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Published in:
7th Industrial Product-Service Systems Conference - PSS, industry transformation for sustainability and business, Cape Town, South Africa, 23-29 August 2015

DOI:
10.1016/j.procir.2015.02.145

Published: 01/01/2015

Document Version
Publisher's PDF, also known as Version of Record (includes final page, issue and volume numbers)

Please check the document version of this publication:
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Link to publication

Citation for published version (APA):

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A Dynamic Capabilities Perspective on Service-Oriented Demand-Supply Chains

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Abstract

Organizations in the current competitive business environment need to provide highly customized integrated solutions through dynamic collaborations within value networks. This need has been increasingly considered through different notions like Product Service System (PSS) and Service-Dominant (S-D) logic. These emerging notions shift a conventional supply chain towards a Service-Oriented Demand-Supply Chain (SODSC). The SODSC embraces the co-creation of a customer-centric value in the form of integrated solutions through a dynamic networked business. This paper, from a dynamic capabilities perspective, aims to move towards the operationalization of the characteristics of the SODSC. For this, we conduct a design science research approach that results in ten concrete dynamic capabilities enabling service-orientation. The validity of these concrete dynamic capabilities is evaluated on the basis of a case study in a mobility service ecosystem.

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Keywords: Product Service Systems (PSS), Service-Dominant (S-D) logic, dynamic capabilities, service-orientation, demand-supply chain

Introduction

The current business environment can be characterized as an environment with empowered customers and globally distributed suppliers [1]. Organizations in this business environment need to provide highly customized integrated solutions through dynamic collaboration within value networks [2], [3]. This situation has been considered in different contexts, in particular marketing, operations management and information systems contexts, by notions such as Service-Dominant (S-D) logic [4], Product Service Systems (PSS) [5], and dynamic virtual enterprises [6]. Based on [7], these different notions of service-orientation are reflected by the Service-Oriented Demand Supply Chains construct (SODSC).

Although the characterization of notions related to the SODSC has been increasingly considered in recent research, the operationalization of these characteristics is still in its infancy. In this paper, from a dynamic capabilities perspective [8], we aim to move towards the operationalization of the SODSC characteristics. A dynamic capabilities perspective highlights the required abilities to deal with highly changing environments [9], [10]. With respect to high dynamism, originating from the characteristics of the SODSC [7], this perspective provides a well-established basis to explore the required capabilities for service-orientation.

The dynamic capabilities enabling the responsiveness and agility in a supply chain have been explored in previous research (e.g. [11–13]). However, these proposed dynamic capabilities do not address the characteristics of the service-orientation clearly. Previous research does not point out how the value co-creation and the integrated products and services provision can be supported by dynamic capabilities. In this paper, we conduct a design science research approach to...
Develop and evaluate a set of concrete dynamic capabilities which enable the specific characteristics of the SODSC construct. These concrete dynamic capabilities highlight in particular the required capabilities for value co-creation and integrated products and services provision.

The next section of the paper reflects the two main background concepts in this research, respectively the SODSC and the dynamic capabilities. The research approach is illustrated within section 3. Section 4 and 5 develop and evaluate a set of concrete dynamic capabilities that enable the operationalization of the SODSC construct characteristics. We conclude the paper in section 6.

2 Research Background

Based on the mentioned research problem, two concepts need to be clarified as a research background. The first concept illustrates the context of this paper that is reflected by the SODSC construct. The second concept is the dynamic capabilities perspective that represents our point of view to the operationalization of the desired characteristics of a networked business.

2.1. The characterization of the SODSC

This paper focuses on a particular type of a networked business that is addressed by the SODSC. The SODSC aims to offer mass-customized integrated solutions for customers through highly dynamic collaborative networks. Rasouli et al. [7] characterize the SODSC through a distinction between supply chain and demand chain dimensions of service orientation. These two dimensions rely on the distinction between the supplier and the customer contexts for value creation [14], [15]. The supply chain perspective (or the supplier context) embraces the processes like designing, sourcing, manufacturing, and delivery that are undertaken by actors within a supply chain. The demand chain perspective (or the customer context) surrounds the processes related to the customer usage of a product or service. The service orientation within the supply chain dimension addresses the supplier-supplier interactions in the form of a networked collaboration. The aim of service orientation within this dimension is to provide an integrated package of products and services that supports a broad scope of customers’ requirements within a product-life-cycle. On the other hand, the service orientation within the demand chain dimension highlights the customer-supplier interaction for value co-creation. The aim of service orientation within this dimension is the co-creation of value-in-use by a customer through the facilities provided by suppliers [23].

