



# Servitization: A Pathway Towards A Resilient, Productive And Sustainable Future

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## Research and Programmes

### The Advanced Services Group



#### The Advanced Services Group

The Advanced Services Group (ASG) is a centre of excellence within Aston Business School specialising in servitization and, in particular, advanced services. It delivers education, training and research to help global manufacturers and technology innovators to develop services-led strategies. The Centre have worked with over 200 businesses, including Baxi, Domino Printing Sciences, Ishida, Legrand, Thales and Waters, as well as a multitude of SMES, who have both informed and benefited from its research.

#### The Advanced Services Partnership

This is an international research network, which was formed in 2015, and comprises larger manufacturing organisations that are traditionally production-focused, and now in the earlier stages of exploring, developing and deploying advanced services. It sustains a nurturing environment comprised of one-to-one support and roundtables that are structured so that experiences can be shared openly and constructively. Partners are drawn from across Europe and the USA.



Digitally Enhanced Advanced Services (DEAS+) NetworkPlus. A community of researchers and practitioners funded by the EPSRC. The DEAS NetworkPlus works collectively across disciplines (e.g., computer science, engineering and business) and industry sectors (manufacturing, transport and financial services), to accelerate the innovation of Digitally Enhanced Advanced Services.



Pathways Towards Servitization: A Transnational Study of Organisational Transformation. An ESRC project with the primary aim of developing organisational transformation pathways that manufacturers can follow to efficiently and effectively innovate their organisations through servitization and compete through advanced services.



Advanced Services Growth 1. This project will provide new knowledge, accessed through a digital learning platform, for SMEs in the Greater Birmingham and Solihull region of the UK – it will underpin changes that SMEs will need to make in order to benefit from the changing digital landscape.



## **European Union**

European Structural  
and Investment Funds

Advanced Services Growth 3. This project will underpin new growth in manufacturing SMEs in the Black Country of the UK – it will be achieved through a series of business support interventions to help these SMEs to develop business models for advanced services that ‘co-create’ value for themselves and their customers.

## Introduction

The Spring Servitization Conference (SSC) is dedicated to understanding how organisations can develop and adapt their business models around servitization and advanced services. Since its inception, the mission of SSC has been to play a key role in the development of a better understanding of servitization and to demonstrate the potential impacts upon businesses and society. SSC continues to fulfil this mission and provides the major forum for researchers from across disciplines including operations management, strategic management, service innovation, service marketing, information system, etc. to constructively share and debate their findings, generates new ideas, network and forge research partnerships.

We were planning to host the Spring Servitization Conference 2021 in Florence, Italy. However, similar to SSC2020, due to the COVID-19 pandemic, we were forced to move this year's conference to a fully virtual event too. The theme will be *Servitization: A Pathway towards a Resilient, Productive and Sustainable Future* and once again we will follow the now established format of a single stream where all contributors have an opportunity to present to the whole conference audience and engage in both structured and semi-structured panel sessions to discuss their work. The programme is designed to encourage strong participation, extensive debate, and bridge research theory and industrial practice. The conference will also feature keynotes from senior executives at leading manufacturing businesses.

We would like to thank all contributors, both new and returning colleagues, reviewers, delegates, sponsors, and staff for the continued support and commitments to the Spring Servitization Conference despite the uncertainties and challenges generated by the COVID-19 pandemic. We are truly hoping to return to our normal face-to-face conference from 2022.

Dr Ali Z. Bigdeli and Professor Tim Baines  
*The Advanced Services Group, Aston University, UK*  
May 2021

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# COLLABORATING WITH SERVICE AND DIGITAL SUPPLIERS FOR SMART PRODUCT-SERVICE SYSTEMS DEVELOPMENT: COLLABORATIVE CONFIGURATIONS BASED ON THE SOCIAL EXCHANGE THEORY

Lucas S. Dalenogare, Marie-Anne Le Dain, Néstor F. Ayala, Giuditta Pezzotta, Alejandro G. Frank

## ABSTRACT

**Purpose** – This paper aims to define the main configurations of inter-firm collaboration to develop Smart Product-Service Systems (PSSs) in the digital servitization context.

**Methodology** – We propose four configurations of inter-firm collaboration for Smart PSS development, considering the level of value creation joint activities and value capture interdependence among the actors. We conducted four case studies, one for each type of collaboration. These cases were analyzed according to the four elements of Social Exchange Theory (SET): trust, commitment, reciprocity, and power.

