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Digital servitization in BtoB manufacturing systems

Combining theory and practice for competitiveness enhancement

Collana del Dipartimento di
Scienze Aziendali, Management
& Innovation Systems
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Sezione Ricerca - N 8

DIPARTIMENTO DI SCIENZE AZIENDALI MANAGEMENT & INNOVATION SYSTEMS

FrancoAngeli

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Edizioni La passione per le conoscenze

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Il presente lavoro monografico è collocato nella Sezione Ricerca, Area “Management, Organization and Social Responsibility” ed è stato autorizzato per la pubblicazione a valle di un processo di doppio referaggio anonimo.

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INTRODUCTION

The last decade is characterized by perpetual change, high uncertainly, and growing complexity fueled by the so-called "4th Industrial Revolution" and the related "Industry 4.0". Emerging technologies (i.e., Internet of Things, blockchain, big data, cloud computing platforms, robotics) have made possible a strong connectivity within and among people and organizations in interactive ecosystems where an unprecedented value can be created and exchanged. Thus, Industry 4.0 can sustain the industrial' business transformation from a product-centric to a service-centric logic – known as servitization – enabled by digitalization. However, the links between digital transformation and value-creating opportunities arising from servitization implies a nuanced understanding of not only technological issues but also underlying organizational and managerial ones. As prior literature contends, the digital transition to service seems far from easy because it adds complexity entailing profound changes in business orientation in terms of managerial mindset, organizational layouts, relationship management, and decision-making processes, as well as a reconfiguration of value creation processes, also involving customers and equipment suppliers. Organizations competing in business-to-business (B2B) markets are not immune to these transformations because digitalization alters the communication, appropriation, measurement, and representation of value in industrial setting.

In the light of such disruptive trends, the book aims to reconceptualize the servitization narrative through digitalization, investigating digital service transformation patterns undertaken by industrial manufacturers in B2B markets.

The remainder of the book proceeds as follows. The Chapter 1 delves on the state-of-the-art on the topic of servitization in academia. More in depth, different concepts, and definitions of servitization are presented, highlighting the lack of a unanimous conceptualization in the scientific debate. A frag-

mented scenario also emerges in terms of research streams on servitization. The myriad of viewpoints reflecting the diversity of scholars' research traditions and theoretical backgrounds are enclosed in three major research streams identified in service strategy, service innovation, and service dominant logic. Next, the same Chapter is aimed at tracing the theoretical development of servitization research to understand the progression in body of knowledge on this topic. Different theoretical lenses providing a specific perspective for explaining the phenomenon are grouped into categories covering resources, organization, and systems. At the end of the same Chapter, main themes in servitization literature are identified in: i) service offerings; ii) strategy and structure; iii) drivers, benefits, and barriers; and iv) resources and capabilities. These themes are singularly discussed to provide a complete overview on servitization phenomenon.

The Chapter 2 is centered on the description of changing landscape for manufacturing in the digital era. Firstly, Industry 4.0 is addressed as on open issue for industrial organisations. It is due to the variety of smart solutions provided to satisfy the increasing needs of manufacturers to digitalize at intra- and inter-organizational business processes to achieve higher efficiency, effectiveness, and competitiveness in the current scenario. After a brief focus of the main enabling digital technologies, the links between Industry 4.0 and servitization are clarified in terms of a promising convergence between these two research fields traditionally decoupled. Such reflections are the premises of an in-depth study on digital servitization in manufacturing, ranging from definition and perspectives of analysis, to the usage of digital technologies, opportunities, and challenges for digital servitized companies.

The Chapter 3 stresses the importance to complement servitization and digitalization in systems perspective. The latter is extended to the marketing management literature by the Viable Systems Approach (VSA), according to which a system is an organized and self-regulating entity aimed to the viability as survival within the context. These themes are echoed in the Service-Dominant (S-D) logic where value co-created by actors influences the ecosystem viability. Thus, an interpretative framework of digital servitization is defined combining VSA and S-D logic to re-read the overall socio-technical dynamics, and the underlying mechanisms leading to a digitized value creation. In particular, digital servitization framework represents an iterative and non-linear process that dynamically evolves through the interplay of key dimensions as building blocks that illuminate the workings of the non-linear relationships within and among intra- and inter-systemic actors.

