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A multi-level multidimensional approach for measuring dynamic capabilities in service innovation management

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Abstract

Service innovation is a domain with growing strategic importance for a broad variety of firms all around the world. Due to

a lack of adequate management models, many attempts to introduce new or enhanced services result in failures. One way of informing the field of service innovation about how organizations can adapt and reconfigure their resources is offered by the dynamic capability view (DCV). However, conceptualization and measurement of dynamic capabilities in service innovation have been difficult. This paper addresses this issue by arguing that a set of common dynamic service innovation capabilities consists of measurable processes on a lower level - their microfoundations. We introduce a new scale for measuring dynamic capabilities in service providing firms. This, in turn, allows for the development of a set of indicators to consistently measure them. We test the reliability and validity of the scale with multi-industry data collected from a survey conducted among 461 firms. Our results prompt discussion of a number of options for further research.

A multi-level multidimensional approach for measuring dynamic capabilities in service innovation management

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. Nowadays, services account for more than 70% of GDP and employment figures in Western economies (OECD, 2005). Even firms that are widely known for the technological goods they produce are switching towards a focus on service provision. Where service used to be seen as an addition ‘around the product’, more and more organizations actually rely on the services around the goods they deliver or even replace these goods entirely with services. An important reason for this service dominant logic (Vargo & Lusch, 2004) is the insight that more value can be added and appropriated when an organization delivers actual solutions and experiences. Producing goods might eventually run into a competition that is favourable for countries with low wages and cheap materials. In order to avoid the commodity trap, also manufacturing firms choose to leverage their knowledge of clients into new service offerings (Chesbrough, 2011). Thus, focusing on service innovation does not mean focusing on service firms alone; instead it allows a multi-industry perspective.

Despite their enormous socio-economic relevance, services and service innovation are under-researched phenomena (Gadrey & Gallouj, 2002, Drejer 2004). Traditional innovation research used to focus on manufacturing (Gallouj & Djellal, 2010), having a strong technological focus and thereby ignoring many ‘soft’ aspects of innovation. The fact that many attempts to develop new services are found to be unsuccessful (e.g. Smith et al., 2007) clearly expresses an urge for more theory on this account. An explanation for limitations in the understanding of service innovation is that they are essentially different from manufacturing activities. Traditional innovation theories may not be applicable in an industry of which the output is characterized as heterogeneous, intangible, non-stockable (due to simultaneous production and consumption) and coproduced with clients (Parasuraman, Zeithaml & Berry, 1985). All these factors hamper the development of innovation theories and thereby management instruments that can support service companies in enhancing their performance (Drejer, 2004; Nysveen & Pedersen, 2007; De Jong & Vermeulen, 2003).

Insights in how to achieve sustained competitive advantage are provided by strategic management. Over the past twenty years, the dynamic capability view (DCV) became to account for a dominant stream within management literature (Teece, 1997; Dosi et al. 2001, Prahalad and Hamel, 1990).

Given their abstract nature, measuring dynamic capabilities has proven to be quite a challenge (e.g. Zahra, Sapienza and Davidsson, 2006; Dutta, Narasimhan and Rajiv, 2005). Many authors expressed their critics against earlier attempts to do so (e.g. Priem and Butler, 2001; Arend & Bromiley, 2009). A major concern in qualitative studies is the fact that dynamic capabilities tend to be identified at an ad hoc basis, rather than on the basis of predefined concepts. Similarly, many qualitative studies limit themselves to proxies that

sometimes are very distant from the concept they are supposed to measure (e.g. using patents for measuring ‘technological capability’). An influential article that opened the door to more sound research was Eisenhardt and Martin (2000). They argued that dynamic capabilities have idiosyncrasies in their details, but communalities at a more general level. This conception allows for a multidimensional framework of common dynamic capabilities, which enables comparison amongst firms and even sectors. An aggregate perspective to dynamic capabilities was taken up by Den Hertog et al. (2010), who proposed a conceptual framework of dynamic capabilities specifically within service providing firms. The six dynamic service innovation capabilities (DSICs) they proposed are: sensing user needs and technological options, conceptualization, bundling and unbundling, coproducing and orchestrating, scaling and stretching, and learning and adapting. The availability of the conceptual set of DSICs has a huge potential for the management of service innovation. It covers a wide range of reconfigurative abilities, fitted to the specificities of service providing organizations. Acknowledging that service innovation occurs both in a wide variety of firms, including those classified as industrial, the DSICs are applicable to practically type of firms. However, Den Hertog et al. point at the challenge to contextualize their framework in order to discover which DSICs are dominant in which type of sector. Moreover, they urge for extra analysis in order to make their framework more comprehensive. Both types of research ‘requires rigorous formal testing of the proposed conceptual framework in both explorative case studies and large-scale surveys’ (2010, p. 506). It is the latter challenge we take up here.