2.2. Dynamic capabilities perspective

Within the strategic management literature, the capability view is supported by two main perspectives respectively the resource-based view [16] and the dynamic capabilities view [8]. Whilst the resource-based view has a static view on a business environment, the dynamic capabilities perspective is more relevant in highly changing and dynamic environments [17]. The resource-based view indicates the operational (or zero-level) capabilities that support the current processes to achieve the current target of a system. But, the dynamic capabilities aim to align a system with respect to changes in an environment. Teece, et al. [8] define dynamic capabilities as ‘the ability to integrate, build, and reconfigure internal and external competences to address rapidly-changing environments’. Dynamic capabilities as high-order abilities, in comparison with the aforementioned zero-level capabilities, govern the rate of change of operational capabilities to be aligned with the environmental changes [18].

Dynamic capabilities are more important in the highly dynamic and rapidly changing environments. It is evident that the SODSC embraces high dynamism that originates both from supply and demand chains. The dynamism in the supply chain dimension originates from the new suppliers that can provide new products and services within a value network. The dynamism in the demand chain dimension results from the emerging needs of customers (co-creators). So, it clearly can be concluded that the dynamic capabilities perspective can provide a relevant basis to explore the required capabilities of the SODSC.

3 Research Approach

We conduct a design science research approach [19], [20] to develop and evaluate a framework that refines the required dynamic capabilities for service orientation in demand-supply chains. To perform a rigorous research, the usage of a structured and well-established process for the development and evaluation of the framework (as a design artefact) is essential. For this purpose, based on the design processes proposed by March [21], we conduct this research within two main phases: A development phase and an evaluation phase, see Figure 1.

Within the development phase we conduct a productive and deductive reasoning. The productive reasoning relies on previous research to create a preliminary basis for the required dynamic capabilities. This preliminary basis is a nomological network of relationship between the abstracted dynamic capabilities and the SODSC characteristics. The deductive reasoning aims to refine these abstracted dynamic capabilities to a set of concrete dynamic capabilities for service orientation. This refinement is based on the two critical
characteristics of the SODSC, respectively, the co-creation of the value-in-use (i.e. service orientation within demand chain dimension) and the provision of the integrated products and services (i.e. service orientation within supply chain dimension).

To evaluate the significance of the proposed concrete dynamic capabilities for service orientation, we conduct a case study research approach. This approach enables us to explore how the proposed concrete dynamic capabilities in a real-world situation support the characteristics of service-orientation. For this purpose, we rely on the evidences from a car leasing organization in the Netherlands that aims to shift from its asset-based business towards a service-oriented networked business.

4 Developing the Required Concrete Dynamic Capabilities for Service-Orientation

4.1. The Nomological Network of the Abstracted Dynamic Capabilities

Within this step, by using related literature, we intend to determine a preliminary set of dynamic capabilities that enhance the characteristics of the SODSC. Related literature mostly focused on the dynamic capabilities that shape agility in Supply Chain Management (SCM) (see [13], [22], [23]). The dynamic capabilities that are indicated within these research studies highlight the ability of SCM for sensing the changes in the environment and rapidly responding to these changes. These dynamic capabilities describe the required abilities to achieve strategic advantages in highly changing and dynamic environments. Although these dynamic capabilities can enhance the characteristics of the SODSC, they do not focus on specific characteristics of the SODSC. In other words, these research studies do not reflect how these dynamic capabilities enable value co-creation and integrated products and services provision. So, the dynamic capabilities proposed by previous research on agility can be seen as abstracted dynamic capabilities for the SODSC.