The Chapter 4 investigates how the proposed framework supports industrial manufacturing firms in creating value in the B2B markets. To this aim,

a longitudinal case study methodology is proposed, employing the proposed interpretative framework as analytical template, and by adopting an abductive research strategy. Case company operates in the automotive sector. The empirical research reveals that the combined effect of the viability mechanisms allowed a dynamic reconfiguration of the ecosystem actualized in co-created activities. In particular, the digital servitization led case company to ongoing service innovation and data-intensive processes enhancing the quality of decision-making, as well as to co-innovative smart service solutions for new emerging needs.

Thus, human-mediated integration of digital resources, platforms, and tools turns into strategic assets actualizing improved value co-creation that sustain an enduring digital innovation. Hence, viability and co-evolution of the entire ecosystem are fostered over time.

The research, enriches and extends the literature on digital servitization. This is the first study that adopts a system perspective such as VSA combined with S-D logic to examine relational dynamics and viable mechanisms between B2B actors in order to accomplish value co-creation in digitized servitized context.

Core theoretical contribution is the proposal of an interpretative framework as original key to understand how digital servitization can enable and foster industrial organisations to create value in industrial markets. In this regard, VSA is proposed as a suitable approach to gain a holistic understanding of the multifaceted and complex phenomenon of digital servitization. In fact, service research is inducing a paradigmatic change in business management and marketing that the adoption of a systems perspective can help to realize. The adequacy of VSA is also justified by its ability to capture the crucial role played by strategic management of value co-creation process underling the digital servitization, contributing thereby to ecosystem's viability and co-evolution in the long run. In addition, the study encourages the consolidation of a research orientation that expands its scope to the systematic integration of multi-actor perspectives and investigation of interdependencies among actors.

At managerial level, the research offers direct implications for managers coming from the manufacturing industry that drive digital servitization initiatives in B2B markets. The practical stance lies in the identification of specific digital servitized pathways that research findings reveal value-driven and partnership-focused. Thus, organizations that plan similar endeavor can benefit from this study and more effectively and efficiently manage the necessary transformational shifts. In this regard, executives can rely on practical mechanisms when designing innovation projects that are consistent with digital servitization plans. This would lead to the definition of managerial mod-

els that highlight the paths of digital servitization with greater potential for companies according to contingency factors, such as industry, company size, and supply chain position. All in all, the book could represents a valuable solution for practitioners and industry groups that seek a more contemporary managerial framework that, being receptive to the ecosystem view, enables to see beyond the enterprise and perceive multiple tiers of suppliers, customers, and stakeholders that directly and indirectly provide information and resource flows. This change in perspective may represent a relevant contribution to business management helping understand the decision-making in conditions of complexity.

Campus di Fisciano, aprile 2021

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1. SERVITIZATION IN INDUSTRIAL COMPANIES: THE STATE OF THE ART

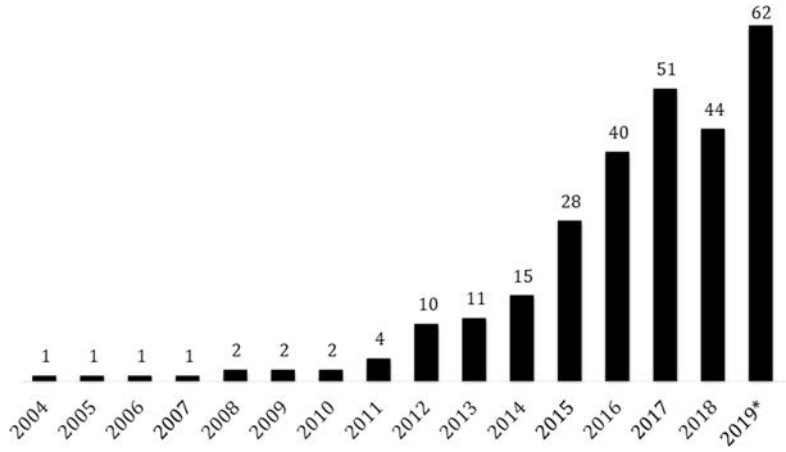
1.1. Concepts and definitions of servitization in the scientific debate