Before entering the stage of empirical verification, either by case studies or surveys, there is yet another step to make. Increasing the comprehensiveness and development of measurement scales for dynamic service innovation capabilities can only occur when these concepts have a sound theoretical grounding. Therefore, we start with applying recent insights on the very nature of dynamic capabilities. Several authors have urged DCV-scholars to adopt a multilevel perspective on capabilities, in order to bridge the divide between higher order constructs and the actual behavioural and/or cognitive regularities a firm deploys (e.g. Foss, 2011). In the black-box approach that is typical for many DCV-studies, capabilities are considered as ‘truncated, collective, recurrent entities’ (Salvato and Rerup, 2011). Neglecting the microfoundations of dynamic capabilities leads to difficulties in understanding what these abstract concepts essentially represent (Teece, 2007). As a consequence, the measurement of dynamic capabilities misses a solid basis of observable traits. Moreover, drawing prescriptive lessons from DCV-research is hampered by the lack of theoretical and empirical links with actual firm behaviour and structure. In order to provide such fundamentals, we start with providing a multi-layered multidimensional perspective on dynamic capabilities. This conceptualization will serve as the basis for our attempt to measure dynamic service innovation capabilities.

Enabled by the perspective we introduce, the ultimate goal of this paper is to develop and validate a consistent measurement scale for dynamic capabilities amongst service providing firms. Our results contribute primarily to the literature of service innovation management, but also enrich the dynamic capability view. 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. In our view, a multi-level multidimensional perspective to dynamic capabilities helps to meet these criteria. Bridging the divide between microfoundations and higher constructs makes dynamic capabilities more comprehensive, allows for their measurement, and provides a basis for normative implications. As argued by Helfat et al. (2007) a mixed method approach towards DCV is essential for coping with its abstract nature. In this paper we present the results of our statistical analysis, of which the validity can be supported later on (i.e. not reported here) by case-studies we performed. After establishing our conceptualization of dynamic (service innovation) capabilities, we propose a set of core processes, structures or techniques that undergird the DSIC-concepts. Secondly, we develop scales for measuring DSICs. Hereby, we lay the foundations for quantitative studies on the nature and importance of DSICs.

The remainder of this paper is as follows. First, we elaborate more on the nature of dynamic capabilities and issues related to their measurement (section 2). Besides introducing a multi-level multidimensional approach, we describe the dynamic service innovation capabilities as proposed by Den Hertog et al. (2010). On this basis of a list of undergirding processes and structures we identified, we develop a measurement scale in section 4. Results of our quantitative analysis will be discussed, as well as the reliability and validity of this scale. Finally, in section 5, we conclude with a discussion containing suggestions for further (management-oriented) research.

2. Theory

As an extension of the resource based view (RBV), the dynamic capability view (DCV) is based on the idea that competitive advantage can be assigned to the resources and capabilities a firm possesses (Wernerfelt; 1984; Barney, 1991). The RBV states that a firm will outperform competitors when its resources meet the so-called VRIN-criteria; valuable, rare, inimitable and non-substitutable (Barney, 1991). An important critique is that the RBV only provides explanations and guidance in static situations (Bowman and Ambrosini, 2003). When circumstances change, new configurations of resources will gain favor and strength of current asset positions can disappear. The DCV is an answer to these critiques. Initially, dynamic capabilities are coined as a firm's ability to "integrate, build and reconfigure internal and external competencies to address rapidly changing environments" (Teece et al., 1997). Long-term performance is argued to depend on a firms' competences to renew, reorganize and refocus itself. 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. Although dynamic capabilities were proposed as essential capacities for coping with market changes (Teece et al. 1997), it is argued that they are relevant in more static markets as well (Eisenhardt and Martin, 2000; Zollo and Winter, 2002; Helfat and Winter, 2011). With the development of the DCV, definitions got redefined. Zollo and Winter (2002) describe a dynamic capability as "the learned and stable pattern of collective activity through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness". Helfat et

al. (2007) state that “a dynamic capability is the capacity of an organization to purposefully create, extend or modify its resource base” (Helfat et al., 2007).

From the ever expanding scholarly debate about dynamic capabilities, two major issues with respect to their nature can be abstracted: hierarchy and multidimensionality. A line of questions concerning the first issue is: on which traits do dynamic capabilities rely; how do their microfoundations look and how do these relate to dynamic capabilities? The second issue relates to questions like: which dynamic capabilities can we distinguish; is there a comprehensive set of distinct dynamic capabilities? On the basis of these questions, we continue our discussion of what dynamic capabilities really are. In doing so, we move towards a perspective that allows us to actually measure dynamic capabilities in the specific context of service innovation management.

Multi-level perspective

The DCV-literature shows that many of the proposed definitions leave ample room for discussion (e.g. Wang and Achmed, 2007). An important question concerns the place in which dynamic capabilities reside. It is commonly stated that dynamic capabilities are not processes themselves, but that they are embedded within processes. The subtle difference here is that one cannot 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 behaviour 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. Behaviour that entirely relies on talent is excluded as well.

Remarkable is also the two different objects in the earlier presented definitions; dynamic capabilities can be used for changing routines and for changing the resource base. Confusion may arise because of the broad use of the notion ‘resource’; this can relate to 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 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 cannot be denied that there is some logic in this more differentiated alternative, the mainstream DCV still distinguishes zero-order resources and operational capabilities on the one hand, and first-order dynamic capabilities on the other hand.

