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Dynamic Capabilities as Enablers of Digital Servitization in Innovation Ecosystems: An Evolutionary Perspective

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Part 3: Strategic approaches in servitization

c. Dynamic capabilities in servitization

Dynamic capabilities as enablers of digital servitization in innovation ecosystems: An evolutionary perspective

Keywords: dynamic capabilities, servitization, digital, innovation, ecosystems.

1. INTRODUCTION

The resource-based view (RBV), the dynamic capabilities view (DC), and the business model approach are the dominant perspectives in the servitization field (Rabetino, Harmsen, Kohtamäki, & Sihvonen, 2018). Recent literature reviews of the servitization-related research highlight the limited theoretical diversity and call for frameworks to study digital servitization at the ecosystem level rather than at the organizational level (Kohtamäki, Parida, Oghazi, Gebauer, & Baines, 2019; Rabetino et al., 2018). A growing body of research, beyond the servitization literature, also considers the importance of dynamic capabilities in innovation ecosystems and focuses on dynamic capabilities in digital transformation processes (Lütjen, Schultz, Tietze & Urmetzer, 2019; Parida, Oghazi, & Cedergren, 2016). These processes require collaborative approaches, redefining the scope of firm-centered business models to others which are ecosystem-driven and innovation-oriented (Rothaermel & Hess, 2007; Warner & Wäger, 2019).

The present chapter develops a multilevel framework on digital servitization that builds on the above research and integrates dynamic capabilities, business ecosystems, and innovation

processes. In doing so, the chapter addresses the following research question: *what is the relationship between the development of dynamic capabilities at the level of business ecosystems and individual companies' business model innovation processes toward digital servitization?* The answer to this question includes two main discussions. First, the chapter discusses the specificities of digital capabilities. Second, the chapter argues how specific "digital capabilities" may serve as a value capture instrument to improve business performance.

The chapter is structured as follows. The second section introduces the relationship between dynamic capabilities and digital servitization. Section 2.1 identifies the central concepts and their link to business model innovation processes. Next, the chapter reviews the advances in the conceptualization of digitalization capabilities. Section 2.2 includes contributions from studies on digital servitization, service-oriented ecosystems, configurations, digitalization capabilities, and organizational transformation. The chapter then presents a conceptual-explanatory framework in Section 2.3, shifting the analysis of digitalization capabilities from the firm- to the ecosystem-level. The framework also includes changes in structures and routines, technological and non-technological innovations, and their impact on business performance. Based on the previous discussions, section three summarizes the conceptual contribution and elaborates a heuristic proposal that includes tools and practices with managerial implications.

2. THEORY DEVELOPMENT

This section builds our conceptual discussion from the review of 37 publications on "digital servitization" systematically selected by using the SCOPUS database. From these articles, other studies related to "dynamic capabilities," "digital capabilities," and "digitalization

capabilities" were selected and examined. Several studies link resources, capabilities, and servitization; studies specifically focused on dynamic capabilities, digital servitization. However, studies focusing on the relationship between dynamic capabilities, digital servitization, and ecosystems are still relatively recent (Paschou, Rapaccini, Adrodegari & Saccani, 2020; Raddats, Kowalkowski, Benedettini, Burton & Gebauer, 2019). Next, we explore the most relevant concepts, processes, and results involved in this relationship.

2.1. Dynamic capabilities and digital servitization

Digital servitization enables service innovation through digital technologies and innovative business models (Gebauer, Paiola, Saccani, & Rapaccini, 2020; Vendrell-Herrero, Bustinza, Parry, & Georgantzis, 2017), but it is not a straightforward endeavor (Rabetino, Kohtamäki & Gebauer, 2017). Firms face two major external contingencies: technological turbulence and competitive intensity (Coreynen, Matthyssens, Vanderstraeten & van Witteloostuijn, 2020). Additionally, the mere incorporation of digitizing assets does not imply an automatic process toward digital servitization. Developing appropriate business models that fit the firm's digital servitization strategies is critical. Strategic decisions configure different governance structures based on value creation and capture logics (Lerch & Gotsch, 2015; Sjödin, Parida & Kohtamäki, 2019). Thus, existing capabilities must be realigned, leading to a reconfiguration of resources and the development of new dynamic capabilities (Coreynen, Matthyssens & Van Bockhaven, 2017), not only technological but also organizational (Lerch & Gotsch, 2015). Business model-related capabilities drive and shape the innovation processes (Nylén & Holmström, 2015; Sjödin, Parida, Kohtamäki & Wincent, 2020).