In the late '80s, Vandermerwe and Rada (1988) launched the servitization concept discussed as "*the process of creating value by adding services to products*" (p. 315) - such as spare parts delivery, repair and maintenance, consultancy and training - in order to increase competitiveness, turnover, and market power of companies acting in industrial markets. Since then, interest in servitization in terms of theoretical construct, empirical phenomenon, and research domain has been growing over the time as many dedicated journal publications, conferences and special sessions have demonstrated (Rabetino *et al*., 2015). A recent analysis of the servitization literature by Kowalkowski, Gebauer, and Oliva (2017b) set the boundaries and conceptual foundations for research in this area. In particular, the authors reconstruct the evolution of the research on service growth identifying two main phases. The first one starts during the last two decades of the last century and is characterized by definition of research domain's boundaries. The starting idea considers services as customer service that is an add-on to products, a crucial element of the buyer-seller relationship, and levers for competitiveness (Vandermerwe and Rada, 1988, Bowen *et al*., 1989; Martin and Horne, 1992). The second phase starts around 2000 with the emergence of the conceptual foundation including different conceptualizations, barriers, and key success factors[1] (e.g., Mont, 2002; Oliva and Kallenberg, 2003; Gebauer *et al*., 2005). Yet, Kowalkowski *et al.* (2017b) argue that the servitization is a mature field of research but it is still in a theoretical and methodological largely nascent stage. Echoing these considerations, a recent bibliometric

[1] They will be discussed in the following paragraphs.

analysis points out the fragmented literature on servitization in industrial business management that makes it a struggle to obtain a comprehensive understanding of this topic (Khanra *et al.*, 2021). As Figure 1 shows 225 articles were published between 2014 and 2019, exhibiting a recent boost in research interest on the topic.

Figure 1 – Research evolution on servitization



Source: Adapted from Khanra et al., 2021

Consequently, little progress has been made toward agreeing on unanimous conceptualization of servitization that varies according to the scholars' theoretical lens and context of study (Table 1). Complexity increases further as the lack of common lexicon has led to a conceptual equivocality that hinders the direct comparison of findings from different studies (Brax and Visintin, 2017). Among a plethora of terms, service infusion (Kowalkowski *et al*., 2013), service addition (Matthyssens and Vandenbempt, 2010), service transition (Oliva and Kallenberg, 2003; Fang *et al*., 2008; Ulaga and Loveland, 2014), hybrid offerings (Ulaga and Reinartz, 2011), and integrated solutions (Wilkinson *et al*., 2009) are most commonly used to indicate the development of industrials' core product offerings into services.

Table 1 – Overview on servitization concept

Definition	Author/s
A wave consciously driving companies into services to gain competitive ground, offering fuller market packages or "bundles" of customer-focussed combinations of goods, services, support, self-service, and knowledge by which services are beginning to dominate	Vandermerwe and Rada, 1988
A change in management philosophy where service is re-evaluated as an integral part of the supply transaction with importance before and after the moment of object supply	De Toni *et al*., 1994
The emergence of product-based services which diminishes the difference between companies operating in the manufacturing sector and those operating in the classical service sector	Tellus Institute, 1999
The ability to differentiate through supplier/customer relationships, providing an escape from product providers' cost leadership strategies	Robinson *et al*., 2002
A trend in which manufacturing companies are adopting more and more services within their offerings	Desmet *et al*., 2003
A strategy that seeks to change the way in which the functionality of a product is delivered to its market	Lewis *et al.*, 2004
A process of change in which manufacturing companies embrace a service orientation and/or develop more services in order to meet customer needs, gain competitive advantage and improve business performance	Ren and Gregory, 2007
The innovation of an organization's capabilities and processes to better create mutual value through a shift from selling product to selling Product-Service Systems	Neely, 2008
A process of change of strategy where manufacturing companies opt for an orientation to services and/or develop more and better services with the goal of satisfying customer needs, obtaining competitive advantages and improving the company's performance	Almeida *et al*., 2008
Servicing is the innovation of an organization's capabilities and processes to create better value by moving from selling only products to offering the product-service systems (PSS) market	Baines *et al*., 2009
A transition process to the stage where organizations continuously innovate new services and add value with its core product, which in the end signifies a firm as a value provider	Ahamed *et al.*, 2013
A change process whereby a manufacturing company deliberately or in an emergent fashion introduces service elements in its business model	Brax and Visintin, 2017

Source: Our elaboration

Within a similar fragmented scenario, the common aspect to the body of literature on this topic is the sense of shift from traditional product-based business towards a strong strategic and operational emphasis on service[2]

[2] The word "service" plays a central role in the definition of servitization. Four characteristics, translated by the acronym IHIP, are intrinsic of services, such as intangibility, heterogeneity, inseparability, and perishability. In other words, services are represented by performance, deed or effort instead of tangible objects (Intangibility); services are never performed in the same way since time, place, and context always change, so that they cannot be standardized (Heterogeneity). Furthermore, service production and consumption occur simultaneously (In-