We find it worthwhile to elaborate more on how lower order resources and higher order constructs relate to each other. Most of the discussions tend to look at the direction in which higher order capabilities influence the reconfiguration of more routine-like capabilities. However, equally important is how lower order resources and capabilities shape the higher order constructs. Given the multi-layered nature of routines and capabilities, it has been urged to break capabilities into component elements; their microfoundations (Salvato and Rerup, 2011). According to Foss (2011) establishing the link between microfoundations and capabilities is essential for creating explanatory leverage for every resource-based theory. Teece himself did a notable contribution in this perspective with his ‘effort to separate the microfoundations of dynamic capabilities from the capability itself’ (Teece, 2007). He did this by making distinctions between ‘the organizational and managerial processes, procedures, systems, and structures that undergird each class of capability, and the capability itself’. However, the actual content of the microfoundations he proposes is highly specific for technology firms in highly dynamic markets. This makes it difficult to apply directly in the context of service innovation, leaving us only with a promising theoretical approach.

Multidimensionality of dynamic capabilities

The second issue we address concerns the identification of specific dynamic capabilities. The microfoundations Teece et al. (1997) proposed consist of three organizational and managerial processes¹ that were later explained to be a subset of processes that support the dynamic capabilities of sensing, seizing and managing threats (Teece, 2007). Earlier, specific types of dynamic capabilities were 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 (2007) 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 theories or research with a more general coverage, including our ambition to stretch over all activities of service innovation.

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 forms of the dynamic capabilities

¹ These processes are: coordination/integrating, learning, and reconfiguring.

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. Drnevich and Kriauciunas (2011), like several authors before them, argue that dynamic capabilities contribute especially to firm performance when they are heterogeneous, i.e. unique, customized, idiosyncratic and/or specific to a firm.

Eisenhardt and Martin (2000) question this heterogeneity and some DCV-critiques. 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 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. An aggregate multidimensional perspective on dynamic capabilities was taken up by Edwards in 2001 (Baretto, 2010), and also other authors did attempts to disaggregate dynamic capabilities into their component parts. Thereby, they provided several candidates for main component factors. Earlier, we mentioned the framework Teece proposed (2007), consisting of abilities to *signal* the market, *seize* opportunities and *reconfigure* the organization. Wang and Ahmed (2007) write about *adaptive capabilities*, *absorptive capabilities* and *innovative capabilities*. 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 methods 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 New Service Development literature rather than the DCV.

Many of the attempts to develop a multi-construct framework of dynamic capabilities do not meet the broad perspective that we prefer to take in this paper. In order to capture all the dynamics of reconfiguration of resources and capabilities in service providing firms

(whatever sector they are categorized in), we do not wish to exclude dynamic capabilities that are somehow related to these activities. Operationalizations of dynamic capabilities that tend to focus on a single aspect do not meet this criterion. An example is the model for service innovation by Ordanini and Parasuraman (2011), in which a dynamic capability of customer orientation is combined with collaborative competences and knowledge interfaces in order to explain innovative outcomes and firm performance. Similarly, the ‘capability-based framework for open innovation’ by Lichtenthaler and Lichtenthaler (2009) only takes into account a variety of knowledge management dynamic capabilities, and García-Morales et al. (2011) study strategic dynamic capabilities by focusing on transformational leadership capability (which they relate to shared vision capability and teamwork cohesion capability). The dynamic capability-building framework for elevated service offerings by Agarwal and Selen (2009) does contain a scope for enhancement within service organizations, but has a strong focus on innovation through partner-arrangements. Generic sets like the framework by Teece (2007) and Ambrosini, Bowman and Collier (2009) are neither preferable. The danger here is that they tend to miss out on specificities of reconfigurations in service providing firms. Finally, our criterion also implies that sets with highly specific applications, like the one by Avlonitis et al. (2001) for financial services, are no ideal candidates.

Recently, the DCV brought forward a coherent framework which does capture a large variety of activities related to reconfigurations in service providing organizations. Den Hertog et al. (2010) proposed a set of six higher order abilities, called dynamic service innovation capabilities (DSICs). Together, these abilities stretch over a wide range of competences, processes and other forms of resources that are crucial for the improvement and renewal of services a firm delivers. Many years of empirical and theoretical research form the basis for the set of dynamic capabilities Den Hertog et al. (2010) developed. Since the DSICs evolved out of contributions within both the DCV and service innovation literature, similarities can be found with (sets of) capabilities that were identified elsewhere. In the description of the six dynamic service innovation capabilities, provided in section 3, we will refer back to some of these influences.

Conceptual framework

So far, we discussed how views of hierarchies and communalities in the nature of dynamic capabilities emerged. Building on these developments, some of them very recent, we synthesize them into a coherent conceptual framework. Figure 1 provides a visual representation of our multi-level approach.

INSERT FIGURE 1 HERE

Essential for the comprehensiveness of dynamic capabilities is their link with microfoundations. When disaggregating capabilities, it is common to take individuals as the most basic level (e.g. Grant, 1996). Their actions, cognitions and even emotions represent the most concrete forms of resources undergirding capabilities (Salvato and Rerup, 2011).