Digital servitization strategies also shape firm boundaries (Huikkola, Rabetino, Kohtamäki & Gebauer, 2020b) as industry boundaries blur and companies reposition beyond the industry value chain and across an ecosystem. Firms often move from product-provider and industrializer-style business models to complex and digitalized models, such as integrated solutions provider, outcome provider, and platform provider (Kohtamäki et al., 2019). Therefore, "*digital*" and "*digitalization*" capabilities become increasingly more relevant too. As discussed below, both capabilities are implicit in digital servitization and can be analyzed from the perspective of dynamic capabilities at the firm and ecosystem level.

Previous studies used the dynamic capabilities approach to understand digital servitization (Lenka, Parida & Wincent, 2017; Parida et al., 2016). Regarding the operationalization of dynamic capabilities, the distinction between "digitization" and "digitalization" must be considered (Ritter & Pedersen, 2020) (Table 1). "*Digitization*" is the process that has facilitated servitization for a long time. It is considered as the transformation of analog into digital. The *digitization capabilities*¹ are oriented to digitization resources and platforms. These capabilities focus on exploiting the technological possibilities of data transferability, expanding the communication frontiers. They also focus on increasing information, and facilitating the adoption of servitization strategies based on innovation ecosystems (Sklyar, Kowalkowski, Tronvoll & Sörhammar, 2019; Tronvoll, Sklyar, Sörhammar & Kowalkowski, 2020). Digitization leads to commoditization unless it incorporates digitalization processes.

In contrast, "*digitalization*" emphasizes adopting the above technologies and how they can improve business performance. It represents the generation of more complex socio-technical

¹ There are also other related concepts (Paschou et al., 2020), such as IoT capabilities (Naik et al., 2020), ICT capabilities (Parida et al., 2016) and technology capabilities (Huikkola et al., 2020b).

structures and processes (Hinings, Gegenhuber & Greenwood, 2018). This incorporation requires developing new digital capabilities from the organizational viewpoint (Sklyar et al., 2019), which enable exploration and exploitation processes that are critical for business model innovation (Pisano, 2017; Teece, 2018).

As we will discuss in section 2.2, *digitalization capabilities* have shown to be critical to co-creating value with suppliers and customers (Kohtamäki et al., 2019). Therefore, these capabilities must be examined in the context of digital servitization ecosystems.

Table 1. Dynamic capabilities, digitalization, and digitization at the organizational level

Digital servitization at the organizational level	Digital servitization process	Dynamic Capabilities related to Digital servitization	Dynamic Capabilities orientations (outputs)
Digitization	Digitization resources and platforms	Digitization capabilities	Exploiting the technological possibilities, from analogic to digital
Digitalization	Complex socio-technical structures and processes	Digitalization capabilities	Exploration and exploitation are critical processes for business model innovation

2.2. Organizational dynamic capabilities and ecosystems in digital servitization

The reconfiguration of dynamic capabilities results from interactions with stakeholders, including suppliers, intermediates, and customers (Raddats et al., 2019). Therefore, because these capabilities have a *relational sense* (Kohtamäki, Partanen, Parida & Wincent, 2013), necessary to implement digital servitization strategies, co-generate capabilities, and co-create value in business networks and ecosystems (Henneberg, Gruber & Naudé, 2013). *Ecosystem* and business networks appear to be the right analytical levels for defining digital servitization strategies and business models (Kohtamäki et al., 2019; Lütjen et al., 2019). Regarding the organization of service ecosystems, evidence shows that centralized decision-making, together

with a coherent implementation of digital platforms, improves firms' efficiency and responsiveness. Thus, understanding digital servitization-oriented business ecosystems' governance structures is crucial when evaluating digital technologies' effects on the structural flexibility between firms (Sklyar et al., 2019). The governance configurations that show the best performance are those that facilitate service innovations. Those configurations based on relational governance offer a good fit with digital servitization processes. Suppliers and customers are key stakeholders to ensure successful cooperation and governance for value co-creation (Kohtamäki et al., 2019; Sjödin et al., 2020).