**Findings** – We show four main types of inter-firm collaboration: expanded business, enhanced business, platform business and symbiotic business. Our findings show that the type of configuration for inter-firm collaboration chosen by product firms varies according to the level of innovation sought in the Smart PSS offer. Additionally, during each type of collaboration, different arrangements of the elements of trust, commitment, reciprocity, and power can be found.

**Originality/value** – Our study provides an in-depth analysis of inter-firm collaboration for Smart PSS offering and show how service and digital suppliers interact with the servitized company.

**KEYWORDS:** Digital servitization, Collaboration, service supply chain

## 1. INTRODUCTION:

Smart product-service systems (PSSs) – the outcome of the digital servitization process – are considered advantageous for product firms, creating, as they do, new ways to create and capture value in innovative business models (Kohtamäki et al., 2019). However, in order to develop and benefit from Smart PSSs, product firms need to develop capabilities in different domains, which can become too costly for them (Coreynen et al., 2017). Instead, through collaboration, product firms can combine synergic capabilities from different partners, such as service providers and digital technology suppliers, to co-create and capture value, obtaining competitive advantage without the need to master every knowledge domain (Dyer et al., 2018).

In general, the extant literature has considered inter-firm collaboration to be an important strategy for traditional servitization (Ayala et al., 2018). However, it is only recently that such an approach was first studied within the context of a Smart PSS (Kohtamäki et al., 2019). In this context, the question emerges: *How can inter-firm collaborative networks be configured for the offering of Smart Product-Service Systems?*

This article analyzes the relational and power-dependence aspects of collaborative networks for Smart PSSs. First, we develop a framework for business model inter-firm collaborations, taking into account two dimensions: value creation joint activities and value capture interdependence (Dyer, Singh, and Hesterly 2018). Based on this framework, we propose four main collaborative configurations: (i) expanded business, i.e., an independent inter-firm collaboration that generates additional benefits; (ii) enhanced business, i.e., inter-firm collaboration with joint activities oriented to the digital servitization of a focal firm; (iii) platform business, i.e., an inter-firm combination of products and services with lower relationships among the actors but higher value capture interdependence; and (iv) symbiotic business, i.e., inter-firm collaboration for integrative co-business.

## 2. THEORETICAL BACKGROUND:

Inter-firm collaboration is considered an important strategy in servitized environments (Paola et al. 2013), especially in contexts involving digital technologies (Skiyar et al. 2019), where traditional 'make-or-buy' decision should be updated to a 'make-or-collaborate-or-buy' decision (Kohtamäki et al., 2019)., By means of inter-firm collaboration, networked companies can co-create and capture value and thereby obtain a possible joint competitive advantage for the whole network (Dyer and Singh 1998). The understanding of value creation and value capture dynamics is crucial for inter-firm collaboration (Dyer, Singh, and Hesterly 2018). The creation of value is related to the required activities performed outside the boundaries of a focal firm, collaborating with partners, suppliers or customers. For value capture, the bargaining power between actors will determine the extent to which each actor can appropriate the common benefits of the collaboration outcomes (Dyer, Singh, and Hesterly 2018; Zott and Amit 2010). Different configurations of inter-firm collaboration are possible in the servitized business models. External partners can be useful for value creation, value capture, or for both (Tangpong et al., 2015). In this sense, we propose the framework represented in Figure 1 to describe these different types of inter-firm collaborations.