Whenever these aspects occur in a repeated fashion, one could speak of practices. Aggregating a coherent configuration of practices into a higher level of abstraction, we can characterize a firm by its patterned processes and structures. Finally, dynamic capabilities are regarded as a set of core processes (Teece, 2007). These individual core processes each serve to perform functional activities. However, together they give shape to dynamic capabilities that allow a firm to reorganize itself and its output (Helfat et al. 2007). Note that this representation of different layers in reality is not that clear-cut. Some processes, for example, can rely on a single practice, which makes them hard to distinguish from each other.

By going down the hierarchy, the number of ways to deploy a capability increases. A dynamic capability relies on a few core processes. These, in turn, can each be achieved by a variety of different practices, constituted on even a bigger number of behaviours and cognitions. This structure follows the notion of equifinality (Eisenhardt and Martin, 2000), stating that there are different ways to achieve a common dynamic capability. Which way is most suitable depends on the current composition of microfoundations a firm possess. Therefore, the optimal way to build a dynamic capability varies for each firm.

As discussed extensively, recent contributions to the DCV prefer to speak of sets of dynamic capabilities rather than ‘the’ dynamic capability of the firm. Acknowledging that there are different dimensions of dynamic capabilities, our representation contains several sides. The reason these triangles are connected to each other, forming a solid pyramid, denotes that individual microfoundations (regardless the level of abstraction one is looking at) rarely constitute a single capability exclusively. The extent to which a microfoundation supports a particular capability determines where in the body of our conceptual pyramid it should be located. A process dedicated to a single capability is conceptually placed at the corresponding surface, whereas a process equally related to several capabilities lies more in the centre of the three-dimensional shape. Especially in the lower parts of the pyramid, it is clear that certain actions or practices might undergird several dynamic capabilities. This conception of interrelatedness and complexity meets the urge to rethink organisational capabilities as assemblages or networks of heterogeneous parts, rather than as collective entities (Salvato and Rerup, 2011).

The proposed multilevel multidimensional approach contains an important implication for attempts to measure dynamic capabilities. Instead of focusing on the abstract high-level constructs directly, with resulting vague survey-questions, it allows researchers to look at microfoundations that can be observed more easily and accurately. As long as it is clear which dynamic capability is being supported, it is possible to measure those microfoundations existing at a lower in the conceptual hierarchy. However, the problem which arises is the increasing options for fulfilment. With a higher number of behaviours and structures to measure, it becomes more difficult to create a comprehensive image of the actual presence and strength of a dynamic capability. Hence, we encounter a common trade-off between reliability and validity.

In our attempt to measure dynamic service innovation capabilities, we then choose to focus on the firm processes and structures which are neither too high in the conceptual hierarchy,

nor too low. This requires an identification of observable microfoundations (at the process-level) for each of the present dimensions. By consulting service innovation literature we develop a list of processes and structures that indicate the presence of every individual dynamic service innovation capability. It remains challenging to develop a list of perfectly observable items stretching the full coverage of DSICs. As Teece stated (2007): “identification of microfoundations must be necessarily incomplete, inchoate and somewhat opaque”. Although these threatening weaknesses are unavoidable to a certain extent, they should not discourage scholars from attempts to explore the nature of dynamic capabilities in more depth.

Dynamic Service Innovation Capabilities and their microfoundations

In this section we briefly describe the dynamic service innovation capabilities, for more detail we refer to Den Hertog et al. (2010).

Sensing user needs and technological options

The capability of sensing user needs and technological options relates to keeping up-to-date of market developments (Teece, 2007; Den Hertog et al., 2010). 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 sensing capability consists of two elements, related to the old distinction of forces that have a market-pull or a technology push effect (e.g. Chidamber & Kon, 1994). 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). Close and systematic interaction with different kind of users is an essential element of sensing. 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 sensing capability concerns technological options. Being familiar with the latest technologies can be useful inspiration for modifying the services a company provides (Kindström et al., 2009). Just like in the case of user needs, 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 (Parasuraman et al., 1985), 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 sensing capability can also reside in business development departments. A question one could 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)². This matches quite well with the ‘customer orientation’ and ‘competitor orientation’ by Menguc and Auh (2006).

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 (Normann, 2002). The development of a detailed service concept and how to produce it is a dynamic capability that asks for creativity and inventiveness (Edvarsson and Olson, 1996). 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. 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. Another part of this dynamic capability is thus the creation of an open-minded and entrepreneurial organization with an innovative culture.

(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. According to Den Hertog et al. (2010), being able to (un)bundle 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.

From a multi-level perspective based on microfoundations, there is no indication for any specific processes or structures contributing to the blending of service concepts. All of the required activities we find are related to the development of concepts, which is already part of Conceptualizing. In fact, (un)bundling is a form of recombinative innovation, and therefore more like an output from innovation processes rather than a process itself. Since we cannot relate this presumed capability to specific organisational capabilities, we decide to exclude it from the set with which we will continue our analysis.