Likewise, Huikkola et al. (2020b) consider that new specific capabilities are generated in closer interaction with customers, facilitating learning with them. Capabilities range from *generic* (e.g., digitization capabilities) to *relational* (e.g., system integration, project management, IT-systems, consulting, financial competencies, delivery, and aftersales services). The complex relationship between dynamic relational capabilities and digital servitization strategies redefines firm boundaries. They are determined by the interaction between business opportunities, the reconfiguration of digitization capabilities, and the resulting innovation processes. Thus, *complementary digitization capabilities* emerge (as digital assets) from feedbacks between *co-construction of knowledge, the cogeneration of capabilities, and relational governance configurations* (Coreynen et al., 2020; Huikkola & Kohtamäki, 2020a; Kamalaldin, Linde, Sjödin & Parida, 2020; Sjödin et al., 2020).

2.3. Dynamic capabilities in digital servitization innovation ecosystems

This section presents a conceptual framework for exploring and analyzing the relationship between dynamic capabilities development at the business ecosystem level and individual

'companies' business model innovation processes toward digital servitization. The framework assumes that digital servitization also depends on socio-technical interactions between global (outside-inside) and organizational (inside-outside) phenomena², resulting from a systemic emergence³ involving Digital Transformation – DT - (Warner & Wäger, 2019) and Servitization (Rabetino et al., 2018). From this assumption, dynamic capabilities are key factors to analyze how firms adapt to their environments (Teece, 2007, 2018). Simultaneously, the framework adds the notion of actor-rules system dynamics (Geels, 2020) and the multilevel analysis on transitions and socio-technical systems (Geels, 2004, 2020). Accordingly, *digital servitization is part of open-ended, non-linear, and uncertain, socio-technical transitions, which imply relationships between environmental and organizational dimensions*. DT develops from an ongoing techno-economic paradigm that involves an intensification of the service-oriented technological convergence (Adams, Taricani & Pitasi, 2018; Kodama, 2014; Rabetino et al., 2018). The shift implies a new form of consumption, cultural changes, institutional redefinitions, new infrastructures, and business model reconfigurations.

² In the neo-Schumpeterian tradition of evolutionary studies, technological change and **innovation** processes are part of a complex dynamics on micro-meso-macro relations (Dopfer, Foster & Potts, 2004). As Rabetino et al. (2020) suggest, we assume that the above research stream shares ontological assumptions with the dynamic capabilities approach.

³ The relationship between systemic emergence and dynamic capacities has been recently developed to explain the co-evolution in historical processes of capability generation and the complementarities between types of capabilities according to their level of complexity (Kay, Leih & Teece, 2018).