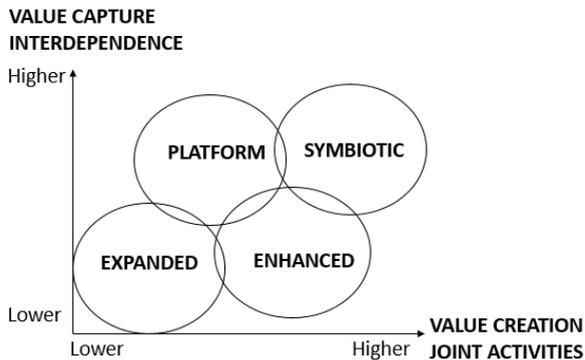


Figure 1: Inter-firm collaboration

In the Expanded business, each actor has an independent value proposition for the customer, but their relationship brings benefits through the expansion of their business model. It has lower levels of joint activities for value creation and lower value capture interdependence. The Enhanced business is a collaboration with unilateral dependence, in which the focal firm depends on its suppliers (Tangpong et al. 2015), forming an hierarchical collaboration with joint planning activities for new product development (Whipple and Russell 2007; Pathak, Wu, and Johnston 2014) to a greater extent than the previous arrangement. This collaboration follows a classic supply chain configuration, in which the actors provide their solutions to one actor, who delivers the value to the customer. The Platform business is based on a foundation of products, services, and/or technology for external actors to develop innovative complementary value (Gawer and Cusumano, 2014). This approach enables actors to be connected, sharing resources and integrating systems in a synergic way (Allmendinger and Lombreglia 2005) and is a viable solution for them to complement their offerings and increase both their value creation and their value capture. Lastly, the Symbiotic business has a strategic/bilateral partnership, characterized by joint decision-making (Tangpong et al. 2015; Whipple and Russell 2007), in which companies belonging to multiple competing supply chains join in consortium (Pathak, Wu, and Johnston 2014). Unlike Platform business, this collaboration has high investments in relational assets by each partner, as they engage in activities ranging from engineering to after-sales. The network configurations are shown in Figure 2.

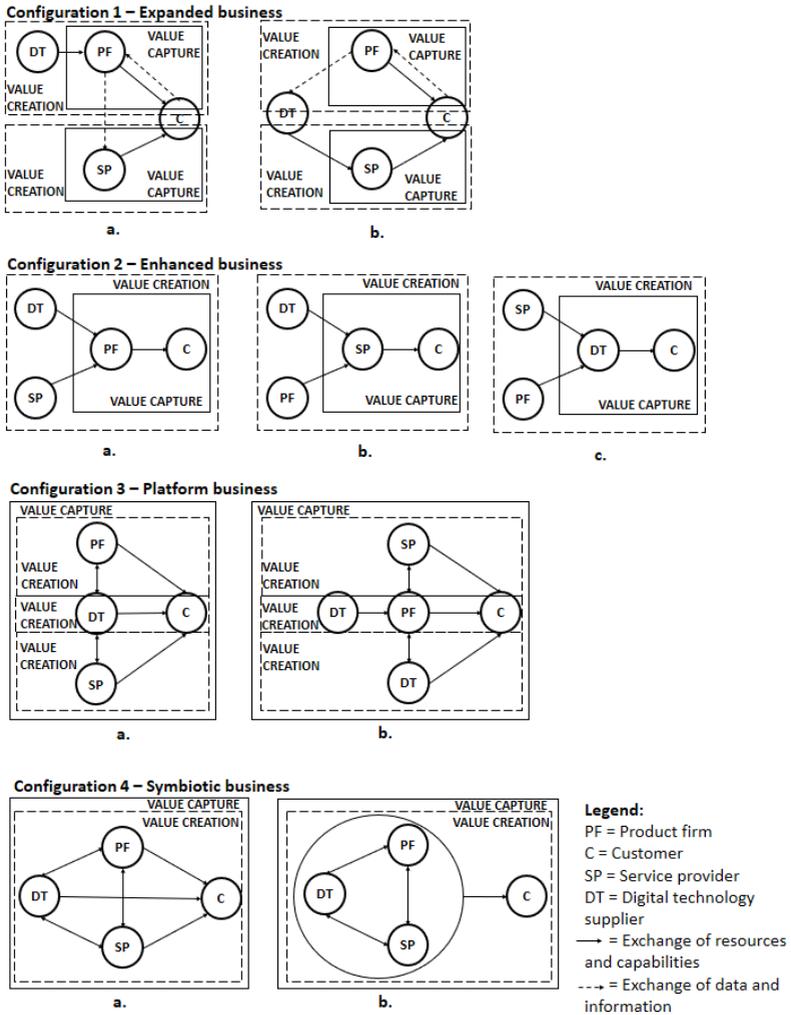


Figure 2: Network configurations of the typology

**3. RESEARCH METHODOLOGY:**

Based on the proposed typology, we conducted four case studies, one for each type of collaboration. Case studies were selected according to a theoretical sampling approach, where cases are selected due to their suitability for explaining the constructs. We conducted interviews with companies that operate in collaborative Smart PSSs, in which we identified and selected four of them as the most suitable cases for the purpose of this study and that shows differences between them, allowing us to categorize in the four predefined configuration types. In Table 1, we show the four selected case studies for this article, listed by their aliases, one for each type of collaboration.