(Brax and Visintin, 2017). More in depth, almost all authors cited in Tab. 1 seem to agree about customer orientation. In fact, the contrast between goods and services loses any relevance if producer's perspective is replaced with customer's point of view. The need to break away from a logic of opposition between goods and services also derives from developments in demand. Customers are increasingly looking for offerings able to create value, beyond their material or immaterial content (Vargo and Lusch, 2004). Furthermore, the literature reviewed also agrees about offering as packages or systems[3], which include mixes of both products and services, without the consumer noticing the distinction between the two categories. The uniqueness of this integrated offering allows companies establish a competitive edge. Finally, different definitions collected in Table 1 share the need for change required by servitization. The latter involves a radical transformation of the company, from organizational structure to corporate culture, and value proposition. Unsurprisingly, many cases of deservitization can be traced back precisely to the massive adaptation of the company to above-mentioned changes.

In sum, servitization is herein defined as a transformational process from a product-centric to service-centric business model (Kowalkowski *et al.*, 2017a). In this view, servitization is associated with significant changes in the company's mission, shared norms and values, and managers' mental models (Kindström and Kowalkowski, 2014). Servitization also entails redeployment and reconfiguration of organizational capabilities, structures, and resource base (Baines *et al.*, 2009). In addition, servitization involves a redefinition of the company's position in industry value stream, and types and scope of market offerings (Brax and Visintin, 2017).

Given these complex changes, several models have been identified to capture and explain the servitization. In this regard, end-state models focus on manufacturer's business model or solution offering as outcome of service-oriented strategic change (Barquet *et al.*, 2013; Saccani *et al.*, 2014). Within this body of literature, the intangible value of service offerings, value for customer, and how value creation and delivery would take place are the more discussed topics (Bakås *et al.*, 2012; Martinez *et al.*, 2019). Against end-state models, gradual transition ones explore the organizational transformation from a pro-

separability), and there is the impossibility to store and resolve services because once they are performed, they vanish (Perishability). See Lovelock and Gummesson (2004), Baines *et al.* (2009), Ciasullo (2018).

[3] Multiple terms are used in literature to describe innovative combinations of goods and services, such as Product-Service Systems (PSS), Integrated Product Service System (IPSS), Industrial Product-Service Systems (IPS2), hybrid bids, solutions, and integrated solution. See Kowalkowski *et al*. (2017).

cess-oriented perspective describing how the shift from product-focused to service-focused gradually occurs (Brax and Jonsson, 2009; Kowalkowski *et al.*, 2012). At strategic level, the processual aspects most frequently discussed are: start with product-related services and then extend the service offering; establish a service culture; prepare and identify the potential services-products that will be offered; and, confirm and select the service design or service concept and pilot study (Marques *et al.*, 2013; Martinez *et al.*, 2019). At operational level, instead, the establishment of employees as operant resources in light of their service-related knowledge and skills, as well as the implementation of performance management and measures for the service business are the most frequent shifts that occur in service transition (Martinez *et al.*, 2010; Baines *et al.*, 2014). Finally, stepwise progression models indicate sequential stages of servitization process (Holmström *et al.*, 2010; Visintin, 2012).

All these models (end-state, gradual transition, stepwise progression) have led to a conceptual incommensurability in literature, that Brax and Visintin (2017) attempt to overcome proposing an integrative model of servitization. It comprises the range of generic stages – production, business analysis, solution design, supply network design, implementation, operation, support, and disposal - that could occur when a complex solution based on a product-service-system is supplied (Table 2). In addition to the stages, the conceptualised model also comprises elements such as solution ownership, payment model of supplier, and financing of the solution investment.

Table 2 – The integrative model of servitization

	Stages	Description
1.	Production	Companies design, engineer and manufacture the hardware, software and service elements characterizing their solutions
2.	Business analysis	Supplier analyzes customer-specific business processes and figures out how these processes could be optimized through the implementation of a new solution
3.	Solution design	Functional and technical design of solution are outlined
4.	Supply network design	Collaborative network of external partners (i.e., specialized component suppliers, sub-contractors, and service providers) are created to access a broader set of capabilities useful to deliver solutions
5.	Implementation	Solution is implemented and installed in the customer's socio-technical environment through system engineering activities (e.g. software development and system integration), field engineering activities (systems installation and configuration), and training activities
6.	Operation	Processes enabled by solution are managed
7.	Support	Solution is monitored to prevent and fix breakdowns. End-users are supported in the daily interaction with the solution
8.	Disposal	End-of-life activities targeted at replacing, recycling, disassembling and/or disposing the solution

Source: Adapted from Brax and Visintin, 2017

Moreover, generic value configurations are conceptualized at each stage of servitization and ranging from low to high servitization degree and from least to most complex in the supplier's perspective (Figure 2).