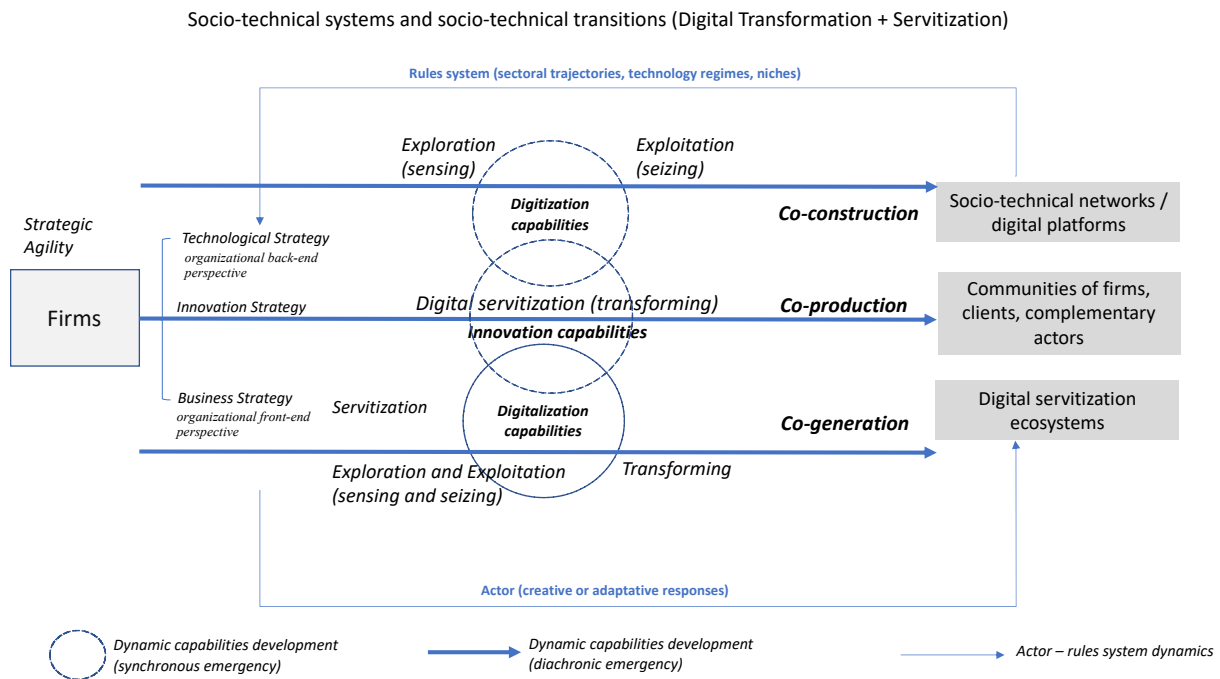


Figure 1. Digital servitization and dynamic capabilities

Figure 1 gets inspiration from the contributions on evolutionary-systemic emergence and dynamic capabilities (Kay et al., 2018) and actor–rules system dynamics (Geels, 2020). It highlights the accumulated and strategic superior cognitive skills oriented to build and sustain competitive advantages (via technological, business, and innovation strategies) at the organizational level (Pisano, 2017; Teece, 2007). According to their type, strategies give rise to *organizational processes* (internal and external). In this context, the starting points are digital transformation (technological processes) and servitization (business processes). Both processes are evolutionary (Nelson & Winter, 1982) and generate systemic emergence phenomena, that is, properties that are more than the individual parts involved (Kay et al., 2018). Consequently, the emerging transformation of both processes is digital servitization. The wider arrows indicate the emergence of dynamic capabilities in a diachronic sense (co-evolutionary), while the circles comprise a synchronic emergence (complementarities between capabilities).

Both types of systemic emergences in an organization are related. Synchronous ones consider the effects of complementarities between types of dynamic capabilities according to different levels of complexity. Diachronic ones cause changes in the firms' routines. Thus, digitization capabilities lead to changes in routines related to the co-construction of knowledge (sensing to seizing). Instead, digitalization capabilities introduce changes in the trajectory of the value cogeneration (seizing and sensing). The complementarity between both types of capabilities generates innovation capabilities, which cause changes in routines in the firms' co-production with other actors in their environment, mainly users or customers. Finally, organizational (socio-technical) transformations towards relational governance modes emerge from the relationship between strategies, processes, dynamic capabilities, and routines according to their typology (Table 2).

Table 2. Digital Servitization and relational governance.

Strategies	Processes	Dynamic Capabilities*	Routines**	Organizational Transformations
Technological	Digital Transformation	Sensing to seizing	Knowledge Co-construction	Digital Platforms/ socio-technical networks
Business	Servitization	Seizing and Sensing to transforming	Value Cogeneration	Digital servitization ecosystems
Innovation	Digital Servitization	Transforming	Co-production	Communities of practices

* synchronous emergency, ** diachronic emergency

Following digital technological strategies, platforms generated and dynamize socio-technical networks. Servitization strategies allow the formation of business ecosystems. Simultaneously, innovation strategies facilitate communities of practice between firms, users, and complementary actors.

The above framework suggests that firms develop digital servitization strategies according to their path dependence (Dosi, Grazzi, Marengo & Settepanella, 2016) within complex socio-

technical transitions (Geels, 2010, 2020). Nevertheless, socio-technical shifts do not impact the firms in an entirely deterministic manner because they *operate in actor-rule system dynamics* (Geels, 2020). Here, two types of strategies are relevant: technological strategies and marketing strategies.