² Sidhu et al. also define a third category: geographical search. This aspect is not relevant here.

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 (Van der Aa & Elfring, 2002). In many situations, a single service provider is not able to deliver all 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 (Teece, 2007). These alliances can be providers of other services or goods such as supporting technology, but it concerns customers as well (Parasuraman et al. 1985). 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.

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 (Winter & Szulanski, 2001). 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 (Bruni & Verona, 2009). Strategic construction and use of brand names increases the value of service, since it is an important attribute that customers use to evaluate service quality.

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 (Ambrosini et al. 2009). 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.

3. Quantitative measurement

Method

Research Setting

A broad scope on service innovation is warranted by the choice for a multi-industry setting. Apart from approaching different service sectors, generalizability is pursued by also

including firms that are registered in industrial sectors. It has been acknowledged that manufacturing firms frequently engage in service activities (Gallouj and Savona, 2009), which implies that they perform service innovation as well. The public sector was excluded, based on the belief that it is subjected to other types of dynamics than the market-forces we wish to study with other elements of the survey which was sent out.

Sampling and Data Collection

Data was collected through a self-reporting survey with 130 items, some of them dedicated to the subject of this paper. In two more or less equal batches, this questionnaire was sent to 8000 firms with more than 10 employees from the Dutch provinces Noord-Holland and Utrecht. Since we are asking for processes at the firm-level, we directed a survey to the CEOs and other senior team members who are likely to be knowledgeable about the topics within our questionnaire (Miller et al., 1998). The respondents had the option to choose between a written and web format for the survey. In order to enhance our response follow-up phone calls were made. In 56 % of the cases, we received digital responses rather than traditional mail responses. In total, we collected 461 responses, accounting for a 5.8 % response rate. This is common for similar type of research. From these responses, 384 were entirely completed and useful for analysis on the basis of case-wise deletion. An analysis of non-response showed no significant differences between respondents and non-respondents in terms of observable organizational characteristics such as industry, age, and size ($p > 0.05$).

Measurement

Given their abstract nature, measuring dynamic capabilities has proven to be quite a challenge (e.g. Zahra, Sapienza and Davidsson, 2006; Dutta, Narasimhan and Rajiv, 2005). Instead of using single items (e.g. Tsai, 2004), we develop multi-item scales for dynamic service innovation capabilities. Based on the microfoundations we identified in DCV and service innovation literature, we came up with 20 core processes and structures covering all the DSICs except for (Un)Bundling³. These microfoundations, shown in table 1, serve as the basis for our survey items. Most of the other questions in the survey were adapted from existing scales. Choosing for a 7-point Likert-scale ranging from “strongly disagree” to “strongly agree” is a common practice in this kind of research. 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 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. The final phrasing of all the items can be found in table 2, in which we will also report our results.

INSERT TABLE 1 HERE

³ Recall that this dynamic service innovation capability was removed from the original set by Den Hertog et al. (2010), since it refers to outcome of innovation processes rather than the processes themselves.

Results

Exploratory factor analysis

Our measurement scale is constructed as follows. We entered our 20 items in a principal component analysis. A response of 384 is enough to test all the constructs at once, given the fulfilled requirement of a 5 to 1 ratio of sample size to number of estimated parameters (Shook et al., 2004). According to the Kaiser-Meyer-Olkin measure for sample adequacy, performing PCA on our data is allowed; the KMO-value of .896 is far above the critical value of .5. Following common practice, we extract all factors with an eigenvalue greater than one. This resulted in extraction of five factors, from which the largest one accounts for 39,9% of the total variance explained. Table 2 shows the characteristic statistics of the Varimax-rotated analysis.

INSERT TABLE 2 HERE

The largest factor we retrieved consists of items that were expected to belong to several distinct DSICs. Processes and structures associated with Conceptualizing turn out to be part of a single dimension containing items for Learning & Adapting as well⁴. Looking at the communalities between all those items and relating them to their actual microfoundations, leads us to conclude that we are encountering a single dimension for internal processes and structures for activities explicitly devoted to new service development. From a microfoundation perspective it is hard to make a distinction between conceptualizing and learning; they both concern explicit attention for innovative effort. The conceptual difference is that conceptualizing relates to organisational activity with respect to the very creation of new services, whereas learning denotes the subsequent evaluation of any activity devoted to service development. In essence, it is all about reflection on the way a firm is delivering and developing services. Especially for the issue of experimentation, it becomes clear that both DSICs – previously presumed to be conceptually distinct – are constituted by the same kind of capabilities and their corresponding microfoundations. Experimenting requires the development of a test, for example by using a prototype, but also analysis of the results. Whereas the first activity relates mostly to conceptualizing, the latter clearly is part of Learning & Adapting. In short, we argue that although Conceptualizing concerns service concepts and Learning & Adapting concerns the service innovation process, they both rely on the same type of microfoundations. Crucial is whether a firm consciously facilitates service innovation, be it in a formalized or unformalized way. Therefore, we propose the name ‘Deliberate Learning’ for this newly encountered dynamic service innovation capability: the name resonates the point made by Zollo and Winter (2002) that dynamic capabilities emerge from deliberate investment in knowledge transformation processes, as opposed to unplanned learning by doing activities.