Figure 2 – Value configurations of servitization

Generic Value Configuration	1 Production	3 Solution design	5 Implementation	6 Operation	7 Support	8 Disposal	a Ownership	b Payment model	c Financing
A) Products with limited support	S	C	C	C	S/T	-	C	input	-
B) Installed and supported products	S	C	S	C	S	-	C	input	-
C) Complementary services	S	S	C	C	S	-	C	input	-
D) Product-oriented solution	S	S	S	C	S	-	C	output	-
E) Systems leasing	S	S	S	C	S	S/T	S	input	N/A
F) Operating services	S	S	S	S	S	-	C	input	-
G) Managed service solution	S/T	S	S	S	S	-	C	output / outcome	-
H) Total solution	S/T	S	S	S	S	S/T	S	outcome	N/A

Operational responsibility: C= customer; S =supplier; T= third party
Payment model: input = supplier is paid for the service activities performed; output = supplier is paid for the output of his service activities; outcome = supplier is paid for the outcomes delivered rather than merely assets or activities.

Source: Brax and Visintin, 2017, p. 27

1.2. Reading servitization through major research streams

Servitization in industrial manufacturing context appears fragmented into separate streams since it has been studied from a broad range of academic disciplines and communities, such as general management, marketing management, operations management, and service management (Bilgeli *et al.*, 2017; Martinez *et al.*, 2019). Anyway, this myriad of viewpoints reflecting the diversity of scholars' research traditions and theoretical backgrounds can be enclosed in three major research streams identified in service strategy, service innovation, and service dominant logic (Lightfoot *et al.*, 2013; Martín-Peña *et al.*, 2017).

Service strategy is the research stream with the largest number of studies stemming from both the service and operations management domains. Overall, they are aimed at explain servitization as a business strategy that represents a source of differentiation through the most appropriate addition of services to products, creating more value for customers (Neu and Brown, 2005; Sawhney, 2006; Gebauer, 2008). Furthermore, servitization implies designing new business models in which products and services are better integrated (Visnjic *et al*., 2016). This research stream is also focused on contextual factors affecting the industrial firms' servitization in order to identify those that determine the most suited combination of products and services and the servitization type to be applied. They are distinguished in internal factors (e.g., organisational structure, strategy design and implementation, managerial behaviour, human resource policies) and external ones, such as environmental complexity (Windahl and Lakemond, 2006; Tuli *et al*., 2007; Johnstone *et al*., 2009; Turunen and Toivonen, 2011). At the same time, both effects and consequences of servitization for industrial manufacturers are analysed, especially in terms of costs and benefits, risks, and influence on financial performance (Mathieu, 2001; Sawhney *et al*., 2004; Neely, 2008).

Service strategy is followed by the research stream of service science by number of studies on servitization. In this vein, researches revolve around relationship marketing, service marketing, and the concepts of value co-creation and value co-production (Vargo *et al*., 2008; Parry *et al*., 2012; Smith *et al*., 2014). In fact, this research stream builds heavily on the service dominant logic (S-D logic) (Vargo and Lusch, 2004; Wilden *et al*., 2017). In particular, the S-D logic's and the servitization literature's concepts of service are aligned. In S-D logic, all exchanges are service-for-service exchanges where value is co-created and directly linked with customers' usage experiences (Vargo and Lusch, 2008). Drawing on this argument, servitization literature highlights that the transition to service is more than adding services to improve products since it implies the integration of services to jointly achieve and continuously improve value outcomes (Raja *et al*., 2013; Smith *et al*., 2014; Macdonald *et al*., 2016). The alignment between S-D logic's and servitization literature is also evident in the value concept. Both consider the intangible, co-creative, and potentially perishable nature of value that is heterogeneously experienced. Especially notable is that S-D logic contributes to understand the manufacturers' transformation from a traditional value-in-exchange economic orientation to a servitized value-in-use interactional orientation (Ulaga and Reinartz, 2011; Bastl *et al*., 2012; Garcia Martin *et al*., 2019).