The *technological strategies* aim to execute *digital transformation* processes based on digitization capabilities at the organizational level. The specificity of *digitization capabilities* (Ritter & Pedersen, 2020) lies in the idea that they are oriented toward enhancing *sensing* resources, routines, and skills, internal to the organization and external. Concerning the latter, digital technologies allow opening firm boundaries and generating knowledge co-construction relationships with clients and other stakeholders through cross-platforms. Knowledge management from digital platforms creates a disruptive change in how sensing dynamic capabilities work (Teece, 2018). Thus, the *digitization capabilities generate organizational innovations of different scope*. Significantly, the external ones, for that firms develop relational capabilities generating different dynamics of socio-technical networks. These networks use unique relational governance modes that impact digital servitization-oriented technological strategies (Sjödín et al., 2019).

Accordingly, the digital transformation strategies imply incorporating digital technologies and the expansion of the dynamic sensing capabilities based on socio-technical networks and shared digital platforms. These conditions allow collecting large volumes of data as inputs to generate learning (seizing) about clients, suppliers, and even competitors. Knowledge co-construction, socio-technical network synergies, and the learning levels in a distributed knowledge environment show the degree of virtuosity that the firms' DT's technological strategies can have (Callon, Méadel & Rabeharisoa, 2002).

From the arguments above, firms define their *business strategies* based on digitization and relational capabilities⁴. Business strategies of digital servitization use the digitization and relational capabilities to innovate their business models (seizing), moving from goods-dominant to service-dominant exchange logic. Therefore, we assume that a minimum threshold of these capacities is required to promote dynamic capabilities oriented to seizing activities, with different modes and knowledge exploitation and exploration levels (seizing and sensing). In this context, the interaction between dynamic capabilities and business models has a central purpose, enhancing value co-creation (Lenka et al., 2017).

The business digitalization capabilities deal with co-creation processes that affect the value propositions according to different service-dominant logic (Lusch & Vargo, 2014; Taylor, Hunter, Zadeh, Delpechitre & Lim, 2020). By this, the platform ecosystems' organizational designs can be analyzed according to who owns the digital platform, the mechanisms of value co-creation, and the autonomy of the complementors (Hein et al., 2020). Therefore, innovations in marketing impact the firm-level and influence the firm level and the global configuration of the ecosystems where they participate (Taylor et al., 2020).

Along with technological strategies and digital-servitization-oriented business models, firms develop *innovation strategies* according to their ecosystem positioning. The digital servitization innovations processes are assumed to be systemic emergences, which relate socio-technical systems and socio-technical transitions (macro-level) and technology and business strategies and their corresponding dynamic capabilities (micro-level) (Geels, 2020; Nambisan, Wright & Feldman, 2019). We focus on micro-level issues and assume that innovation

⁴ Several authors consider this process to be related to absorptive capacity (Cohen & Levinthal, 1990).

activities in digital servitization contexts occur in *co-production* processes mediated by dynamic capabilities (Chen, Kerr, Tsang & Sung, 2015). Based on digital servitization-oriented platforms and ecosystems, co-production processes are dynamized in socio-technical networks that define services' qualification and singularity (Callon et al., 2002).

New or improved product-services systems (PSS) or services can emerge among the digital servitization-oriented innovation strategies based on innovation models. They allow co-producing with clients and other complementary actors in spaces of distributed and situated cognition that generate *communities of actors* (Romero & Molina, 2011). Therefore, co-production starts changes in routines and capabilities at the networks/platforms level (incorporation of digital technologies and process innovations) and digital business ecosystems (marketing innovations). *Co-production* can also drive the emergence of new networks/platforms and digital business ecosystems guided by service-dominant logic.

As a complex process of organizational change, digital servitization executes three interconnected types of strategies. Each involves organizational transformations (Tronvoll et al., 2020) and specific value generation modes (Rabetino et al., 2017). *Technological strategies of digital servitization* involve routines and capabilities in organizational changes from planning to discovery, based on the generation and adaptation of networks/digital platforms, which aim at a specific form of *value appropriation and productivity*. From an *organizational back-end perspective*, digital technologies improve the 'firm's operational and R&D capabilities in terms of efficiency, resource allocation, and information on the business environment, key for decision making and product and service development.

