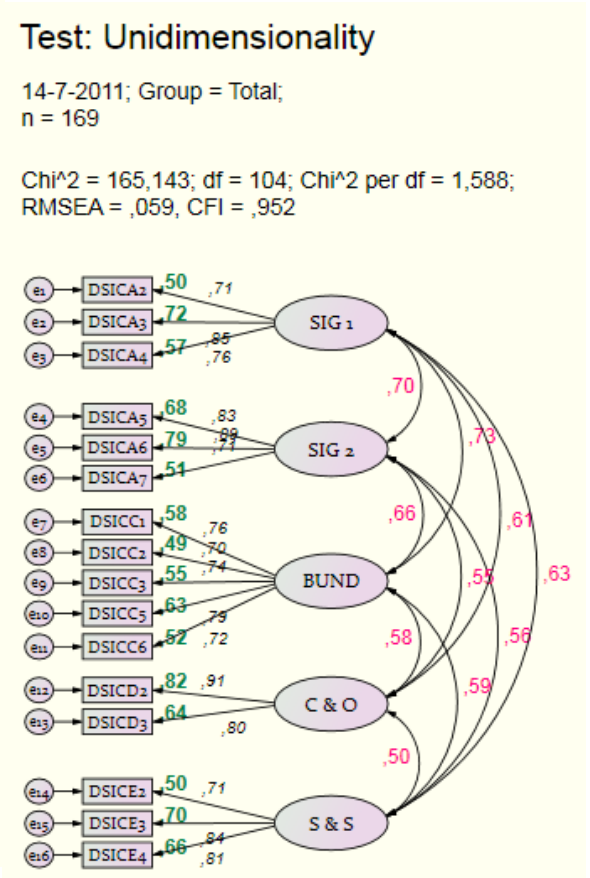


A3.11 Refined model; full mediation of service innovation on the link between DSICs and relative firm performance.



A3.12 Check for unidimensionality; AMOS-output





A3.13 Results of Principal Component Analysis of items for Market Dynamism.

	Component
	1
dyna_A	,863
dyna_B	,738
dyna_C	,882
dyna_Drev	,666

Extraction Method: Principal Component Analysis.

A3.14 Regression weights of reversed SEM-model.

			Estimate	S.E.	C.R.	P
Sensing_User Needs	<---	Service_Innovativeness	,674	,105	6,415	***
Sensing_(Tech.) Options	<---	Service_Innovativeness	,840	,111	7,532	***
(Un)Bundling	<---	Service_Innovativeness	,653	,095	6,840	***
Coproducing &_Orchestrating	<---	Service_Innovativeness	,798	,112	7,105	***
Scaling &_Stretching	<---	Service_Innovativeness	,563	,107	5,282	***
Performance	<---	Service_Innovativeness	,100	,327	,306	,760
Performance	<---	Sensing_User Needs	,025	,159	,155	,877
Performance	<---	Sensing_(Tech.) Options	,062	,134	,466	,641
Performance	<---	(Un)Bundling	,051	,198	,258	,796
Performance	<---	Coproducing &_Orchestrating	,013	,127	,105	,917
Performance	<---	Scaling &_Stretching	,148	,139	1,068	,285

Appendix VI: Questionnaire

The questionnaire on the following pages was sent to 5880 firms. Receivers could respond digitally or by returning the paper questionnaire in the return-envelop that was included. Attached was also a letter that explained the goals of the project and provided reasons to participate.