Apart from the large dimension in which different previously separated kind of processes are united, the results show four distinct additional DSICs. After all, having institutionalized

⁴The item ‘scaling up new service solutions’ seems to be part of this factor as well, but loads quite low.

attention for new service development is not sufficient for actually being able to renew and adapt a firm and its output. The single largest factor consists of the remaining items for Scaling & Stretching. Whereas the one that loads on general innovation has an internal perspective, the other three clearly have an outward focus. Engaging in activities on the account of marketing and branding are activities devoted to turn a potential source of advantage (i.e. a sophisticated new service concept) into an actual source of advantage (i.e. a recognizable new service offering). Creating external attention for a new concept is a crucial step in the path from idea to success.

A remarkable finding from our statistical analysis is that sensing user needs and sensing technological options appear to rely on different processes; their respective items load consistently on two distinct factors. According to our PCA, there is more consistency within the microfoundations from ‘Sensing User Needs’ and ‘Sensing Technological Options’ than between them. This introduction of two separate dynamic capabilities essentially is yet another adaption of the initial set of DSICs, be it that now it concerns a separation rather than a merger (which was the case for Conceptualizing and Learning & Adapting). Thus, the formerly single capability for sensing consists of two elements that do not necessarily co-occur. Apparently, segmenting user groups and analysing their demands requires a different approach than staying up to date with respect to market developments. Next to being able to develop new service offerings and promoting them, there are two separate DSICs for remaining dynamic; analysing demand and scanning supply-side developments. Each of them provides information that is helpful in organisational transformation.

Finally, we extracted a factor consisting of processes and structures related to coproduction of services. Since services are aimed at the provision of the actual solution or experience a consumer desires, rather than an intermediary product, it is common that service providers collaborate in their effort to realize a satisfying service offering. Our results suggest that the ability to do so resides in a distinct DSIC.

Validity and reliability

Validity of our resulting scale is assessed in several ways. First, content validity is ensured by taking an existing framework as the basis for our research, which we applied and validated in an extensive content-based (qualitative) study not described here. In the transformation to a survey instrument, we followed procedural precautions like guaranteeing respondent anonymity and counterbalancing question order (Podsakoff et al., 2003). Item rotation was achieved by changing the order of items in the second wave with respect to the order of questions in the first wave. Common method bias then was checked by means of Harman’s one factor test. Our principal component analysis resulted in multiple (five) distinct factors. The largest factor accounted for 40% of the total variance, which is below the critical value of 50%. An additional test was performed by adopting a marker variable out of our survey (Lindell and Whitney, 2001). When the theoretically unrelated concept of advice seeking was included in the PCA, the share of variance explained by the first unrotated factor dropped to 34% while the pattern of items loading on different factors remained equal. In the Varimax-rotated matrix, the biggest factor only accounts for 17% of the variance.

Unidimensionality of our constructs is established by the principal component analysis. The fact that the items of the refined set only load on a single factor each, except for a minor cross-loading by an item from Deliberate Learning, is also evidence for discriminant validity. Both convergent and discriminant validity can be enhanced by performing confirmatory factor analysis (CFA) subsequently (following Ordanini and Parasurman, 2011; Agarwal and Selen, 2009). Factorial validity or internal consistency was assessed by looking at the Chronbach's alpha of each factor, as shown in table 2. This estimation for composite reliability indicates that all the items converge into separate dimensions, since all values are well above the accepted threshold of .60 (Eisenhardt, 1988; Van de Ven & Ferry, 1980). The reliability of the scale for Coproducing could be higher (increasing from $\alpha = .656$ to .765) if the reversed item is deleted.

4. Discussion

This paper has aimed to advance the measurement of dynamic capabilities amongst service providing firms. In doing so, we addressed the lack of a set of distinct but coherent and observable dynamic capabilities. Especially in the field of service innovation, with its poor stock of adequate management theories, there is a necessity of stronger conceptualizations. The conceptual framework by Den Hertog et al., (2010) offers a starting point for developing the fundamentals of new service innovation management theories based on a set of common dynamic capabilities. The broad perspective of the DCV can enrich the practice of management decision making; it provides management a tool for assessing which abilities to develop. When introducing their framework Den Hertog et al. state that it can only be used as a prescriptive management tool after it has been tested empirically (2010, p. 506), which is the very challenge we addressed with this paper.

Our first contribution is the introduction of a multi-level multidimensional perspective on dynamic capabilities, which provides a basis for the development of measurement-scales. Clarification of the link between microfoundations and dynamic capabilities opens up the possibility to operationalize these higher order constructs by focussing on the observable processes that undergird them. Application of our multi-level multidimensional perspective led us to conclude that (Un)Bundling is not a capability that can be traced back to its microfoundations. In fact, it was found to be an outcome of innovation processes rather than a combination of processes itself.