Based on digital servitization, business strategies drive organizational transformation from scarcity to abundance, understanding the dynamics of their digital servitization-oriented ecosystems. Central to this is how they carry out routines and capabilities to drive value co-creation and relationship management. Thus, from a *front-end organizational perspective*, business models based on digital servitization promote new types of integration and interaction with customers and complementary actors (Tronvoll et al., 2020). While those *innovation digital servitization-oriented strategies* transform the firms from a hierarchy to a partnership approach, they also consider open organizational modalities to generate value based on the co-production and configuration of communities with clients and complementary actors. Each of these organizational dimensions has its outcomes, modes of interaction, and logic of action and learning, which induce organizational transformations that drive organizational (socio-technical) innovations integrating people, technologies, infrastructures, cultures, and purposes⁵ (Coreynen et al., 2017).

3. DISCUSSION

3.1. Theoretical contributions

At least three contributions of research emerge from the proposed framework. First, *from the dynamic capabilities approach*, the recognition of the complexity of the digital servitization process (Parida et al., 2016), together with the operationalization and redefinition of capabilities in the context of digital servitization-oriented innovation ecosystems (Teece, 2018), gives way to exploring new operationalizations covering dynamic capabilities (Kohtamäki et al., 2020b). The second contribution follows the recurrent criticism observed in

⁵ The literature related to *digital transformation* oriented to Industry 4.0 is already extensive and raises different models and analytical tools in socio-technical terms to analyze degrees of change in the firms and its networks (Bertolini, Esposito, Neroni & Romagnoli, 2019).

servitization concerning the lack of approaches that could deepen the understanding of the phenomenon using a multilevel approach (Rabetino et al., 2018). Our framework moves in that direction by reconciling such complementary approaches as dynamic capabilities, the economy of innovation (Arndt & Pierce, 2018; Nelson & Winter, 1982; Teece, 2018), socio-technical transitions, and actor-rules systemic dynamics (Geels, 2020; Lepratte, 2016). Finally, a meta-paradigmatic question is related to what Rabetino et al. (2020) observed when analyzing the strategic management field. Although different onto-epistemological positions may coexist, synergic approaches that answer the emerging canonical questions beyond positivism are needed (Luoto, Brax & Kohtamäki, 2017). Deepening a convergent perspective oriented to digital transformation processes and servitization poses challenges in this regard (Kohtamäki, Einola & Rabetino, 2020a; Kohtamäki et al., 2018; Kohtamäki, Parida, Patel & Gebauer, 2020b). In any case, the socio-technical approach responds to the need for multilevel and multi-paradigmatic research (Geels, 2020) to study digital servitization (Rabetino et al., 2018).

3.2. Managerial implications: practices and tools to enhance digitalization capabilities

Enabling ambidexterity in the firms' strategic management is critical to face the paradoxes in servitization (Kohtamäki et al., 2020a). These circumstances also call for placing innovation at the top of the servitization management agenda (Sjödén et al., 2019), bearing in mind that the value capture process will be beyond the firm's boundaries and must focus on relational governance models (Vendrell-Herrero et al., 2017). Because old and new business models can coexist, strategic agility is a prerequisite (Bustinza, Gomes, Vendrell-Herrero & Tarba, 2018; Tronvoll et al., 2020) to foster ambidextrous processes. Due to its importance, the agility to adapt resources and capabilities in collaboration with complementary actors in the ecosystem is another critical attribute that managers must develop. Managers must be prepared to identify

changes and opportunities that generate socio-technical transitions and effect changes in their mindset (Bustinza et al., 2018; Huikkola & Kohtamäki, 2020a; Sjödin et al., 2020). A successful digital servitization strategy calls for implementing coordinated efforts and redefining organizational culture, involving a closer link between business units (Sklyar et al., 2019). Another necessary condition is to develop relational capacities to interact and, above all, co-create value, with financial impact and in terms of quality, with customers and other stakeholders in a service ecosystem (Kohtamäki et al., 2020b).

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