Table 1: Case studies for the research

Collaboration type	Company	Description	Sources	Interviews
Expanded business	ElectricCo	Multinational manufacturer specialized in electrical distribution (products and services)	2 procurement managers and 1 marketing director	3 interviews of 1 hour
Enhanced business	MoldCo	Multinational manufacturer for molds development and assessment	1 sales manager and 1 R&D engineer	2 interviews of 1 hour
Platform business	IndustrialCo	Multinational supplier of digital solutions, automation and electric distribution for industries	2 managers of cloud applications solutions	2 interviews (1 hour and 1,5 hour)
Symbiotic business	AutomationCo	Multinational supplier of automation solutions in sensors, software integration and machine vision	1 CEO of regional subsidiary	2 interviews (1,5 hour and 0,6 hour)

We analyzed how the actors from each supply chain configuration organize themselves using the Social Exchange Theory (SET) view with its four internal elements (i.e., trust, commitment, reciprocity, and power). In order to collect data to analyze the relationships, we conducted semi-structured interviews with the selected companies. These interviews were divided into two parts. The first part of each interview consisted of questions on: (i) general information about the company's business; (ii) details about their offerings, including identification of the products and services of which these were comprised, and how they were enabled by digital technologies; (iii) types of revenue and relationships with customers; (iv) the relationship with suppliers and how the company engaged in collaboration with them. After analyzing the possible collaboration with suppliers according to the product firms' offerings, we proceeded to the second part of the interview. We posed questions about the relationship with their suppliers and other external companies, including a general description of the relationship, the frequency of interaction with them, their expected capabilities the type of agreement and questions about the SET elements, and its outcomes. Data was collected from multiple information sources to ensure the reliability of our analysis. Before the interviews, we gathered information about the companies from their websites and reports, in particular with regard to their offerings and investments in the areas of service development, digital technology acquisition and development, and their partnerships within these contexts. Deriving information from a range of sources resulted in data triangulation, which supported construct validity.

#### 4. FINDINGS AND DISCUSSIONS:

In the area of electrical distribution, ElectricCo usually sells products intermediated by electricians, the service providers for electrical installations. In order to form a closer connection with its end customers, ElectricCo has been investing in digital services across all business units, offering remote monitoring services integrated with manufactured products such as switchboards, aiming to create large systems with connected products. By acquiring connectivity modules, cloud solutions and network services from digital technology suppliers, ElectricCo has developed connected switchboards that allow customers to have real-time information about electricity distribution in their buildings via digital services. These services generate data about the energy system and use predictive analytics to avoid supply disruption. The new solution proposed by ElectricCo brings the company closer to its end customers and generates new revenue through the provision of additional services. Moreover, the Smart PSS developed by ElectricCo brings the prospect of

benefits beyond its core business: the generated product data can be used for new collaborations, to expand the business model and become a data provider. ElectricCo considers selling this data to external actors, such as insurance companies (Configuration 1A of Figure 2), which can use this product data to improve their predictions about power distribution safety. ElectricCo has no dependency on this type of revenue, which represents an additional revenue source for its business model, increasing the importance of its position in the supply chain. As dependency lies with the data buyer, this type of relationship represents a low value capture interdependence and the mere provision of data represents lower levels of value co-creation.

The case chosen for the Enhanced business collaboration type has MoldCo as the focal firm, as represented in the Configuration 2A of Figure 2. MoldCo designs and manufactures injection molds for plastic components, and offers different types of contract for warranty and maintenance according to customer needs. In some cases, the customer is responsible for the maintenance of the molds, but the services provided by MoldCo represent more than 50% of its current revenues. In order to optimize service provision, MoldCo collaborated with a supplier with expertise in sensors, IoT connectivity modules and infrastructure, and artificial intelligence, in order to develop a smart mold. By means of embedded sensors, cloud connection and digital services, this offering can collect data from operations and communicate with humans and machines, improving the performance metrics of the current solution. Thus, the smart mold provides a cost-reduction in service provision, improvement in product quality and the customer process, and a reduction in the energy consumption of the customer process. The smart mold offering is a highly innovative solution for the company and the market, requiring a close working relationship with the digital technology supplier: during the six-month solution development process, the two companies usually interacted on a daily basis.