In addition to this theoretical investigation of DSICs, resulting in the exclusion of (Un)Bundling, we followed a quantitative approach by testing a novel set of measurement scales on multi-industry firm level data about service providing firms. Two of the DSICs by Den Hertog et al. (2010) were found to be mutually distinct, but the pattern we encountered by performing PCA lead us to make two major adaptations.

The items of Learning & Adapting and Conceptualizing, turned out not to belong to their respective presumed dimensions. Although there is an analytical distinction between the original capabilities (focus on innovation process versus innovation concepts), their microfoundations tend to show similarities in nature and occurrence. The processes and structures involved all seem to be a part of a single dynamic capability we call 'Deliberate Learning'.

A second modification of the original set of DSICs concerns the separation of Sensing User Needs and Technological Options. In this case, microfoundations for both analytic scopes of sensing appear to be empirically distinct. ‘Sensing User Needs’, on the one hand, seems to be supported by processes that are not necessarily present within firms able to keep track of relevant technological development by ‘Sensing Technological Options’.

In parallel to the empirical study presented in this paper, we also conducted case studies meant at understanding those microfoundations that we discussed as crucial for grasping dynamic capabilities. By interviewing managers of several service delivering firms, we got confirmation with respect to the adaptation of the set of DSICs. Our next step will be to use the complementary case-based evidence for drawing stronger conclusions about the validity of our measurement scale.

Implications for research

The multi-level multidimensional approach and the corresponding measurement scale allow for several avenues for future research. Comparing DSICs between firms of different sizes, or from different sectors or geographical areas, contributes to a further contextualization of the use of such capabilities. Furthermore, linking DSICs to measures of innovation output or performance creates a better understanding of the role of dynamic capabilities. Earlier studies on this account tend to find contradicting results (e.g. Zahra et al. 2006; Zott, 2003; Drnevich and Kriauciunas, 2011; Ray et al. 2004). The aim of this kind of research would be to identify paths that help firms, given their current abilities, to achieve the innovation or performance they aspire to. Future research can also link our findings to a process perspective in innovation management, relating specific microfoundations to phases of new service development and commercialization (De Jong and Vermeulen, 2003). Also the link between the DSICs deserves more theoretical and empirical attention.

Implications for management

The introduction of a measurement scale for DSICs serves as a step towards the development of a prescriptive management tool. Firms can gauge the presence and strength of their DSICs and uncover strength and weaknesses of their service innovation management strategy. Once additional insights on performance implications of DSICs are available, firms can choose to develop their DSICs further. In order to do so, the approach needs to provide guidance in the actual activities a firm must engage in, which requires knowledge about the microfoundations lower in our multi-level framework. Identification of practices and behaviours supporting the functional processes we propose as the core of DSICs can inform managers on this account. Additional qualitative research is required to extend the knowledge on microfoundations. How an application of our multilevel multidimensional framework could look for two of the DSICs we redefined in this paper, is shown in figure 2.

INSERT FIGURE 2 HERE

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Figures and Tables

Figure 1: Multi-level multidimensional perspective on dynamic capabilities

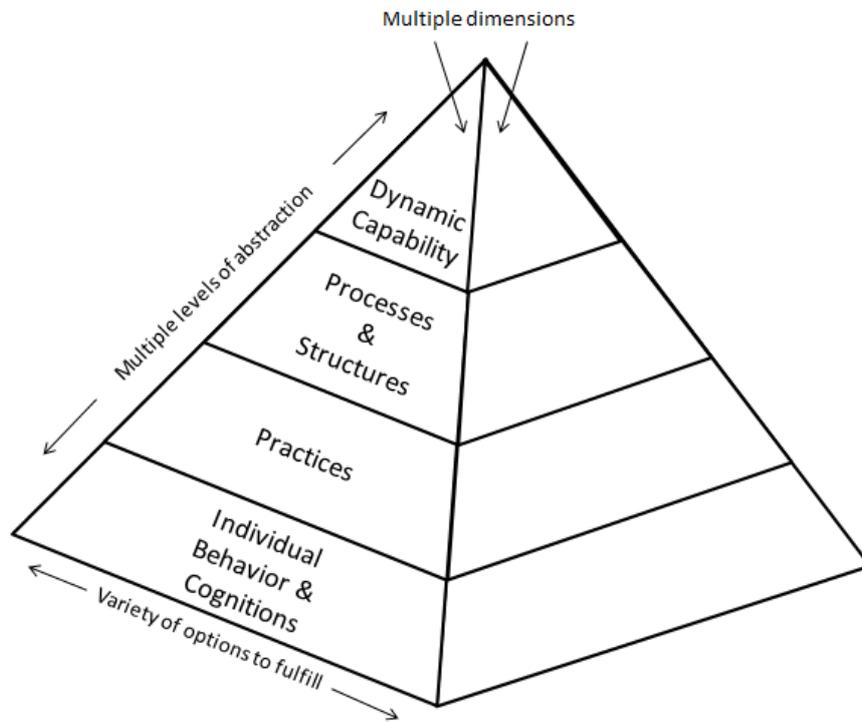


Figure 2: Examples of microfoundations for dynamic service innovation capabilities