The conceptual model of the dynamic capabilities for shaping the agility in SCM that is proposed by [13] is a well-established framework in this context. This conceptual model rigorously integrates underpinning theories and has been referred repeatedly as a basis for current research in this domain. Regarding the objective of this step of our research approach, to provide a well-established basis for abstracted dynamic capabilities for service-orientation, we rely on this conceptual model. This conceptual model highlights three important dynamic capabilities including digital options, agility, and entrepreneurial alertness [13]. Digital options are “a set of IT-enabled capabilities” that is based on process-oriented and knowledge-oriented information systems. Entrepreneurial alertness is the ability of a system to explore its market place through preexisting knowledge and proactive experiments to detect an opportunity and to act upon that. Entrepreneurial alertness comprises two specific capabilities, namely strategic foresight and systemic insight. Strategic foresight is an ability to anticipate the opportunity in a value network through an in-depth understanding of customers’ business concerns. Systemic insight is the ability of a system to architect competitive action through the investigation of possible benefits and risks related to a response to an opportunity. Agility is the ability to detect opportunities for innovation and to seize these opportunities by assembling requisite assets. Agility includes three interrelated capabilities: customer agility, partnering agility, and operational agility [13].

Since we do not aim to investigate the IT related aspects of dynamic capabilities, we don’t address in this paper digital options. Considering the service-orientation characteristics as most important competitive advantages, the adopted conceptual model in our research is exhibited within Figure 2. The abstracted dynamic capabilities which are reflected within this conceptual model are refined in the following subsection.

4.2. The refinement of the dynamic capabilities in the context of SODSC

For the refinement of the abstracted dynamic capabilities exhibited within the Figure 2, we rely on two critical characteristics of the SODSC, namely value co-creation and integrated products and services provision. We explain how aforementioned dynamic capabilities within Figure 2 enhance each of these characteristics of the service-orientation. For this purpose, we conduct a deductive reasoning. This deductive reasoning is mainly established upon the logical distinction between the value co-creation and the integrated products and services provision [7]. This logically states how each of the abstracted dynamic capabilities enhance the value co-creation as well as the provision of the integrated products and services. In this way, each of abstracted dynamic capabilities is divided into two concrete ones. This approach results in ten concrete dynamic capabilities that explain the

![Figure 2](image-url)  
**Figure 2.** The Nomological Network of the Abstracted Dynamic Capabilities (Adopted from [13])

![Figure 3](image-url)  
**Figure 3.** The logic of deductive reasoning for the refinement of the required dynamic capabilities in the SODSC
required high-level routines to support the characteristics of the SODSC, see Figure 3. These ten concrete dynamic capabilities are explained further.

4.2.1. Customer agility for value co-creation can be described as the ability of sensing and seizing the opportunities for the creation of better experience for a customer during the usage of a product or service. These opportunities mainly originate from the changes in customers preferences during the usage of a product or service [24]. This dynamic capability addresses the ability of a networked business for the facilitation of the customer-supplier interaction during the whole period of the usage of a product or service by a customer. This facilitated interaction enables the identification of the desired preferences of value-in-use by customers and to respond to them quickly.

4.2.2. Customer agility for co-production demonstrates the engagement of the customer as a resource in the supply processes [25]. This dynamic capability reflects the ability of a networked business to sense and facilitate customers’ engagement opportunities in designing, procuring, manufacturing, and delivering processes. In other words, this dynamic capability can be conceived as the ability for exploring customer’s competencies. These customer’s competencies can be the basis for exploiting from the business models encompassing the customer engagement in the form of co-innovation, co-manufacturing, and crowd-sourcing [26].

4.2.3. Partnering agility for value co-creation reflects the ability of a networked business to form a dynamic coalition of resources in support of the value co-creation processes. This ability enables a SODSC to use the best set of the value co-creation resources regarding the specifications of a customer. The value co-creation resources are the facilities provided by different suppliers within a value network to interact with customers during the usage of products or services. With respect to the nature of the value network, a customer can interact with all suppliers and not with a pre-determined one [27]. In that case, this dynamic capability points to the ability of a networked business to exploit the interaction facilities provided by different suppliers dynamically in order to shape the most appropriate interaction experience for a customer.

4.2.4. Partnering agility for integrated products and services provision highlights the supplier-supplier interactions that enable a networked business to provide as complete as possible a package of the products and services that are required by customers. Since the requirements of customers in the form of a complete package of products and services are quite different, this dynamic capability embraces the need for an adaptive partnership between suppliers. A SODSC should be able to provide a high variety of integrated packages of products and services that necessitates a dynamic collaboration between suppliers. This dynamic capability addresses the ability of a networked business to sense the opportunities for new collaborations between suppliers, in order to provide more interesting packages of products and services for customers.