Lastly, service innovation is the last research stream by number of studies on servitization. This stream is focused on service design in the context of

product-service systems (PPS). The impact of innovation or technology on the servitization process is investigated and some case studies are conducted on the development of technological services that supplement firms' product supply (Roy, 2000; Sakao and Shimomura, 2007). Moreover, sustainability and eco-efficiency, which can be reached by de-materializing the offering, are the other central topics of research regarding PSS (Tukker, 2004; Wong, 2004; Cook *et al*., 2006). This stream has recently supported the circular economy in which manufacturing firm engages its partners in the sharing, leasing, reuse, refurbishment, and recycling of PPS (Tukker, 2015; Bourguignon, 2016; Kortmann and Piller, 2016).

Finally, notable is that few papers are co-authored by scholars from these different research streams and most of the majority of references belong to the same scientific domain. This reveals an apparent lack of interdisciplinary perspective limiting knowledge accumulation (Rabetino *et al*., 2018).

1.3. Theoretical development in servitization research

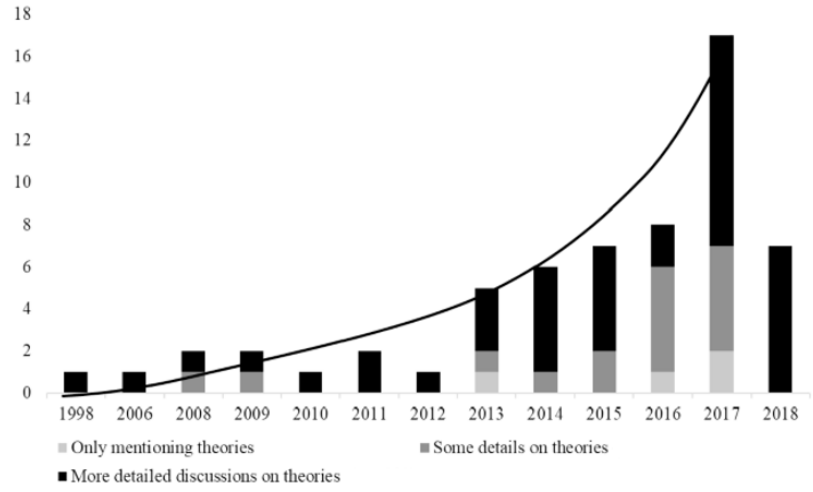
The above research streams focus on servitization phenomenon in an isolated manner, so their theoretical support is relatively endogenous to each academic disciplines and communities (Annarelli *et al*., 2016; Rabetino *et al*., 2018). Given the fragmented nature of the research field, much of the extant studies lack of robust theoretical underpinning and substantial theoretical extensions (Kowalkowski *et al*., 2017b; Li *et al*., 2020).

Against this backdrop, over the last few years, there have been witnessed a significant surge of theory on servitization to understand the progression in PSS[4] research through different theoretical lenses and how each lens provides a specific perspective for explaining the phenomenon. Since 2009, efforts in theory development are continuously increased with an intense growth from 2013 to present day. In this period, many authors have introduced and explained theories at least one place of paper ('some details on theories'), as well as numerous authors have explicitly applied and explained theories throughout the paper ('more detailed discussions on theories') (Fig-

[4] According to Baines *et al.* (2009), the term "PSS" is used as synonym of servitization given that the principles underlying are almost identical. Some differences are related to the country of origin since PSS is a Scandinavian concept while servitization is linked to Anglo-Saxon's context. Moreover, servitization is related to the shift of organizational capabilities and processes while PSS is related to the final object (Neely, 2008). Baines *et al.* (2013) also state that PSS is a special type of servitization that provide value to customer through the integration between products and services.

ure 3). Moreover, the combination of two or more theories in the same research is still rare despite the use of multiple theories allows a better understanding of the phenomenon (Li *et al*., 2020).

Figure 3 – Papers with theory development by year (till September 2018)



Source: Li et al., 2020, p. 6

For a deeper analysis of predominant theories within this research field over the last decades, the following categories of theoretical approaches are identified, such as resources, organization, and systems. Resources' category embraces theoretical approaches that address how transition from goods orientation to service orientation is justified to create competitive advantage (Ulaga and Reinartz, 2011; Kindström *et al*., 2013; Bustinza *et al*., 2015). Since servitization frees firms from competing on cost alone (Porter and Ketels, 2003), in fact, it offers the opportunity for greater offering differentiation (Kohtamäki *et al*., 2013). Specifically, the most relevant contributions derive from the market forces (Porter, 1980), Resource-Based View (Barney, 1991, 1995), Dynamic Capabilities (Teece *et al*., 1997; Teece, 2007), Relational View (Dyer and Singh, 1998; Lavie, 2006; Dyer *et al*., 2018), and Knowledge-Based View (Grant, 1996), as Table 3 shows.