In order to boost its Digital Solutions business, IndustrialCo has developed a digital services platform. This platform is cloud-based and works with IoT open standards. The main goal of this solution is to provide customers with access to a wide variety of digital applications, using customer data collected in the cloud. Thus, through the platform, the company provides access to digital services related to products, such as machines and equipment, and digital services related to industrial processes. IndustrialCo follows a strategy based on open-source software, anticipating widespread adoption of its solution. Thus, as shown in in the Configuration 3A of Figure 2, IndustrialCo promotes a common platform, with internal and external developers offering digital applications to industrial customers. The platform works with a model based on annual licenses, providing three different types of access: customer, developer and operator. Customers buy and use the applications available, which are built by the developers. Operators provide these applications. Thus, operators and developers offer their solutions to the customers, who buy these on the platform. The solution is also of interest to device manufacturers, who can provide digital applications for their devices on the platform. Users and developers can also work together to develop solutions for specific issues. In this way, IndustrialCo offers an innovative solution to the market with great flexibility, since joint activities with customers or external developers are not required.

In one business unit of AutomationCo, the product firm offers optical sensors for machine vision solutions, along with commissioning services. In this business, the company has to collaborate with the machine manufacturers to provide the solution for the customer – the interviewee describes collaboration as taking place within a “(...) *magic triangle, where there is the knowledge provider, the machine builder, and the end-user*”. For more advanced solutions, especially for customers in the life sciences sector, AutomationCo must also collaborate with specialized system integrators who provide more advanced software in machine vision technology. This case is therefore symbiotic, as all actors need each other’s resources to create and capture value from the customer, with each actor offering their solution to the customer, while remaining integrated with the others. The system integrators provide the software, carry out the installation on the customer’s site, and are responsible for the functioning of the system. The machine builders provide the equipment into which the machine vision technology will be integrated, with

AutomationCo providing the sensors and supporting validation of the solution in the customer’s process through commissioning. This collaboration is shown in the Configuration 4A of Figure 2.

The elements identified in SET are summarized in Table 2. The differences regarding the different types of collaboration, in terms of SET elements, are discussed subsequently.

Table 2: Summary of the results

Collaboration type	Value exchange	Social Exchange Theory (SET)				Value reward
		Trust	Commitment	Reciprocity	Power	
Expanded business	Data for third parties	Contractual	Long-term - low interactions	Low	Imbalanced - manufacturer	Additional revenues
Enhanced business	New solution development	Competence	Long-term - higher interactions in development phase	Medium	Balanced	Innovation and capability development
Platform business	Flexible solutions	Contractual	Long-term - low interactions	Medium	Balanced	Innovation, capability development, access to new markets and cost-reduction
Symbiotic business	Development of more advanced solutions	Goodwill	Long-term - continuous interactions	High	Imbalanced - digital service provider	Innovation and access to new markets

The *Expanded* business represents an inter-firm collaboration with low joint-activities for value creation and low-value capture interdependence. In this case, companies exchange information about product-related services, which does not demand intense interactions. Relation-specific investments are not present in this type of collaboration, resulting in low informal trust mechanism requirements. Only contractual mechanisms of *trust* are required because external parties need to access internal data from the company and the customer. Security issues are an inherent challenge of digital offerings, being cybersecurity an increasing concern. In this context, the demanded *trust* is not necessarily implied in opportunistic behavior from the other party. However, for this type of collaboration, the company must also feel confident about its partner’s data security. The companies form a strategic *commitment* to expand the existing business, resulting in a network with low reciprocity, in which the expectations are limited to a firm that requires a complementary resource or information from another firm. The rewards are new revenues and more *power* to the servitized company. Prior research has stressed the importance of data for the future of business models, with some companies interested in acting as a data provider and having a central role in the ecosystem, creating dependency among other actors on the company (Deloitte 2014). Thus, we developed the following proposition:

*Proposition 1: Expanded business is a type of collaboration among partners with low requirements of trust, commitment, reciprocity, and power. Collaboration can be unbalanced, favoring one partner over the other, but power is not a defining mechanism of the relationship, being one of the drivers of this type of collaboration.*

On the other hand, *Enhanced business* has joint-activities for value creation. Companies share information regarding customer process-related services, developing relation-specific assets that require more interactions among the actors, and informal trust mechanisms. However, this collaboration is marked by unilateral dependence and moderate level of *reciprocity*, not requiring

a goodwill level of *trust*. The companies form a *commitment* due to a technical need, with the product firm retaining a cooperation agreement to have support from a partner to improve the efficiency of an existing business (Zott and Amit 2010). As the servitized company also relies on the partner's solution for the after-sales phase of the Smart PSS life cycle, collaboration demands a long-term commitment with event types of interactions. This partner is no competitor in the market, not requiring the servitized company to rely on strong power mechanisms to obtain more benefits. However, *power* is more important in this type of collaboration than the *Expanded* business, as the servitized company has the dependence on the partner's resources and expertise. We developed the following proposition:

*Proposition 2: Enhanced business* is a type of collaboration with moderate requirements of trust, reciprocity, and power. The digital servitized company might require a strong commitment from the partner, depending on the importance of the resource and the phase in the life cycle in which the resource is required for the Smart PSS.

The *Platform* business is a strategy to create value with other companies without joint activities, becoming dependent for value capture. This dynamic reduces the need for informal trust mechanisms, requiring only contractual mechanisms for the same reasons as the *Expanded* business. The platform approach requires the companies to have access to the platform in order to profit from it. The *commitment* is then long-term oriented, but with low interactions among the actors. This type of collaboration is a trend for digitalized environments, in which companies can autonomously develop their Smart PSSs that are complemented with solutions from other product firms, digital technology suppliers, and service providers (Zott and Amit 2010). The network has a medium-level of *reciprocity*, as the platform is valuable with actors' engagement, but a significant number of actors is available. *Power* can be determined by the strategy of the digital platform provider: open or closed-source. In closed platforms, the company has more control of the solutions incorporated in the platform, providing more differentiation to the customers. However, in open platforms, many players can be engaged, offering more solutions to the customers and reducing specific companies' bargaining power (Gawer and Cusumano 2014). Considering this, we developed Proposition 3:

*Proposition 3: Platform business* is a type of collaboration with low trust requirements, a long-term oriented *commitment* with low interactions. The engagement of partners can adopt several options, reducing the *reciprocity* to a medium level. *Power* will also be determined in function of the platform's dynamics, in which open-source platforms have more balanced *power*.

Lastly, *Symbiotic* business is the most integrative type of collaboration, consisting of exchanges regarding customer process-related. This collaboration requires higher levels of informal trust mechanisms with high relation-specific assets and bilateral dependence for value creation and value capture. The *commitment* is long-term oriented, usually with continuous interactions among the engaging partners that shared operational linkages through their combined solutions. The *commitment* has a technical and strategical driver, as the companies involved create an interdependent ecosystem, with high *reciprocity*, to provide a more advanced solution to their customers, developing new activities and/or new business models (Zott and Amit 2010). The dependence is defined by many factors, in which in a Smart PSSs, the innovative degree of the solution is an important determinant for the *power* dynamics. Among all types of collaborations, *power* is more determinant in the symbiotic business, as the engaged actors can also be competitors in their markets. Thus, we developed the following proposition:

*Proposition 4: Symbiotic business* is a type of collaboration in which the strong integration among the engaged actors results in high requirements of *trust*, *commitment*,

and *reciprocity*. Power is an important determinant for the relationship, in which companies with the most innovative solution can obtain more benefits from the collaboration.

##### 5. THEORETICAL AND PRACTICAL CONTRIBUTIONS:

By identifying elements that distinguish differences between the types of collaboration, we propose a framework for inter-firm collaboration in digital servitization, considering different configurations in terms of value creation and value capture for each type. We offer advances in literature gaps on collaboration in digital servitization. Many authors have highlighted inter-firm collaboration as an important strategy for this context, but, as pointed out by Kohtamäki et al., (2019), further studies are necessary. Our study provided new insights in this direction, showing how the interaction between the firms occurs within each type, by using a SET perspective for the first time in a digital servitization context. Thus, we extended the current literature of inter-firm relationships and business model innovation.

Our results also offer practical information for managers and practitioners. By showing the ways in which some companies are collaborating, and explaining their objectives and relationships, we provide the means for other manufacturers to identify what they need in terms of external support with specific actors (product firms, customers, service providers and digital technology supplier) and to understand the different forms of value creation and capture, considering their relational implications. With a clear presentation of the interactions among the engaging actors, practitioners know what to expect when collaborating with other companies.

We analyzed the current dynamic of the four cases and categorized them using the SET. We suggest further cases studies to corroborate or not our propositions. Moreover, we did not consider how companies arrived at the configurations and their transition and transformation. Future studies could consider the dynamic aspects of collaborations to capture such effects.

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