4.2.5. Operating agility for value co-creation indicates the ability of a networked business for managing dynamic processes that support the value co-creation during the usage of a product or service. Value co-creation processes enable the interaction between customers and suppliers through well-established activities (e.g. value co-creation processes proposed by [24]). Based on the nature of the value co-creation that completely depends on the individual customer’s experience during the usage of a service or product [28], the processes supporting the value co-creation also need to be adaptive. This dynamic capability represents the ability of a networked business to identify the requirements for changing the value co-creation processes based on the customer’s experience and to redesign and re-implement these processes.

4.2.6 Operating agility for integrated products and services provision covers the provision of the integrated products and services by using the distributed resources within a networked business. This requires integration of the intra and inter-organizational processes in a supply chain [29]. Based on the dynamic nature of the integrated products and services in a SODSC, these processes need to be redesigned and re-implemented dynamically. This dynamic capability reflects the ability to explore the emerging requirements of business processes based on the change in the characteristics of the output (i.e. the integrated products and services) and to quickly respond to these requirements by implementing re-designed processes.

4.2.7. Strategic foresight for value co-creation reflects the ability of a networked business to anticipate the expected experience of a customer from a product or service (i.e. value-in-use). This dynamic capability highlights the in-depth understanding of customers concerns. This ability is based on the analysis of customers’ experience that is recognized through value co-creation processes during the usage of a product or service by customers.

4.2.8. Strategic foresight for integrated products and services provision is described as the ability to anticipate potential actors of a networked business to develop a collaboration to provide integrated products and services. This capability enables the establishment of a strategic collaboration between actors within a value network. This strategic collaboration can be considered as a basis to shape instant virtual enterprises [30] supporting the provision of integrated products and services. In recent research, this capability has been addressed by a business modelling approach [31] for the delineation of a collaborative value network.

4.2.9. Systematic insight for value co-creation demonstrates the ability for the investigation of possible benefits and risks related to value co-creation. This capability addresses the comprehensive view to align aforementioned agility capabilities for value co-creation. This comprehensive view enables the investigation and architecture of particular value co-creation actions. Value co-creation actions embrace three related agility capabilities for value co-creation. Systematic insight reflects the alignment between these three dynamic capabilities regarding the possible benefits and risks.

4.2.10. Systematic insight for integrated products and services provision describes the ability for the investigation of different packages of products and services that are offered by
a networked business. This capability aligns three agility capabilities for the provision of integrated products and services. This ability reflects the investigation of the benefits and risks related to a value proposition in the form of integrated products and services. This investigation enables dynamic value proposition within a networked business [32].

5 Evaluating the Proposed Concrete Dynamic Capabilities for Service-Orientation

In this section we evaluate the significance of the aforementioned ten concrete dynamic capabilities for service-orientation in a real-world situation. For this purpose we conduct a case study research approach. This case study demonstrates how these concrete dynamic capabilities enable the service-orientation. The case study is based on a Car Leasing Organization (we refer by CLO) in the Netherlands embracing branches located in ten European countries. CLO’s current business is focused on car provision that is quite asset-based. As a strategic transition, this organization has decided to move from its asset-based business towards a service-oriented networked business. As a vision of this strategic transition, CLO intends to provide integrated mobility solution for its customers. The provision of integrated mobility solution requires offering a complete package of products and services relating to the mobility experience of a customer. To characterize this strategic transition, CLO, as a partner within the “CoProFind” project [33], has already developed three relevant artefacts including a business strategy, a business model, and a service composition model. The developed service-oriented strategy defines the new identity of CLO as a mobility solution provider. The developed business model describes the interactions between different partners in the form of a networked business aiming to provide the defined integrated mobility solution. The service-composition artefact portrays the intra and inter-organizational processes that support the provision of the mobility solution. Indeed, based on the delineated strategic transition, CLO aims to be an orchestrator within a mobility networked business.