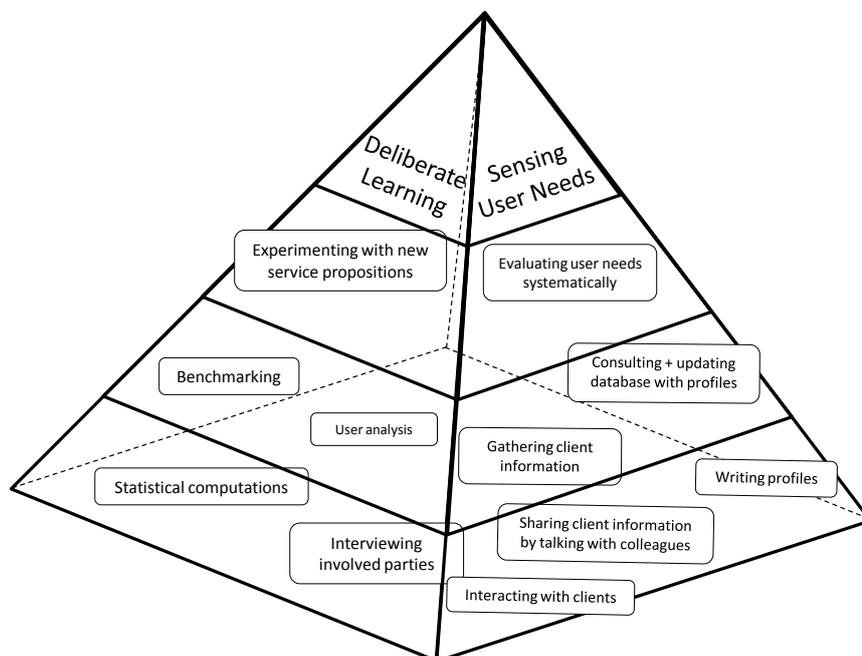


Table 1: Dynamic service innovation capabilities and their underlying processes/structures.

| DSIC | Underlying processes and structures |
|-------------------------------|--|
| Sensing User Needs | <ul style="list-style-type: none"> • Evaluating user needs systematically • Analysing actual use of services • Segmenting user groups |
| Sensing Technological Options | <ul style="list-style-type: none"> • Scanning for new technologies and services • Following competitors • Using external sources for identification of options for new services |
| Conceptualizing | <ul style="list-style-type: none"> • Dedicated capacity for development of new services • Experimenting with new service propositions • Aligning new services with current business |
| Coproducing & Orchestrating | <ul style="list-style-type: none"> • Creating and maintaining relations/partnerships • Benefitting from partnerships • Coordinating activities over partnerships |
| Scaling & Stretching | <ul style="list-style-type: none"> • Scaling up new service solutions • Brand development • Promotion of new services • Dedicated marketing capacity/ marketing plan |
| Learning & Adapting | <ul style="list-style-type: none"> • Evaluating effect of innovation • Reflecting on innovation approach • Providing internal feedback on innovation-related activity • Modification of innovation processes on basis of experiences |

Table 2: Results of PCA: factor loadings on Varimax-rotated solution.

| Survey items | Factor 1: Deliberate Learning | Factor 2: Scaling & Stretching | Factor 3: Sensing Technological Options | Factor 4: Sensing User Needs | Factor 5: Coproducting & Orchestrating |
|---|----------------------------------|-----------------------------------|--|---------------------------------|---|
| <i>Cronbach's alpha</i> | .864 | .747 | .821 | .765 | .656 |
| <ul style="list-style-type: none"> • We systematically observe and evaluate the needs of our customers. • We analyse the actual use of our services. • Our organisation is strong in distinguishing different groups of users and market segments. | | | | .725 | |
| <ul style="list-style-type: none"> • Staying up to date of promising new services and technologies is important for our organisation. • In order to identify possibilities for new services, we use different information sources. • We follow which technologies our competitors use. | | | .776 | .721 | |
| <ul style="list-style-type: none"> • We are innovative in coming up with ideas for new service concepts. • Our organisation experiments with new service concepts. • We align new service offerings with our current business and processes | .657 | | .737 | .615 | |
| <ul style="list-style-type: none"> • Our organisation has troubles with the development and maintenance of partnerships. • Collaboration with other organisations helps us in improving or introducing new services. • Our organisation is strong in coordinating service innovation activities involving several parties. | | | .695 | | -.603 |
| <ul style="list-style-type: none"> • We are able to scale up successful new services to corporate level. • In the development of new services, we take into account our branding strategy. • Our organisation is actively engaged in promoting her new services. • We introduce new services by following our marketing plan. | .472 | | | | .793 |
| <ul style="list-style-type: none"> • We evaluate the effect of innovation efforts • Our organisation reflects consciously on innovation deployed activities. • Employees involved in the development of new services provide each other feedback on a regular basis. • On the basis of recent experiences we frequently adapt the organisation of our innovation process. | .563 | | | | .786 |
| | .523 | .558 | | | |
| | .589 | | | | |
| | .624 | | | | |

For the sake of clarity, loadings below .4 are suppressed.