With respect to the role of CLO as a focal organization aiming to orchestrate a networked business of mobility solution, we focus on this organization to evaluate the significance of the proposed dynamic capabilities. Indeed, we explore the evidences that state how the proposed dynamic capabilities can enable CLO to be service-orientated. For this, we mostly rely on the evidences gathered in two workshops to delineate the service-orientation artefacts. These two workshops have been arranged within the CoProFind project and all of the business executives of CLO have been involved in these workshops. For data gathering within these workshops a pre-defined format of aforementioned artefacts had been prepared and each part of these artefacts were discussed during the workshop. The discussion was being continued until achieving the consensus about each part of artefacts by all participants. The discussion was facilitated by research team through clarifying the scientific terms used within artefacts. For the triangulation of evidences, we also conduct two in-depth interviews with respectively a practitioner and a researcher involved in the workshops. Within these two in-depth interviews we also test the correctness of the interpretation of the empirical evidences gathered within two workshops [34]. The evidences resulting from this case study research are described further.

In order to shape a customer-centric value (i.e. the value-in-use) rather than focusing on a car (i.e. value-in-exchange), the mobility solution by the CLO is characterized as “a seamless experience for a customer that embraces being at the right place, at the right time, by the right cost”. To be able to facilitate this experience, CLO requires a preliminary mindset about the expected experience by each segment of customers. This need in the CLO has been addressed by trying to develop a service orientation strategy (which reflects the entrepreneurial alertness). The heart of this preliminary mindset is the anticipation of the expected experience by each segment of customers. For this, CLO has tried to characterize the mobility service for different segments of customers within the service-orientation strategy (which reflects 4.2.7). They also have delineated a service ecosystem to offer the expected experiences. This service ecosystem delineation embraces the core and enriching services (which reflects 4.2.10) as well as the core and enriching partners (which reflects 4.2.8). This preliminary mindset also has been considered as a basis to anticipate the required interaction with customers (which reflects 4.2.9).

Although this preliminary mindset is needed, they require mechanisms to provide a unique seamless mobility experience based on customers’ real expectation. Indeed, service-orientation necessitates the provision of customer-centric value that is customized by unique expectations of a customer. This means that CLO in addition to a preliminary mindset of service-orientation requires a set of capabilities enabling the mass-customization in operations (which reflects the agility). The CLO has responded to this need through business modeling and service composition. On the basis of the designed tools for service-orientation, CLO is supposed to be able to develop and implement customized business models and service compositions that fit to a customer’s expected experience. By the business modeling tool, they aim to understand the real expected experience of a customer through organized co-creation interactions (which reflects 4.2.1). Regarding the presence of different partners within the defined service ecosystem, the co-creation interactions can be handled by channels provided by different actors (which reflect 4.2.3). By applying the business modeling tool, they also determine the ‘best fit’ partners within the delineated service ecosystem to provide a seamless experience (which reflects 4.2.4). Through the business model tool, CLO also facilitates the co-production role of customers. This means that customers are also able to provide resources (e.g. by carpooling) to shape a mobility experience (which reflects 4.2.2). The service composition tool is supposed to be used

* A collaborative research by TU/e and a financial service corporation to design innovative business models in a service-oriented business context
for the enabling of the operations among actors to co-create and co-produce an expected mobility experience (which reflects 4.2.5 and 4.2.6).

6 Conclusions

In this paper a set of ten concrete dynamic capabilities enabling the characteristics of the SODSC construct were developed and evaluated. These concrete dynamic capabilities, addressing the required routines within a networked business, enhance the operationalization of the service-orientation characteristics, particularly those of value co-creation and those of integrated products and services provision. The proposed concrete dynamic capabilities, which are evaluated within a case study research, enhance networked businesses to provide customer-centric integrated solutions through highly distributed and dynamic suppliers.

Although the significance of the proposed concrete dynamic capabilities has been evaluated within a networked business for a mobility solution, the generalizability and effectiveness of them need to be evaluated in future research. Indeed, in this research, on the basis of theoretical development and empirical evaluation, the need for the proposed concrete dynamic capabilities has been highlighted. But, regarding the limitations within the investigated case, which experiences the transition phase of service-orientation, the exploration of the impact of proposed dynamic capabilities on the characteristics of service-orientation has not been conducted. Moreover, the exploration of the relationship between the ten proposed concrete dynamic capabilities can provide more beneficial insight for the operationalization of the SODSC construct. Also from the theoretical point of view, taking into consideration the process transformation aspect of dynamic capabilities would be a relevant direction for future research.

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